Management---The Systematic or Kill-Initiative Type

By E. St. Elmo Lewis *

The present is the second of a series of three articles which deals with the subject of management as exemplified in three different types of men — the strenuous, the systematic and the efficient. The points brought out relative to the useful accomplishment and otherwise of each are worthy of careful study.

SYSTEM is the rut in which some men are proud to live. It is the rut in which the thoughtless run without fear of serious catastrophe. System at its worst, affords the incompetent and indifferent a nice comfortable, easy way of doing things. They progress along the road that has already been marked for them, beaten down and road-rollered by the hundreds of feet of men who have gone before. Automatically, every New Year's Day, salaries are increased a few dollars a week, to the "soldier" as well as the worker. Automatically each one is checked up. If each has followed the system, he is ignored, but if he hasn't, he is called down. Each has learned a set, prescribed way of going through his work until, as the youngster said, "he could play the piano with his eyes shut." Under a systematic management a man doesn't have to think, but he does something and remembers. A great many go through their work just as they eat their meals. They eat them whether they want them or not; so they do their work whether it is useful or not.

When the President's Efficiency Commission investigated the Government Department at Washington, it found that Government workers were making copies of original documents laboriously by hand. By the introduction of a photographic process of making these copies, a 75 per cent. saving of clerical time and 90 per cent. in cost was effected. $242,000 a year was saved. In the handling of public documents, $242,000 also was saved. It was estimated that another $850,000 could be saved annually if the departments would properly standardize the handling and filing of correspondence.

The same discovery applies to the majority of business houses. Each department stands alone. To all intents it is a separate business. This department files correspondence one way, this one has another, that one still another. If four or five departments have correspondence with the same customer or prospect, even about the same thing, it is only rarely that the complete correspondence can be brought together without a very great deal of difficulty and trial. Why? Is it not because the management does not see the business as a whole, however, thorough may be its grasp of details?

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Improvement Over Rule-of-Thumb Type.

The systematic type of manager is a decided improvement on the rule-of-thumb type. The systematic type recognizes that there are some better methods of getting information about what is going on. It aims to find what is a good way to do things by comparing the results of the good, bad, and indifferent methods of the past. It is making the first step toward finding out the facts about your business. The systematic type of manager has one drawback which is so common as to be almost universal—he is still thinking about things and not about people. To him a system is a chart of accounts, or a bunch of cards, or a vertical file, or a loose-leaf ledger with its accompaniment of books and forms and ideas about their handling, but still it leaves out the human element. He continues to believe that the man element is the uncertain, the unsystematic, the untrainable element. He does not think about men—how to train them — but he simply forces them into the grooves of handling a thing in a so-called systematic fashion. He makes them what he thinks they are—automatons.

System a Humanizer.

System is on the contrary, a machine means to a humanizing end. Its primary purpose is to raise efficiency, and a system that doesn't raise efficiency is fallible, weak, impotent, in the way and a nuisance. The purpose of a system is:—

1.—To keep a true record of what has actually happened.

2.—To keep this record in such terms that the manager may readily translate it into the most productive action.

3.—To insure a reliable, immediate, and accurate record, in order that the manager may determine standards relative to the practice of work, and the conditions surrounding the work, and the operations and their sequence, and fix an adequate reward for the best work.

> **THE THREE-FOLD REQUIREMENT.**
>
> **The important thing in management is the realization that we need the strenuous, the systematic and the efficient. We need the strenuous to help fix quantity standards, the systematic to maintain them, and the efficient to still further develop them.**

In the highly systematized type of management the man gets caught in the net of a pre-determined method of following the work, and can make no change from it, without dislocating the whole business routine. How often have you heard when you go into a retail store and you ask them to do something — "Well, we have never done it that way?" I once made a purchase of some hundred odd dollars in a jewelry store and asked them to deliver the purchase to a steamer. The clerk said that "The delivery doesn't go out until three o'clock." I had to have it delivered at two. In his routine way of thinking it never occurred to the clerk that he could have a special messenger do the delivering, and even the head salesman had to "see if it could be done."

Harrington Emerson tells the story of a systematic government official. When he was living in Germany, there were only four official religions—Reformed, Lutheran, Catholic and Jewish. When Mr. Emerson was filling out the census blank for his father's family, he told the census official he wasn't a member of any one of these four faiths, but he was told that he had to choose one of them or else be fined. Of course he chose!

In a business with which I was at one time connected there was a certain chart of accounts arranged, and you had to select which of these accounts a disbursement was to be charged. New conditions arose, but the chart of accounts remained the same. Items, for instance, such as were used for the development of the sales organization were charged to advertising accounts, and the management of the company, therefore, got an entirely erroneous idea of the amount of money it was spending for advertising. Nearly a sixth of the amount of money charged to the advertising accounts never even remotely affected the state of mind of the prospective purchaser. The consequence was that the chart of accounts ran the business, and not the business the chart of accounts.

Relies on Precedent.

The systematic type of mind constantly falls back for precedent—it is traditional. H. G. Wells, in his thought-provoking book, "The Discovery of the Future," hits off this type of mind remarkably well.

The systematic type of mind.—One might speak of as the legal or submissive type of mind, because the business, the practice, and the training of a lawyer disposes him toward it; he of all men must adhere constantly to the law made, the right established, the precedent set, and consistently ignore or condemn the thing that is only seeking to establish itself.

The efficient type of mind.—I might for contrast call the legislative organizing, or masterful type, because it is perpetually attacking and altering the established order of things, perpetually falling away from respect for what the past has given us. It sees the world as one great workshop, and the present is no more than material for the future, for the thing that is yet destined to be. It is in the active mood of thought, while the former is in the passive; it is the mind of youth, it is the mind more manifest among the western nations, while the former is the mind of age, the mind of the Oriental.

The Needed Combination.

Now, the important thing in management is to realize that we need the strenuous, we need the systematic, and we need the efficient. We need strenuosity to help fix quantity standards, because when the strenuous man is properly guided and handled, he gets a maximum quantity efficiency; but he must be guided.

The systematic type furnishes those reliable records by which we keep track of efficiency, find it out and establish its standards; but left to itself without guidance, the systematic type of man runs to seed. He becomes petrified in the attitude of changeless superiority. It is only the efficient man that can be left alone, because he will not leave anything alone.

The systematic man, of course, is the stand-pat and conservative mind at work. He prefers to write history rather than prophecy. His mind is set towards the setting instead of the rising sun. He compares to-day's result with yesterday's result, instead of comparing it with the ideal standard of to-morrow. The systematic manager inevitably curtails initiative in the plant, for he sets wage limits instead of work limits. He is not concerned about the value so much as he is concerned with the price.

The efficient man is after what we shall do to be perfect. The systematic man is content if he has properly taken care of to-day in comparison to yesterday. The efficient man is principally concerned in seeing that to-morrow is taken care of in order that to-day will automatically be looked after. Place the systematic man in charge of your cost work. He is perfectly content if he can devise a system that will attach a string to every dollar, with the consequence that in the hands of the small systematic men a cost system rarely gives costs, though it produces a lot of figures.

A Cost Fallacy.

The great fallacy in costs, as some of the efficiency experts have pointed out, is to generalize from the whole to a part, to apply data covering a ten-year period to a lesser period, down to a day. Averages are the pitfalls of the system-mad cost accountant. "The average temperature, or rainfall, ought not to be taken as the weather indication for an outing," is the witty way Mr. Emerson has put this failing.

Mr. Emerson in his book brings out one very important item by a very vivid comparison. There is a difference between expense and cost. If a salesman on the road paid 25 cents for a cigar with a hundred-dollar bill and neglected to get the change, the trip cost you $100, but the expense was only 25 cents for the cigar. The systematic cost man wants only to know what becomes of the money, the material and the work where it has gone. The efficient man wants to know what you have gotten for the money, and vitally important, if what you received in return for the money is worth the price. We have crude so-called cost systems which do not reflect the activities of a business at all. Merely because a man is systematic, merely because he has a system, is no indication that the system is telling him any useable facts about his business.

Establishing a Cost System.

It is important, therefore, in the establishment of a cost system to pre-determine what you want it to do. You can't let a cost system just grow. If you do let it grow, it will grow in many ways that will be expensive and bristling with misinformation pitfalls for your unwary judgment. Put in a cost system by all means. Bring to bear upon the problem the same concrete information, skill, experience and attention to scientific detail you would in making an installation of an electric power plant or a transmission system, or putting up a new factory building.

As a matter of fact, what do you know about the matter of costs? What do you want a cost system to tell you? If you want to have a cost system to help produce a greater efficiency, then you want it to aid in a real managerial function. If you want it merely as a supplementary historical record to be tied into your accounts, then a mere cost system will do. But make no mistake; that kind of a cost system will give precious little aid in raising the efficiency of management.

The cost system that doesn't tie up with production standards; that doesn't show how closely you have come to realizing the best way of doing anything; in other words, that doesn't give values as well as costs, is a misnomer, and one that is destined to breed narrow, cribbed and inefficient management. Therefore, any cost system should be, as Mr. Emerson points out, so arranged that it gives:

1.—To the comptroller—information that will show him where the money goes.

2.—To the efficiency engineer—information to show him whether standards are being realized.

3.—To the manager—information to show him where his losses are occurring and his highest efficiencies are being realized.

In order to do this, Mr. Emerson contines: "The requisition system must be materially increased. You apply requisitions to materials—why shouldn't you apply them to personal services and other charges?"

The Method and Manner of Laying-out Plates

By Joseph W. Ross

The laying out of plates to form the various shapes for which sheet metal parts are used involves difficulties that are only discovered when such a job is undertaken. It is well known to superintendents and foremen that some men require much more time than others to do this work in which system and right methods are the great economizers.

PLANE or flat surfaces are generally fairly easy to lay out. It really amounts to marking off on the plates the full-size dimensions as given on the smaller scale of the blue print or drawing. For example, it is required to make a hopper or bin with open top, as shown in the parallel perspective drawing, Fig. 1. The material consists of 1/4-in. plate, 2 in. x 2 in. x 1/4 in. angle, and 1/2-in. rivets.

The projection or working drawing

from which he would obtain his dimensions, is shown in Figs. (2), (3), and (4); Fig. 2 being the plan, Fig. 3 the elevation, and Fig. 4 the profile or side

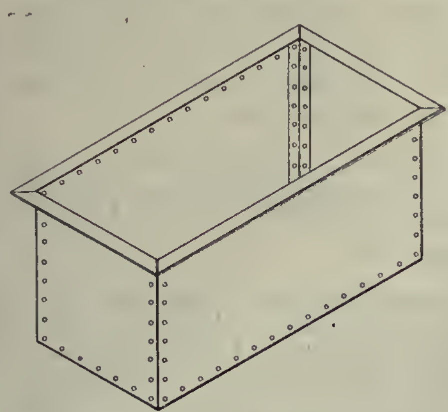
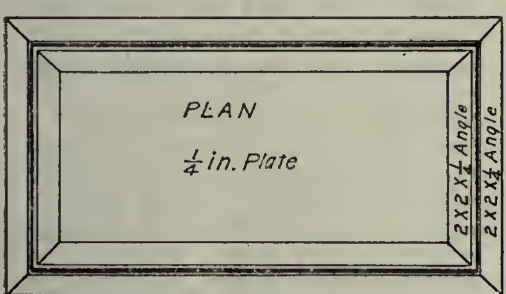
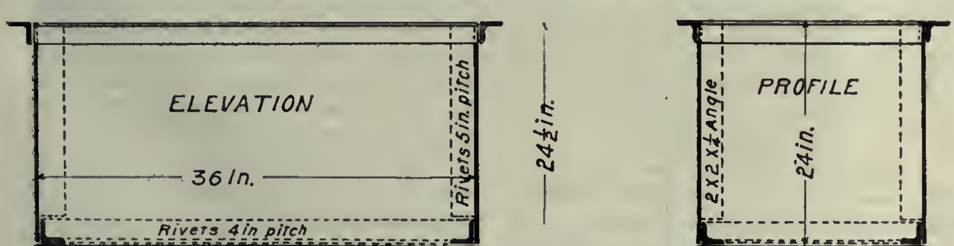


FIG. 1. PERSPECTIVE VIEW OF TANK.

view. The internal dimensions are 3 feet long, 2 feet wide and 2 feet deep.

The bottom plate will be marked off first, and as the bottom edges of the sides and end plates rest on the bottom





FIGS. 2, 3, 4—TANK AS SHOWN ON BLUE PRINT.

plate, and the edges of the bottom plate are flush with the ends and sides, the length and width of the bottom plate will be 36½ in, by 24½ in., which is ½

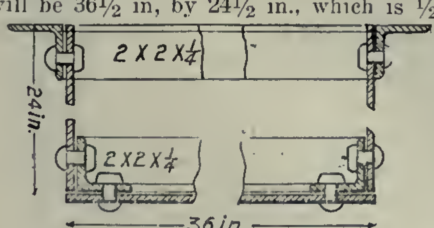


FIG. 5. ARRANGEMENT OF ANGLES, SIDE AND BOTTOM PLATES.

in. wider and longer than the internal dimensions. This is illustrated in enlarged sketches, Figs. 5 and 6.

Mark off a line 36½ in. long lengthwise the sheet, and parallel to this line mark off the rivet line a distance equal to the thickness of the side or end plates plus the distance from the heel of the angle to the hole centers, which, in this case, equals ¼ in. plus 1⅛ in., or 1⅜ in. See Figs. 5 and 6. This gives the rivet line. On this, measure exactly 36½ inches; bisect to obtain center and square up the plate as explained in article I on this subject.

The plate squared up will appear as shown in Fig. 7. The rivets are spaced

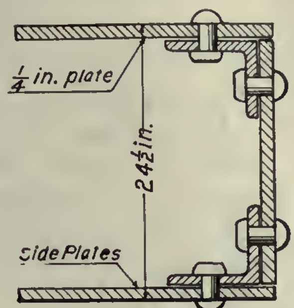


FIG. 6. DETAIL OF BOTTOM JOINTS.

off 4 inches apart with the dividers, in one direction from the center line. Obtain a thin wooden strip or lath and transfer these hole centers to it, then swing the lath to the other side of the center line, keeping the same center line of the lath to the center line of the plate and transfer the hole centers from it to the plate. This makes the hole centers at each side of the center line exactly equal or universal. Now transfer all the hole centers to the lath, place the lath on the opposite rivet line and mark off all the hole centers, care being taken that the center of the lath is exactly on the center line of the plate. Hold this lath for further marking of the side plates and angle iron, and call it lath 1.

Bisect the line BD, Fig 7, and mark off two equal spaces from center line. In this case, the spaces will equal 5 ins. These should be marked on another lath and transferred across the center line as in the previous operation. Transfer all the hole centers to its opposite side, thus giving all the necessary holes in the bottom plate. Call this last lath 2.

This method of laying out makes the side and end plates interchangeable; that is to say, the plates may be assembled right or left, also, all the plates and angles may be marked off and punched before assembling any of the parts. Examination of the drawing

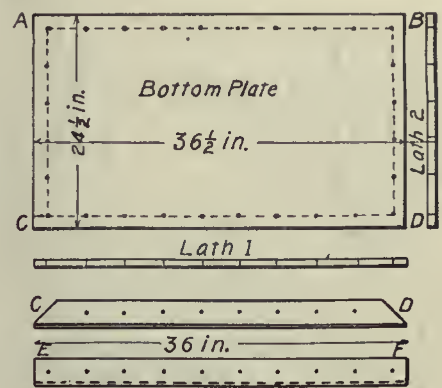


FIG. 7. BOTTOM PLATE AND ANGLE LAYOUT.

shows the side plates to be of the same length as the bottom and their height 24 inches, which is the internal depth of the tank. This plate will therefore be 36½ inches by 24 inches.

As the angle iron comes flush with the edge of the side plate, the rivet line EF will be 1⅛ in. from its edge. Mark off this line; bisect and square up. With the long lath that we marked off the bottom plate (lath 1), transfer all holes from lath to the line, working in every case from the plate center line. As the side plates cover up the edges of the end plates, the vertical rivet lines EG and FH will be a distance equal to ¼ in., plus 1⅛ in. from the plate edge. Space off the holes as per drawing, making both vertical rivet line spacings the same. Lay off the rivet holes at the top to the desired pitch in a similar manner.

After this plate is punched, it may be placed on top of the opposite side plate, and the holes marked through, thus insuring uniformity in both. The end plates, as shown in the side elevation view, will be marked off next. All the angles are flush with the edge of the plate, therefore all the rivet lines will be 1⅛ ins. from the edge.

Mark off the bottom rivet line 1⅛ ins. from the edge; bisect, square up and

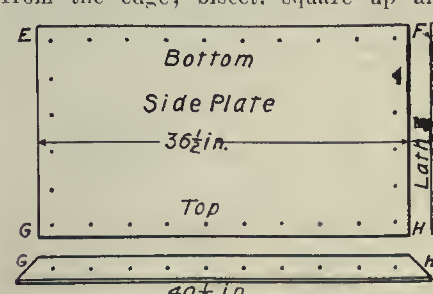


FIG 8. SIDE PLATE LAYOUT.

transfer the hole centers from lath 2 to this line. Use lath 2 also for the opposite side and lath 3 for spacing rivet lines on the sides.

The angles are next to be marked off. The bottom angles at AB and CD are 36 in. long. Mark off the rivet line 1⅛ in. from the heel on both flanges as

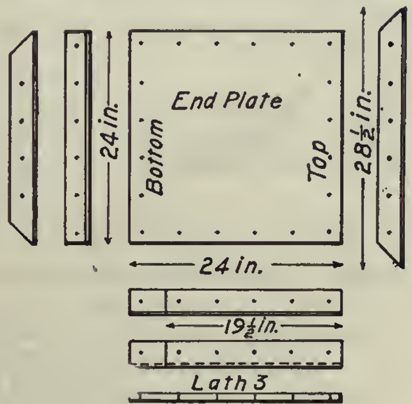


FIG. 9. END PLATE AND ANGLE LAYOUT.

shown in Fig 11. Obtain center, and space the holes with lath 1; equare over center bole to the other flange, and again use lath 1 for marking off the holes. Square over the end holes from one flange to the other as a proof of accuracy. Perform the same operation with the other angles, marking off each line of holes with the proper lath.

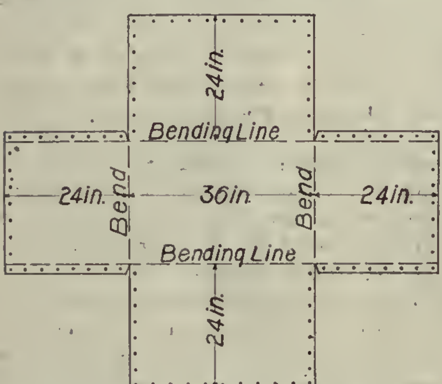


FIG. 10. ARRANGEMENT OF SHEET FOR TANK OF THIN METAL.

If a number of these boxes are to be made, it is advisable to assemble one, and if satisfactory, the plates and angles may then be used as templets, thus insuring uniformity. For a bin constructed of light plate, say 1-16 in. thick, or lighter, a different method would be adopted for laying out. The pattern for

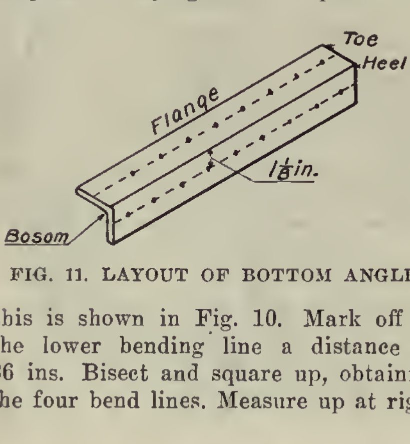


FIG. 11. LAYOUT OF BOTTOM ANGLE.

this is shown in Fig. 10. Mark off on the lower bending line a distance of 36 ins. Bisect and square up, obtaining the four bend lines. Measure up at right angles to these, the widths of the bent-up parts equal to the height of the box. To the lengths of two sides, add the flange parts as shown. Mark off the holes with a suitable lath, making all the sides alike.

Bend over the flanges; proceed to make the long bend, and finally the short bend. If the work be correctly done, the rivet holes will match and the whole will then be ready for riveting. Flat iron, 1 in. or ¾ in. by ⅛ in. may be riveted to the top edges for reinforcement. The heavy bin, if fitted with suitable clevices or wheels, may be used for transportation or trucking purposes. The next article in this series will deal with cylindrical work.

Recent Improvements in Casehardening Practice-II*

By H. L. Heathcote, B.Sc.

The subject matter of this article treats of what has been done relative to case-hardening in the works of the Rudge-Whitworth Co., Coventry, England, and indicates at the same time how the problem presents itself and the manner of seeking a solution.

EXPERIMENTS relative to case-hardening, extending over a considerable time and range of compositions, have confirmed the following suppositions:—

1.—The depth of case depends chiefly on the temperature that the steel attains and the duration of the hot condition. On these factors depend the rate and extent of the diffusion of the carbon or carbide.

(2).—The concentration of the carbon in the case depends chiefly on the activity of the mixture or rate at which it or its products part with carbon to the steel. The concentration of carbon in the surface layers may increase or decrease with temperature, but usually increases as the temperature rises and with the time.

(3).—The duration of the hot condition for a given time of heating depends chiefly upon the permeability to heat of the case-hardening composition.

Exhaustion Tests.

Comparative depth of penetration has been the subject of a number of investigations, but is so much dependent on factors other than the case-hardening composition that the author has sought for some other test. The one finally adopted is to take a known volume of the composition and ascertain the volume of the case that can be got from it without replenishing.

The ratio total volume of case initial volume of case-hardening material, affords a good indication of the efficiency of the composition, and is not so dependent as a single penetration measurement on other factors, such as size of pot, number and size of the articles it contains, loss of heat from furnace walls when the pot is introduced, etc. These exhaustion tests have been made in pots of various sizes, but usually in nickel-plated steel tubes 7 inches long by 1½ inch diameter, and heated in a laboratory muffle for 1½ to 2 hours, starting with the muffle hot. A fresh piece of mild steel, such as ⅜ inch round, is used for each heating, and the period is that required to give, at 900 deg. to 930 deg. C., a case deep enough for commercial use, viz., 0.015 inch to 0.065 inch. Transverse sections are examined microscopically, and the mixture is considered to be exhausted when ferrite bands can be seen between the pearlite grains at the periphery, that is, when the case is unsaturated. With most commercial case-hardening mixtures it is usual to find that the periphery is unsaturated after six or seven heatings of two hours each. The results of testing some experimental mixings are to be found in the following table:—

Mixture.	Ratio Total Volume of Case; Initial Volume of Mixture.
Anthracite 75 per cent., oil 25 per cent.	......
Anthracite 95 per cent., potassium carbonate 5 per cent.	0.0042
Coke soaked in 10 per cent. aqueous solution of potassium hydrate	0.0048
Anthracite soaked in 10 per cent. aqueous solution of potassium hydrate	0.0061
Anthracite 90 per cent., calcium cyanamide 10 per cent.	0.0109
Crushed bone	0.0122
Anthracite 90 per cent., bone black 10 per cent.	0.0138
Wood charcoal	0.0140
Charcoal 90 per cent., crushed bone 10 per cent.	0.0262
Wood charcoal 90 per cent., calcium cyanamide 10 per cent.	0.0331
Wood charcoal 90 per cent., crushed bone 10 per cent.	0.0368
Bone black	0.0405
Leather charcoal	0.0405
Wood charcoal 90 per cent., bone black 10 per cent.	0.0451
Charcoal soaked in 20 per cent. caustic potash 90 per cent., crushed bone 10%	0.058
Wood charcoal impregnated with soda ash	0.116

An Improved Case-hardening Composition.

The last mixture in the above table is eminently suitable on the score of permanence, and can be used over and over

*From a paper read before the Iron and Steel Institute.

again indefinitely, provided that the inevitable waste involved in commercial usage is made up from time to time with fresh composition and that the ingredients are well incorporated and in the proper proportions. The author was led to combining charcoal with potassium carbonate, sodium carbonate, and potassium hydrate by the results of tests on charcoal. This rapidly loses its carburizing power. It also contains traces of potassium carbonate, which would react with red-hot charcoal and produce carbon monoxide.

Incorporating a little potassium carbonate with exhausted charcoal is found to restore at once it carburizing power and make it give up its carbon more readily than the original charcoal. The same is true when potassium hydrate or sodium carbonate is incorporated.

Permeability to Heat.

Having found a composition far more permanent in its properties than any then in current use, the author then proceeded to investigate the factors concerned in permeability to heat. Most commercial mixtures consist of or contain a large proportion of small particles which it seems reasonable to expect will block up all the interstices and prevent the free passage of heat, for it has been shown that the heat conductivity of insulating materials depends chiefly on their air spaces. To test this point granular charcoal was employed, and two model case-hardening pots were made 5 inches high, 3.7 inches diameter, and 0.04 inch thick, made of sheet steel and welded together. One contained the charcoal under investigation, and the other was used empty. A thermometer bulb was placed at the center of each pot and the apparatus placed in an oven at 180 deg. C. Two striking points were brought out by this test.

1.—The arrest of temperature at the center at about 100 deg. C. while moisture is being driven off.

2.—The effect of size of grain, and particularly of dust, upon the duration of the arrest.

When the same samples were again heated, the temperature rose much more quickly, the absence of any arrest being, of course, due to the moisture having been expelled during the previous tests. Needless to say, the temperature at the core of a hardening pot will not remain at 100 deg. C. for nearly three hours if the heating be done in a red-hot muffle; but the author has observed that there is an arrest, and another when other volatile matter begins to be given off, when the model pots are filled with oily bone black and heated in red-hot lead at about 850 deg. C.

A mixture which can be used over and over again possesses the great advantage that moisture, oil and other volatile constituents have, for the most part, been already expelled by the previous heatings. The author considers .9 to 1.1 per cent. carbon satisfactory in the composition of the "case."

Methods of Testing Hardness.

So far as the author is aware, very little work has been done to provide commercial means for testing the suitability of case-hardened articles. The practice of examining test-pieces carburized, heat treated, and hardened along with each batch is, of course, sound as far as it goes. The Shore scleroscope and Brinell test have their spheres of usefulness, but still the file is the instrument most used, and perhaps rightly, for it does give an idea of the resistance the surface of the article offers to abrasion under pressure, which is what most articles are case-hardened to withstand. This and the Brinell test are, we believe, the instruments in commonest use for testing case-hardened work and test-pieces.

For small articles the modified center punch is particularly suitable for rapidly getting a working idea as to whether the case is above the minimum permissible depth. It is an ordinary 6-in. Brown & Sharpe automatic center punch to which we have fitted a screwed-on container for holding a ⅛-in. bicycle ball. The hard point has been removed and the container screwed on in its place. The ball protrudes just sufficiently to prevent the container coming into contact with the article under test. This is very useful for large as well as small articles, and its readings appear to refer more to the case and less to the core than those obtained with a Brinell testing machine.

Colors of Hardened Work to Facilitate Viewing.

Many articles, such as cups and cones, cannot be conveniently tested with a scleroscope or sclerometer on account of their shape. Realizing the need for some method which would enable articles of all sorts to be tested in bulk, the author turned his attention to the production of colors on hardened surfaces which would afford an indication of the nature of the steel composing such surfaces. The ordinary solutions employed by the metallographer are unsuitable for commercial application, some because of their inflammability, others because they will not flow evenly over a somewhat oily or greasy surface. A suitable solution which has been found to give satisfactory results consists of:—

Alcohol, 1 liter.

Distilled water, 1 liter.

Nitric acid, pure, 100 cubic centimeters.

Articles ground or polished after hardening and immersed in this for ¼ to 1 minute are stained brown or light blue where the structure is martensitic; dark blue or dark gray where there is troostite; and hardly stained at all on ferrite or pearlite.

By treating hardened articles in this way before viewing, inequalities are rendered visible and can readily be detected. The fact that the whole of the surface is tested, and not merely the parts touched by the file, sclerometer, or scleroscope is an enormous advantage for commercial purposes. The test reveals at once spots that have been splashed before quenching, and contain troostite, also superficial tempering due to a glazed surface on the grinding wheel or to excessive pressure. It does not appear to be possible to obtain a colorimetric scale of hardness in this way, but when a number of articles are dipped at the same time the eye readily detects those that have a different appearance, and all that is then necessary is to check the odd ones with a file or sclerometer. This test is also suitable for tools and complicated articles that cannot conveniently be tested with an instrument. It also shows the depth of case if a part is left on and ground away, and should prove useful for ascertaining whether an article has been properly tempered.

The swinging hammer is the outcome of another attempt to replace the variable muscular force of the tester by the constant force of gravity. Instead of a skilled viewer wielding a hammer we have a boy, and this simple instrument, which consists of an ordinary hammer swinging on a support passing through a bushed hole in the handle. The heavy steel block which carries the support is arranged to admit various holders adapted for receiving, and if necessary clamping, the parts to be tested. It has been found very useful for testing small parts, such as the rollers of motor cycle engine bearings, the blow being controlled by observing the angle on the graduated quadrant behind the hammer.

Calgary, Alta.—Work is now fully under way on the new Government elevator, which will be one of the finest in the Dominion. It is to be located just to the south of the proposed inside stock-yards site, and will have a capacity of three-and-a-half million bushels. Mr. Howe, the Government engineer, is at present in Calgary superintending the beginning of operations. The contract was let two weeks ago to Janse Brothers, Boomer, Hughes, & Crane, fifteen months being the time given for the completion of the work. Mr. Crane states, however, that he is confident that the work can be completed considerably within the limit. Besides the elevator proper, there will be storage, separating and cleansing plants, and other buildings.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

AN UNUSUAL LATHE JOB.

By J. Davies.

SOME time ago at the New Yard Iron Works, Cumberland, it was required to overhaul and re-tube two locomotive boilers. By some unfortunate circumstance it was found that all of the copper tubes ordered for the job had been cut too short by one inch. The foreman, a resourceful Scotchman, devised a means of lengthening them the required amount in a lathe, which proved very successful and satisfactory.

A piece of shaft was first prepared as an arbor for the pipe. It was made a light drive fit for the tubes, and was provided with large centers, while the ends were tapered to facilitate placing and removal. The tube being slipped into place, was secured to the arbor by a pair of steel clamps, which also served as a drive. A system of hardened expanding rollers was now prepared, as shown in the end view, Fig. 1, two being supported by an angle bracket at the rear end of the carriage, and a third set up in the tool post. The shapes of the roller faces were varied so as to give the maximum expanding effect. The one for the tool post is shown at (a) Fig. 2, while (b) and (c) represent the rollers in the rear.

The machine was driven at a fairly high speed, and the feed adjusted to four to the inch. The carriage was run back and forth until the tube had stretched to a mark placed on the end of the mandril for the purpose of gauging the length. This process required several passes, leaving a short length on each end untouched, so that the fit in the tube sheet was left intact. After careful annealing, the tubes were placed in the boiler. Whether this treatment had a deteriorating effect upon them or not, we have not been able to determine, but the locomotives have been giving good and constant satisfaction ever since.

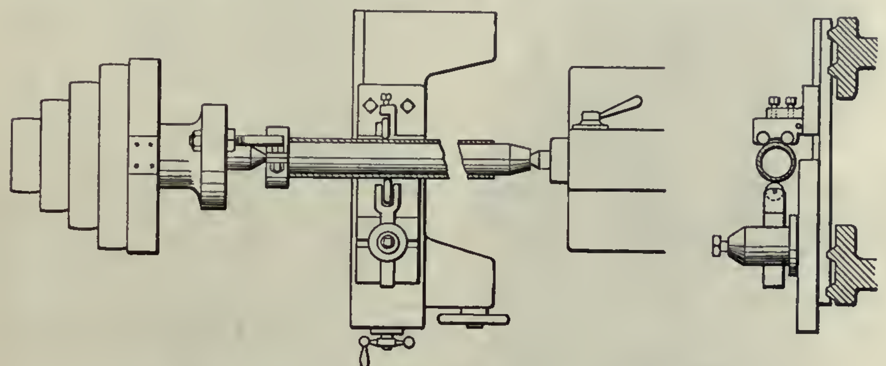


FIG. 1. PLAN AND END VIEW OF TUBE IN LATHE.

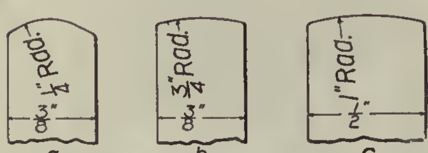
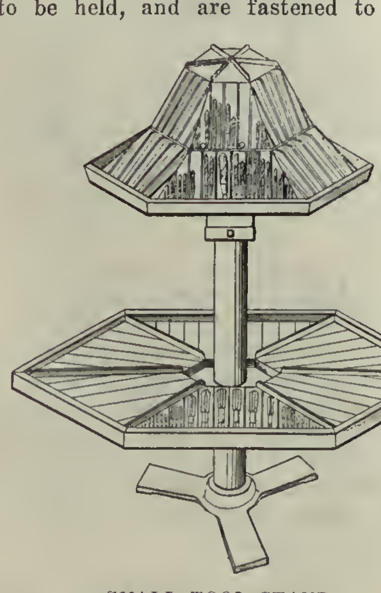


FIG. 2. FORMS OF HARDENED ROLLERS USED.

A CONVENIENT TOOL STAND.

By C. I. W.

The accompanying cut illustrates a type of tool rack employed in the toolroom of the Calgary Iron Works for conveniently holding the most used small tools. It consists of two or more hexagonal wooden trays, supported by set collars at suitable heights on a vertical 1 11/16-inch shaft. The trays are suitably partitioned off for the class of tools to be held, and are fastened to large cast iron flanges, which are bored a loose fit for the vertical shaft. An appropriate flange into which the shaft is fastened by means of set screws forms the base which is screwed to the floor. This type of tool holder can be used in places where, on account of lighting and other considerations, an equal amount of shelf space could not be secured in any other way. The stands may be much cheapened by using pipe for standards and pipe flanges to support the trays.

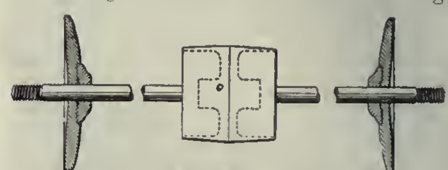


SMALL TOOL STAND.

ADAPTING SAFETY FLANGES TO OLD EMERY WHEEL ARBOR.

By W. Gibbs.

Among the many problems instituted by the safety first campaign in our plant, that in connection with the safetyizing of grinding wheels in the foundry cleaning-room at first offered considerable difficulty. It was decreed that all wheels not completely hooded should be held between flanges extending to within four inches of the periphery of the wheel. As there were a large number of grinding machines already equipped with the small flanges shrunk on or otherwise fastened in place, any radical changes were bound to involve considerable expense. Permanent 10-inch flanges would also render a large part of a rather expensive wheel unusable.



GRINDING WHEEL ARBOR WITH AUXILIARY FLANGES.

The accompanying sketch shows how the change was accomplished. Steel flanges of different sizes were made to fit over the original collars on the arbors. The new wheel is placed in the machine with the largest pair of flanges, and when worn down as far as practical, a smaller set is substituted, and finally the wheel is used up in the small original clamps furnished with the machine. This scheme has proved very satisfactory. The spare clamps are kept hung up in a convenient place, and the change takes little time; besides, complete safety as well as wheel economy is secured.

Better results can be secured by operating the new wheels upon arbors with large flanges, and which are run at suitable speeds. As the wheels are worn down, they may be placed in other machines between flanges of the proper size and run at speeds faster in accordance with the reduced diameters.—Editor.

MANUFACTURE AND USE OF INTERNAL GAUGES.

By Spring Craig.

IT is being recognized more every day that interchangeability and accuracy are two of the most essential features in multiple machine building. One of the most successful firms in the world size all parts of their product to standards, even the outside dimensions of collars and other seemingly unimportant dimensions being accurately maintained. The writer has known of more than one factory in which it cost more to assemble the machine than to manufacture the several parts.

In order to be interchangeable, all pieces must be alike, and gauges play a very important part in getting this desired result. To be sure there are jigs, fixtures, templets. tools and various machines used as well, but the final inspector accepts or discards the work according to the verdict of the gauge.

Without gauges as exact standards of size, each machine must be " fitted " together and the advantages of rapid and unhindered assembling along with interchangeability of parts are entirely lost. With present-day machine shop facilities, the building of but a small number of machines will repay the cost of a set of gauging tools, and, if the plant be properly equipped with standard gauges, the special ones required may be reduced to a comparatively small number. The machine hand provided with a proper gauge accomplishes the " fitting" as well as the production of the general form of the machine component, and as machines are replacing hand work more and more, the parts can in this way go directly from machine hand to assembler.

Many toolmakers attempt to get up a complete set of gauges from the designer's drawings of the machine to be built. Experience has proved this to be a mistake. The correct and most practical way is to build a model or sample machine, which should be made as much as possible to standard gauges with which the shop is regularly equipped.

The standard set of gauges with which a machine shop should be supplied will consist of plug gauges ranging in size from ¼-inch to 3-inch by sixteenths for the various classes of fits likely to be required; and for sizes above this, rod gauges for standard sizes as are needed. The cost of gauges depends largely upon the class of man that makes them, and should be balanced against the cost of the time lost in many ways without their use. It takes considerable time to caliper a hole and then set a micrometer to the caliper, several chances of error existing in the process.

Internal gauges, plug snap and rod can be used in any shop for a large variety of work. The size of the bore or the diameter of reamed holes forms the starting point for most machine operations, and the convenience with which other parts can be fitted to these plays an important part in the harmonious progress of erection.

Material for Gauges.

For plug gauges in a great many shops where there are no case-hardening facilities, tool steel is the only material to use, and in the majority of plants this is used in any case, being thought best by the most experienced gauge makers. Some firms use machine, open hearth and other steels case-hardened. One objection against case-hardened machined steel for plug gauges is that sometimes a soft spot will be left in the surface of the gage. In grinding, this becomes charged with emery and has a tendency to stick in the hole and cause the tool to gauge over size.

Built-up Gauges.

Built-up gauges require but one-third the material needed for solid ones. They are also much lighter to handle, take up less room to store, and one handle may do for five or six sizes. This saves turning and knurling a handle for each gauge.

There are several ways of building them up, one being to have a taper shank projecting from and turned integral with the gauge, on which a handle with a corresponding female taper is driven. This style does not save much stock. Another method is to have a hole bored through the gauge with a slight taper and the handle, having a shank of the same taper, is driven into the gauge. This form has a tendency to split the gauge and both have the objection that the gauges may be injured while being knocked on and off the handles. The writer has made and successfully used

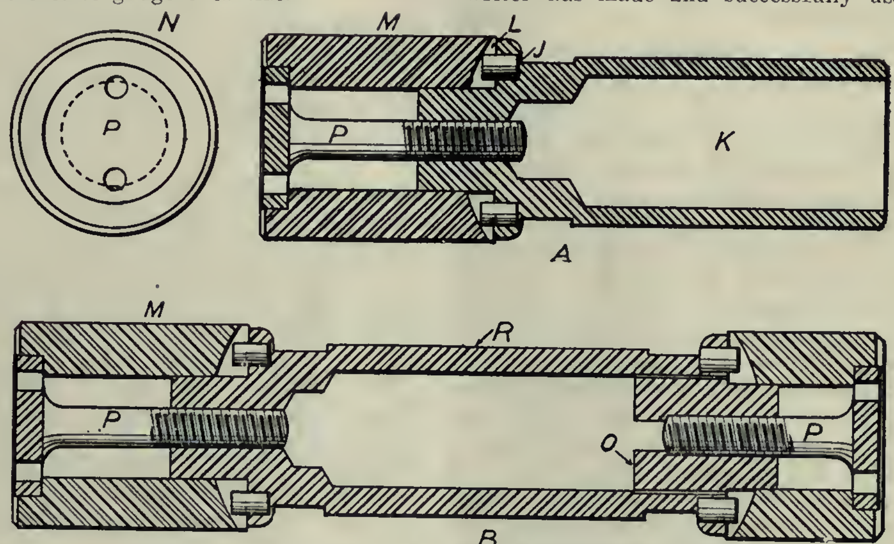


FIG. 1. A—BUILT UP PLUG GAUGE.
B—BUILT UP LIMIT GAUGE.

For snap gauges machine steel is generally used, and gauges can be purchased in the rough in different sizes from any of the leading drop forging manufacturers. Profile and end gauges (rod or pin) are made of machine steel, usually hardened on the ends only, with cyanire or prussiate of potash.

Up to three inches for internal work, the gauges are usually made solid or plug. From three to six inches snap gauges, as shown at C and D, Fig. 2, of which G is an end view, are most used. All sizes above are made in the form of rod gauges, as shown at F, Fig. 3. In most large modern shops the plug gauges are built up for sizes from 1¼-inch to 3 inches in diameter, with machine steel handles for economy and lightness, while in others they are made solid, as shown at E.

The stock used should be ⅛ inch larger in diameter than the finished gauge.

built-up plug gauges of the form shown at A, which is a standard, and B, a limit gauge, one end to go and the other not to go. One end was one-half thousands under size and the other one-half thousands over.

The gauges of this set are of tool steel and vary from 2 inches, by sixteenths, to 2½ inches. They are bored one inch, so that one handle does for seven or eight. At the bottom end they are recessed nine thirty-seconds ins. deep to accommodate the screw that holds them to the handle K, Fig. 1.

There is a recess milled in the top at L three-sixteenths in. wide for the pins J in the handle to slip into. These pins are to prevent the handle turning in the gauge. The screws P have two holes drilled in them as shown in A and end view N to facilitate tightening and removal. The handle K is machine steel and is bored out as shown, leaving three-sixteenth walls which are knurled on the outside.

At B in the limit gauge it is made the same, with the difference that after the handle is bored it is threaded internally at the upper end and plug O is screwed in and turned up to fit the gauge, being also tapped for screw P. The pieces of tool steel for the gauges were cut off the right length to finish up for the whole set, and laid aside. When a lathe man was short of work or was waiting for a job, these gauge blanks made very convenient alternatives, and were thus made much more cheaply than might be expected. They were turned twenty thousandths large on the outside and bored about three or four thousandths small. The reason for the latter procedure was to get a true hole and thus prevent any possible moving on the arbor during grinding. Another reason was that surprisingly little pressure on the inside distorts the gauge, and a plug gauge that is not absolutely round will give a great deal of trouble.

Hardening.

The turned gauges were heated to a dull red and set aside to cool. For hardening, they were heated very slowly to the hardening temperature, then dipped and kept in the water until cool enough to be held in the hand. As soon as they were withdrawn from the water they were sprinkled with lard oil and reheated until the lard oil smoked, which condition represents a pale straw color or about 430 deg. F. They were then immediately dropped into oil and left there to cool. The gauges were afterwards put away to season for about a month before being ground to size.

The centers in the solid plug gauges up to $1\frac{1}{4}$ inches in diameter require to be lapped, after being hardened, with a piece of brass turned sixty degrees and used in the drill press, with emery powder. This cleans them out, making them run true on centers. The same care should be observed with the mandrils on which the built-up plug gauges are ground. In grinding, the gauge and mandril must turn on dead centers; that is, neither center should revolve. If the grinding is done dry, the gauge should be cooled to the room temperature before removing the last thousandth. A difference in temperature will cause a difference in size from one-tenth of a thousand to four-tenths. They should be left preferably one-tenth of a thousandth over size rather than any amount under, on account of wear, this being plenty close enough for most work. To get them closer to size than this they would have to be measured by a measuring machine, an instrument not possessed by one shop in one hundred. After being ground, if a medium smooth piece of emery paper is rubbed over them while running at high speed, it will give a glass finish and make the gauge wear better.

The micrometer used should be set to standard gauges and should read in ten-thousandths, although some toolmakers can get very close with those reading in thousandths. The gauges were beveled 45 degrees on the front end to help to start them easily into holes, and on the back a slight radius is turned to prevent them being injured.

The snap or flat and rod gauges have to be case-hardened. In using them they

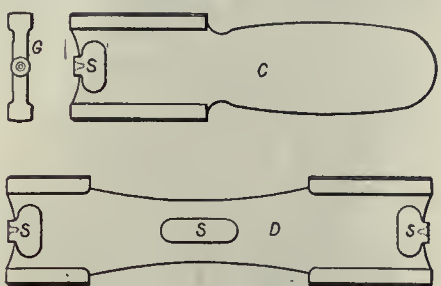


FIG. 2. SNAP AND LIMIT GAUGES.

are deceiving in that a hole bored to standard plug gauge size will fit loosely on the corresponding flat gauge C, Fig. 2. The amount that the flat gauge will have to be made larger will be about .0004 in., and for a rod gauge the amount will be about .0006 in. Most mechanics will readily recognize this through using ordinary spring calipers, as the hole has to be bored so that one end of the caliper will swing back and forth in the hole slightly for a fit in order that the shaft will go without driving.

The flats S, Figs. 2 and 3, are for stamping number and size. For measuring the rod gauges, a two-foot vernier is the handiest way, but if one is not available, two parallels clamped to a scale and set with a magnifying glass will

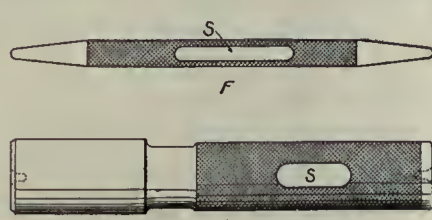


FIG. 3. ROD AND PLUG GAUGES.

come close enough for the majority of large work. If inside micrometers are obtainable, the parallels can be set more nearly the right distance apart. For the larger rod gauges, the scale and parallels are often used, and a good, careful mechanic can get very accurate results with a reliable scale.

RULES FOR ELECTRIC CRANEMEN.

1.—Never go on top of crane, or permit anyone else to do so, without opening main switch and placing warning sign or lock on it. Do not close same until you are absolutely sure there is no one on crane or crane runway who might be caught.

2.—Before racking carriage or moving crane bridge, be sure that hook and chains are high enough to clear all obstacles.

3.—Under no circumstances permit your crane to bump another crane until you are positive that no one on the other crane is in a position to be injured.

4.—Examine your crane every turn for loose or defective gears, keys, runways, railings, warning bells, signs, switches, sweepbrushes, cables, etc., and report any defects to foreman. Keep crane clean and well lubricated. Report to foreman any repairs which you cannot handle promptly.

5.—After completion of any repair job, make sure that bolts, tools, etc., have been removed so that no damage to machinery will result when crane is started, and so that nothing can fall off. Keep tools, oilcans and other loose objects in box provided for that purpose.

6.—Warning signs provided in cabs should be used when crane is under repairs.

7.—When there are more than two cranes on the same runway there shall be provided stops at a suitable location near the center of the runway for the purpose of isolating a crane while repairs are being made on same.

8.—Do not carry load over men on floor, use warning gong to attract their attention.

9.—Do not allow men to ride on load carried by crane, nor on crane hooks.

10.—Do not move load without signal from proper authority.

11.—Do not take any side lifts.

12.—Do not hoist any job that you consider insecurely slung.

13.—When handling heavy loads, particularly hot metal, test hoist brake by throwing to "off" position after load has been lifted a few inches; if brake does not hold, do not move crane until it has been repaired or adjusted.

14.—Do not carry objects up and down ladders, use rope for handling anything too large to go into pocket.

15.—When on duty, remain in cage for prompt service.

16.—Do not forget that bumpers are put on for emergency and not for everyday use.

17.—Crane operators must be absolutely sure that all controller handles are on the "off" position before closing switch.

18.—Do not, under any circumstances, reverse controllers, except in an attempt to prevent accidents.

19.—Emergency cutouts should be tested at least once each day.

20.—Cranemen must not use controllers to supply heat to cage.

21.—On all cranes equipped with the grindstone type of controllers and having main and auxiliary hoists, when either hoist is at rest, controller handle must be removed to prevent accidental starting of same.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

EFFICIENCY IN THE ENGINEERING BUSINESS.—I.

By "Onlooker."

THERE is a saying, which contains more than a little truth, to the effect that lookers-on frequently see most of the game. This is a truism that is particularly applicable to business in general, and a realization of its significance has led to the evolution of the efficiency expert in the modern industrial world. It is also applicable very particularly to the engineering profession, which offers a wide field to the expert on account of the many factors which enter into the business of converting crude ore into highly-finished and accurate machinery. The manager of a foundry, of a factory producing steam engines or boiler fittings, or any other specialized product, is apt to argue that he knows more about his own business than an outside engineer can possibly learn in a few weeks or a few months, and in this he is doubtless right; yet the efficiency expert is the looker-on, who sometimes sees most of the game. The manager himself is often too near his operations, too intimately associated with the running of his business, to take a comprehensive and unbiased view of the whole.

Sometimes he has, through long connection with a particular factory, got into a rut, and almost always there are phases of the business to which he has failed to give sufficient attention. He may be an excellent and up-to-date practical engineer, and yet fail through neglecting the advertising and selling end of the business, or through disregarding the importance of an accurate system of keeping costs. On the other hand, he may be a first-class business man and fall down on the producing end. In either case the business will suffer, and in either case a good efficiency expert, bringing to the problem the clear sight of an outsider, will be able to diagnose the malady and prescribe a remedy. Many liquidations might have been avoided by the timely calling of authoritative advice.

Importance of Small Things.

In this, and in the subsequent articles of this series which will appear from time to time in Canadian Machinery, the writer will endeavor to point out some of the commoner failings which have come to his notice during the course of his experience as an efficiency engineer, and to give a few hints which may be of value to those in charge of engineering shops.

One of the most important points in the running of an engineering concern, and one most frequently overlooked, is the importance of small things. The main processes are usually systematized. It is the little things that get neglected; the systematic filing of drawings and storing of patterns, the orderly arrragement of tool rooms and material stores, the efficiency of the power equipment or the accuracy of the accounting and costing departments. Yet it is the aggregate of such small negligences which count in the long run. It is the small leakages remaining unnoticed that sink the ship, and much of our space will, therefore, be devoted to a review of things small in themselves, but important in their aggregate.

Drawing Office and Designing Departments.

Since every product of the engineering works has its inception in the drawing office and designing departments, these will afford a good starting point. It is a fact that very few drawing offices are efficient in equipment, especially as regards small instruments. Every draughtsman should have a complete set of instruments in the best possible condition. No inferior or damaged draughting tools should be permitted. Every man, moreover, who has any designing to do and who does not work entirely from rough-dimensioned sketches, should have a reliable slide rule, while a fuller should be available for cases where particular accuracy is required. Logarithms are clumsy and slow, and arithmetical work has no place in the up-to-date office. The time saved by good equipment in the drawing office will rapidly repay the relatively small expense of the instruments required, and yet many managers who will spend thousands on a new machine tool will allow their draughtsmen to work for years with poor implements.

If the shop be of any size, an arc light printing apparatus is almost essential. Blue prints can be made outside, but they cost more, and delivery is sometimes slow. Time and money alike are saved by having the prints made on the premises.

Filing of Drawings.

The filing of drawings is an important matter. Much time is saved by the ability to rapidly turn up a drawing. They should be filed flat, in shallow drawers, and each drawer should have on the outside the numbers of the drawings it contains. If a firm is turning out gas engines or any similar product the best way is to have all the drawings embraced in a given type filed together, and to have a reference card giving the number of the drawing for any given part. The drawings should be numbered on the bottom left-hand corner. All that is then necessary to find any given sheet is to refer to the card and turn over the corners of the drawings until the desired number is found. The return of all drawings to their correct drawer is a matter which the chief draughtsman should insist upon rigorously.

Where drawings are more diverse, such as in the case of a factory turning out a wide range of, say, valves and steam fittings, the problem of filing becomes more difficult. A good practice, however, is to give to every valve a letter and a number. Thus a spring loaded safety valve may be designated as A, the different sizes of that particular type being numbered 1, 2, 3, and so on. This designation so given in the catalogues, to facilitate ordering, is used in the shop and in the finished store. The drawings are then filed consecutively, both alphabetically and numerically, under each letter. The various drawings connected with a given fitting, if more than one sheet is required, can be fastened together. All then required in order to turn up the drawings of any fitting is a reference list giving the letter, the number and the corresponding description of valve required. An office boy can then find the drawing, and save a draughtsman's time. A fireproof vault should be used for the storage of drawings where these are of particular value, as the replacing of drawings in the event of fire in the office is a long and costly process.

The Chief Draughtsman.

A good chief draughtsman is an asset to the organization of a firm, the value of which cannot be estimated in dollars. He can, by cheapening designs, without lessening the efficiency of the finished article, save many thousand dollars annually. Frequently it happens that he can, by slightly changing designs, adapt existing parts to new articles, thus cheapening production by rendering possible the utilization of existing patterns and increasing economy by the multiplication of repetition work.

Checking calculations in design work is important. Usually a designer checks over a second time his own original work. It takes him as long to do so, or nearly as long, as it would take another man to do the work, and he is more liable to repeat his original mistake, if there be one, than another would be. It is, therefore, advisable, where possible, to have all work pass through two hands, and to make the two men jointly responsible for the accuracy of the calculations. Mistakes in the designing or draughting department are apt to be very costly; it is, therefore, advisable to get together a reliable set of men and to keep them. A good man is worth paying always, and never more so than when he is in the department where the product of a plant is conceived. It is a good thing to encourage suggestions from the office staff. A draughtsman may not be as experienced as his manager, but he is intimate with his own work, and can frequently see further into it than those of greater experience and less intimacy. We all have much to learn, and all may, at times, be taught even by subordinates.

CHEMICAL ANALYSIS IN THE FOUNDRY.

By R. Micks.

IN the last few years the foundry has made rapid strides in the way of improving the quality and quantity of their output, and to my mind the most important of all these improvements and changes is the introduction of chemical analysis of the constiuents. The old system of judging the mixture by the fracture of the test bar was all right up to a certain point. If the fracture looked all right, everything was O.K., but if it showed sulphur blow holes or other defects how was a foreman or foundry superintendent to know whether to blame the pig iron, scrap, or coke, unless he had the analysis of each and knows how to mix materials accordingly. Right here is where the chemist comes in, for he can trace the trouble, advise how to overcome it and save dollars, both in foundry and machine shop. You are sure of your mixture when you follow his advice, otherwise it is mostly guesswork, and that does not pay in an up-to-date business.

Every foundry should have enough iron and coke on stock so as to be able to get the analysis of new cars of iron or coke before it is necessary to use the latter.

Chemical analysis has come to stay. In a few years, the air furnace will take the place of the cupola in all large machinery foundries and it is impossible to get your mixture right with these furnaces without the chemist's help. There are still a lot of foundrymen who do not consider chemical analysis practical, but I do not think it will be long before the most conservative of them will be won over. No matter how small or how large their foundry, chemical analysis will save many dollars, reduce loss and give a better quality of castings.

ATTRACTIVE FEATURES OF EMPLOYEES.

By A. E. S.

To the foreman and superintendent, the self-reliant man who thoroughly knows his business and at the same time accomplishes a reasonable amount of useful work, embodies the essential requirements of the ideal employee, and is, therefore, the type most sought.

While this is no doubt true, and if these qualities could be accurately defined and located, a very large number of officials would consider their worst problem solved; still, men who are most popular with the management, the men who receive the greatest number of promotions, are often decidedly lacking in one or more of the above features. To other industrious and conscientious, though more or less thoughtless men, the advancement of their seemingly less deserving companions arouses a sense of heart-burning and dissatisfaction.

The actual performing of one's daily work usually falls considerably short of what a subordinate should do for the man above him. His duty to a foreman should be at least humanitarian; besides, there is surely no harm in studying the disposition of the man above even to the extent of catering to his likes and avoiding his dislikes. Many foremen are decidedly crabbed and disagreeable, but workmen should not forget that this is largely the product of the treatment accorded him, and that he himself has a responsibility in this connection.

How often is the pronounced ability to do spectacular things offset by the habit of showing off to the man some stages higher up than the boss. The best man is he who finds pleasure in his work while he is at it, and the most disagreeable is the man who seems to find amusement in making someone else as uncomfortable as possible.

The ability to undertake the most difficult jobs with peculiar earnestness, the faculty of doing a little more than is expected, and the capacity to put a bit of humor in the barren spots of the day's routine are little rays of sunshine that will not only be reflected in those coming into immediate contact, but will be multiplied in him who is their disseminator. The man who is considerate of his immediate superior is the one who eventually becomes a welcomed associate.

ENORMOUS WASTE OF COAL.

Speaking before the Royal Society of Canada recently, Dr. F. D. Adams said: Perhaps the most serious waste which is taking place in our Dominion at the present time in connection with its mineral resources is presented by the mining and utilization of coal. In the first place, in mining a coal seam, from 50 to 90 per cent. of the coal is left in the workings for the purpose of supporting the roof. Of the coal which is taken out and burned under boilers in the usual manner, only about 12 per cent. of the total energy is developed. That is to say, we secure for useful purposes only about 5 per cent. of the total energy contained in the coal contained in the area. If the coal is burned in gas producers and the gas so obtained used in internal combustion engines, these, having a higher efficiency, develop about 30 per cent. of the energy in the coal actually mined, or about 12 per cent. of the energy locked up in the coal of the whole area. This is an improvement, but still represents an enormous waste.

On the other hand, coal may be mined for the production of coke for metallurgical uses. About three-fourths of the coke produced for this purpose in North America and all the coke made in Western Canada is manufactured in beehive furnaces, which yield a relatively low percentage of coke, while the other products of the coal—gas, tar, ammonia, benzol, etc.—go to waste. All these products may be saved by making the coke in by-product ovens, representing in localities where the surplus gas can be sold at a reasonable rate, a gain which is estimated by Mr. F. E. Lucas, manager of the coke ovens of the Dominion Coal Co., at $1.98 per ton of coke made. This figure will, of course, vary with the locality in which the coke is produced, but it emphasizes the great saving which may be effected by the use of the modern by-product oven.

The tar and ammonia obtained by this process, moreover, meet with a ready market. The former is already being used extensively in the Dominion for a variety of purposes—among them as a binding material in the manufacture of briquettes from slack coal, thus enabling this waste product to be successfully utilized—while the ammonia is a fertilizer of the greatest value, for which there is great demand abroad and for which an ever-increasing demand will arise in Canada as the necessity of employing improved methods of agriculture is brought home to farmers.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

With the further development of this course in arithmetic, it will be found by those who have followed the introductory lessons and profited by them that the various practical applications resulting from the succeeding lessons will be easily observed and their time and labor-saving features so appreciated as to be adopted at every available opportunity.

THREAD CUTTING.

THE elements of thread cutting and the procedure to be adopted when cutting single threads were dealt with and explained in our issue of June 25. In the present instance, double, triple, square threads, etc., are featured, allowing thereby in the combination of the two articles quite an intelligent and comprehensive grasp to be had of this important factor of machine shop practice.

To cut 30 threads per inch with a 4-thread lead screw, gears increasing by 4 from 24, being available.

Ratio=4:30=1:7½.

Using gear of 24 teeth on stud we have

$$D=\frac{A\times T}{L}=\frac{24\times30}{4}=180 \text{ teeth.}$$

To compound the train. Dividing 180 by 3, we get 60 for the gear on the lead screw. Now, the intermediate gears must have a ratio of 3:1, or 84:28, therefore,

$$T=\frac{B\times D\times L}{A\times C}=\frac{84\times60\times4}{24\times28}=30 \text{ thds.}$$

Care must be taken when cutting threads that the lead is not confused with the pitch. The pitch of the screw is the distance between the centers of two adjacent threads, while the lead is the advance in one revolution of the screw.

While the pitch and the lead are the same in single cut threads, the lead in a double thread is twice the pitch; in a triple thread, three times the pitch, etc. Chart 24 shows a single cut left-hand thread, and a double cut right-hand thread.

To cut a double thread ¼-in. pitch with a 4-thread lead screw, gears increasing by 5 from 20. When cutting threads other than single, the lead must be considered when calculating gear wheels. In this case the lead is ¼ in. x 2=½ in. or two turns per inch.

It is obvious that the saddle must travel ½ inch (two turns of the lead screw), while the lathe spindle—or work—makes one revolution.

Ratio = 4:2 = 2:1.

Multiplying both terms of the ratio by 10, we get 40:20, or by 12½ we get 50:25, or by 15 we get 60:30. Any of these pairs will be suitable wheels.

To cut a triple thread having a lead of 1¼ in. with a 2-thread lead screw, gears increasing by 4 from 24, the turns or threads per inch are found by dividing 1 by the lead of the screw, as

$$\frac{1}{1\frac{1}{4}}=1\times\frac{4}{5}=.8,$$ then ratio=2.8, or,

as was shown in a previous lesson, that multiplying both terms of a ratio by the same number does not alter its value; then multiplying both terms by 5 we get 10:4 as a new ratio.

Now, if we had gears of 10 and 4 teeth respectively they would give the desired result; but as such gears are practically impossible, we must continue the calculation further for proper wheels. Therefore, multiplying the new ratio by a number, say, 8, or the original ratio by 40, we get 80 and 32 as the required gears.

Proof—Threads per inch on lead screw multiplied by gear on lead screw equal threads per inch on the work multiplied by gear on stud; or by formula (chart 22).

$$T=\frac{L\times D}{A}=\frac{2\times32}{80}=\frac{8}{10}=.8$$

$$\text{Lead}=\frac{1}{.8}=1\times\frac{10}{8}=1\tfrac{1}{4} \text{ ins.}$$

To cut a triple thread of ⅜ in. pitch with a 4-thread lead screw; gears increasing by 4 from 24.

$$\text{Lead}=\frac{3}{8}\text{ in.}\times3=\frac{9}{8}=1\tfrac{1}{8} \text{ ins.}$$

Turns per inch

$$=\frac{1}{1\frac{1}{8}}=1\times\frac{8}{9}=\frac{8}{9}$$

$$\text{Ratio}=4:\frac{8}{9}$$

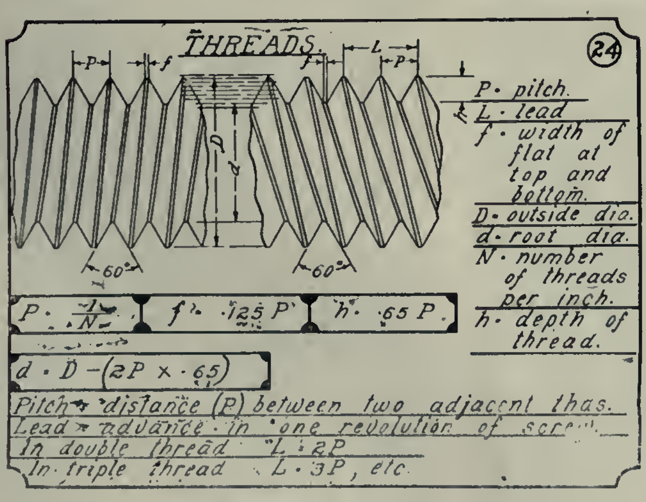
Multiplying by a number (27) for wheels required, we get 108 and 24.

Proof.—By formula (Chart 22).

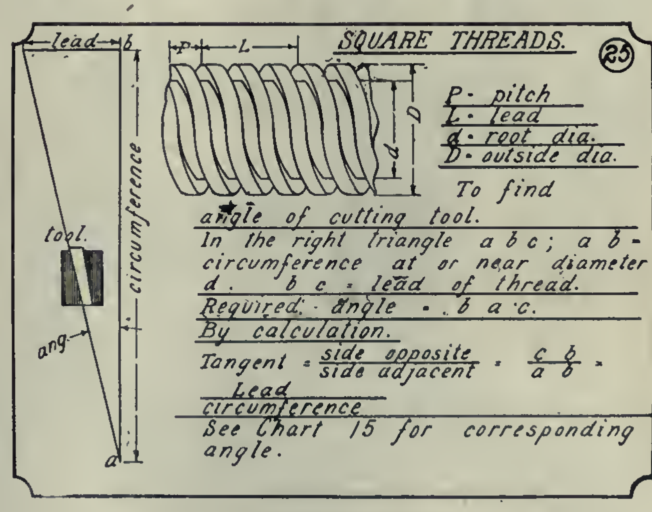
$$T=\frac{L\times D}{A}=\frac{4\times24}{108}=\frac{8}{9}$$

$$\text{Lead}=\frac{9}{8}=1\times\frac{9}{8}=1\tfrac{1}{8} \text{ ins.}$$

It occasionally happens that a thread is required having an odd pitch. In such a case the method of solution may require changing.



ARITHMETIC CHART 24.



ARITHMETIC CHART 25.

To cut a single thread of 5-16 in. pitch with a 4-thread lead screw; gears increasing by 5 from 20.

5-16 inch pitch equals 16 threads in 5 inches.

Lead screw pitch equal 20 threads in 5 inches.

Ratio = 20: 16 = 5: 4.

Multiplying by 10 we have 50 and 40 for required gears.

$$\text{Proof—}T = \frac{L \times D}{A} = \frac{4 \times 40}{50} = \frac{16}{5} = 3\frac{1}{5}$$

$$\text{Or pitch} = \frac{1}{3\,1\text{-}5} = 1 \times \frac{5}{16} = \frac{5}{16}\ \text{ins.}$$

It will be noticed that the pitch is always the reciprocal of the threads per inch, and vice-versa.

Sometimes, odd jobs appear, though not screw cutting, which require a selection of a train of gears for their solution.

To find the gears to chase a spiral having 6 turns in 9¾ inches; 4-thread lead screw, and gears increasing by 4 from 24.

$$\text{Turns per inch} = \frac{6}{9\frac{3}{4}} = 6 \times \frac{4}{39} = \frac{8}{13}$$

$$\text{Ratio — } 4 : \frac{8}{13}$$

Multiplying each term by 13 for an even ratio, we have 52: 8, and again multiplying by 3 we get 156: 24.

Having no gear of 156 teeth, we must use a compound train.

Dividing 156 by 2 gives 78, but as we have no gear with 78 teeth, try dividing by 3.

156 ÷ 3 = 52 for gear on stud.

Now the intermediate pair must be in the ratio of 3:1, or 84:28.

Proof.—By formula (Chart 23).

$$T = \frac{B \times D \times L}{A \times C} = \frac{28 \times 24 \times 4}{52 \times 84} = \frac{8}{13}$$

$$\text{Pitch} = \frac{1}{\frac{8}{13}} = \frac{13}{8} = 1\frac{5}{8}\ \text{inches.}$$

When cutting threads especially square threads of excessive pitch or lead, considerable clearance is necessary on the tool to avoid interference. To find the required angle graphically. Form a right triangle of which the short side is the lead of the screw and the other side the circumference of the work taken at or near the root diameter of the thread. Then the angle formed at A (chart 25) will be the required angle. By calculation:—

$$\text{Tangent} = \frac{\text{side opposite}}{\text{side adjacent}} = \frac{\text{lead}}{\text{circumference}}$$

Example:—To find angle when a triple square thread of ½ inch pitch is required on a 2 in. bolt, depth of thread ¼ inch.

$$\text{Tangent} = \frac{\text{S.O.}}{\text{S.A.}} = \frac{\text{lead}}{\text{circumference}}$$

$$= \frac{1.5}{1.5 \times 3.1416} = \frac{1}{3.1416} = .3183$$

Looking in chart 15 for corresponding angle we find 17 degs. 40 ft. nearly.

What will be the bore for a nut to fit a U.S. standard 3-inch bolt, 3½ threads per inch?

By formula, chart 24.

$$d = D - (2P \times .65) = 3 - \left(2 \times \frac{1}{3.5} \times .65\right) =$$

3—.371=2.629 inches diameter.

RIVETING EFFECTS.

In a paper prepared for the summer meeting of the German Naval Architects, Professor R. Baumann, of the Technical College, Stuttgart, directed attention to the importance, first, of the power applied in the forming of the rivet head and of the pressure with which the latter bore on the plates after it was formed; secondly, of the pressure of the hot soft rivet on the sides of the rivet hole; and, thirdly, of the heating experienced by the plates connected. He sounded a warning against the application of excessive pressure by means of hydraulic riveters. The plates were thereby bruised and bent, and the holes were subjected to strong radial pressure, and it was no wonder that cracks showed themselves in cases in which the material was also not of the best.

The effects of the application of excessive pressures were illustrated in the paper by a series of sketches. The importance of allowing rivets to cool down, and the advantages that might accrue from a cooling of the riveting dies were pointed out. The plate round about the rivets was found to be heated in the process of closing to a temperature of 350 degs. C., or more at a distance of 5 mm. (about 2 in.) from the edges of the holes. Strains thus set up between the hot and the cold parts of the plate were, it was shown, most intense at the weakest points—i.e., at the edges of the plates opposite the rivets. Strain figures could be observed on the plates when the latter were polished showing that the yield point had been passed.

To enable a distinction to be made between the respective effects of pressure and heat, the laboratory had pieces of riveting done with cold lead rivets, and then had the latter replaced by hot iron ones put in with the same pressure. In order to produce the flow figures on the plates, much higher pressures had to be applied in the case of the cold than in that of the hot rivets. The formation of the figures began at the points of contact of the plates. With the hot rivets, figures appeared at 15,000 kilos. (nearly 15 tons), or rather more than a quarter of the power available, although the rivet heads were not yet properly developed.

The temperatures attained in riveting were often of degrees corresponding with yellow or blue heats, which were usually accompanied by brittleness. As a result of such conditions, cracks might develop later. An examination of a boiler plate in which some of the rivet holes had developed radial cracks showed that the insides of the holes had deep rough fissures probably due to rimering. The material would subsequently have been heated to yellow or blue heats, and the combinations of tension— rimering and heat straining—had sufficed to cause the cracks. Other holes that did not show signs of rimering had escaped without cracks. The punching of rivet holes would on the application of these principles also appear in a new light.

GILDING DIE CASTINGS.

In gilding die castings the articles must be previously coated with brass or copper and have a bright lustre. The following formula will give excellent results:

Phosphate of soda.......	8 ounces.
Sulphate of soda.......	1½ ounce.
Cyanide of sodium......	6 pennyweights.
Chloride of gold........	6 pennyweights.
Water	1 gallon.

To prepare the solution, dissolve the cyanide and chloride of gold in part of the hot water and the sodium salts in the balance; then mix together thoroughly. Anodes of gold, platinum or carbon may be used, and the bath should be kept at a temperature of 180 degrees F. at 2 volts pressure. If the articles are previously coated in the copper bath they should afterward be flashed in the brass bath to save an excess of gold.

The usual lacquers should be applied to brass, copper, silver or gold finishes. In plating die castings or articles of zinc, it is a distinct advantage to use as little free cyanide as possible. If this be reduced to a minimum, very little difficulty will be experienced in the blistering of the deposit. In nickel-plating, the baths should be maintained at the neutral point, as previously mentioned.

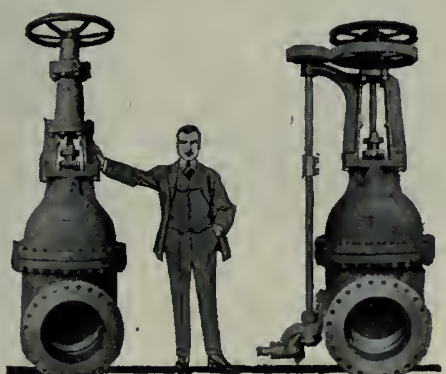
Contracts Placed. — The Board of Control of the City of Toronto, have recently placed the following contracts; Culvert pipe at $370 per foot, to the Canada Ingot Co., Guelph; electrical equipment, to the Canada Westinghouse Co., Hamilton; crushed limestone at $1.25 per ton to G. W. Essery, Toronto.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

GATE VALVES FOR N.Y. EDISON COMPANY.

PERHAPS the largest steel gate valves for superheated steam yet installed in any of the immense power plants of the American metropolis are those recently built by the Nelson Valve Co., of Philadelphia, for the New York



GATE VALVES FOR N. Y. EDISON CO.

Edison Co., New York City. That these valves are strictly in keeping with the proportions of this, one of the largest public service plants in the world is best shown by the photograph in which an ordinary man appears but a dwarf when compared to the valves beside him. Seven of these valves of the two types shown were built and shipped by the Nelson Valve Co. in fifty days from the receipt of the order, a remarkable record when it is considered that new patterns had to be made throughout.

Each valve, from top of stem, when valve is open, to bottom of body, stands 9 feet 1 inch in height, and the two types weigh 3,600 and 3,900 lbs. respectively. The valve shown at the left of the photograph is hand operated, though made with a large bushing just below the hand wheel, which may be removed for attachment of spur gears, if desired. The left hand valve is fitted with spur gears, bevel gears and chain for chain operation. The New York Edison Co. will install this valve on a vertical pipe line and run the extension stem, (to which is attached a bevel gear) through a wall for operating from another room. This valve can also be operated by chain, the chain wheel being attached directly to the valve stem. These valves will be used by the New York Edison Co., on header lines, 200 lbs., pressure and 150 degrees superheat.

Regarding the details of construction, the Nelson Co. say: — The valves have steel body and bonnets, with seat and disk wings of forged Monel metal and stem of rolled Monel. Guides in both bonnets and body are machined, also wing lugs on the gate disks. Bracks are provided on the inside of the yoke to support the gland when repacking the stem, while eye bolts at the top of the bonnet, swing out of the way so that the valve may be repacked.

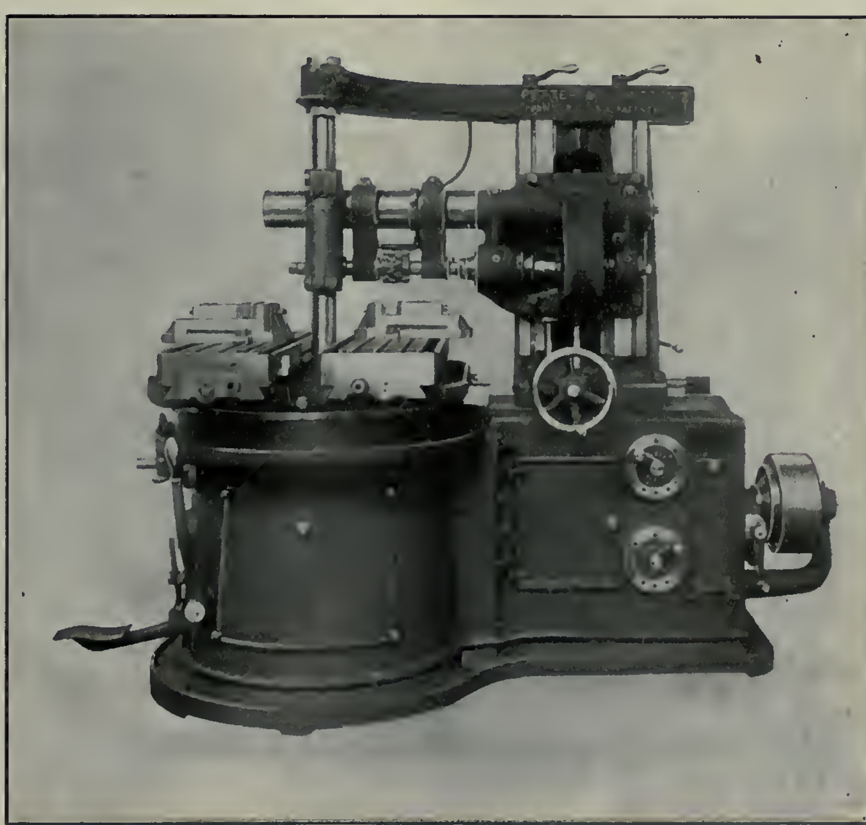
Both the steel and Monel metal used in these valves have a tensile strength of over 65,000 pounds per square inch, and the coefficients of expansion of the two metals is practically the same. This last point is an important one, since with the great changes in temperature where superheated steam is used, the expansion and contractions will cause a loosening of the seat rings, and other parts were this point not taken into consideration and provided for.

TURRET PRINCIPLE MILLER.

The description and accompanying illustration refer to a new machine being put on the market by the Potter & Johnston Co., Pawtucket, R.I., which is intended for the production of duplicate parts, and may be designated a semi-automatic manufacturing miller of the station type having a cutting and a loading position in use at the same time. It is semi-automatic, the operator only having to put work into the vise or fixture, and trip the indexing mechanism that shifts the position of the work tables. All other movements are automatic.

The work tables are located at a fixed height and parallel, and are carried on a circular saddle or turntable, which in turn is carried on a rigid base extending to the floor plate. The rotation or indexing of this turntable is the operation to which the turret principle is applied. The lost time between cuts is the time required for one index, plus a small amount of additional time, which may be necessary to clear the fixture from the cutters, as in straddle milling. The time for the overrun is reduced by providing a rapid traverse for this purpose. The rotating of the turntable is only in one direction so the finished work does not pass under the cutters after the cut is finished.

The spindle is fixed in a vertically adjustable slide which in turn is carried by a horizontally adjustable column. These adjustments are necessary for the reason that there is no knee or saddle or part to take their places. The overhanging arm and rigid arbor support are a feature of



TURRET PRINCIPLE MILLER.

the machine, and these are adapted to meet the conditions of the adjustments of the spindle slide and column.

When completing the machine the need for a strong, rigid, easily operated and compact miller vise was felt. This resulted in the design and construction of that shown in the cut. This is flanged, provided with jaws of hardened steel, and has a capacity of 6 in. wide, 1⅝ in. deep, and an opening 3½ in. long. The feature is the inserting of the wrench through the top instead of at the end. This wrench can be conveniently operated with a second bevel pinion integral with the nut on the vise screw. The construction is exceptionally compact.

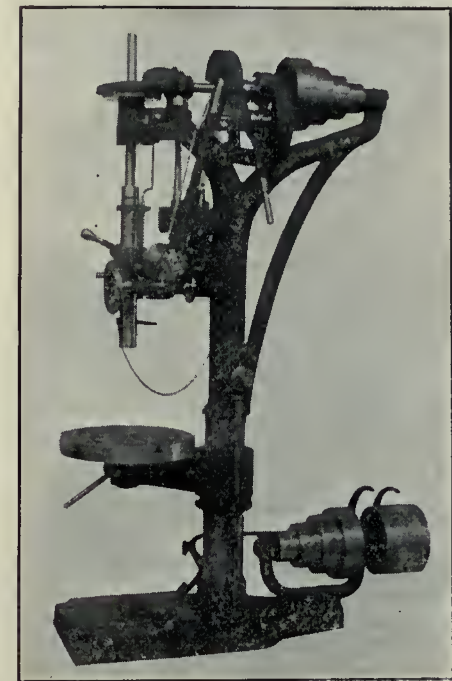
The machine complete with countershaft weighs about 7,000 pounds, and a 5-h.p. motor is recommended for the individual drive.

20-INCH STATIONARY HEAD DRILL.

The cuts represent the new 20-in. Aurora drills which have recently been re-designed and which embody some notable features. They are unusually heavy and rigid. The column and base are well ribbed, while the head is fitted on column with tongue and groove and securely bolted with three ½-in. cap screws. The bevel gears are of 3 to 1 ratio, the spindle gear being 7½ in. in diameter and made of a special semi-steel. The cone pulleys are from 4½ in. to 9¼ in. in diameter, and carry a 2½-in belt. The tight and loose pulleys of 9 in. in diameter carry a 3-in. belt and run at 550 to 600 r.p.m. The table rests on a large flat bearing besides the usual pivot bearing, thus insuring perfect alignment even when drilling on the edge of the table. The spindle is fitted with ball thrust bearing and has 8-in. travel.


PLAIN WHEEL AND LEVER DRILL.

On the plain wheel and lever drill, the worm is engaged and disengaged by means of an eccentric bush. The feed lever is operated by ratchet and pawl, which automatically disengages when in vertical position. On the power feed drill the feed gears are of hardened steel, mounted directly on the head in an oil-tight case, and three feeds can be obtained instantly without stopping the machine. Each feed is marked in view of the operator. The spindle sleeve is graduated and equipped with automatic stop collar, which disengages feed at any desired depth. Table and base are furnished with T slots. The plain wheel and lever feed drill weighs 735 lbs., and the drill complete with back gear, geared power feed and automatic stop weighs 900 lbs.


POWER FEED AUTOMATIC STOP DRILL.

The Aurora Tool Works Co., Aurora, Ind., are the manufacturers of the foregoing products.

THE QUICTITE AUTOMATIC DRILL CHUCKS.

A VERY neat automatic drilling machine chuck has been recently put on the market by the Automatic Drill Chuck Corporation of Detroit, Mich. It is the result of the increasing demand for quick change drill chucks created by the popular systems of interchangeable manufacturing.

The device consists essentially of three sets of eccentric cams geared to an outside knurled shell or cover so that rotating the shell increases or decreases the space between the cams or jaws. The simple gripping of the casing by the fingers when it is in motion serves to turn it backwards and release the drill, the jaws being returned to the closed position by means of a flat coiled spring.

The chuck is applicable to straight shank drills, counter bores and reamers within its capacity and operates at speeds as high as 4,000 r.p.m. The jaws tighten as the torsion on the drill increases and the grip is by means of curved surfaces of fairly large radius rather than sharp edges.

Quictite chucks are made in three sizes for use with drills, No. 40 to ⅜ in., 3-16 in. to ½ in., and ½ in. to 1 in., and are furnished with the regular Morse taper shanks or without as desired. The whole presents a neat and attractive appearance with no projecting points and should commend itself from a safety point of view.


QUICTITE AUTOMATIC DRILL CHUCK.

WIRE DRAWING MACHINE.

A wire-drawing machine of compact yet heavy and rigid design and furnished either direct connected to motor, in series or belted, as shown in Fig 1, is a recent product of the Standard Machinery Co., Auburn, R.I.

This machine is driven, as can be seen in Fig. 1, by a friction clutch. The driving shaft is back geared to the large spur gear which sets directly under the table, and on the shaft with this spur gear is a bevel pinion which in turn meshes with the vertical spindle of the drum. The machine is started in motion by throwing in the clutch with the shipper handle shown on the extreme left. The handle on the extreme right is for the purpose of throwing the internal clutch and setting the draw-out drum in motion.

The wiring starting attachment seen in Fig. 2, then starts pulling wire through the die, and when it revolves as far as the back of the machine, the hand lever on the starting tongs is hit by the knock-out which automatically opens the tongs, and throws the main drawing drum into operation. The wire thus started, amounting to one-half of the periphery of the drawn out drum, is clamped in the jaws on the top of the main drum, and the machine draws this continuously through the dies which are supported in the knee shown in the table of the machine. The wire yokes shown going from the inside of the main drum are for the purpose of preventing the wire from going any higher and also serve as guides for the baling of the wire.

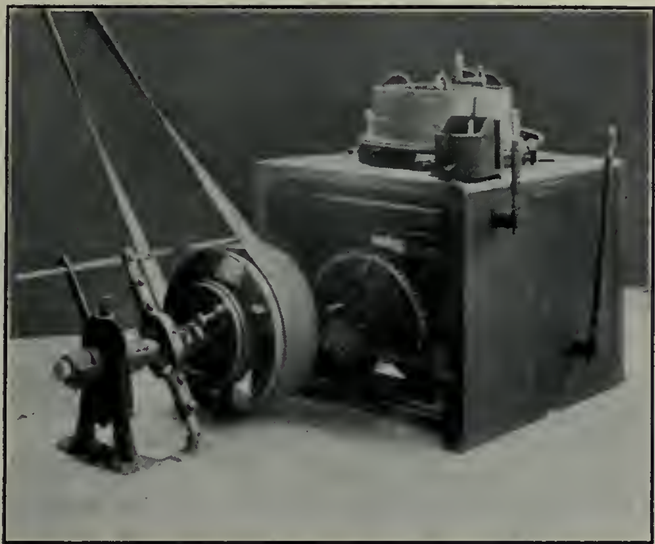


FIG. 1. WIRE-DRAWING MACHINE.

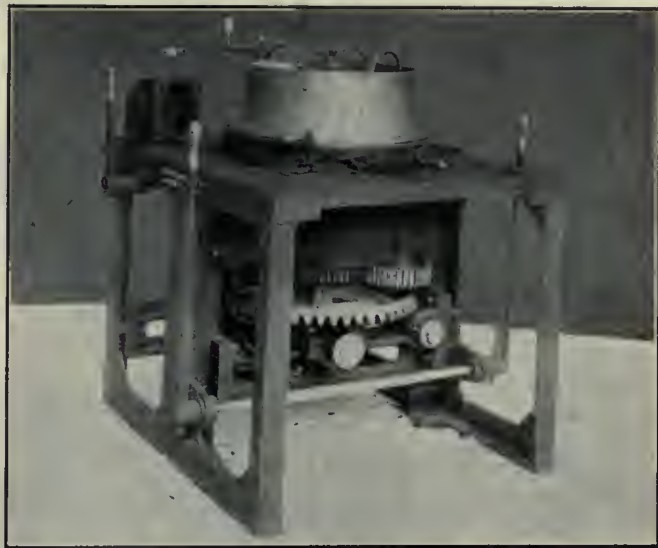


FIG. 2. WIRE-DRAWING MACHINE.

The front and back of the machine are fitted with sheet metal panels which can be easily removed when repairs or overhauling become necessary.

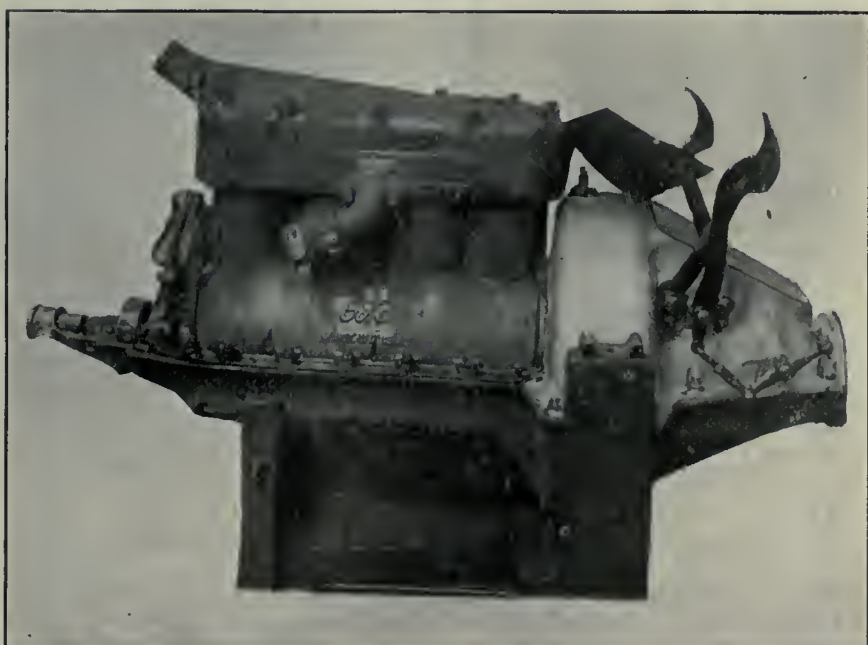
The diameter of the drum is 22 ins.; the height, 8½ ins.; linear speed, 50 feet per minute; linear speed of draw-out drum, 19 ft. per minute; diameter of clutch pulley, 24 ins.; face of clutch pulleys, 8 ins.; speed of clutch pulley 92 r.p.m.; height of machine, 5 feet; width, 4 ft. 6 in.; length including clutch and outboard bearing 7 ft., 6 in.; weight of machine, 4,000 pounds. The particular model shown is suitable for drums of 22 ins. to 30 ins., inclusive.

FORD COMPANY NEW ASSEMBLING PLANT AT LONDON, ONT.

The growth and expansion of the Ford Motor Co. of Canada, Ltd., is illustrated by the new branches the Company is constantly building, as well as by the ever-increasing number of cars seen on city streets and country roads. At the present time the Ford Company is adding three big branch assembling factories in the Dominion. Announcement has already been made that in Toronto a Ford branch factory is under process of construction; and at Montreal the site of the building is being excavated. Now comes word that at London property has been purchased and plans are being prepared for a similar assembling plant of the most modern construction and equipment.

The Ford Motor Co. of Canada is following in this manner the same policy pursued by the parent organization at Detroit. That is, it has always been the plan of the Ford management to aid its distribution machinery by the erection and maintenance of company branches at strategic points throughout the world. This is one of the secrets of huge production and the economy of manufacture that characterize the Ford, for these branches are more than sales rooms and distributing centers under company management. They are also complete assembling plants by the aid of which cost of transportation is reduced and promptness of delivery is secured.

The J. B. Turney & Co., Ltd., of Lethbridge, Alta., has been awarded the contract by the Cranbrook city council for the supply of Mannesman seamless steel water pipe. The contract is for over 5,000 tons at a cost of approximately $43,000.



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Vol. XII. JULY 2, 1914 No. 1

PRINCIPAL CONTENTS.

CANADIAN MACHINERY, VOL. XII.

VOLUME XII of Canadian Machinery starts with the present issue, and we think it opportune to direct the attention of our subscribers and advertisers not only to the scope of our publication but to the effort being made as evidenced by the practical value of the different departments, to maintain it as the premier, most effective and reliable medium in its field here in Canada.

Canadian Machinery in its editorial and advertising columns seeks to set forth the development of the machine tool and directly kindred industries not only within the confines of the Dominion of Canada but of the leading countries of the world in these particular spheres, providing thereby opportunity for the enterprise of these latter, and incentive and direction to our own manufacturers and mechanics in order that they too may design and build to the highest purpose, and in the nature of things so improve on example and precept that in the matter of achievement, all may correspondingly be benefited.

From fifteen to twenty pages in each issue, which by the way is weekly, are devoted to articles bearing on machine shop practice and equipment, this broad phrase embracing general articles on lighting, sanitation, employees' welfare, plant layouts, materials and processes of manufacture, methods and devices, systems of remunerating workmen, efficiency applications, systems of time-keeping, storekeeping and accounting, instruction courses, an editor's correspondence department for the discussion of live industrial topics, a question and answer series dealing with the arithmetical and consequently more rapid, systematic and correct determination of equipment size, disposition and application to the efficient and economical performance of not only the more common tasks but those presenting more or less hitherto unusual features, etc.

Our industrial news department, to which some half dozen pages in each issue are devoted, contains a complete and current record of business opportunities, and the privileges of having these available in snappy, compact reference form is so highly appreciated, being closely followed by manufacturers, agents and dealers, that a pardonable pride in having prominently featured a **Business Opportunity** section is naturally felt by us. There is no such phrase in our organization as **standing still**, and though for the time being industry's wheels are rolling lazily, and the scope of manufacturing enterprise is curtailed, our plans are being matured to still further enhance to our clientele the value of, to them, our indispensable **Industrial News Department.**

Market quotations on raw and finished materials entering into the various products of machinery manufacturing plants, together with weekly market letters from correspondents in touch with the pulse of business in leading industrial centers across Canada show at a glance the price of a required commodity and indicate to the shrewd buyer the influences that may be at work or that are likely to early develop, with the relative price trend.

Practically every machine and railroad shop, iron and steel mill, iron and steel foundry, steam, marine, hydraulic and electrical engineering establishment is represented on our subscription list in their capacity as such and in the persons of their employees, the foreman of every department of many of them included. Advertisers have therefore the opportunity to influence sales of machinery and equipment through the administration and operating departments with an effectiveness not otherwise possible.

Ten years of conscientious work and service have given Canadian Machinery a prestige unapproached by any class medium in Canada, and in the birth of a new volume there is abundant evidence that this will not only be maintained, but still further enhanced by the editorial service to be rendered in the various sections of machinery developments, progress and activities.

We have just crossed the threshold of a new year of experience for a United Canada, and there is no gainsaying that its close will register a further advance in the direction of added commercial and industrial achievement. That Canadian Machinery will not only contribute but actively direct such a consummation is both desirable and conclusive.

INDUSTRIAL NOTABILITIES--No. 41

JAMES WHALEN, the subject of this brief sketch, was born at Collingwood, Ont., April 29, 1869, the son of Joseph W. and Alice Broad Whalen.

He accompanied his parents to Port Arthur, Ont., in 1873, receiving his education in the public schools of that city, and thereafter entering the logging business. Following considerable experience gained and success achieved in this, he entered the field of railroad contracting.

Mr. Whalen has taken an active part in the commercial development of Port Arthur, in both its city and port feature; as a result we find him occupying the following among other positions in prominent marine and industrial enterprises, a majority of

JAMES WHALEN,
President, Western Drydock & Shipbuilding Co., Port Arthur, Ont.

which he organized: President Western Dry Dock & Shipbuilding Co., Port Arthur, Ont.; president and general manager Great Lakes Dredging Co.; president and general manager Canadian Towing & Wrecking Co.; vice-president and general manager Thunder Bay Contracting Co.; president General Realty Corporation; president Canada Pebble Co.; director Thunder Bay Harbor Improvement Co., etc.

He married Miss Laurel Conmee, daughter of James Conmee, M.P. in 1896, and has two sons and three daughters. He is a Roman Catholic in religion, a member of the Knights of Columbus, and resides at 120 Court Street North, Port Arthur, Ont.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 65
Lake Superior, charcoal, Chicago	.....	16 00
Ferro Nickel pig iron (Soo)	.....	25 00
	Montreal.	**Toronto.**
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X	18 50	17 85
Victoria, No. 2 Plain	18 25	17 60

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.00
Steel bars, f.o.b., Toronto	2.00
Common bar iron, f.o.b., Montreal	2.05
Steel bars, f.o.b., Montreal	2.00
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs.	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in.	75%
Finished Nuts over 1 in.	72%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	
Cut nails	$2 60	2 65
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼ per lb. off
Nuts, Hexagon, all sizes	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh	$20 00
Open hearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	24 00
Wire rods, Pittsburgh	25 00

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛ in	$ .05½	⅛ in	$ .12	½	$ .32
¼ in	.06	¼ in	.07½	¾	.35
⅜ in	.06	⅜ in	.07½	1	.37
½ in	.08½	½ in	.11	1¼	.52½
¾ in	.11½	¾ in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼ in	.23½	1½ in	.30	2½	1.37
1½ in	.27½	1½ in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½ in	.58½	2½ in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½ in	.92	3½ in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½ in	1.27	4½ in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	40½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload	$15 75	$15 75
Electrolytic copper	15 50	15 50
Casting copper	15 25	15 45
Spelter	5 25	5 25
Tin	34 50	33 00
Lead	4 85	5 25
Antimony	8 50	8 50
Aluminum	20 00	19 00

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3 45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue. French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15
Lard Oil, per gal.	0.60

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

BELTING RUBBER.

Standard	60%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4.95
1 inch	8.05
1¼ inch	12.65
1⅜ inch	15.30
1½ inch	16.50
1⅝ inch	19.40
1¾ inch	22.50
1⅞ inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1½-in	$37.50	$30.00	$17.50
33/64 to ¾-in.	41.25	33.00	19.25
7/16 to ½-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., June 29, — Business is still reported to be on the quiet side, though a number of contracts are said to be pending which would help considerably to liven up the situation if they could be closed. Most of the supply houses state that there is a general dullness prevailing and that there seems little likelihood of much improvement until the fall. Local building operations are considered quite satisfactory, in view of the general tendency to proceed with caution. In addition to several bank and office buildings, and two projected theaters, the Harbor Commissions are erecting new freight sheds, the Dominion Government is completing the new Customs building, and an unusual amount of residential building is also being carried on.

It was announced last week that the Canadian Northern Railway would erect a temporary terminal on Lagauchetiere Street, at the entrance to the Mount Royal Tunnel, in order to take care of traffic there next year. It is expected to have the tunnel completed and in operation by May, 1915, and the projected million-dollar terminals could not be finished inside of two years. The temporary building will be utilized later for express and freight purposes.

The Board of Control of Montreal has decided to buy a steam pump of 24,000,000 gallons capacity instead of two 12,000,000-gallon pumps, for which tenders have already been received. New tenders will be called for. The new pump will increase the daily water consumption capacity to 102,000,000 gallons.

The Shawinigan Technical Schools, at Shawinigan Falls, Que., are nearing completion and orders were placed last week for the installation of machinery and supplies with the Canadian Fairbanks-Morse Co.

Metals.

Metal markets still remain quiet and buying is of a hand-to-mouth nature. There seems to be a disposition on the part of many to buy only sufficient for immediate needs, under the impression that prices will not go higher for some time. A scarcity of pig lead is reported and a slight advance in price resulted this week. Sterling quotations are: Tin, spot £137, future £138 12s 6d; copper, spot £60 1s 3d, future £60 13s 9d; lead, £19 7s 6d; spelter, £21 5s; pig iron, £51 1s.

Toronto, Ont., June 30. — There is no perceptible change in business conditions this week. The external political situation has not improved and is having a depressing effect on the money market, and therefore on trade. Taken on the average, we should estimate that plants are running at not more than 60 per cent. capacity, but the view seems to be generally held that the turn has been made and that conditions will from this on improve. The recovery, however, will be slow, although none the less sure. There is no doubt that business is very quiet, although we hear occasionally of a revival in a specific industry. In spite of this being sometimes of a temporary character, it serves to show that conditions are not really as bad as some would suggest.

Firms most seriously affected by the depression are makers of agricultural implements, automobiles and builders' supplies. The buying season for implements and automobiles is practically over, which may account to some extent for this condition. Manufacturers will not risk laying in large stocks for next season unless the outlook improves considerably, and until there is an assured demand for their products. The building trade is quiet, and it is doubtful whether it will show much improvement this year.

Dealers throughout the country have allowed stocks to get low and sooner or later the demand must revive, and substantial orders will result when trade does pick up. On account of poor trade, manufacturers have been retrenching and curtailing expenses of all kinds as much as possible. As money becomes more plentiful and the requirements of the community accumulate, there will be created a condition which will hasten a return to greater business activity. In the meantime, manufacturers must continue to exercise rigid economy and keep a watchful eye on developments.

Steel Market.

Business in the iron and steel market shows no change, being still very quiet. The railroads, except in one isolated case reported last week, have not come into the market. The Grand Trunk Railway recently raised $10,000,000 to finance the G.T.P., and the effect of this should be seen at an early date. The reorganization of the Canada Iron Corporation is being proceeded with and it is expected that a report will be presented to the bondholders at a meeting to be held on July 2nd. The demand for structural steel is light on account of the continued dullness in the building trade. In the United States the buying of steel products this month has not come up to expectations, although the tonnage showed a considerable increase over May. Prices have been maintained except in some cases where the mills are showing a tendency to grant concessions to consumers.

Pig Iron.

The pig iron market is very quiet, little business being done. Consumers are still continuing to keep stocks as low as possible. We understand that the International Harvester Co. and the Oliver Plow Co., both of Hamilton, have recently laid off a number of hands. Both these concerns are large users of pig iron.

Machine Tools.

Dealers in machine tools have become resigned to the situation, and what would be a small order in good times assumes quite important dimensions these days. There is consolation in the fact that industries must expand and the requirements for tools will accordingly increase.

Metal Market.

Business in metals shows no change of any description, the market being quiet and demand light. Prices are steady, with the exception of tin, which has weakened, being quoted at $33.

Ottawa, Ont., June 29. — Canadian manufacturers, especially of machinery and agricultural implements, will be interested in the information which has been received from Australia that the Commonwealth is contemplating a complete revision of the tariff. An interstate commerce commission has been making a thorough investigation. Victoria, Tasmania and New South Wales have already been visited and subsequently sittings will be held in Queensland, Western Australia and South Australia. It is expected the Commission will complete its work about the end of the year.

The report received at Ottawa says:

"To facilitate investigation, special confidential forms are set out enumerating a comprehensive series of questions which must be completed by applicants soliciting amendments of the existing tariff—either for increases or decreases—and accompanied by a statutory declaration.

"Established industries must set out in detail particulars respecting the capital, value of plant, raw materials, and the number of and wages paid to employees. Prospective industries are required to submit estimates in relation to the capital, plant and employees, etc., to be engaged, should sufficient protection be granted by Parliament. In both instances, information is desired respecting imported goods of similar character, the rate of wages paid by oversea manufacturers, and evidence is solicited in regard to the articles being exported to Australia at less than the fair market value at which they may be sold in the country of production (otherwise 'dumping')."

The applications so far received are as follows:—

For increased duties or retention of duties	205
For reduction of duties or against duties	220
Miscellaneous	44
Total	469

In view of the bill which was introduced to form a tariff commission in the Canadian Parliament but which was killed by the Senate, the organization of the Australian Commission is interesting. Its scope is very wide and it seems to fulfill the duties of the Canadian Railway Board as well as that of a tariff commission. In addition to its powers in regard to railway rates, the commission is charged with the duty of investigating all matters which in the opinion of the Commission ought in the public interest to be investigated affecting:

(a)—The production of and trade in commodities;

(b)—The encouragement, improvement and extensions of Australian industries and manufactures;

(c)—Markets outside Australia, and the opening up of external trade generally;

(d)—The effect and operation of any tariff Act or other legislation of the Commonwealth in regard to revenue, Australian manufactures, and industry and trade generally;

(e)—Price of commodities;

(f)—Profits of trade and manufacture;

(g)—Wages and social and industrial conditions;

(h)—Labor, employment, and unemployment;

(i)—Bounties paid by foreign countries to encourage shipping or export trade;

(j)—Population;

(k)—Immigration, and

(l)—Other matters referred to the Commission by either House of the Parliament, by resolution, for investigation.

Personal

Geo. E. Turner, building commissioner at Edmonton, Alta., since 1909, has resigned.

W. H Young, manager of the Winnipeg office of the A. R. Williams Machinery Co., is in Toronto on business.

Henry Bertram, president of the John Bertram, Sons & Co., Dundas, Ont., recently visited Fort William, Ont.

Leonard L. Merrifield, consulting engineer to the Consumers Gas Co., Toronto, died suddenly on June 21, aged 58.

George Bradshaw, G.T.P. safety engineer, is now in Winnipeg installing the "safety first" principles among the officers and employees of the system.

A. R. Wooldridge, who is in charge of the scale sales department, Canadian Fairbanks-Morse Co., Toronto, has left on a visit to El Paso, Texas, where he will be married.

L. D. Gillett, boiler inspector of the Dominion Board of Railway Commissioners, is at his home in St. Thomas, Ont., suffering from an injury which he received to his foot while in Windsor a few days ago.

W. H. Rosevear, secretary the Western Canada Railway Club, Winnipeg, has resigned, and until the annual elections in September, Louis Kon, Immigration Agent, G.T.P. Ry., Winnipeg, will assume the duties.

Herbert M. Ewan, assistant sales manager of the Canadian Steel Foundries, Ltd., Montreal, Que., has been appointed general sales manager of the company, and also of the Canada Car & Foundry Co., and Pratt & Letchworth, Brantford, Ont.

T. C. Burpee, C.E, president of Concrete Builders, left Fredericton, N.B., on June 23, for Montreal, Toronto and other Canadian cities for the purpose of visiting the best and newest concrete plants with a view to securing new machinery. Mr. Burpee proposes buying the latest brick-making machinery on the market.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Milton, Ont.—The town will guarantee the bonds of the Imperial Foundry Co., to the amount of $7,000.

Calgary, Alta.—It is reported that an eastern corporation will locate a steel plant in Calgary in the near future.

Nelson, B.C.—The town will buy a number of gas meters, piping and fixtures. H. P. Thomas is superintendent of the gas plant.

Okotoks, Alta. — The International Supply Co., of Medicine Hat, will establish a machine shop here for repairing oil well drilling outfits.

Yorkton, Sask.—Plans are being prepared for a cooling system at the new power house, which will be under the supervision of the town engineer.

Stratford, Ont.—The Water Commission is securing information on the advisability of replacing the present steam auxiliary plant at the pumping station with a gasoline driven pump.

Toronto, Ont—The Board of Control approved of a recommendation of Commissioner Harris for an addition to the main pumping station at a cost of $97,000.

Harriston, Ont. — Fire on June 25, broke out in a warehouse belonging to the Harriston Stove Works. The loss is estimated at $1,000, which is fully covered by insurance.

Medicine Hat, Alta.—The building being erected by the Carey Wright Radiator Co. on the south industrial site was seriously damaged by a wind storm recently.

Toronto, Ont—A provincial license was issued on June 5, to the National Tube Co., incorporated by Dominion charter on January 10, 1912, to carry out all the provisions of its charter in the Province of Ontario.

Regina, Sask.—The first carload of bunkers and coal handling machinery for the new power house has arrived, and the work of installing this is now in hand. Other consignments are expected to follow immediately.

Toronto, Ont.—The National Iron Works obtained a permit recently for the erection of a $50,000 pipe foundry to be located at the foot of Cherry street. It will be one storey in height and built of brick, steel, cement and gypsum.

New Toronto, Ont. — Tenders have been asked for the pumps, building of pump-house and filters, and laying of intake pipe, and it is expected that contracts will be let shortly.

Esquimalt, B.C.—The Dominion Government will call for tenders in a few days for the new public drydock which is to be built at Esquimalt, B.C., at a cost of about $3,000,000. It will be 1,100 feet in length and similar in design to the dock under construction at Quebec.

Galt, Ont.—A new industry for this town is the Galt Ornamental Iron Co., of which John Spalding, jr., for 12 years superintendent of the Otis-Fensom Elevator Company, of Hamilton, is president, and R. J. Spalding, a well-known commercial traveler, is secretary- treasurer.

WHAT OUR MANUFACTURERS SHOULD DO.

To hold and expand our foreign trade, our manufacturers must do their part. It is not wise for the Government to attempt to supplant private enterprise or to do that for the manufacturer which he should do for himself. The manufacturer must be up-to-date in his machinery and in his methods, and in the conduct of his business. He must turn out his best goods. He must do his part co-operatively with others through trade organizations. He must go after the foreign business as well as the domestic business. He must send his agents out into the field he would occupy. He must pack his goods properly. He must outdo his competitors.

Montreal, Que.—City Engineer Janin has recommended that a 24-million gallon pump be installed at the low-level pumping station instead of two 12-million gallon pumps, for which tenders were received two months ago. The Board of Control will consult the city attorneys regarding the cancellation of the former tenders.

Quebec, Que.—The large agricultural implement factory of Charles A. Julien, at Pont Rouge, was destroyed by fire on June 23. The loss, it is said, is over $100,000. The factory was one of the largest of its kind in the province, and employed many hands. Besides manufacturing implements, the plant furnished the power for lighting, etc., in the village of Pont Rouge, and this is now cut off.

Edmonds, B.C. — Another industry wants to locate in the Burnaby municipality. Seven acres of land is the amount asked by an iron and steel manufacturing concern for a site on the Fraser river. In a letter to the Board of Trade, the company stated that they would employ in the neighborhood of 200 men and would start work on the plant in the very near future. The matter was referred to the secretary with power to investigate.

Chatham, Ont.—A special meeting of the city council was held on June 29 for the purpose of considering a proposition whereby Chatham will secure a new industry. There is a concern in communication with the city for the purchase of the old Defiance Ironworks plant, and the deal will likely be closed. This plant has been on the city's hands for some time and the present proposition is only one of many made in recent years whereby the plant would be disposed of.

Electrical

Armstrong, B.C. — A by-law is contemplated for raising $5,000 for electric light extensions.

Grenfell, Sask.—The town proposes to make extensions to the electric light system. The sum of $6,500 will be required for the purpose.

Belleville, Ont.—It is reported that the Hydro-Electric Commission will take over the Seymour Power Co. and affiliated companies.

Lucan, Ont. — The Hydro-Electric money by-law was carried here last Friday by a record vote of 95 per cent. of the available vote. Not one ballot was cast against it.

St. Catharines, Ont.—Hydro-Electric lighting was officially turned on in St. Catharines, last Saturday evening by Mayor Petrie in the presence of a number of city officials and citizens.

Simcoe, Ont—A by-law on June 26, carried by a vote of 399 to 11, to raise $40,000 for the purpose of installing a plant in connection with the hydro-electric for street, commercial and private lighting. The vote was heavy, considering the fact that no other by-laws were submitted.

Windsor, Ont. — The work on the Windsor-St. Thomas extension of the Ontario Hydro-Electric Commission's power line, has we understand progressed sufficiently to warrant power being available by the end of July. The engineers are now preparing to make the connection with the local distributing stations at Windsor and Walkerville.

General Industrial

Hamilton, Ont.—The McGregor Shirt Co. will build a factory here.

Edmonton, Alta—The Board of Education will purchase equipment for the new technical school at an estimated cost of $5,000.

Estevan, Sask.—A project is on foot backed by Regina financial men, that will assure for Estevan a large briquetting plant to make raw lignite into domestic fuel.

Oakville, Ont.—The by-law to exempt the Glassco preserving plant here from taxes and water rates for ten years, was carried by a majority of 137. This is the third industrial concern to locate here in a short time.

Sarnia, Ont.—C. L. Anker-Holt, of Port Huron, states that he expects to interest a number of Canadians in the establishment of a branch cream separator factory here. He is president of the Anker-Holt Co., of Port Huron, Mich.

Estevan, Sask.—A strong company is being formed for the purpose of manufacturing carbonized lignite for commercial purposes. The company, which consists largely of Winnipeg capitalists will build a large plant just east of here.

Regina, Sask.—Excavation work for the new Saskatchewan Co-operative Elevator Co. building, on the corner of Twelfth avenue and Smith street, was commenced recently. The building when completed, will be a two-storey structure and will cost in the neighborhood of $45,000.

New Westminster, B.C.—The Pacific Chocolate Co. plant was completely destroyed by fire on June 25. The total damage is estimated at $75,000. It was only through the exertions of the firemen that adjoining premises of the Borden storage warehouse and the Vulcan Ironworks were saved.

Redcliff, Alta.—A large deposit of silica sand has just been discovered near here. Under test it withstands a temperature of 3,000 degs., and possesses properties which indicate its suitability in clay products, iron works and rolling mills. The discovery has aroused considerable interest in Redcliff.

Vancouver, B.C.—Quite a number of offers of leases on very reasonable terms have been received by Industrial Commissioner Davison in answer to his advertisement for industrial sites. The communications which he had in hand indicate that the advantages of Vancouver are being well studied. The establishment of a cigarette factory before very long is practically assured.

Windsor, Ont.—With the finding of a supply of salt that will last 200 years, according to officials of the company, work will be started on the erection of the Canadian Alkali Co. plant at Sandwich, immediately. The company was granted tax exemption for ten years by the Sandwich ratepayers at the elections in January by a large majority. According to Manager Dodson, the plant will mean an expenditure of nearly $1,000,000 before it is completed.

St. Mary's, Ont.—It is reported that a second cement company proposed some weeks ago, is now a certainty and construction work will begin at once on a building designed to turn out about 1,200 barrels of cement a day, the capacity of the present plant. Local men as well as outside capital are involved. Mr. F. G. Sanderson is one of the leading local men in the deal. It is expected that the new plant will be in operation in time for next year's trade.

London, Ont.—In connection with the inducing of pottery and clay industries to locate here, Industrial Commissioner Phillips has had tests of clay found in this neighborhood made by the Department of Mines. The data, which has not been sent on as yet, will be furnished manufacturers with a view to inducing them to locate here. It is understood that the Department reports very favorably on the quality of the clay for manufacturing purposes.

Brantford, Ont.—The Ontario Concrete Post Co., will establish a plant here for making reinforced concrete posts for all purposes. The company has been capitalized at $40,000, and the following officers have been elected, with G. H. Cooper as manager: J. W. Clark, president; Col. J. Z. Frazer, vice-president; John O. Whiting, secretary-treasurer; Joseph R. Moyle, director; R. W. Devereaux, director; A. R. Rose, director; D. W. Henry, director.

Montreal, Que.—The Thompson & Morris Co., of Brooklyn, N.Y., which has numerous branches throughout the United States, and which manufacture corrugated paper board for packing purposes, have located on a property north of the Delorimier race track on the C.P.R. line and intend to erect a large factory for the manufacture of the above mentioned product. Vice-President Day and Manager Hays closed the deal regarding the site. The establishment of this plant is expected to involve an expenditure of over a million dollars.

Montreal, Que.—It is reported that the C. F. Massey Co., of Chicago, capitalized at $20,000,000, have closed a deal through Andrew Christ, junior, secretary, and T. H. Parker, general manager, locating a site for a branch plant to be known as the Canadian Concrete Products Co., to be situated on the line of the Canadian Pacific Railway behind the mountain on the Cote des Nieges road. The company intends to erect the building immediately. It has secured large contracts from the railways and other big corporations for concrete poles, battery wells and other products in which it deals.

Municipal

Fort William, Ont. — The Board of Works will buy a street flusher at a cost of $1,170.

St. Catharines, Ont. — A by-law is contemplated for raising $30,000 for extensions to the water works system.

North Bay, Ont.—A by-law will be voted on by the ratepayers on July 8, to authorize the purchase of fire-fighting apparatus to cost $5,000.

Windsor, Ont.—A by-law will be voted on by the ratepayers on July 3, to authorize the borrowing of $23,000 for the purpose of establishing an incinerator plant.

Weston, Ont.—The waterworks system may be improved by having another filter bed added. It is the idea of the commissioners that the new bed shall have a concrete bottom so shaped that it can be drained out.

Brantford, Ont.—By a vote of 763 to 550 property owners last Friday, car-

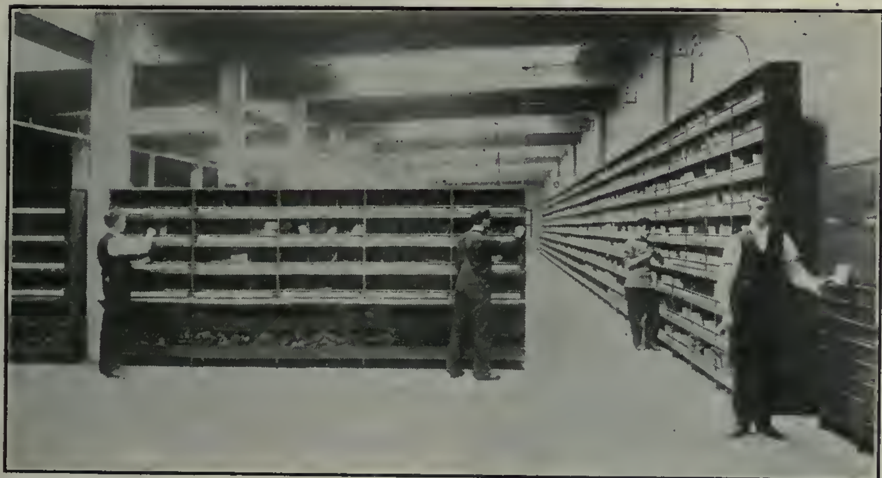
Scientific Arrangement and Operation of a Store-room

By W. G. Astle *

As a factor in the prevention of waste arising from the materials entering into the manufacture of an individual or variety products, the storeroom in its various phases, the more important aspects of which are dealt with in this article, may be reckoned as the greatest.

THE establishment of a storeroom according to scientific principles necessitates a study of the following:—

Efficiency or scientific management.
Object and purpose of the system.
Location of the storeroom.
Physical arrangement.
Care of the materials.
Method of operation and use.
Results obtained from proper maintenance.



LYON STANDARD RACKS WITH EXTENSION SHELVES AND BIN FRONT ATTACHMENTS.

Definitions of Efficiency or Scientific Management.

The Harrington Emerson definition is "the elimination of all needless wastes in material, in labor, and in equipment, so as to reduce costs, increase profits and raise wages."

The Roosevelt definition is "applying the conservation principles to production."

The Brandeis definition is "universal preparedness."

The Casson definition is "the securing of a higher percentage of results, by applying scientific methods to the activities of the business world."

In an article published in the Review of Reviews, Herbert N. Casson says that "no definition can be very accurate, for the reason that efficiency is new. Very little of it has been written in books. As a general tendency, it is everywhere; but as a clear-cut system of thought, it exists only in the minds of a comparatively small number of men."

Object and Purpose of the Stores System.

The object and purpose of a stores system is to always have on hand the proper amount of material to meet the regular requirements, but, at the same time to keep the stock as low as possible consistent with the time and cost of replacing.

To properly care for materials so that they can be given out promptly with a minimum cost of distribution.

To know what materials are required to manufacture the product in the most efficient manner.

To determine the kind and quantity of material on hand at the time manufacturing orders are put in process.

Location of the Storeroom.

The storeroom should be located convenient to railway or team connection, or both, when the material is such that it will be sent to and from places outside of the factory. To obtain the best location in relation to the other parts of the building, the elevators, aisles, and runways should be given careful consideration, and as far as possible the movement of stock should be in direct lines as determined by the general routing of the product through the factory. A careful study of this one point alone will very often reduce expenses considerably.

The location as regards the different departments should be determined by the kind and the quantity of material that one department may use, compared with the requirements of some other department. If one department uses an amount much larger than another, the location should be as near as possible to the department using the greater quantity.

Physical Arrangement.

The physical arrangement should be such that all material can be easily received and distributed when required. It should also have the proper facilities for preserving the condition of the material, and it should also be kept safe from disturbance by outside parties.

In order to handle the material satisfactorily, various kinds of trucks adapted to the product should be used. These will not only facilitate the handling, but will also aid in keeping the material in good condition.

A space should be laid out near the entrance of the storeroom for receiving before being placed in the bins or racks. There should also be laid out a space in which out-going material may be temporarily placed. These two spaces should

TERRELL ADJUSTABLE STOREROOM SHELVING.

*Storekeeper, the Toronto Electric Light Co.

be separated so that it will be impossible to make mistakes as far as incoming and out-going material are concerned. The provision of these two spaces will facilitate the work and allow the material called for by stores requisition to be got ready in advance of the time that it is actually required.

In laying out the space required for any particular material, the needs of the manufacturing department should be studied, and standards of maximum and minimum quantities established. From these figures of maxima and minima, the necessary space may be readily calculated. The storeroom should then be arranged, according to the kind of classification used, so that all of one kind will be together, and those of similar kinds next to one another. The bins should be arranged in sections with ample aisle space and good light should also be provided to facilitate the handling and listing.

The exact arrangement will depend upon the nature of the material stored. The most satisfactory arrangement yet found is that in which standard size bins are used, with provision for subdividing and re-subdividing on the unit principle. By this arrangement a large or small bin can be had by simply slipping into the larger one or more smaller units, which allows the material to occupy only the space actually required. If more space is required for a particular material, it can readily be obtained by simply removing the unit subdivision.

Bin and Rack Tags.

Each bin and rack should be provided with a means for hanging a bin tag. This tag should carry the symbol of the stock stored in the particular bin to which it is attached and entries should always be made on it whenever quantities are received or issued, deductions or additions being made with each entry so that it will always show the exact quantity of material on hand. If the materials are arranged according to some type of harmonious classification, it will not be necessary to number the bins in any way. If the material is of a class that this arrangement cannot be satisfactorily used, it will be necessary to number the bins and sections, and to maintain a bin index.

In establishments using the master bin tag, the material is stored wherever it is most convenient, and a bin index maintained. The master tag and one bin tag are placed on the first bin, and the total quantity of material stored is shown on the bin tag. When the original bin is exhausted, both the master tag and the regular tag are moved to the next bin. All bins excepting the original bin have a green tag with the symbol of the material contained therein, and sometimes the number of the original bin.

Care of the Materials.

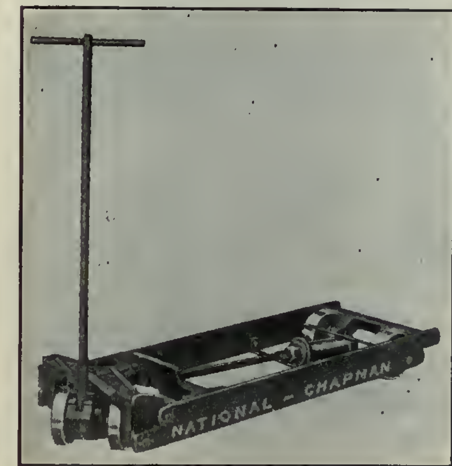
Materials can be divided into three classes, as follows:—

Raw material; being material which is bought to be used in a process before it has been subjected to that process.

Finished commodity and worked material; being material on which work has been done, and material which is introduced into the composition of another product, usually as an accessory part.

Special and accessory materials, such as tools, etc., necessary for a process, yet not actually entering into the completed article, but commonly considered a part of general manufacturing expense, particularly if used over and over, and not directly chargeable against any one particular job.

The location of these different classes of material should be arranged as regards the nature and the frequency with which they will be handled. If handled many times they should be stored near the department where used. If handled only occasionally they can be stored in the basement or a shed outside of the regular storeroom building. Consideration should be given to such features as protection from weather, theft, fires, dampness, unusual dryness, etc.



TYPE OF ELEVATING TRUCK.

The location and arrangement should be further governed by the fragility, value, weight and the bulk of the material. Consideration of these features will determine what facilities should be provided for the handling, sorting and arranging of the materials and just what provisions for light and heat will be required.

Small materials of great value must be stored in an especially safe place, such as a vault, where the protection against fire and theft will be absolute.

Materials of a delicate nature should be protected from dampness, and materials that suffer from unusual dryness should be stored in a properly humidified storeroom.

Material, such as oils, paints or others of an inflammable nature, should be stored so as to be protected from danger of ignition themselves, and also so that they will not add any undue risk to the remainder of the plant.

Fragile material should be stored so that it will not come in contact with that of a heavier or coarser nature. Unusual weight either of the individual parts or of the great quantity of material stored will necessitate the location of the storeroom upon the ground floor in order that ample support may be provided without undue expense for strengthening the floors and walls of the building. If the materials are light and easily handled and are kept in relatively small quantities, they can be stored in almost any convenient location.

Method of Operation and Use.

Materials that are received from outside of the factory should pass through the receiving department, where it should be thoroughly checked. The receiving clerk should then sort the various kinds of material, attach the lot tag showing symbol, quantity and date received, and enter each item on a receiving report, showing symbol, quantity, date, and from whom received.

Material or parts that are manufactured in the factory and returned to the storeroom for re-issuing are accompanied by a received-in-stores slip showing the symbol, quantity and date. As the materials are received they should be distributed to the proper bins, and the quantity and date received entered upon the bin tags.

The operation of the storeroom as well as the entire system will be simplified if some form of harmonic classification is used. It is the general practise to assign the letter S of the general classification as the first part of the symbol for all materials which have been purchased. This should then be sub-divided for the classified stores and followed by a consecutive number for unclassified or miscellaneous stores which are purchased in small quantities, and which are not usually carried in stock.

Material which is made in the factory and returned to stock for future use in connection with other parts for the completion or assembly of some article should be carried under some letter or letters of the general classification which would indicate the particular product for which the parts are used. This class of stores is termed "worked materials" to distinguish them from stores that have been purchased. These classes should be further sub-divided by letters and numbers to indicate the part itself. Such a classification worked out to cover the entire stores of a factory enables the material itself to be arranged consecutively in the bins in the storeroom.

If the storeroom be operated on the double bin system, the main bin, assigned for a particular kind of material, should be divided into two parts, and in each part should be placed the standard quantity, and the tag attached to the materials by the receiving clerk should be placed on the hook for that section of the bin. Stores requisitions should then be filled from one section of the bin until that quantity is exhausted, at which time the bin tag for that section should be taken off and sent to the storekeeper as a notice that the quantity on hand has reached the minimum, and that an order for the standard ordering quantity should be placed. Any stores requisition received after that should be filled from the other division of the bin. The maximum and minimum quantities should be so fixed that there will always be a part of a lot in one section of the bin. It is seldom necessary to carry more than two lots at any one time; that is, one complete lot in each section of the bin.

The maximum or ordering quantity should be large enough to enable the purchasing agent to take advantage of low prices, slow delivery, or any other market condition that would result in economy where purchasing; or if the materials be made in the factory, advantage should be taken of convenient and economical manufacturing quantities. The minimum should only be large enough to meet the requirements during the time required to secure the maximum by manufacture or by purchase.

When the materials are such that the amount on hand is subject to great fluctuation in quantity, or is not carried at all during certain portions of the year, it is more economical of space to arrange them in bins that may be available at the time. In such a case it is necessary that the bins should be numbered and a bin index showing location of each kind of material maintained. Under the single bin system these maximum and minimum quantities are carried on the balance-of-stores sheets, while with the double bin system the minimum is one lot, the ordering quantity one lot, and the maximum that seldom will be exceeded is two lots.

No material under any consideration should be given out without a stores requisition, showing the symbol of the material, the quantity and any other particulars necessary. Upon the receipt of this requisition the stock clerks should remove the material called for from the bins, make the proper entry on the bin tag, attach an identification tag to the material and place it in the outgoing section of the storeroom, where it should remain until the move-man presents a move order calling for delivery. When the material has been issued the storekeeper signs the requisition and sends it to the accounting department.

When the material has been issued for an order in excess of the amount required, the balance is returned to the storeroom, accompanied by the proper credit slip, which is signed by the storekeeper upon receipt of the material. He then places them in their proper location, and the credit slip is sent to the accounting department.

Results Obtained From Proper Maintenance.

If this department of a business be properly maintained, the following results will be obtained, which will more than pay for the operation of the storeroom, and will give facts and information which cannot be obtained in any other way:

The elimination of waste due to improper care, and to carrying stock over from year to year which has become obsolete, instead of disposing of it or using it at a time when it is of value.

Materials will be ready when wanted, and will be available in such quantities as are needed.

Ability to fix responsibility for errors.

The prevention of tying up material and labor in process on account of the shortage of some material which has not been provided.

Ordering and purchasing material becomes a matter of routine nature.

The amount of space required for storage will be less under a proper stores system, because the amount carried will be smaller and the arrangement more economical, and the consequent overhead charge for floor space will be reduced accordingly.

A knowledge will be had of the exact quantities required for economic manufacture and for running machines or jobs in the best manner for the proper fulfilment of orders.

The better care of stores of all kinds.

Ability to replenish your stock automatically when it is getting low without unnecessary delay.

The prevention of tying up material in over-large quantities and a consequent saving in the money invested in the material and in the interest charge on this money.

Ability to route material direct from the storeroom to the job or machine where it is needed, instead of delaying progress on account of the time required to purchase and secure delivery from outside.

The maintenance of a balance sheet, which shows not only the amount on hand in the storeroom, but the amount ordered, the amount available for future orders, and the amount drawn out for use during any period.

Simplicity of control with less labor to operate and a consequent smaller cost for handling the same amount of material.

If the system be properly maintained with competent help, the taking of the annual inventory becomes an easy matter; it will also be accurate. It consists of simply taking off from the balance sheets and on to the inventory sheets the quantities in the storeroom, the quantity in process, together with the cost or value. This method is perfectly practicable, but in order to obtain accuracy the help in the storeroom must be competent and all work should be checked and inspected in a routine manner.

FOUNDRY REGULATIONS.

The British Home Office have issued the following proposed new regulations governing the casting of iron and steel:

1.—Where iron plates are used in a molding shop, either as gangways or under furnace spouts, they shall be kept constantly dry.

2.—Where molten metal is carried by hand between rows of molds or boxes, a clear passage way, not less than 18 inches in width, shall be provided and maintained between such rows.

3.—Where molten metal is conveyed across an open space, a clear passage way, dry and covered where practicable, shall be provided and maintained between the cupola and the place where casting is done.

4.—No person under 16 years of age shall convey or assist in conveying molten metal.

5.—Requisites for treating wounds and burns shall be kept at hand, and be placed in charge of a responsible person.

6.—All chains used for lifting or moving any material shall have been tested and shall be periodically examined, a register being kept on the premises, containing the distinctive mark or number of each chain, the date of each test and re-test, the test load, the safe working load and the dates of annealing or firing.

7.—In any part of a molding shop where molten metal is caught, conveyed, or poured, adequate protection for the feet shall be provided and maintained in proper order and repair for the use of all persons employed.

The power of a man increases steadily by continuance in one direction. He becomes acquainted with resistance and with his own tools; increases his skill and strength and learns the favorable moments and favorable accidents. He is his own apprentice, and more time gives a great addition of power, just as a falling body acquires momentum with every foot of the fall.—Emerson.

Management -- The Efficient or Waste-Eliminating Type

By E. St. Elmo Lewis *

The present is the final of a series of three articles which deals with the subject of management as exemplified in three different types of men—the strenuous, the systematic and the efficient. The points brought out relative to the useful accomplishment and otherwise of each are worthy of careful study.

THE efficient manager has one object constantly before him—the elimination of waste. He realizes that every bit of material in his place can be used at 100 per cent. efficiency or less; that every bit of energy that he pays for can be used at 100 per cent. efficiency or less; and that time can be used in the same way. He knows that things do not happen; that there is a cause for every effect. He knows, also, that men can be taught, for he is teaching them. He knows that stenographers in an office can be taught accuracy, speed, English, or how to write a letter. He takes from his department manager the time-wasting job of acting as primary school teacher to his stenographers.

He knows that foremen should simply supervise, they should not be expected to teach men the best ways of doing work. He knows that men vary in capacity, but he knows also that men learn to do better work at twenty-five than they did when they started as apprentices; that the best men have a certain way of doing things that can be taught to others, and therefore a plant can be taught how to increase production. It is a question of analysis, planning and executing. Therefore he goes at the proposition of raising efficiency in a definite, concrete, tangible way, something like this:

Plan Starting Point and Purpose.

1.—He makes time studies of the work.

2.—He places these studies in the hands of trained thinkers and scientific men who plan the work and fit the schedules.

3.—He establishes the idea of functional foremanship.

4.—He makes improvements in shop methods necessary to get the greatest possible product from the worker.

5.—He puts a wage system at work that will place a premium upon a man who exercises the greatest efficiency. A big problem? Of course it is, but it must be solved, must it not? Its bigness does not affect its pressing call for a solution.

The efficient manager, after analysis, adopts a plan starting with the Taylor System, or the Emerson System, or any one of many, which all come under the general term of scientific management. He starts from somewhere to go somewhere in his management.

Suppose he decides to start with the Emerson system. He tests his present management against the twelve Principles of Efficiency, as Mr. Emerson calls them:

1.—Definite plans and ideals.
2.—Supernal common sense.
3.—Discipline.
4.—Competent guidance.
5.—The fair deal.
6.—Despatching.
7.—Reliable, immediate and adequate records.
8.—Determination of standards.
9.—Standard practice instructions.
10.—Standardized conditions.
11.—Standardized operations.
12.—Efficiency reward.

Department Sequence.

While this is not a treatise on general efficiency but on cost keeping efficiency, intended to show how to eliminate the waste of time, work, thought, material (all of which spell m-o-n-e-y in business) in the handling of costs, yet it is necessary to explain the philosophy of efficiency if we are to handle costs efficiently. "Increase the net," is the cry, and no manager can escape the necessity for knowing the value of what he does when it comes to costs any more than he can of any other part of his work. Every manager should realize that all work in a factory or in an office goes by dependent sequence. No man's work stands alone.

The other day a manufacturer was asked what he thought his efficiency was in different departments. He said, "He thought that his efficiency was 75 per cent. at least," and he forgot the law of dependent sequence. If the raw stock department was 75 per cent. efficient, and the department to which it first went 95 per cent. efficient and the next two were each 75 per cent. efficient at the end of the fourth operation, the end result would be only 40.1 per cent. If each of the four departments were 80 per cent. efficient, the end result would be 41 per cent.

If one department were 75 per cent. efficient and another department were 125 per cent. efficient, the end efficiency would only be 93.75 per cent. The efficient manager, therefore asks of the cost department such records as will assist in the establishment of a complete record of the efficiency and of how much it has cost to gain the amount of efficiency that has been attained. Values must be established as well as costs, and for this purpose we must have every order that goes through a plant, every function of department standardized, establishing the best as a standard of value, by which to judge our efficiency. Out of that will come the best rate of pay for each man or woman, the proper number of people to be employed in doing a particular job, the kind of men best suited for each kind of work, and the standard time for its operation. These standards should be indicated on the same records by which the system tells the actual things that were done in the course of the work. In other words, it should show standards as well as performance on each record.

If the comptroller be necessary to show where money goes, then the efficiency manager is necessary to show what is obtained for the money. The cost accountant should be concerned principally with arranging his systems of cost-keeping so that reliable, immediate and adequate records may be kept of the value of the commodities received for the money invested. The same record should show the comptroller or auditor where the money goes, and the manager where standards of value have been realized, and where losses are occurring in time, labor and material.

The Cost Accountant Feature.

In the past the cost accountant has too frequently been merely man of figures, having little or no conception of what the figures really meant. He was essentially a bookkeepeer who didn't know the significance of the things he was handling, and he was only concerned with totals, averages, percenages. So long as he secured his balance, he was satisfied with his results. He knew of no standards for comparing with values. He failed to realize that accounting really consisted of balance sheets to be used as efficiency charts. Balance sheets can be veritable miles of misinformation, for paper profits have mislead many a manager. A plant can be made to show fine profits on the balance sheets for a time, but efficiency charts would show up the starvation at a glance.

Before the cost accountant can become efficient, the management must become efficient. If the management is not efficient, the cost work will not be organized and functionalized so that it can reflect truly, adequately and completely

*Advertising Manager, the Burroughs Adding Machine Co., Detroit, Mich.

the real value of the business performance; therefore, the cost accounting has to reflect what is actually being done. No matter how efficient the cost accountant may be, he cannot make an inefficient plant or an inefficient organization efficient. He can reflect only what an organization is doing, showing blanks for those kinds or records which the management handling the business does not permit him to make.

On the other hand, no matter how efficient may be the plan or organization, no matter how efficient may be the individual members of the organization, if the cost accounting records are not efficiency records, there will never be any adequate information placed before the comptroller or the general manager that will give them an oportunity to accurately guage, in the first place, what has been received for the money, and in the second place, where inefficiencies may be eradicated.

Waste a Large Fixed Charge.

The manager under any efficient plan of organization must realize that wastes, principally those which he does not now see are the most vital concern of management. The "doer" type of American manager wants volume of production, volume of sales, volume of this and volume of that. He doesn't realize that efficiency is concerned with the net. That is the final as well as the primal test of his efficiency, of his real worth to the organization. An engineer of national prominence said the other day—"It is absolutely bewildering to note how managers will permit continuous, relatively large wastes to continue rather than incur a pay roll expense that will stop it." Let such men understand that waste is the largest "fixed charge" in most factories."

The efficient manager will, therefore, develop his cost system along the line of obtaining efficiencies as against standards set up by those who are most familiar with what machines and skilled men can produce when all these highest efficiency of production. He knows a cost system to be a means to an end, and not an end in itself. He knows that knowing costs is but the beginning of knowledge, and that unless he has some ideal standards with which to compare his costs he is still running the business with but half the information necessary to realize its greatest possible success.

Manager Type Differences.

What is the real difference between the rule-of-thumb manager and the the systematic manager? The former guesses at what happened and the latter knows what happened. Neither necessarily knows what the value of the happening really is—the latter knows what it cost, the former can't be sure, but he can pay his bills—sometimes.

The difference between the systematic manager and the efficient manager is fundamental. The former occupies his time in writing history. He is thinking of yesterday; he is always at least one day behind the work; generally he is from a week to a month behind. The efficient manager is writing prophecies. He is scientifically determining what is going to happen the day after to-morrow. He is systematic, too, but his system is projected into the future. He does not care what happened last week. He is never later than to-day. He was preparing for to-day six months ago.

Step into a great business—get behind the scenes a moment, peer into the laboratories. There are unique furnaces for steel-making, there are schools for man training, there are machines that will not be placed on the market for five years — there are careful analysis of markets to be developed two years from now. Researches are being made—men with note books and open ears and eyes are traveling—engineers are experimenting—all preparing for to-morrow.

When the day comes these managers go ahead methodically developing their day-before-yesterday plans, and the game of doing business pays for the prophetic vision. As battles are not fought under the inspiration of the moment," so the efficient manager never waits for the fighting. He always forces it."

That is the difference between the various types of managers—the difference between their business—the difference between their cost systems. It appears in the net!

Cupola versus Air Furnace in the Foundry

By "Melter"

The writer is not the least sanguine as to the displacement of the cupola by the air furnace, a conclusion easily noted in both the opening and closing sentences of the article. The subject, however, is one of deep interest to foundrymen, and we shall be glad to have experiences and expressions of opinion from those who have had the opportunity of making the necessary comparisons.

WHETHER the air furnace has come to stay, as was intimated by U. K. N. in his article in a recent issue of your journal, is a very interesting question. The outstanding features as I view them are:—

The air furnace is principally used for melting iron to be turned into malleable because the silicon and carbon can be accurately controlled and the burning out process stopped at the required point. Malleable castings commonly contain a total carbon content of 2.75, which was possibly reduced from 3.50 and a silicon content around .60 per cent. reduced from silicon .80 to 1.2. Malleable is however, largely being supplanted by steel in the car industry.

My experience has been that very little scrap is being used on account of the difficulty of averaging up the analyses of the scrap pile, which would possibly vary more in sulphur and phosphorous than in any other elements. Both of these, however, are necessary up to certain points. Phosphorus up to about 0.7 per cent., has no apparent effect, while sulphur which has been assumed to be the cause of so much trouble to the foundryman in the past is now being used up to .18 per cent. in chilled iron and as high as .20 per cent on occasions in the grey iron foundry. When melted hot it gives no trouble, but just how much sulphur one might allow to be present depends upon the manganese content, for the bulk of the sulphur not present as manganese sulphide is present as iron sulphide which is more brittle.

Manganese sulphide unites in drops while iron sulphide spreads out in sheets producing lower ductility and strength. The freezing temperature of manganese sulphide, about 2,550 degs. F., is much nearer the melting point of the iron, while iron sulphide solidifies at a very much lower temperature, thereby producing inequalities in the iron. This difference in the coefficients of expansion are what cause hot shortness as they occur at a red heat. The air furnace metal takes up from 1/100 to 8/100 of 1 per cent. sulphur from the gases, but, as pointed out above, the sulphur content can be neglected if sufficient manganese is present, and if enough silicon be added to counteract the effect of sulphur on the production or rather retention of carbon in the combined form which effect is about fifteen times as great. In other words each .01 sulphur is equivalent to .15 silicon.

If a cupola be carefully lined, patched up to preserve the right contour, blast pressure adjusted uniformly depending upon the size of cupola and grade of fuel, slagged periodically, coke and iron charged carefully and the latter thoroughly sized and mixed on the buggies before charging, as is done in any well regulated foundry, there should and will not be enough variation to be noticed by transverse or tensile tests. The only noticeable points, and then only on low silicon irons, will be on chill tests due more to temperature conditions than to large variations in analyses.

Comparative Analyses.

Results of analyses, transverse and tensile tests on cupola and air furnace irons from my observations show an increase in strength of approximately 6 per cent. in favor of the air furnace.

	Cupola.	Air Furnace.
Silicon	1.8	1.8
Manganese	.5	.7
Sulphur	.15	.08
Phosphorous	.55	.40
Combined carbon	.70	.70
Graphitic carbon	2.80	2.80
Total carbon	3.50	3.50
Transverse test,	2,700 to 3,100 lbs.	2,900 to 3,300 lbs.
Deflection	.15 to .20	.17 to .22
Tensile strength. Lbs. sq. in.	24,000 to 28,000	27,000 to 30,000

The bars are of the American Society for Testing Materials standard, and are $1\frac{1}{4}$ in. diameter cast in dry sand and tested on 12 ins. supports. After they are broken, one-half is turned in a lathe for tensile test.

The principal points involving the physical properties of cast iron are:—Hardness, grain structure, shrinkage, fluid properties, resistance to heat, strength, elastic properties, resistance to wear.

My observations have shown that melting just hot enough to pour castings $\frac{1}{4}$ in. thick and getting them good gives the strongest metal for high silicon (silicon 2.00, manganese .50, total carbon 3.50), and where the silicon is low the colder the iron the stronger the bars. Bars slightly and uniformly mottled all through give the highest bar strengths. The rate of cooling through the solidification range or the establishing of a high melting zone (consequently melting quickly), and melting just hot enough and no hotter governs the size of graphite crystals, for in the case of high silicon irons the graphite separates within the semi-liquid iron and gives the crystals of graphite more chance to grow larger, whereas the graphite in iron melted at a lower temperature and formed within the solid metal will not have such large graphite plates. All these points may be adjusted with as much ease in cupola as in air furnace melting.

Comparative Melting Cost and Speed.

The cost and speed of air furnace melting are the greatest factors in determining whether the air furnace has come to stay or not. Speed is important because in foundries where cupolas are in operation it takes three hours to melt 45 tons of iron and an air furnace requires from four or five hours for the same tonnage.

Cupola

Pig iron, 1,500 lbs.	$16.6
Steel, 1,000 lbs.	5.8
Scrap, 2,500 lbs.	19.25
80% Ferro-Mn., 30 lbs.	.75
Cost of tapping, weighing and charging	.60
Fuel, 630 lbs.	1.97
	$44.97
Cost per 100 lbs.	90c.

Air Furnace.

Pig iron, 5,000 lbs.	$46.9
Steel, 1,000 lbs.	5.8
Scrap, 2,000 lbs.	15.4
Coal, 2,000 lbs., $6 per ton	12.0
Cost of tapping, weighing and charging	5.28
	$85.38
Cost per 100 lbs.	$1.67

Difference per 100 lbs. in favor of the cupola, 16.7 cents.

The cost of coal may seem excessive but where hand firing is done it is necessary to obtain best results to have a long flame coal with an analysis of approximately:—

Total volatile matter	38.1
Fixed carbon	54.8
Ash	7.1
Sulphur (low)	8.2
Total combustible matter	92.42
British thermal units	14,270

When using pulverized coal this cost may be reduced considerably.

Tapping Air Furnace Iron.

As to the difficulties experienced in tapping air furnace iron in small quantities I have not been up against the proposition. Generally, in malleable plants the moulders line up and catch hand over hand from the spout and pour it back into the furnace, in this way mixing the iron thoroughly. This is advisable if a silicon addition has been made and if the furnace was charged cold. The iron on the top which is subjected to the direct flame is far hotter than that underneath. When ready the iron is retapped as before, and if castings are two hundred pounds or so, two or more moulders are employed. As to varying the depth of chill on rolls this can be accomplished by using varying sized chillers, heating the chillers, taking iron at different temperatures (in low silicon irons the colder the iron the more chill), and tapping the furnace before the silicon and total carbon is at its lower point.

One of the largest piston rings manufacturers in the United States is turning out a gun iron melted in the air furnace and comparative results show that there is nothing in favor of air furnace over cupola melted iron. In my opinion the cupola will never be superseded by the air furnace, but one of these days electricity will take care of the melting of iron for metallurgical purposes.

APPROPRIATENESS OF MATERIALS.

By A. E. S.

THE great amount of time and thought given to the design and composition of bearings has resulted in the production of very high-class anti-friction journals and boxes for rotating parts. It is peculiar that an exceedingly well-trained designer will often, after accomplishing the above, give little attention to other equally wasteful sources of friction and will construct mechanisms regardless of the rule that friction is greater between similar substances than dissimilar ones.

In plants where much large and important machinery is made the writer has noted that little attention is paid to making pistons, piston rings and engine cylinders of different and most suitable grades of iron. We have seen cross-heads and guides cast from the same ladle at the same time where much could be gained even by casting one of the wearing surfaces at the beginning of the heat and the other near the end.

Great improvements have been accomplished by chilling the bearings for tumbling barrels and casting the journals of soft gray iron. The remarkably long life of modern high-speed gasoline and air engines can, in many cases be attributed to making cylinders of a hard close grained iron and annealing the pistons or vice versa. Great virtues have been attributed, and in a great many cases rightly, to Muntz metal, Monel metal and similar compositions, which, under conditions where non-ferrous metals are essential, accomplish the same thing that could be brought about by varying the composition of the brass.

When it is realized that with the aid of grinding machinery, castings can be machined when harder than a file, and that by annealing suitable gray iron it can be made soft enough to cut with a pocket knife and to machine at 600 ft. per minute, some idea of the variety of iron available can be the better realized.

There is no doubt that very much has been accomplished along these lines by the larger specialty manufacturers with the aid of analytical chemistry. There remains, however, a great deal to be accomplished by the man who builds expensive machinery in small quantities or single units with the help of judgment and horse sense.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

BORING MILL PRACTICE.—I.

By Albert A. Dowd.

THE vertical type of turret lathe is a machine of great manufacturing possibilities when in the hands of a competent operator and supplied with a full complement of tools. It can also be used to advantage for single piece work with a very modest equipment. The excess of power which is a feature of the machine and its great adaptability to various conditions, together with its convenience and rapidity of operation, makes it

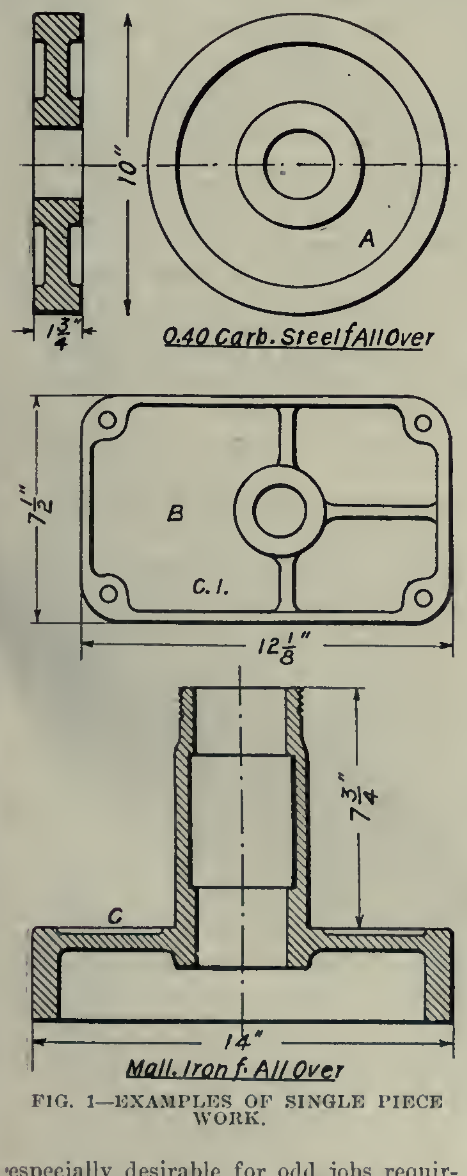


FIG. 1—EXAMPLES OF SINGLE PIECE WORK.

especially desirable for odd jobs requiring heavy cutting and a great saving in production time can be effected by its use providing the tool equipment is carefully selected. In using this type of machine for single piece work there are several important points which have an influence on the rapidity and accuracy with which the work can be handled.

Important Points in Handling Single Piece Work.

First.—The skill of the operator is one of the most important factors in handling work of this character, and in addition to his ability in this regard, he must also be a man who is quick to understand the important points in the work and one who can read a blue print rapidly. If the shop conditions permit, it will be found advantageous to allow one man to handle as much of this single piece work as possible, for his familiarity with his tools will allow him to use the machine much as another man would use a lathe on which he might be at work constantly.

Second.—There should be a conveniently accessible rack or table on which the tools and holders necessary for this class of work can be kept. These should be considered as a part of the equipment of this particular machine and should not be kept in the tool crib or borrowed by other men.

Third.—The tool equipment itself must be carefully selected according to the general class of work to be handled. All cutting tools should be of high speed steel and should be well kept up so that they will be ready for use at all times. A good operator will attend to these matters without being told.

Fourth.—The equipment of jaws, clamps, plugs, bushings and bolts must also be carefully looked after so that when changes in setting become necessary, the means will be at hand by which the work can be profitably handled. A few shims and a set of size blocks will also be found valuable aids.

Examples of Single Piece Work.

Figure 1 shows several examples of work which can be very profitably handled on a vertical turret lathe even when only one piece at a time is wanted. The upper illustration A is a forged (hand) gear blank of 0.40 carbon steel, about $10\frac{1}{4}$ diameter by two inches thick in the rough state, and somewhat irregular due to its being hand forged. It is to be finished all over to the dimensions shown, and no work has been done on it except the rough drilling of the hole $\frac{1}{4}$ inch undersize.

The middle figure B is a bracket having an internal hub eccentric to the outside of the casting. This bracket is of cast iron and is to be faced on one side along the edges and the hole is to be bored and reamed. General dimensions are given on the drawing.

The lower Fig. C in the illustration is of malleable iron and is to be finished all over, although the relieved portion of the web is simply roughed out, being afterward painted so that no great accuracy is required at this point. Attention is called to the fact that the inner surface of the hub is relieved, while the upper end is threaded.

Tool Equipment for Single Piece Work.

Fig. 2 shows a group of tools, holders, etc., which will be found adapted to a wide variety of work. Nearly all of these are standard and can be bought of

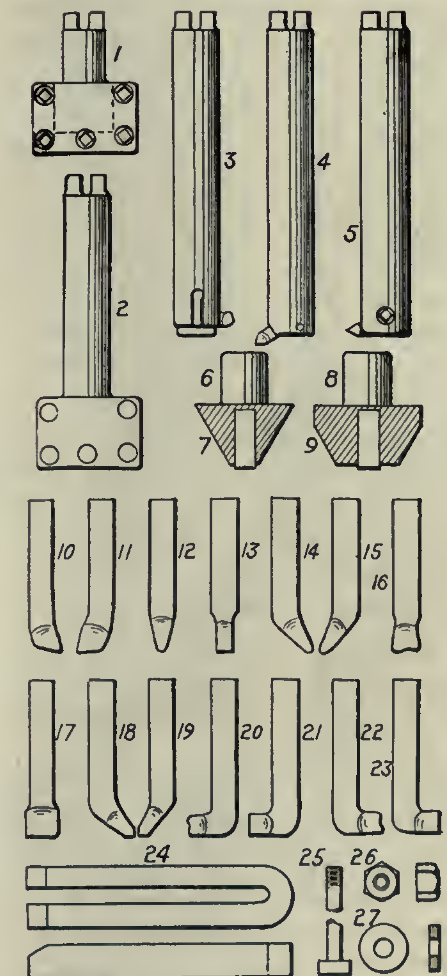


FIG. 2—TOOLS AND HOLDERS FOR A WIDE VARIETY OF WORK.

the manufacturer at reasonable prices, while those which are of special design may be very easily and cheaply made.

Nos. 1 and 2 are respectively regular and extra long tool holders for use in the turret, and designed to hold any of the forged tools. These holders are slotted to receive the tools and are provided with set screws by which tools can be firmly held.

No. 3 is a combination boring and reaming bar having a series of "slip cutters" for boring and reaming holes of various diameters. These cutters may be bought in sets for any specified size of hole, one bar being sufficient for a number of sizes when provided with the proper cutters; three sizes of bars are enough to cover a wide range of work with cutters for standard size holes. The reaming cutter floats in a slot, thereby obtaining much the same result as a floating holder.

No. 4 is a regular bar having an angularly placed cutter, which may be used for turning, facing or boring, while No. 5 is a thread chasing bar which can be used for either external or internal threads in connection with the thread chasing attachment of the machine.

No. 6 is a steel stem on which a conical shell 7 is mounted for the purpose of roughly centering the cores in irregular work. Nos. 8 and 9 are for the same purpose but of larger diameters.

The group of forged tools Nos. 10 to 23 inclusive is sufficient to cover almost all conditions which may come up in the general process of handling single piece work. No. 10, 11, 12, 14, 15, 16, 20 and 22, are roughing tools, while the remainder are used for finishing. Nos. 16, 17, 20, 21, 22, 23 are special, but all the others are standard tools.

Nos. 10 and 11 are intended principally for use in the side head for heavy turning operations, and they can also be used for facing or undercutting. No. 12 is a plain round nose tool the uses of which are manifold. No. 13 is a finish facing or grooving tool. Nos. 14 and 15 are right and left turning and facing tools for roughing operations, and they will cut in two directions. No. 16 is a special roughing tool which can be used to cut in three directions, while No. 17 is a finishing tool having the same characteristics. Nos. 18 and 19 are right and left finishing tools for the same purpose as 14 and 15.

Nos. 20, 22, 21 and 23 are roughing and finishing right and left offset tools for shoulder work or something of a similar nature. All these forged tools should be made in duplicate. The U-straps, bolts, nuts and washers, 24, 25, 26 and 27 are very important and should be provided in several sizes.

Machining a Plain Spur Gear Blank.

It is important in setting up a machine for single piece work of constantly changing character, to so select the turret and slide head tools so that as few alterations as possible will be required when handling the various pieces. The turret and side head set-ups shown in Fig. 3, will be found capable of handling a considerable variety of work with very little changing. The three tool holders F. J and L are placed as shown in the main head turret and are provided respectively with the starting tool E, and the roughing and finishing tools K and M. The combination boring and reaming bar N is provided with cutters for boring as shown at O and slip floating reamer blades P, for sizing the hole. The side head tools Q and R are respectively rough and finish facing and turning, while S and T are shoulder tools.

The table of the machine is of the three-jawed universal type having a set of standard jaws C, by which the work is centered and held. In this instance

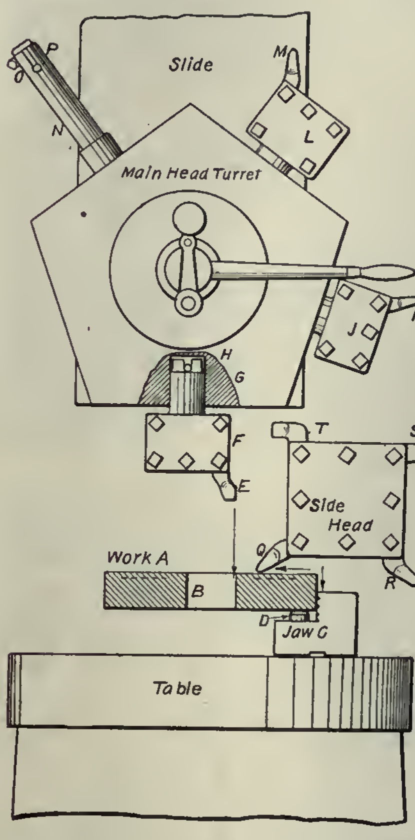


FIG. 3—SET UP FOR PLAIN SPUR GEAR BLANK.

a set of raising buttons D is used to support the blank A so that a part of the periphery may be turned at the first setting in order to provide a method of holding for the second setting. These buttons rest in the screw holes of the jaws and are obviously all of the same height.

In machining this piece of work, the main head is set over beyond center sufficiently to enable the starting tool E to remove a little of the surplus stock in the hole to a diameter slightly smaller than the first boring bar tool O. The side head tool Q is started on the facing operation and the starting tool removed by indexing the turret until the tool K is in position, after which it is started facing out from the center, and the side head drawn back out of the way and used for partially turning down to the top of the jaws, as indicated by the arrow.

The offset roughing tool S in the side head is now brought into use to cut the relief shown by the dotted line and after starting the feed out away from the center, the main head turret is indexed and the facing tool M follows closely after it for the finish facing. The tool R in the side head finish turns the periphery while the facing tool in the main head is completing the facing operation. The table is now speeded up and the boring and reaming bar N finishes the hole to size. It is advisable to allow a few thousandths for the final finishing of the periphery, this final cut being with the tool R. The piece may now be removed from the table and laid aside for the time being unless it is wanted immediately.

If any other work of a similar nature be waiting to be machined, this should be placed on the table and machined before the jaws are changed for the second setting of the gear blank. A considerable amount of time can be saved by using a little forethought when handling work of this character, by combining several jobs so as to avoid the constant changing of chuck jaws. It is not always possible to do this if the work be required in a great hurry, but it is well to bear it in mind so as to take advantage of the situation whenever possible.

Lubricating Wire During Drawing.—According to a recent patent for lubricating wire during drawing, lubricating material combined with organic binding material is applied to the wire, and the binding material is carbonized to cause the lubricant to adhere to the wire. A suitable lubricant is made by incorporating glucose or cane sugar with graphite stirred up in water; one pint of the material known under the trade mark "Aquadag" is mixed with 2½ pints of water, to which is added about 70 c.c. of the glucose solution sold as "Karo Korn syrup" or cane sugar boiled down to molasses. Suitable preservative, such as a solution of bichloride of mercury, may also be added. The preparation may be applied by drawing the wire through a vessel or cotton waste containing it, or by passing it over a grooved pulley running in the liquid.

Le Pas, Man.—A contract has been awarded to the Canadian General Electric Co., for motors, and to the De Laval Steam Turbine Co., of Trenton, N.J., for two 250-h.p., two-stage centrifugal pumps and two 10-h.p. vertical singlesatge pumps.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

With the further development of this course in arithmetic, it will be found by those who have followed the introductory lessons and profited by them that the various practical applications resulting from the succeeding lessons will be easily observed and their time and labor-saving features so appreciated as to be adopted at every available opportunity.

TAPER WORK.

IN calculating for the offset of the tail-stock center or angle of inclination of compound rest or dividing head on the milling machine, or other means whereby the necessary results are obtained, some interesting and often apparently difficult problems may be involved, but by a close scrutiny and an application of some already noted principles, many, if not all, of these seemingly cut-and-try methods may be accurately solved by the use of a few formulae and the knowledge of how to apply them. When offsetting the tail-stock center to cut a taper, extremely accurate results cannot very easily be obtained, due to the varying depths to which the centers go into the work; but for very close approximate results the formulae on chart 26 are given.

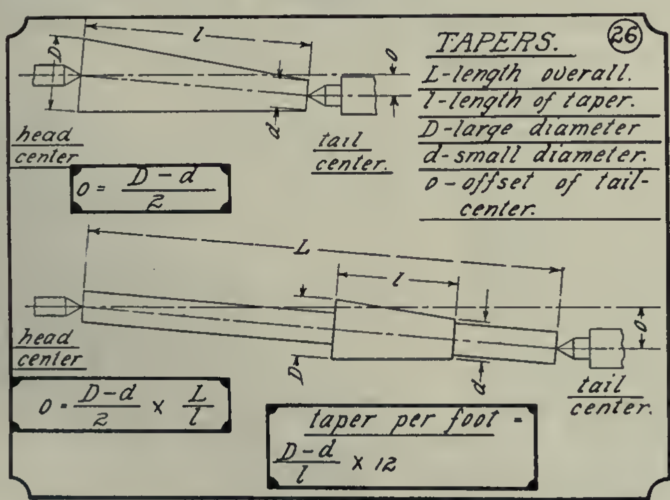
When the taper to be turned forms only a fraction of the total length, use the formula, $O = \frac{D-d}{2} \times \frac{L}{l}$, where L = length overall, l = length of taper, and D and (d) same as before.

Example:—A piston rod 3 ft. 2 in. long has a taper end with a length of 6 in., large diameter $2\frac{3}{4}$ in. and small diameter $2\frac{1}{2}$ in. Find offset of tail-stock center.

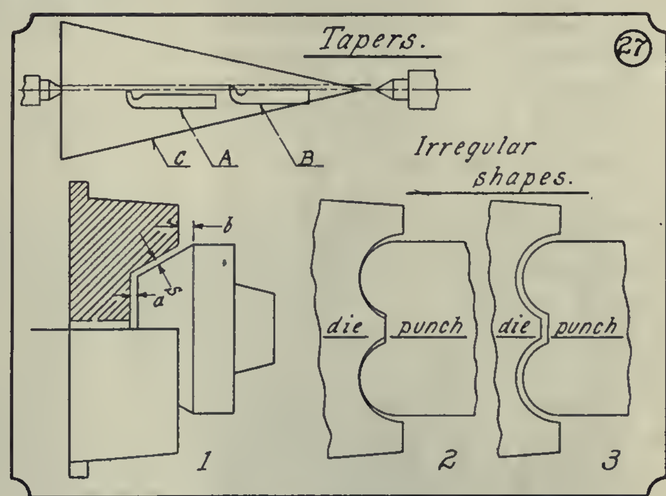
By formula, $O = \frac{D-d}{2} \times \frac{L}{l} = \frac{2.75-2.5}{2} \times \frac{38}{6} = \frac{.25}{2} \times \frac{38}{6} = \frac{4.75}{6} = .791$ inches, or $\frac{51}{64}$ in. nearly.

the error will be in proportion to the position in height of the tool. This may be easily seen when fitting tapers. If the tool be not on a level with the lathe centers, each additional cut will show a different taper.

In fitting tapers or odd shapes in forming tools for bar stock or sheet metal, allowance must be made for the necessary stock. To form the stock, the space (a) and the space (s), chart 27, will necessarily need to be the same, but if the punch be lowered so that the faces (a) come together, there will still remain clearance between the two faces at (s), due to the vertical travel of the punch. This may be more clearly shown at 2 and 3, where 2 shows the punch resting freely in the die, while at 3



ARITHMETIC CHART 26.



ARITHMETIC CHART 27.

If the taper run the full length of the work, or from center to center use the formula $O = \frac{D-d}{2}$, where O = offset of tail-stock center, D = large diameter and d = small diameter.

Example:—A tapering plug (frustrum of a cone) is required, large diameter 8 inches, small diameter 5 inches, and length, 14 inches. Find offset of tail-stock center.

By formula, $O = \frac{D-d}{2} = \frac{8-5}{2} = \frac{3}{2} = 1\frac{1}{2}$ inches.

Example:—A shaft similar to that shown on chart 26, is required, having an overall length of 5 ft. 3 in. The tapering part (l) has a length of 8 inches and a taper of $\frac{1}{8}$ in. per foot. Find offset of tail-stock center.

Here the equal of D—d is the taper per foot multiplied by the length overall in feet; or $.125 \times 5.25 = .656$, then $O = \frac{.656}{2} = .328$ inches, or $\frac{21}{64}$ ins. nearly.

When cutting tapers, care should be taken that the cutting edge of the tool is the same height as the centers, otherwise the work will not be true. As all tapers are cones or frustrums of cones, it is obvious that the only possible straight line will be from the apex to the base, therefore the cutting tool must travel upon this line; see A, chart 27.

If the cutting edge of the tool be below or above the center, as at B, chart 27, the punch is raised equal to the thickness of the metal being operated on.

Shop Problems.

In **Canadian Machinery** of May 28, a short letter appears from J. Davies with reference to the milling of square centers. Problems of this nature come generally under the section of the solution of triangles. As it will be impossible in this brief course of lessons to deal with every specific case where shop arithmetic may be applied, suggestions such as this from those who have met puzzling questions in their daily work, will receive due consideration, and if possible be answered by bringing them to the attention of the editor.

SAFETY FIRST IN RIVETING.

As a result of the "Safety First" movement, numerous safety appliance laws are being drafted, among the provisions of which are requirements that riveting hammers embody in their construction devices to prevent the accidental ejection of the rivet set from the nozzle of the hammer. A novel rivet set retainer is that now put out with the "Little David" pneumatic riveter.

The retainer consists of but a single piece of heavy spring steel, closely wound into a spiral form. One end of this spring fits over the outside of the hammer nozzle and hooks over a projection integral with the nozzle. The other end is wound to a smaller diameter. Sets for rivets over ⅞-inch diameter are formed with a coarse thread, and are simply screwed into place. Sets for rivets ⅞-inch diameter and smaller are formed with a shoulder, and are slipped into the retainer while it is detached from the hammer, the shoulder holding it in place. The device positively prevents the rivet set or piston from being driven out, even when the hammer is run free.

Other important improvements have been embodied in the above riveter. There is but a single ground joint handle and barrel, and these parts are securely held together by two bolts, one on either side of the barrel. This construction eliminates the need of a vise in taking the tool apart for inspection, a feature of value to the structural worker, as well as others who are not usually equipped with special facilities for repair work. There are no threaded joints on the barrel. The valve chamber is placed beside and parallel to, instead of in line with the cylinder, obviating all possibility of injury to the valve by the piston. This construction gives a short tool, adding to its usefulness, as it can be used in closer quarters.

"Little David" riveters are manufactured by the Ingersoll-Rand Co., of New York and Montreal, and are made with either outside or inside types of triggers, in five regular sizes adapted for all kinds of riveting work. In addition, there are two sizes of jam riveters, which have an exceptionally short over-all length, making them also peculiarly well adapted for riveting in very cramped quarters.

FOUNDRY AND MACHINE CO. EXHIBITION.

We are advised that the coming Foundry and Machine Co. Exhibition to be held in Chicago during the week of the American Foundrymen's and Allied Associations' Convention will probably surpass in scope and variety of equipment last year's junction. A large number of reservations have already been made, and several manufacturers have increased their space of a year ago, while the number of exhibitors seems likely to exceed that of any previous occasion.

AMERICAN FOUNDRYMEN'S ASSOCIATION CONVENTION.

The advance program for the annual convention of the American Foundrymen's Association at Chicago, September 7-11, has now been prepared, and will be generally as follows:

Monday, September 7.—Registration at the LaSalle Hotel.

Tuesday, September 8, 10 a.m.—Joint meeting with the American Institute of Metals and Associated Foundry Foremen at the LaSalle Hotel. Formal addresses to be followed by a number of papers on "Safety Work in Foundry Operations."

Tuesday, 2 p.m.—Individual session of the American Foundrymen's Association at the LaSalle Hotel. Papers will be presented on "Foundry Construction and Equipment."

Wednesday, September 9, 10 a.m.—Joint meeting with the American Institute of Metals at the Saddle and Sirloin Club, adjacent to the International Amphitheater, where the Foundry and Machine Exhibition Co. will conduct its big exhibition of foundry equipment and supplies. This session has been termed a "Cost Congress." Paper will be read and addreses delivered on the necessity of obtaining accurate costs in foundry operations. How to make bids for work will be discussed and a report on this all-important subject will be submitted. The cost committee of the American Foundymen's Association will present its annual report, suggesting a revision of the Standard Foundry Cost System and a number of papers will be read on "Efficiency in Foundry Operations."

Wednesday, Noon.—Ladies' luncheon at the Stockyards Inn.

Wednesday, 2 p.m.—Entire session devoted exclusively to the discussion of "Malleable Foundry Practice."

Wednesday Afternoon. — Stockyards inspection.

Wednesday Evening.—Visit to the White City.

Thursday, September 10, 10 a.m.—This session will be devoted to "Steel Foundry Practice," the program being prepared by R. A. Bull, senior vice-president of the American Foundrymen's Association.

Thursday, 2 p.m.—This session will be devoted exclusively to the presentation of papers and the discussion of "Gray Iron Foundry Practice."

Thursday Evening.—Banquet at the LaSalle Hotel, for members only. Speeches will be limited to one or two addresses by speakers of national fame. Banquet for ladies at the LaSalle Hotel.

OFFICERS ELECTED BY ELECTRICIANS.

Canadian Electrical Association. — The Canadian Electrical Association concluded its twenty-fourth annual meeting on June 26. Colonel D. R. Street, Ottawa, was re-elected president, and the other offices were filled as follows.— First vice-president, D. H. McDougall, Toronto; second vice-president, R. M. Wilson, Montreal; third vice-president, Wills Maclachlan, Toronto; honorary secretary, T. S. Young; secretary-treasurer, Alan Sullivan, Toronto. Managing Committee—J. S. Gould, Smith's Falls; G. W. Magalhaos, Toronto; P. T. Davies, Montreal; H. G. Matthews, Quebec; A. E. Dunlop, Pembroke; J. S. Norris, Montreal; Geo. Kidd, Vancouver; Robin Boyle, Niagara Falls; W. G. Angus, Hamilton; W. S. Robertson, Toronto; E. L. Milliken, Sydney; L. W. Pratt, Hamilton; H. R. Mallison, Montreal; H. Hulme, Montreal. The next place of meeting was left to the managing committee to decide.

TURBINE AUTOMOBILES.

The Royal Automobile Club of England has just announced that it will hold a competition next year for internal combustion turbine motors.

A double novelty is here—a motorcar run by a turbine and a turbine worked by internal combustion. It was said years ago that an internal combustion turbine would be possible if only platinum were not the most precious of metals, the idea being that nothing but platinum or some similar practically infusible metal could be used for the rotor blades. The action of the Royal Automobile Club in announcing this competition indicates that substantial propress has been made, for otherwise there would be no reason for such an announcement.

"As a matter of fact," writes W. Whittall, motoring editor of the Illustrated London News, "I am able to say that not only has such progress actually been made, but that there is in existence at the present moment an internal combustion turbine motor which I am told on excellent authority does comply with all the requirements necessary for success. In power output for weight of motor it compares quite favorably with engines of the reciprocating type, while in point of fuel efficiency I am told that it leaves little to be desired."

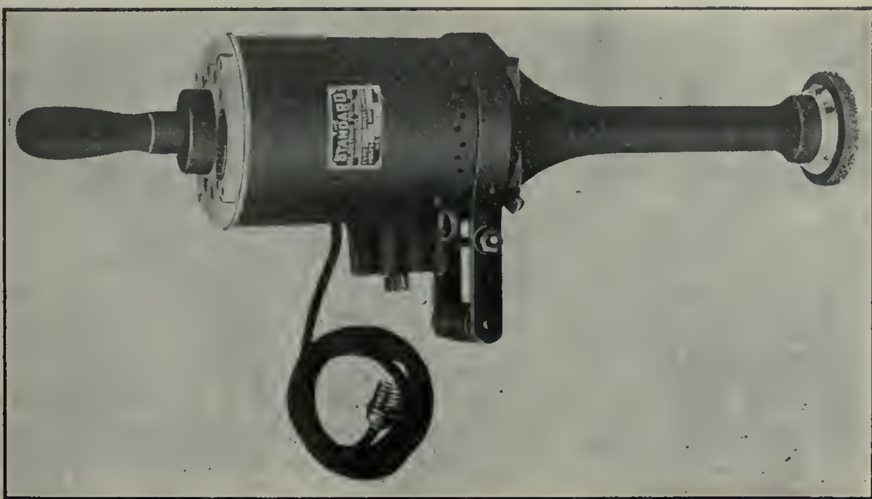
Strassburg, Sask.—The general contract has been awarded to Winnipeg Engineering Co., for the supply of material and construction of a telephone system, at a cost of $6,575 for East Mt. Royal Telephone Co.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

UNIVERSAL PORTABLE ELECTRIC GRINDER.

THE Standard Electric Tool Co. of Cincinnati, Ohio, have placed on the market a new grinder of the aerial type for surfacing rough castings and for buffing. This tool has a universal motor that operates on both alternating and direct current, being interchangeable, with enqual efficiency. It is especially adapted to low frequency circuits such as 25, 30 and 40 cycles.



UNIVERSAL PORTABLE ELECTRIC GRINDER.

The motor is form-wound and impregnated in Bakelite, which method of winding and insulation prevents short circuits, grounds and other troubles incident to high speed apparatus if constructed according to slow speed motor practice. The speed is 6,000 r.p.m. and the tool is fitted with an emery wheel of 4 ins. in diameter, 1 in. face. Ball bearings are employed throughout.

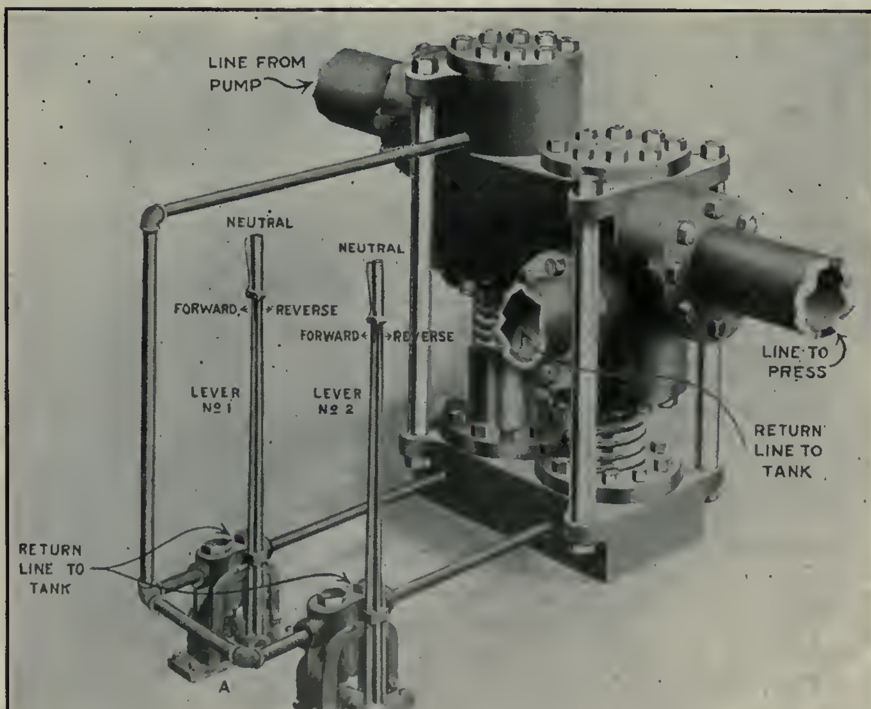
The motor has a capacity of ½-h.p. and claimed to be durable and efficient. It is highly effective on alternating current. The workmanship and material are high grade, and the tool will stand up under the most vigorous continuous service.

PILOT OPERATED HYDRAULIC POPPET OPERATING VALVE.

Those who operate high pressure hydraulic presses requiring a very large volume of water find it difficult to obtain an operating valve which has sufficient internal areas for this service and one which can be easily controlled. It is an easy matter to design a valve with large openings and large valve seat areas, but the difficulty arises in its manipulation. For high pressure, where a large volume of water is required, the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, have designed and are putting upon the market the Hydraulic Three Way Pilot Operated Poppet Operating Valve shown by the accompanying illustration. This valve has a steel body and is designed for a pressure of 5,000 pounds per square inch and upwards. It has double checks and flanged connections. Special gun metal bronze is used in constructing the valve seats and checks, while the operating cylinder, glands and rams are cast of steel.

This type of operating valve is controlled by means of two small pilot valves. These are marked A and B in the illustration and are necessary on account of the large area of the main valve openings. These controlling operating valves need not be located near the main valve as shown in the illustration, but may be located at any point convenient. The main valve may be located under the press next to the cylinder and out of sight and yet be controlled by the pilot valves which are located at any convenient place on the floor. This is a feature often overlooked by operators of hydraulic equipment.

The main valve has three openings and four positions. The first applies the pressure to the press; the second holds the pressure on the press, line and pump; the third holds the pressure on the pump and line and relieves it from the press, while the fourth position relieves the pressure from both the press and pump. The method of obtaining the four positions is described as follows:



PILOT OPERATED HYDRAULIC POPPET OPERATED VALVES.

Position No. 1, lever No. 1 should be forward and lever No. 2 reverse.

Position No. 2, lever No. 1 reverse and lever No. 2 reverse.

Position No. 3, lever No. 1 reverse and lever No. 2 forward.

Position No. 4, lever No. 1 forward and lever No. 2 forward.

Either of these pilot valves used to operate this poppet operated valve may be employed singly to control the operation of an hydraulic press which requires a medium amount of pressure. Each valve has three openings, two cheeks and three positions. When used singly to control the pressure on a single hydraulic press their operation is described as follows:

The middle position is neutral. With the valve in this position, the pressure is held on the pressure line and the return line from the press is closed. In the forward position, the pressure is applied to the press and the return line is closed. In the reverse position, the opening from the pressure line is closed, the pressure is held on the line, and the press cylinder is open to the return line. This type of pilot valve is suitable for use where the pressure is to be held on the line, but not where the pump is to run free while the pressure is held on the press.

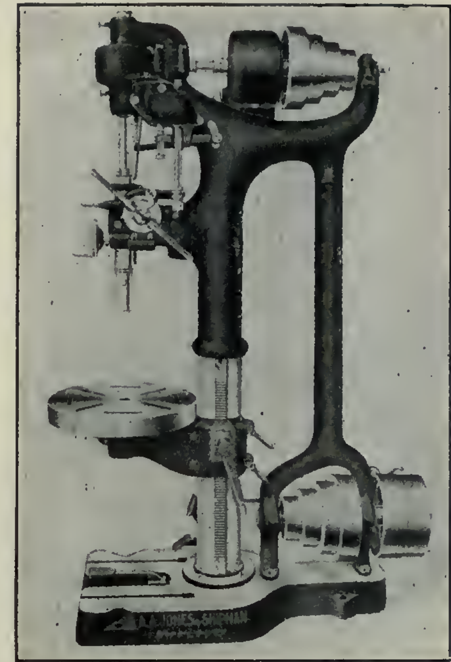
NEW DESIGN VERTICAL DRILLING MACHINES.

One might be almost justified in concluding that in multiplicity of number and more or less variety in design it were somewhat hard to produce anything of really outstanding merit in drilling machines, yet in spite of any tendency that way, there is development and progress being recorded in this important mechanism and in the "New Century" 22 and 25-inch vertical drilling machines which form the subject of this article there are quite a number of features worthy of attention.

It were superfluous, perhaps, to remark that high grade workmanship, weight and power for their particular duty are basic factors in these products. The drilling capacities are such also as to fulfil the high speed requirements of modern manufacturing shops. Among several improvements may be noted the following:—

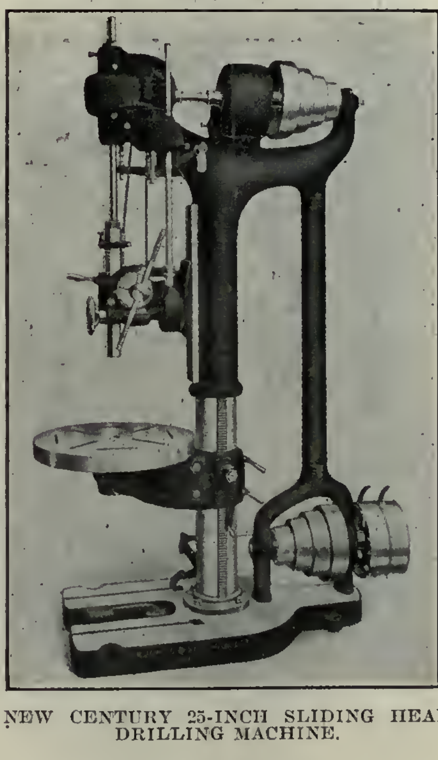
The entire column and arms are in one casting, and the machined portion of the column is ground to within the finest limits of accuracy. The bearings are gun metal ring-oiling, while the back gear pinions and clutches operating same, and the driving bevel pinions are steel.

The automatic feed has four changes, operated by a lever, with positive stop to each position of feed. The drive is positive, by high grade roller chain. All feed gears are of steel, and hardened where necessary. The spindle is made from high carbon steel, accurately ground fitted with high grade ball thrust and adjustable lock nuts. The quill is accurately ground and graduated, and internally lubricated by means of a double spiral groove, and fitted with steel rack which is inserted in a miled groove.



NEW CENTURY 22-INCH FIXED HEAD DRILLING MACHINE.

The new patented cross axle feed mechanism for engaging and disengaging the automatic and hand worm feeds, while practically instantaneous and absolutely positive, enables a fixed worm bracket being used, the worm wheel being always in mesh, the mere fraction of a turn of the knurled boss on the worm wheel throwing the feed instantly in or out of action. The top driving shaft has forced internal lubrication to the cone pulley and back gears.



NEW CENTURY 25-INCH SLIDING HEAD DRILLING MACHINE.

The table is of large diameter, heavy and well-ribbed, while the table bracket is of improved and massive design, the rack for raising and lowering same being of steel.

The tapping reverse control rod is carried inside the column, while the pedal is fixed in the center of base plate and is detachable. The following examples of normal drilling on these machines under ordinary workshop conditions and without special preparation are worthy of notice:

Diameter of drill	1 in.	1¼ in.	1½ in.
Revs. per minute	400	250	250
Revs. per 1 in. feed	50	50	74
Penetration speed	8 in.	5 in.	3½ in.
Cubic inches of metal removed per minute.	6¼ in.	6 in.	6 in.

Referring particularly to the 22 ins., drill with fixed head, the distance from center of spindle to column is 11½ ins.; vertical movement of spindle, 12 ins.; spindle speeds with back gear, 16-26-40-64; spindle speeds without back gear, 100-160-250-400; spindle revolutions per inch of automatic feed, 51-74-121-174; diameter of table, 21 ins.; vertical movement of table, 20 ins.; size of base, 41¾ ins., by 20 ins.; height from floor to top of cone pulley, 84 ins.; approximate net weight, 1,200 lbs. The vertical adjustment of sliding head is 15 inches.

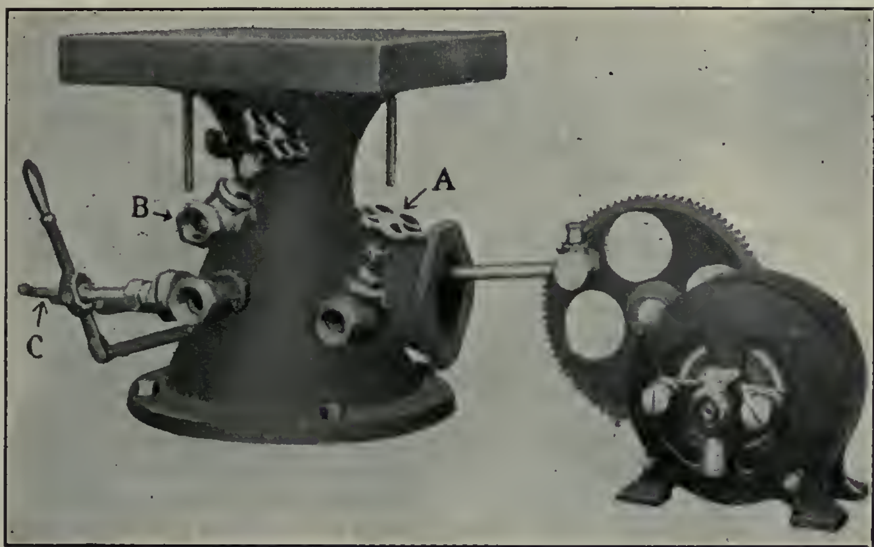
In the case of the 25 ins. drill, the distance from center of spindle to column is 12⅝ ins.; the vertical movement of spindle, 12 ins.; spindle speeds with back gear, 16-26-40-64; spindle speeds without back gear, 100-160-250-400; spindle revolutions per inch of automatic feed, 51-74-121-174; diameter of table, 24 ins.; vertical movement of table, 20 ins.; base 46½ ins., by 24½ ins.; height to top of cone pulley, 84 ins.; approximate net weight, 1,300 lbs. The vertical movement of sliding head is 18 inches.

A. A. Jones & Shipman, Ltd., New Century Works, Leicester, England, are the builders of the above machines.

NEW JOLT RAMMER.

The illustrations and description refer to a new jolt rammer invented by Wm. T. Krause, 3623 N. Ashlands Ave. Chicago. The novel feature of the machine is the direct compression of the air necessary for operation through the medium of an electric motor conected to the apparatus.

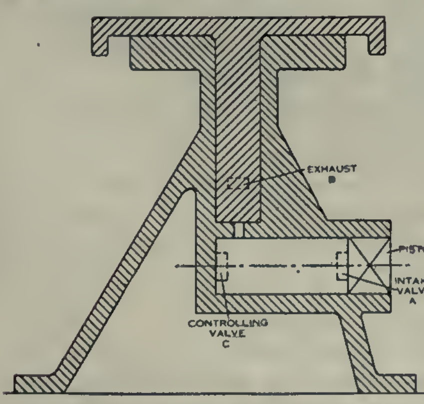
Air at atmospheric pressure is taken into the horizontal cylinder through the intake valve A, and is compressed sufficiently to raise the plunger and table in the vertical cylinder until the former uncovers the exhaust port B, whence the compressed air rushes out and drops the plunger and table. The horizontal and vertical cylinders are connected by a small air port. The idea is to keep the motor running constantly and so control the operation of the machine by opening and closing the quick opening gate valve C; in this manner doing away with the



NEW JOLT RAMMER.

use of a clutch. The photograph shows the valve C open. By substituting a three-way valve for the valve C, it is possible to compress enough air while the machine is not jolting to run the vibrator and blow gun, also to compress enough air in a tank to raise the plunger and table for pattern drawing.

The claims made on behalf of the apparatus are that it is simple, valveless, camless, clutchless, springless, and can, therefore, not get out of order. A high efficiency is also claimed.



SECTIONAL VIEW OF JAR-RAMMING MACHINE.

The photograph shows the machine with the gear case removed and without the piping. The exhaust is connected to the gear case, thereby using the exhaust air which contains a certain amount of oil to lubricate the moving parts and at the same time create a very low air pressure in the gear case which will leak out through the joints of same and blow away such sand as may tend to work its way into it.

RAILWAY CONSTRUCTION.

Carloads of steel for tracks on the C. N. R. route north and west of Kamloops are commencing to arrive at Kamloops. Of the first consignment of 82 cars more than 8,000 tons, 25 carloads, were received last week and other large shipments are en route. Tracklaying is to be proceeded with at once. Forty-five thousand tons of rails have been ordered by the C. N. P. R. for British Columbia lines. Bridge building near Lytton is being rushed so that rails may be laid from the western end of the Port Mann-Kamloops section as well as from the eastern end.

Track laying on the Coalmont section of the V. V. & E. line through the Similkameen is to be started early in July, states J. H. Kennedy, assistant to the chief engineer of the line, who has recently returned from a trip over the Hope Mountain route in company with A. H. Rogeland, chief engineer of the G N. R. This portion of the road is to be used jointly by the Kettle Valley Railway and the V. V. & E., in accordance with an arrangement between the two companies.

The V. V. & E. portion of the line between Coalmont and Otter Summit will be ready for traffic this summer. Pending the completion of the main route from Coquehalla Summit to Hope, the C. P. R. will operate trains via the Nicola Valley branch and Merritt, around by the Kettle Valley line into the Similkameen and the Okanagan. Rapid progress is being made with the portions of the Kettle Valley route east of Coalmont and in the Okanagan.

In order that structural work may be started on the bridge across the Fraser near Hope, grading is being done on the connecting link between the C. P. R. and the bridge on the north side. The sub-structure of the bridge is finished, and as soon as the mile and a half section of track which will be required to furnish the connection has been built, steel for the bridge will be transported. Rails for the Hope-Coquehalla joint section will be shipped via the C. P. R., and over the new bridge to Hope.

CANADA IRON CORPORATION.

The bondholders of the Canada Iron Corporation, at a meeting held in Montreal on July 2, formally assented to the reorganization plan submitted by the committee appointed for the purpose some months ago.

The next step in the reorganization proceedings will be a meeting of the general creditors of the corporation, to be held at the Courthouse, Montreal, on July 15. If the creditors give their consent to the plan, arrangements will be made at once to put it into effect. Failure to obtain this consent of the creditors would upset all the work of the bondholders' committee and necessitate the devising of some new plan of salvage.

The resolution adopted by the bondholders to-day provides for the cancelling of the existing trust deed, and the acceptance by the first mortage bondholders of 6 per cent. debenture stock, to be known as "B debenture stock," on a new company, the exchange to be on the basis of par for par. Ahead of this security will be "A debenture stock," of an authorized amount of $200,000, of which not less than $120,000, and not more than $140,000, will be subscribed at 95 to provide the necessary cash working capital. Preferred and common shares will also be created, the amounts to be determined after negotiation with the second bondholders, holders of secured notes, and other creditors of the old corporation.

The old preference and common stock will be wiped out, but shareholders who subscribe to the A debenture issue will be given a bonus of common stock, which, in the event of the drastic reorganization proving, as is likely, a sound and successful enterprise, will offer some chance of the old shareholders recouping their issues, in part at least.

Harriston, Ont.—The Harriston Casket Co. has recently added to the equipment of their factory a number of new machines of the most recent construction, which will largely increase the capacity of the concern.

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Vol. XII. JULY 9, 1914 No. 2

PRINCIPAL CONTENTS.

ERRONEOUS USE OF SYSTEMS.

OF all the unfortunate words in our language, and be it said, the still more unfortunate results of what it is intended to stand for or accomplish, that known as **system** seems to us—if we might use a slang expression—to be the limit.

In the past two and present issues of **Canadian Machinery**, three different types of management have been featured—the rule-of-thumb, the systematic, and the efficient. It is in no way necessary here to take up in detail the various points dealt with throughout the series, although subsequent reference may be made to some of these in our columns. The glaring misconception of business ideals is clearly indicated in the various articles, and no one who has read them can have failed to note that systems figure largely therein.

Nothing in this world was ever accomplished by adherence to system, and nothing ever will be, unless the turning of human beings into automatons be excepted. System, or keeping men in the rut, will neither breed nor yet will it develop intelligence. For a very good reason. Intelligence is unnecessary.

It seems to be completely overlooked that what are known as systems are simply means to be utilized according as they suit our purpose or work into our plans to attain an end or ideal in the most advantageous way possible. We may go from Toronto to Port Arthur at the head of the lakes by the all-rail route or by the rail and water route. In the former case, we avail ourselves of the Canadian Pacific Railroad system. In the latter case, we go over the Grand Trunk Railway System to Sarnia, and from thence by boat to Port Arthur. Think you that it is a matter of indifference, the choice you are called upon to make, and isn't there a considerable satisfaction in knowing that you are not tied up to either, which you would be if only one of the two existed, or if you were bidden go by either one without choice. The privilege of choice is sweet; in other words, you are not a little flattered at being called upon to exercise your own initiative, and whether the particular decision made be after all the most advantageous, you gain an experience which will be later valuable under like or more momentous circumstances.

Human beings are entirely distinct from street cars or railroad trains. The latter run on rails; yes, on schedule sometimes, but of themselves they achieve nothing. Unfortunately, too many of us run also on rails or their equivalent. We are scheduled to accomplish something, as in the case of the train, in a given time, and maybe are uniformly successful. We seldom, however, make an effort to get ahead of schedule, thereby failing in the duty we owe to ourselves in showing some initiative and in getting beyond system or out of the rut. Not only so, but we, by failing to note that some others in, or some section of our organization are well ahead, prevent a general forward movement, some record accomplishment, it may be, in product output, and cause valuable time to be lost through our dogged adherence to system.

It is a hopeful sign to see the expression **systematic business management** disappear, and its replacement by the word **management** only. The highest efficiency, or, for that matter, any efficiency worthy the name, cannot be got by system as generally understood. Systems are mere subsidiaries or routes to be utilized in whole, in part, or not at all, in the carrying out of our plans, and accomplishment and achievement records go to show that they figured in low degree in most cases.

To have to adhere to a definite system is always expensive, like its prototype in the case of only one railroad to a particular destination. Competition in the latter case usually cheapens transportation (combines excepted), and in business affairs where a definite ideal (that of the highest efficiency in output is concerned), the individual or collective competition to achieve something higher than the system, something beyond grovelling in the rut or being a mummified automaton, will, as in the case of competitive transportation routes, bring its reward. It will, however, be more meritorious, because of its having raised a higher type of men.

INDUSTRIAL NOTABILITIES--No. 42

WILLIAM HORSLEY ROWLEY, J.P., president the E. B. Eddy Co., match, paper and woodenware manufacturers, Hull, Que., was born at Yarmouth, N.S., March 21, 1851, son of Lieut.-Col. J. W. H. and Ann Norman (Farish) Rowley, daughter of Henry Greggs Farish, M.D. He was educated in Yarmouth, graduating later from the Royal Military School, Halifax, N.S., and receiving there his lieutenant's commission.

Mr. Rowley started his business career in the service of the Bank of Yarmouth about 1867, and a few years later he was in mercantile employment in St. John, N.B. He was in the service of the Merchants Bank of Canada from 1871 to 1886, being manager of the Ottawa Branch from 1880. He organized and was a charter member of the E. B. Eddy Co., occupying the position of Secretary-Treasurer from 1886 to 1906, since which last date he has been its president. He is a past-president of the Canadian Manufacturers' Association, and was a delegate to the Commercial Congress of the Empire, in Sydney, Australia, in 1909.

WILLIAM HORSLEY ROWLEY, J.P.

He is a director of the Eastern Canada Manufacturers' Mutual Fire Insurance Co.; director Eastern Canada Exhibition Association; director Ashbury College; director Perley Home for Incurables; was president, Canadian Immigration Guild during 1910; and is an active member and officer of Christ Church Cathedral, Ottawa. Mr. Rowley has been twice married, one son born in 1912 being the sole surviving issue.

A Conservative in politics and Anglican in religion, a member of the Rideau, Laurentian, Royal Ottawa Golf, Ottawa Athletic, Ottawa Canoe, Ottawa Hunt, Victoria Yacht, Ottawa Country Clubs, Ottawa; the Mount Royal, Montreal; and the York, Albany, and National, Toronto, Mr. Rowley finds his outdoor recreations in angling, bowling and riding. His residence is Stadacona Hall, Worfield, Ottawa.

A first-class business man, and controlling the largest industry of its kind in the British Empire, says public opinion.—Photo, courtesy the International Press.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh	$13 65	
Lake Superior, charcoal, Chicago	16 00	
Ferro Nickel pig iron (Soo)	25 00	
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X.......	18 50	17 85
Victoria, No. 2 Plain ..	18 25	17 60

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh............	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh..........	1.15
Beams and angles, Pittsburgh....	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

			Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...			$2 20	$2 20
Heads, per 100 lbs.			2 55	2 55
Tank plates, 3-16 in.			2 50	2 50
Tubes, per 100 ft.,		1 inch	9 50	9 00
"	"	1¼ in.	9 50	9 00
"	"	1½ "	9 50	9 00
"	"	1¾ "	9 50	9 00
"	"	2 "	8 75	8 75
"	"	2½ "	11 15	11 50
"	"	3 "	12 10	12 50
"	"	3½ "	14 15	14 50
"	"	4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base.. $2 15
Cut nails $2 60 2 65
Miscellaneous wire nails... 75 per cent.
Pressed spikes, ⅝ diam., 100 lbs. 2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb. off
Nuts, Hexagon, all sizes..	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright ......85, 10, 7½, 10, 10 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off	

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛ in	$ .05½	⅛ in	$ .12	½	$ .32
¼ in	.06	¼ in	.07½	¾	.35
⅜ in	.06	⅜ in	.07½	1	.37
½ in	.08½	½ in	.11	1¼	.52½
¾ in	.11½	¾ in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼ in	.23½	1¼ in	.30	2½	1.37
1½ in	.27½	1½ in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½ in	.58½	2½ in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½ in	.92	3½ in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½ in	1.27	4½ in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 50
Casting copper	15 25	15 45
Spelter	5 35	5 25
Tin	35 00	36 00
Lead	4 85	5 25
Antimony	8 50	8 50
Aluminum	20 00	19 00

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3 45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15
Lard Oil, per gal.	0.60

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10 3/4 oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

BELTING RUBBER.

Standard	60%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4.95
1 inch	8.05
1 1/4 inch	12.65
1 3/8 inch	15.30
1 1/2 inch	16.50
1 5/8 inch	19.40
1 3/4 inch	22.50
1 7/8 inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1 1/2-in	$37.50	$30.00	$17.50
33/64 to 3/4-in.	41.25	33.00	19.25
7/16 to 1/2-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., July 6, 1914.—There has apparently been little improvement in business, and in most instances the supply men do not expect much change from present conditions for at least a month or two. It is generally anticipated that the fall will see a resumption of activity, and although it is not thought it will be in the nature of a boom, it seems reasonable to assume that after such a long period of quietness there certainly should be a resumption approaching normal.

As has already been stated, there is a good deal of building being carried on locally, and the city government is spending considerable money in street improvements and public works generally. The new plant of the Canadian Vickers' Co., in Maisonneuve, is rapidly nearing completion, and this should add to the general activity when it is in full operation.

Metals.

There has been a slight improvement in the situation as regards metals, though most of the markets are still rather quiet and weak. Spelter was marked up 10 cents, and tin is quoted 50 cents above last week's figures. Sterling quotations to-day are as follows: Tin, £146; copper, £62 10s; lead, £19 5s; spelter, £21 10s; pig iron, £51 3s. There is still a tendency on the part of purchasing agents to buy only sufficient supplies for immediate needs; business, therefore, is not very active.

Toronto, Ont., July 7., 1914—Business is still very dull, and seems likely to remain in this condition in the near future. The crop reports, which continue to be favorable, are helping to keep commercial interests from becoming too pessimistic, and are tending to instill a more hopeful spirit into the situation. Although the general outlook is more promising, the volume of business being done cannot be said to be altogether satisfactory. Manufacturers are in many cases running their plants considerably below capacity, and consequently buying less material, this being in proportion to the output.

A spirit of caution is general, and is justified to a large extent on account of the prevailing conditions. Considering the severity of the depression, it is encouraging to note how comparatively few concerns have gone into liquidation. This tends to show that generally speaking our industries are established on a sound basis, and that a slowing down of business cannot materially affect the economic position of the country.

Steel Market.

The steel market continues dull, with little business being done, and that only at low prices. The rumors which have been circulated lately regarding the proposed steel plant at Ojibway, near Windsor, Ont., have received their quietus. President E. H. Gary, of the United Steel Corporation, in a speech delivered recently in New York, states that the finance committee of that corporation would hesitate to approve of any appropriation at the present time for establishing a steel plant in Canada.

The Algoma Steel Corporation recently booked an order for 3,000 tons of rails for an Ohio railroad in competition with United States mills. The Toronto Board of Control have approved of specifications for the proposed Bloor street viaduct, and tenders will probably be called shortly. It is likely that it will be a steel structure, in which case a large amount of material will be required.

Reports from the United States indicate that the prospects for July steel trade are relatively better than is usual for this month, when business usually falls off. It is anticipated that production will be substantially as large as June. Steel prices are stationary, and a further decline is not expected.

Pig Iron.

There is no change this week in the pig iron situation, and prices remain at the same low level. The Dominion Steel Corporation has decided that in view of the recent heavy sales to Australian and Canadian railways, they will be unable to accept any additional orders for pig iron for delivery to the United States, beyond the 25,000 tons already contracted for.

Machine Tools.

Dealers in machine tools report trade as being very quiet, with little business offering. Consumers are still holding back until conditions improve, which can hardly be expected until the fall at least.

Metals.

Although the metal markets are quiet, a better tone prevails, and rather more business is offering. Prices keep at about the same level, with the exception of tin, which is stronger, having advanced 3 cents a pound.

Trade Gossip

Locomotive Order.—The Canadian Pacific Railroad has ordered 10 locomotives from the Montreal Locomotive Works.

Jonathan Birch & Co., of London, Ont., has been awarded a contract for cast iron pipe, 4 in. to 12 in. diameter, by the city of St. John, N.B.

The Canadian Westinghouse Co., Hamilton, has been given the contract for the installation of two 3-phase self-starting synchronous condensers at $52,900, for the City of Winnipeg.

The Turbine Equipment Co., Toronto, have sold to the Can. Westinghouse Co., one De Laval 6-inch, two-stage turbine pump with a capacity of 700 gallons per minute against a head of 300 feet.

The Marshall-Mitchell Hardware Co. has been awarded the contract for the heating and ventilation of an addition to the Alexandra school, Medicine Hat, Alta., at a cost of $20,789.82.

Poole & Emery, of Moose Jaw, Sask., have been awarded the general contract for a $75,000 office building for the Saskatchewan Co-operative Elevator Co. Architects, Storey & Van Egmond, 1013 McCallum Hill Bldg.

Pressed Steel Car Plant in England.—Charles T. Schoen, formerly of Pittsburgh, the pressed steel car inventor and manufacturer, announces that he is planning to establish a plant at Leeds, England, for the manufacture of this commodity.

Dominion Iron & Steel Co.—Advice from Sydney, N.S., state that at a meeting of the directors of the Dominion Iron & Steel Co., it was decided that in view of their recent heavy sales of rails to Australia and Canadian railways, the company would be unable to make any additional further shipments of pig iron to the United States. About 25,000 tons has been shipped so far.

Escher, Wyss & Co., Montreal, have been awarded a contract by the town of Joliette, Que., for the supply of one 200-h.p. Francis turbine and two belt-driven centrifugal pumps, each of two million gallons capacity, working against 62 pounds pressure when single and in parallel, and 130 pounds pressure when working in series. Surveyer & Frigon, of Montreal, are the consulting engineers.

To Re-open Plants.—Word has been received from New Glasgow, N.S., that the plant of the Eastern Car Co., which has been closed down for some time, is to be re-opened and that men are being engaged to report for work at once. It is stated that the company has received a substantial order from the Intercolonial Railway for box cars, which will keep the works busy for some time. The Eastern Car Co. is the relatively new formed subsidiary of Nova Scotia Steel & Coal Co.

Hon William R. Ross, Minister of Lands, for British Columbia, has received a letter from the Dominion Creosoting Co., Ltd., of South Vancouver, stating that they have received an order for 160,000 creosoted railway sleepers from the Bengal & Northwestern Railway Co., of India, and expressing thanks to the Forest Branch of the Department of Lands, for its efforts in interesting the Indian Railway Co. in British Columbia lumber.

The Steinle Turret Machine Co., Madison, Wis., are making new arrangements for the sale of their turret lathes, as their former selling connections with Manning, Maxwell and Moore, Inc., have been discontinued. They have appointed Hill, Clarke & Co., 156 Oliver St., Boston, Mass., as their exclusive agents in the New England States and Laughlin-Barney Machy. Co., Union Bank Bldg., Pittsburgh, Pa., have been awarded the exclusive right for the sale of their product in Western Pennsylvania.

Doubling Ford Plant.—The Ford Motor Co. will double its Detroit plant this fall, making it the largest manufacturing concern in the United States, and probably in the world. Seven new buildings and a power house are to be erected, at a cost of about $5,000,000. The buildings will each be 900 feet long by 60 feet wide and six stories high. The power house will be 240 feet long, 150 wide and 85 feet high, and will house the largest gasoline engine in the world, driving motors that will produce 80,000 horse-power. The company plans, with these increased facilities, to double its 1914 output next year. This means that when the factory is running full, about 40,000 men will be employed.

Regina Engineering Society.—The Regina Engineering Society executive for the present year is as follows:—President, H. S. Carpenter, Board of Highway Commissioners, Saskatchewan Government, Regina; first vice-president, L. A. Thornton, city commissioner, Regina; second vice-president, R. O. Wynne-Roberts, consulting engineer, City Hall, Regina; secretary, J. M. Mackay, superintendent of waterworks, Regina; treasurer, R. N. Blackburn, chief boiler inspector, Saskatchewan Government, Regina.

Hall Engineering Works.—A strong bid was made recently for the purchase of the Hall Engineering Works, Montreal, by one of the largest British shipbuilding firms, but the offer through substantial was not sufficient to induce Mr. Thomas Hall, the owner, to part with the property which is the largest privately owned ship repairing plant in the Dominion. The works situated on Jurors street were established some ten years ago by Mr. Hall, who was formerly superintendent engineer for both the Canadian Pacific and Elder Dempster Companies in London, Eng. They have grown to a considerable extent since then, being now valued at a quarter of a million. This businesslike plant handles most of the large marine repair work at the port of Montreal, as well as a good deal of land work.

Niles-Bement-Pond Co. Achievement—The Chilean Parliament last year appropriated $30,000 to be given as prizes to enable them to secure the best designs for a general railroad shop to have capacity to take care of 500 to 600 locomotives, 500 passenger cars and 6,000 freight cars; $20,000 to be for the first prize, and $10,000 for the second. The Niles-Bement-Pond Co. submitted plans of what they considered to be the latest practice as exemplified in American railroading. Forty sheets of drawings were submitted showing the ground plan and elevation of every building; also a plan of the yard with tracks, yard cranes, paving, etc., complete; also plans of the wiring, power distribution, etc.; also plans of a central power station and its equipments. Two complete plans of machine and erecting shops were submitted, one on the transverse pattern and one longitudinal. The specifications were officially received on May 1, and there were competitors from various parts of the world. The awards were made in the first week of June, with the result that the Niles Co. were given the first prize, the second prize going to a combination Belgian and English concern. It is expected that these shops will cost about $3,000,000.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Sarnia, Ont.—The Mueller Mfg. Co. will probably build an iron foundry.

London, Ont.—The McClary Mfg. Co. are making an extension to their factory at a cost of $15,000.

Rossland, B.C.—The West Kootenay Power & Light Co. contemplate the construction of a new lighting system.

St. John's, Que.—The Canadian Hart Accumulator Co. will shortly begin the construction of their new factory. Architect, S. Warwick, Montreal.

St. Vital, Man.—Construction will commence shortly on the new engineering building for the University of Manitoba. The cost is estimated at $250,000.

Toronto, Ont.—The Temiskaming & Northern Ontario Railway, will install heating systems at their new stations. A. J. MacGee, secretary-treasurer, Toronto.

Bolton, Ont.—Dick's Foundry was totally destroyed by fire recently. The damage is estimated at $20,000, against which there is only about $5,000 insurance.

Berlin, Ont.—The Regal Motor Car Co. of Detroit, Mich., are building a factory here. It is expected that it will be completed about August 1. Henry Nyberg will be in charge.

Guelph, Ont.—The Light, Heat and Power commission has confirmed the building of the ammonia tanks at the gas works. It is expected that this work will cost about $2,700.

Toronto, Ont.—Commissioner Harris has recommended that the National Equipment Co. be granted permission to erect a 400-gallon gasoline tank under the sidewalk at 1136-1142 College St.

Toronto, Ont.—A new 4-inch. centrifugal pump costing $461 has been purchased for the main sewage disposal works at Morley avenue. This was the lowest tender, and was awarded to a Buffalo firm.

Guelph, Ont.—Two applications have been received from local manufacturing concerns asking that a fixed assessment be granted. After careful consideration the committee decided to recommend that Tolton Bros. be granted a fixed assessment of $4,000 per year for a period of ten years, exclusive of school and local improvement taxes, and that Crowe's Iron Works be given a fixed taxation of $10,000 for the same length of time and under the same conditions.

Toronto, Ont.—The Berg Machinery Mfg. Co. has assigned to J. P. Langley, and the creditors of the concern will meet in Mr. Langley's offices in the McKinnon Building, on Friday, July 10. The company was engaged in the manufacture of brick machinery, engines and boilers and general machinery. Anton Berg is president, John Berg, vice-president, and Severn Berg, superintendent of the works which are situated at the corner of Bathurst and Niagara streets.

EQUIPMENT REQUIRED.

The Victoria (Australia) Railway Commissioners will receive tenders at Melbourne, for the supply of:

3 50-ton overhead electric travelers.

30-ton overhead electric traveler.

3 10-ton overhead electric travelers.

up to August 26, 1914, and up to September 2, 1914, for the supply of:

24 sets air-cooled petrol engine sets for railway inspection cars and,

1 horizonal plain milling machine with vertical milling attachment and accessories.

Mails from San Francisco on August 4, and from Vancouver on August 5, will deliver the above tenders at Melbourne against the respective closing dates.

Full particulars as to specifications, etc., may be secured from the Department of Trade and Commerce, Ottawa.

Victoria, B.C.—A date has now been set, of which notice is given by advertisement, for the meeting of the various bodies which are urging the development of the iron ore resources of Vancouver Island. Representatives of the city council, the board of trade, the real estate exchange, the development association and the manufacturers' association will meet to talk over the best way of inducing operation of the deposits of magnetite around Gordon river, Barkley Sound, and elsewhere in the vicinity of Victoria. The Board of Trade is collecting data on the subject.

New Westminster, B.C.—Negotiations have been practically completed for the disposal of the property of the Morrison Nail & Wire Works on Lulu Island, the company having decided to re-open the plant in New Westminster. Through Industrial Commissioner Darling, a site is being arranged where suitable trackage facilities will be available. It is expected that the plant will be in full operation within thirty days. According to Mr. Darling, it is the intention of the company not to confine business to the manufacture of wire and nails but to enlarge its scope along other lines, including staples and fencing.

New Westminster.—On most farms in the Fraser Valley are to be found small workshops where simple repairs to farm implements and vehicles are undertaken. In these shops there are usually a workbench, to which is fitted a vise, and a number of hand tools. Frequently one finds a forge and anvil, but in the farm of R. A. Anderson, on the Jackman road, Aldergrove, there is a comparatively complete machine shop in which is now being built a small steam engine to be used for farm work. Mr. Anderson's shop is equipped with forge, anvil, drilling machine and band saw, and above the work-benches are cabinets filled with steel, iron and wood worker's tools.

Electrical

Chatham, Ont.—The council will probably extend the electric lighting system.

Kincardine, Ont.—The lighting by-law was defeated by 141 votes on June 29. The proposal involved expenditure on a plan to put in an incandescent lighting system.

Montreal, Que.—The contracts will be let shortly for the electrical work in the new boiler house of the Toilet Laundry Co. A. F. Byers & Co., general contractors.

Hamilton, Ont.—An important event in the history of the city took place on July 1, when Sir Adam Beck turned on the hydro-electric street lights. The Cataract Co. has had this contract for fifteen years. Under the new system the cost of lighting the streets has been increased to $88,000, but it is claimed that the city will be much better lighted.

Blenheim, Ont.—At a representative meeting held here on June 30, steps were taken to have the Hydro-electric Power Commission of Ontario report upon a hydro-radial railway from St. Thomas to Amherstburg, to serve the district lying along the north shore of Lake Erie. A permanent organization was formed, with Mayor Little of Blenheim as President.

St. Catharines, Ont.—Estimates have been prepared for the laying of an ornamental, underground lighting system for the Hydro-Electric Commission as follows: 105 single light standards with 1,000 candle-power lamps, approximate cost $11,304; 61 single light standards with 100 watt lamps, approximate cost $6,093. Chairman Commission, J. S. Campbell.

General Industrial

Ottawa, Ont.—Fire recently destroyed the bakery owned by E. Renaud.

Richmond, Que.—The Boston Last Co. are making extensions to their factory.

London, Ont.—The Forest City Glass Co. will make an extension to their factory.

London, Ont.—The A. A. Langford Co. will build a stationery factory to cost $35,000.

Hamilton, Ont.—L. O. Buist will probably make considerable extensions to his ice cream factory.

Brantford, Ont.—The Canada Glue Co. will build a factory here. P. Kreisman is general manager.

London, Ont.—The London Free Press Printing Co. will make an addition to their plant. J. M. Moore, architect, London.

Langham, Sask.—Fire destroyed Peter Wiebe's flour mill and the National Elevator here, recently. Loss $40,000, insurance about $5,000.

New Westminster, B.C.—The directors of the Pacific Chocolate Factory, which was destroyed by fire recently, state that the loss is estimated at about $35,000. The plant will be rebuilt.

Regina, Sask.—Application has been made to the city council for the city to erect a $15,000 broom factory and sell to the Western Broom Co. on easy terms. N. R. Darrach, Western Trust Bldg., is the architect.

Bathurst, N.B.—The construction of the new pulp mill at this place has been started and workmen are now busy on the foundations. A much larger force of men is soon to be put to work and the buildings will be completed as soon as possible.

Highland, Alta.—The Farmers' Co-operative Elevator Co. has the material on the ground for their new elevator. This makes three elevators for Highland, and present indications are that every one of them will be taxed to their utmost capacity to hold the grain this fall.

Toronto, Ont.—A $90,000 cigar factory will be erected by Andrew Wilson & Co., at 14 and 16 Front street west. The permit was issued last Friday by the City Architect's Department. The factory will be four storeys high and will be constructed of steel and brick.

Calgary, Alta.—Twelve hundred miners have been thrown out of work and the town of Hosmer, not far from Fernie, B.C., is about to be abandoned by its population owing to the fact that the coal mines at that point, owned and operated by the C. P. R. have been shut down for good. The work of dismantling the machinery is well under way.

Winnipeg, Man.—Damage to the extent of approximately $2,500 was caused by fire on June 26, at the premises of the Alaska Bedding Co., Sutherland street. The fire started in the japanning room, and was caused by the spilling of some flaming japan from a pail in which it was being carried. The damage is covered by insurance.

Montreal, Que.—It is estimated that 13,000,000 bushels of American grain have been received in the Montreal elevators since the opening of navigation this year. This is much in excess of previous consignments received from the States for any corresponding period, and is considered to be a factor in the present grain congestion at the Montreal elevators.

Rossland, B.C.—J. S. Deschamps, lumberman of Rossland, and former mayor, has announced that he will build a 40,000 capacity mill, employing about sixty men, in the city of Nelson. He has negotiated for a site once used by the Yale-Columbia Lumber Co., which burned out, and also for three million feet of logs at Nelson, through W. A. Anstie, general manager of the company.

Tillsonburg, Ont.—Following the passing of the by-law permitting the sale of the mortgage on the property of the Dominion Linen mills to the new company promoted by Ferguson and Sanson, the promoters promise that the mills will be in operation in a very short time after the passing of the by-law. There is a provision also, giving a fixed assessment for a period of years to the new company.

Medicine Hat, Alta. — The Hedley Shaw Milling Co., a subsidiary of the Maple Leaf Milling Co., has been formed to take over the contracts and business of the Maple Leaf Co. at Medicine Hat. The Hedley Shaw Co. has an authorized capital of $1,000,000 and an authorized bond issue of $250,000. Of the latter $150,000 has been sold to a syndicate composed of the principal interests in the Maple Leaf Co.

Saskatoon, Sask.—At a meeting of leading business men held in the Board or Trade office recently, a proposition was considered which, if it can be carried through, will mean the establishment of a new and desirable industry in Saskatoon. It concerns a firm already established in business here which, if the necessary backing can be secured, is prepared to branch out in a line of manufacturing not at present undertaken.

Regina, Sask.—A brick plant with a capacity of 40,000 bricks per day will be erected here in the near future, if the experiments being carried out by Dr. Andrews are successful. Dr. Andrews claims to have found a cheap method of converting Regina clay into the very best quality of brick, and the samples he has displayed fully justify his statements. R. E. A. Leach is looking after the financing of the company and is receiving excellent support.

New Westminster, B.C.—The Nanaimo Cannery Co., which operated a plant near the Brechin Road up to last season, has now been reorganized and will henceforth be known under the firm title of Broder & Lucier. The new proprietors have had several years' experience in the cannery business on the Fraser River, and speak very hopefully of the prospects of the industry, in this district, which they believe to promise a brighter future than the Mainland.

Winnipeg, Man.—The Watkins Medical Co., will erect a three-storey reinforced concrete warehouse and factory at the Annabella street subway to cost $95,000. Operations commence at once, the Haglin Stahr Co. being the contractors. The building will be 85 feet wide, 95 feet high, and though three-storeys in height at first, is designed to carry five additional ones. It will be completed by December 1. The head office of the firm is in Winona, and the architects are Woodman & Carey, of Winnipeg.

Municipal

Berlin, Ont.—A number of citizens are protesting against the proposal to establish a gas plant in a certain section of the city.

Elmira, Ont.—A by-law will be voted on by the ratepayers on July 14, to authorize the raising of $2,000 for the waterworks system.

Moncton, N.B.—The council are considering the question of installing a municipal power plant.

Trenton, Ont.—Work on sewer extension has commenced under the direction of the engineer. About $25,000 is to be expended on the improved system.

Berlin, Ont.—Ratepayers of Waterloo on July 4, carried the Doering Trunk Co. by-law for the town to grant a loan of $15,000 for a number of years. The vote in favor of the by-law was 373, against 126.

Castor, Alta.—The town council contemplate purchasing (1)—6 in. piping; (2)—12,000 gallon tank; (3)—suitable pumping engine, for the purposes of fire equipment. Mayor Geo. M. Dillon, secretary-treasurer, L. B. Brown.

Calgary, Alta.—Three by-laws were carried by the ratepayers recently by large majorities. They included $360,000 for exhibition buildings, $300,000 for electric light extensions and $90,000 for the street railway. The park improvements by-law was defeated.

Mimico, Ont.—At a meeting held here on July 2, a Board of Trade was formed and officers were elected as follows: president, James Gormaly; first vice-president, E. Coxhead; second vice-president, J. H. Doughty; treasurer, W. W. Burgess, secretary, B. W. Ballard. A council of twelve members was also elected.

Fredericton, N.B.—The fire committee of the city council met recently to consider the question of repairs to the fire alarm system. The battery room, which is now situated in the tower of the city hall, will eventually be removed to the new central station. A storage battery will be installed, instead of the wet cell system now in use.

Guelph, Ont.—On account of the presence of so many factories in the lower end of St. Patrick's Ward, and their demand for light and power, the erection of another high tension transforming station, similar to the one on Huskisson street, has been decided upon. It will cost in the neighborhood of $4,000, and will be proceeded with at once.

Stratford, Ont.—At a special meeting of the Council in committee last Thursday, Chief Kappele was instructed to ask tenders for one steam fire engine, one city service ladder truck, one horse-drawn combination chemical and hose wagon. In connection with the latter, tenders will also be asked for a motor-driven wagon for the same use.

Winnipeg, Man.—Tenders for the construction of 84.72 miles of the aqueduct of the Shoal Lake water project, costing approximately $8,729,000, will be called by the Administration Board of the Greater Winnipeg water district, and they will be opened September 19. The work will be divided into five sections, exclusive of the Indian Bay intake. The aqueduct will extend from the reservoir site beyond Transcona to the Shoal Lake end.

Toronto, Ont.—The controllers last Friday approved of the specifications submitted by Works Commissioner Harris for the Don section of the Bloor street viaduct, and decided to call for tenders immediately. Although the specifications are for steel, the city council has already issued instructions to the Board of Control to call for both steel and concrete, but the contractors tendering in concrete are supplying their own specifications. There are 70 drawings in Mr. Harris' steel specifications.

Renfrew, Ont.—At the regular meeting of the town council on July 1, a by-law was introduced by Councillor Macdonald to establish a fire limit within the town and for regulating the erection of buildings within such limit. It duly received the necessary three readings. A by-law was introduced by Councillor Murphy and passed, providing for taking the votes of the electors on the by-law to install a new electric lighting system. This latter by-law also received its third reading, which is to raise, by way of a loan, the sum of $16,000 to install the proposed new electric lighting system.

Marmora, Ont.—Owing to the frequency of fires, residents realize the necessity of some system of fire protection. Business men and others have been considering the matter for some time, and a proposition is to be submitted to the ratepayers. Last year the fire loss was $35,000, which is a tremendous amount for a town of this size. In most cases these fire losses could have been greatly reduced if there had been a system of fighting the fires. There have also been serious fires this year, the most serious being on May 24, when several thousand dollars' worth of property was consumed.

Regina, Sask.—The Regina city council has adopted the commissioners' report regarding the reduction of the works program for the current year. The total expenditure is reduced from $3,589,518 to $2,237,165. It is not proposed to construct this season the Hamilton street bridge or the new fire hall. Works will be undertaken practically as follows: Extension to power and light distributing system, $380,000; general expenditure on waterworks, $250,500; pavements, approximately $147,000; general hospital, $111,000; sewers, storm and domestic, about $158,000; sewage disposal works and sewer connections, about $72,000; completion of Broad street subway, about $17,000.

Personal

Charles Dow, the general manager of the Mersey Docks and Harbor Board, of Liverpool, Eng., has sailed on the Megantic for the Old Country.

Thomas Long, of Toronto, vice-president of the Collingwood Shipbuilding Co., has been created a Knight of the Order of St. Gregory the Great by the Pope. This is a lay order and the recipients are honored for extreme friendship to the church.

H. K. Clark, who for the past six months has been with the Wilt Twist Drill Co., of Can., Ltd., Walkerville, Ont., having completed his work, in the organization of a sales department, is now with the Agnew Elec. Welder Co., as manager of their Canadian factory at Walkerville.

Lieutenant Owen Lewis, R. N. R., who has been commander of the Royal Mail Steam Packet Chignecto since she has been engaged in the service between Halifax and the West Indies, has been recalled by his company to take command of one of the R. M. S. P. Co.'s trans-Atlantic liners.

Edward W. Cox, director of the Canadian General Electric Co., Ltd., Toronto, died at Folkestone, England, on June 27, following an operation. Mr. Cox was born in Peterborough in 1864 and was principally identified with the Canada Life Assurance Co., succeeding to the presidency after the death of his father, Senator Cox.

E. W. Alderman, an experienced refrigerating engineer, who has been connected with the Vilter Mfg. Co., for a good many years has been appointed manager of the Pittsburgh district, and will have his headquarters at 314 Curry Bldg., Pittsburgh, Pa. He succeeds Mr. H. W. Loecher, who has been transferred and will be located at the main office in Milwaukee.

J. P. Case has been appointed Canadian representative for the Brown Hoisting Machinery Co., succeeding F. A. Peck, who has resigned. Mr. Case has been identified with the Brown Company for many years and is entirely conversant with all Brown hoist products. He will spend all his time in Canada and will be assisted in his work in this territory by Hoyt E. Hayes.

Major R. W. Leonard, owing to the near completion of the Transcontinental Railway and the demands of his private affairs upon his time, has tendered his resignation as Transcontinental Commissioner, and an Order-in-Council was passed by the cabinet recently accepting it, and leaving the work of the commission to Hon. Frank Cochrane, Minister of Railways. A bill adopted at the recent sessions enables the Minister to exercise the powers, and discharge the duties, of the commission and under his personal supervision the work will be completed.

Tenders

Winnipeg, Man.—Tenders were received by the undersigned up to Monday, July 6 for the erection of a brick and stone school building at Charleswood, Man. E. D. Tuttle, Architect, 709 McArthur Building, Winnipeg.

Medicine Hat, Alta.—Tenders addressed to James L. MacCallum, secretary of the Medicine Hat School Board, and indorsed "Tenders for Heating, Ventilating, Plumbing and Gas Fitting of the Primary School," will be received up to July 13th, 1914.

Winnipeg, Man.—Tenders are being received Tuesday, July 14, 1914, for the supply of Ornamental Lamp and Trolley Poles. Instructions to bidders, specification and form of tender may be obtained at the office of the City Light & Power Department, 54 King street, Winnipeg. M. Peterson, Secretary.

Ottawa, Ont.—Tenders will be received until Tuesday, July 14, 1914, for dredging required at Kincardine, Bruce Mines, Port Hope or Little Detroit, as the case may be. Combined specification and form of tender can be obtained on application to R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Toronto, Ont.—Tenders will be received for the building of an addition to the Macpherson Avenue hydro sub-station, including excavations, masonry work, brick work, steel work, etc., until Thursday, July 16, 1914. Plans and specifications may be seen and consulted at the Station Construction Office, Duncan Street sub-station.

Toronto, Ont.—Tenders will be received up to Tuesday, August 18th, 1914. For the installation of coal and ash handling apparatus at the main pumping station. Specification and tender form for the foregoing may be obtained upon application at Room 12, Purchasing and Accounting Section of the Department of Works, City Hall.

Grimsby, Ont.—The Queenston and Grimsby Stone Road Committee will receive tenders for the building of a steel bridge with a concrete floor, span about 32 feet, width about 28 feet, over the Forty Mile Creek, in the Village of Grimsby. Plans and specifications may be seen at the office of W. B. Calder, Grimsby. Tenders will be received up to July 11th, 1914.

Edmonton, Alta.—Tenders are now being called by the Edmonton Exhibition Association for several building improvements at the exhibition grounds that will result in a relief to the congestion now experienced in several departments connected with the summer fair. The programme includes an addition to the manufacturers' building, two new cattle barns, one new sheep barn and an up-to-date lavatory.

Prince Rupert, B.C.—Tenders will be recived by E. A. Woods, city clerk, Prince Rupert, up till Monday, July 20, 1914, for the supply of approximately 8,000 linear feet of 6-inch and 2,000 linear feet of 10-inch diameter steel pipe and fittings. Specifications and forms of tender may be obtained at the City Engineer's office, Prince Rupert. W. McGeorge Mason, city engineer.

Ottawa, Ont.—Tenders will be received until Monday, June 27, 1914, for 270,000 lbs. of galvanized iron telegraph wire, deliveredat Montreal, Que.;also 342,000 lbs. of same delivered at Vancouver, B.C. Specification and forms of tender can be obtained on application to the office of the General Superintendent at the Government Telegraph Service of the Department of Public Works, Ottawa, R. C. Desrochers, secretary.

Orillia, Ont.—Tenders will be received by the secretary of the Orillia Water, Light & Power Commission, for the following works, until Monday, July 27, 1914: (A) laying water mains; (B 1) constructing reinforced concrete, coagulating tank and pump house foundation; (B 2) constructing brick pump house; (C 1) furnishing cast iron water pipe and specials; (C 2) furnishing steel water pipe and specials; (D) furnishing gate valves and hydrants; (K) laying of intake pipe in Lake Couchiching. Plans and specifications may be seen at the commission office, Orillia, Ont.

Orillia, Ont.—Tenders will be received by the secretary of the Orillia Water, Light & Power Commission, Orillia, for the following works, until Tuesday, Aug. 4, 1914: (E) Furnishing and erection of motor-driven turbine pumps and equipment; (F) furnishing and erection of "Diesel" oil engine and appurtenances; (G) furnishing and erection of mechanical pressure type filtration plant. Plans and specifications may be seen at the Commission office, Orillia, Ont.

Ottawa, Ont.—Tenders will be received until Monday, July 27, 1914, for 23 knots of single conductor submarine telegraph cable (107 lbs. copper and 150 lbs. guttapercha per knot) with sheathing of 12 No. 8 s.w.g. iron wires, to be delivered at Halifax, N.S., within eight weeks after order if one is given. Also for 14 knots same as above on several reels for distribution to be delivered at Vancouver, B.C., earliest dates of delivery desirable. Specification and forms of tender can be obtained on application to the office of the General Superintendent of the Government Telegraph Service at the Department of Public Works, Ottawa. R. C. Desrochers, Secretary.

Shoal Lake, Man.—Tenders, addressed to the undersigned, will be received up till Thursday, 16th July, 1914, for the following contracts: 1. Furnishing and installing generator, exciter and switchboard; 2. Furnishing transformers and meters; 3. Construction of brick power house building. Plans and specifications may be seen at the offices of the Consulting Engineers at Winnipeg and Calgary, and at the town hall, Shoal Lake. A deposit of $25 will be required on Contract No. 3, which will be returned to bona fide tenderers on return of the papers. F. Dobbs, secretary-treasurer, Shoal Lake, Man. The John Galt Engineering Co., consulting engingeers.

Trade Gossip

Mussens, Ltd., Montreal, have received an order for a "Ruston-Proctor" steam road roller to cost $4,000.

The New York Continental Jewel Co., New York, will install a mechanical filtration plant at Laval des Rapides, Que.

Ottawa, Ont.—A special meeting of the shareholders of the Lake Erie & Northern Railway Co. has been called for August 4 in Montreal to consider the advisability of leasing the line to the Canadian Pacific Railway. It is proposed to cancel a mortgage securing $500,000 of second mortgage bonds and to provide a new mortgage to secure a new issue.

The Dominion Government have placed orders for supplies for the Departmental Dredging Branch during the fiscal year 1914-15 as follows: for Prince Edward Island—chain, W. H. Thorne & Co., St. John, N.B.; hose, Geo. T. Polly, St. John, N.B., and the General Supply Co., of Canada, Ottawa; oils and greases, the British American Oil Co., Ltd., Montreal; paint, paint oils, etc., R .C. Jamieson & Co., Montreal; Manila rope, Consumers' Cordage Co., Montreal; wire rope, Poole & Thompson, Montague. P.E.I.; steam pipe, valves and fittings, the Canadian Fairbanks-Morse Co., St. John, N.B. The supplies were ordered for Ontario and Quebec as follows: chain, Lewis Brothers, Ltd, Montreal; hose, the Canadian Fire Hose Co., Montreal, and the Builders' Supply Co., Ottawa; oils and greases, W. F. Kelly Oil Co., Kingston; paint, paint oils, etc., the Ottawa Paint Works, Ottawa; Manila rope, Consumers' Cordage Co., Montreal; wire rope, Drummond, McCall & Co., Montreal; steam pipe, valves and fittings, Empire Mfg. Co., London, and Samuel Fisher, Registered, Montreal. For Nova Scotia and New Brunswick, orders were given thus: chain, Norman S. Sancton, St. John; hose, Estey & Co., St. John; oils and greases, the British American Oil Co., Montreal; paint, paint oils, etc., R. C. Jamieson & Co., Montreal; Manila rope, Consumers' Cordage Co., Montreal; wire rope, the General Supply Co., of Canada, Ottawa; steam pipe, valves and fittings, the Canadian Fairbanks-Morse, Ltd., Montreal.

Contracts Awarded

Welland, Ont.—The Standard Crushed Stone Co., have been awarded a contract for making 34 miles of good roads at $4,850 per mile.

Westmount, Que.—The council has awarded a contract to Eugene Phillips & Co., Montreal. for the supplies of wire cable amounting to $17,707.

Fort William, Ont.—A contract has been awarded the Varlow Foundries, Ltd., for the heating plant for a new school building. The contract price was $9,700.

Port Burwell, Ont.—The contract has been awarded by the Dominion Government to the C. S. Boone Dredging & Construction Co., of Toronto, for dredging this port.

Montreal, Que.—Contracts have been awarded by the Protestant School Commissioners for heating and ventilation of the new Rosemount school to A. Bethune, at a cost of $25,800; and for electric wiring, to Collyer & Brock, at a cost of $3,555.

New Toronto, Ont.—Contracts for the biggest part of the work in connection with the water works have been fixed by the council. Out of six tenders for the supply of water mains, hydrants and valves, the Canadian Allis-Chalmers, Ltd., of Toronto, was successful, their figure being $11,841.

Winnipeg, Man.—The following contracts have been awarded by the Board of Control for the installation of induction regulators: The Canadian General Electric Co., for two 3-phase regulators at $4,625; The Canadian Westinghouse Co., for 2 single-phase regulators at $2,071. Engineer, J. G. Glassco.

New Toronto, Ont.—The offer of the Cargo Bridge & Iron Co., Bridgeburg, Ont., to supply a 75,000-gallon steel tank with tower for $4,450 was accepted, being the lowest of four tenders. There were three offers for an 18-inch steel intake pipe and that of the Thor Ironworks Co., Toronto, at $2.25 per foot was accepted.

London, Ont.—The London and Port Stanley Railway Commission has awarded contracts as follows: Angle bars and tie plates, Algoma Steel Corporation; spikes, J. J. Gartshore Co., Toronto; track bolts, Steel Company of Canada; guard rails and switch stands, Canadian Ramapo Iron Works; and concrete pipe, Canadian Concrete Products Co., London.

Kelowna, B.C.—Contracts for the new equipment for the power house as follows: 322-h.p. engine, to The Goldie & McCulloch, Galt, at a cost of $3,810; condenser and 400 h.p. heater, to the same company, at $626 and $527 respectively; generator and exciter, 150 k.w., Canadian General Electric Co., at $2,333; switchboard panel, the Canadian Westinghouse Co., at $400.

Ottawa, Ont.—The Government has awarded contracts for the substructures of a number of new bridges it is proposed to build along the Intercolonial Railway. The successful tenderers are as follows:—W. M. Leacy, Prescott, Ont.—Kamouraska Bridge, $2,938; St. Jean Port Joli Bridge, $4,326; crossing over N. T. R., $9,548; Black River Bridge, $4,424. R. S. and J. H. Henderson, North Bay, Ont.—River Bras St. Nicholas, $24,252, and River Du Sud Bridge, $37,903. W. R. Fawcett, Temperance Vale, N.B.—Kouchibouguacis River, $7,182; Barnaby River, second crossing bridge, $2,425; bridge half mile west Sayabee, $2,773; Black River Bridge, $1,699, and French River Bridge, $6,448. R. B. Stewart, Derby Junction, N.B.—Barnaby River, third crossing bridge, $11,288. McDonald and McIntosh, Antigonish, N.S.—Barney's River, east crossing bridge, $2,397, and Barney's River, west crossing bridge, $2,959.

Building Notes

Medicine Hat.—It is proposed to build a technical school here, to cost $300,000.

Saskatoon, Sask.—MacDonald's Consolidated, of Winnipeg, will build a warehouse here.

Ottawa, Ont. — J. A. Langelier has purchased a site for $28,000, and will probably build a warehouse.

Galt, Ont.—The site is being cleared and erection of the new Armory to cost $75,000 will soon be commenced.

Cochrane, Ont.—A new public school will be built here at a cost of $30,000. Architects, Angus & Angus, North Bay.

Brantford, Ont. — The Brantford Realty Co., will erect a factory to cost $28,000. Architects Barber & Tilley, Brantford.

Toronto, Ont.—The Crofton Storage Battery Co., will build a brick warehouse at 423 Queen street west, to cost $20,000.

Toronto, Ont.—J. A. Thatcher has obtained a permit to erect a 6-storey brick warehouse at No. 9 Laplante avenue, to cost $30,000.

Calgary, Alta.—The Calgary Oil & Stock Exchange will erect a new exchange building at a cost of $75,000. Mr. Janse, of Janse Bros., contractors, is the president.

Toronto, Ont.—Frankel Bros. have obtained a permit covering a five-storey warehouse on George street, near Duchess. The building will be five storeys in height exclusive of basement. The estimated cost is $62,000.

Penticton, B.C.—James J. Warren, president of the Kettle Valley Railway, has submitted a proposition to build a warehouse for the Fruit Union for certain considerations. The cost is not to be more than $25,000.

Winnipeg, Man.—The Farmers' Supply Co., Ltd., will build a large warehouse here at an estimated cost of $45,000. The building will have four stories and basement with provision made for adding additional stories when necessary.

Toronto, Ont.—Building permits were issued last Friday by the City Architect's Department for two new temporary incinerators, which will cost all told $26,000. Both structures will be of steel, the one at Eastern avenue and the Don Esplanade costing $9,000, while the other at Strachan avenue is to cost $17,000.

Toronto, Ont.—All the plans and specifications for the new Registry Office to be constructed over the whole block lying between Albert, Louisa, Elizabeth and Chestnut streets have now been received and bulk tenders will be called immediately for the work. It has been decided to construct the foundations of sufficient strength to permit the addition of a third story in the future. The building will practically be one huge fireproof vault.

Wood-Working

Elmira, Ont.—The Elmira Furniture Co. are building an addition to their factory.

Brockville, Ont.—The Briggs Planing Mill Co. mill was recently destroyed by fire at a loss of $18,000.

Aylmer, Que.—T. Ritchie & Co., have started work on the rebuilding of their saw mill. Electrical equipment and woodworking machinery will be required.

Brockville, Ont.—Fire recently destroyed the planing mill of the James Smart Mfg. Co., Ltd. The damage is estimated at $20,000, partly covered by insurance.

Cobalt, Ont.—The Fairview Mfg. Co.'s sash and door factory at 2058 Sixth avenue west, was totally destroyed by fire on June 22. The total loss is estimated at $23,000. The factory and contents were insured for $13,000.

Peterborough, Ont.—Fire broke out at the McDonald Estate Lumber Co. plant last Wednesday totally destroying the shingle mill and entailing a loss of about $3,500 to buildings and machinery which is partially covered by insurance.

Railways—Bridges

Ottawa, Ont.—The Morrisburg and Ottawa Electric Railway Co. will extend the line from Ottawa to Chesterville. L. Von Lydow, engineer.

Toronto, Ont.—The Toronto and York Radial Co., will rebuild the car barn on the lake shore road. The building will be a frame structure with galvanized iron, and will cost $4,000.

Brantford, Ont.—The contract for the bridge across the Grand River in connection with carrying the Lake Erie Railway line from this city to Port Dover, has been let.

Victoria, B.C.—The Johnson street bridge will cost about $700,000. That figure includes the land damages. Of the total the city will contribute about $400,000, and the by-law will be introduced at a city council meeting shortly.

Montreal, Que.—It is announced that the Canadian Northern Railway has desided to erect a temporary station fronting on Lagauchetiere street, that they would begin work almost at once and that the cost would be in the neighborhood of a quarter of a million dollars.

Vancouver, B.C.—Track-laying will be resumed on the Canadian Northern Pacific Railway from Kamloops to a point twenty-eight miles west where the right-of-way crosses the Thompson River, in the course of a few days, according to an announcement made recently by officials of the railway's engineering department. Steel has been on the ground for some time and the balance of the material and equipment necessary for laying this stretch of track is now on the way to Kamloops and immediately upon its arrival work will be started. The rails will be held up at the Thompson River until a bridge has been completed across, then another section of the road will probably be built and the uncompleted portion of the work between Cisco and Kamloops somewhat diminished. The steel for the bridge across the Thompson has already been frabricated and as soon as the rails reach the river, work will be commenced and rushed ahead on the erection of this structure.

New Haven Mellen.—W. S. Mellen, former president of the New Haven and allied railroads, has told the story of the manipulation of the stocks of the roads with an amazing cynicism and indifference—or rather with a sense of biting humor, coupled with an owl-like gravity in the box, absolutely unparalleled under the circumstances. He has shown how completely he was under the thumb of the late Pierpont Morgan, who made him president of several roads by telephone; who manipulated the stocks and controlled the whole situation as powerfully and relentlessly as the Czar of Russia. Stocks were exalted and depressed, peddled around, and sold at last by the pound weight, as Mr. Mellen said, with a whimsical humor. The imperturability of the latter; his inconsciousness of anything unusual as far as his relations with Morgan and the roads are concerned; his astounding frankness, coupled with his ability and mordant humor, conspire to form a picture unique in the outstanding feature that mark it.

New Incorporations

The National Tube Co., Ltd., has been granted a license to carry on business in Ontario. Attorney, Harry Rooke, of Toronto.

The American La France Fire Engine Co., of Canada, Ltd., has been incorporated with $50,000 capital. The head office is in Toronto.

The Detroit Sulphite Pulp & Paper Co., have been granted a license to carry on business in the Province of Ontario. Attorney, Robert Bartlet, of Windsor, Ont.

The Northern Trap Rock Co., has been incorporated at Toronto with a capital of $1,000,000 to quarry stone at Toronto. Incorporators: H. A. Hall, J. J. Flint, and W. B. Henderson, of Toronto, Ont.

The Excelsior Electric Mfg. Co., Ltd, has been incorporated at Toronto, with a capital of $40,000, to deal in electric motors at Toronto. Incorporators: L. T. Rutledge, N. H. Manning, and W. E. Carman, of Toronto.

Gardner & Gaskill, Ltd, has been incorporated at Quebec with a capital of $40,000 to carry on business as contractors at Montreal. Incorporators: G. P. Soady, H. E. S. Adams, and C. M. Cotton, all of Montreal.

The Hall Engineering Works, Ltd, has been incorporated at Ottawa, with a capital of $200,000, to carry on business as engineers at Montreal. Incorporators: T. Hall, F. H. Fox, and R. B. Proctor, all of Montreal, Que.

The Galt Wire & Ornamental Iron Co., Ltd., has been incorporated at Toronto, with a capital of $40,000, to manufacture iron goods at Galt. Incorporators: J. Spalding, of Hamilton, R. J. Spalding, and A. E. Moore, of Galt.

The Hedley Shaw Milling Co., has been incorporated at Toronto, with a capital of $1,000,000 to carry on the business of grain millers at Toronto, Ont. Incorporators: W. D. Toye, A. E. Moysey, and A. Mullin of Toronto.

The Chaleurs Bay Pulp & Paper Co. has been incorporated at Ottawa with a capital of $100,000 to manufacture pulp and paper at Sherbrooke. Incorporators: H. R. Fraser, F. S. Rugg, and H. M. Terrill, all of Sherbrooke, Que.

The Niagara Falls Pickles, Ltd., has been incorporated at Toronto with a capital of $40,000, to manufacture pickles at Niagara Falls, Ont. Incorporators: H. F. Naisbett, J. Forde and T. E. Nicholls, of Niagara Falls, Ont.

The Independent Silk Co. has been incorporated at Ottawa, with a capital of $100,000 to manufacture silk goods at Montreal. Incorporators: T. E. Herlihy, J. J. O'Grady, of Westmount, Que., and A. F. Dillon, of Montreal, Que.

The Canadian David E. Kennedy, Ltd. has been incorporated at Ottawa with a capital of $10,000 to carry on business as contractors at Montreal. Incorporators: F. H. Markey, W. W. Skinner, and W. G. Pugsley, all of Montreal, Que.

The J. H. Hamilton Shoe Co., has been incorporated at Ottawa with a capital of $100,000 to carry on the business of boot and shoe manufacturers at Sherbrooke, Que. Incorporators: J. H. Hamilton, of Levis, J. A. LaRue, and E. Trudel, of Montreal, Que.

Scientific Management Results in Automobile Factory *

By G. D. Babcock **

The principle discussed in the entire paper is that of a task and the accomplishment toward the task in magnitude and rate; being the foundation for the belief that any plan of effort which focuses toward a desired result will cause an accomplishment more perfect than before, and the rapidity of this accomplishment will be measured greatly by the intensity of the plan which directs to the focus.

A DESIRABLE attainment and one which influenced us to direct our attention to the Taylor principle of scientific management was the elimination of the peak load of employment of workmen. The tendency in automobile production has been to follow very closely a schedule established by public sentiment and seasonable demand, with the result that labor to produce was drawn from a normal market, and usually about the time that the market had again filled was thrown back on it.

Community Relation to Industries.

If a community could so select its industries that the average peaks of laborers employed in all of the individual industries gave a uniform load of all labor in the community, it would be well worth the time of the civic organizations to try to secure such industries for their community as would tend to level this peak load. Of course, if individual industries could level their particular load this would automatically care for itself, and although this can be approached in a very marked way, it cannot be as perfect as in the case where industries have been selected by a community for this particular quality.

Some causes of peak load in the employment of workmen beside that of management are uncertainty of demand for product, seasonal demand for product, small capital invested in the business, strong competition with small margin of profit, any of which can be materially improved by plans founded upon analytical study and constructive action.

Our experience has been that, through applied scientific management, efficiencies have been created, sales have been enhanced, due to better deliveries, and lower price and greater confidence of the purchaser have come about by the uniform standard of the quality of the product. This has been further affected by good service, better temper of the sales organization due to promise of delivery being kept, a better impression among those who have come in contact with our works or with the workmen, through seeing the more orderly condition of our plant, and the better feeling of the workmen themselves as reflected in their expressions.

It is no reflection on a management to secure the advice of specialists in methods of operation. Not a day goes by but representative specialists of machine tool manufacturers advise us that we are in the dark ages of shop practice; and this practice perhaps rests upon their product of but a year ago. Structural and tool steel specialists are sure that if we change from their material which we are now using to others of particular chemical analysis our results will be greatly enhanced. We know that it is wise to listen to their advice. The viewpoint is, however, quite different. In the one case we seek for advice that we wish to buy. In the other, the specialist has something which he wishes to sell. They are both good, and have their place in our industrial development.

The writer was in a responsible position with this company some years before this practical task plan of work was started, and the deductions are from data which was compiled by him over the periods mentioned. There is no attempt to suggest how others may do, and no offer of panacea for poor management. I am trying to relate an experience of the application of a much considered and discussed form of management as translated by one manager for his particular business.

Stores Department Overhauled.

The first application of the work was on our stores requisitioning, purchasing, receiving and issuing. Up to this time we had had a relatively inaccurate annual stores inventory. Although we inspected incoming materials, and that very rigorously, the inspection was not performed before their receipt into store. Invoices were passed on receipt; and having no particular pressure on it, inspection consumed a great amount of time and caused delay in moving out of stores. This plan was changed, and inspection of raw materials was made before the purchase order was credited with the receipt of the goods. At first this was a difficult task, since the passing of invoices was delayed, but at the present time it demands little of our attention to maintain it permanently in a first-class working form.

Due to the fact that the plan of progress was rather arbitrary and different individuals worked according to their own best translation of what should be done, the burden at times on the inspectors and receiving clerks was tremendous. Express and freight shipments ran high at times and caused a serious amount of overtime work with its incident confusion and inaccuracy. The control plan, which will be described later, has practically eliminated this difficulty, and the flow of materials now in stores is very smooth and uniform.

The receiving clerk had no knowledge of what to expect in any given package, but would try to record what he found. The assumption was that he would be more accurate and would not be liable to assume, but this theory has been completely exploded by our more recent experiences. He is now supplied with a copy of the purchase order placed with the vendor, and thus knows exactly what to expect from the vendor. When the count is made for the passing of the invoices of small materials, like forgings, castings, etc., that can be bagged, they are counted out not by tens or some even number, but in the size of the outgoing lot.

They are then bagged in these lot sizes, wire is wrapped around the bag and through the cloth, and a lead freight-car seal locks it. A tag with proper data is attached, and the material is sent to the bin location as marked on the stores receiving clerk's copy of the purchase order. This bin location is carried by the stock tag when closed (and we have a stock bin tag for each lot of material) to the store's balance sheet. When a requisition is written by the balance clerk, he adds old location, which is the usual assigned location. This has eliminated much confusion due to moving materials on receipt of new lots to new places in the stockroom. The possibility of bagging this material in standard lot sizes is due to the control plan mentioned.

Purchasing Department Experience.

The purchasing department was forever rushing or holding up orders, and, of course, the parties from whom we purchased had the same experience. In the recent year or so our orders have been placed with such regularity that within a few days that they should receive an order, some of our vendors call and ask if they shall make preparations for an order which is due.

The purchasing department has materially reduced its cost, and seems to

*Part I. of a paper presented at the National Metal Trades Association convention, held on April 22, at Worcester, Mass.

**Production manager, the H. H. Franklin Co., Syracuse, N.Y.

be exceptionally happy under the new order of things. Perishable goods have been put under a double bin system, and others will be as fast as we can physically arrange for it. In this double bin system the receipt of material is not confused with outgoing, or on hand. Issues bring the bin stock tag to a flat zero, as one-half of the bin is emptied. It allows extraordinary check of materials on hand, and it takes the stock man in as a factor in accurate record.

Rejected materials are handled with dispatch. Surplus has been very materially decreased and the equivalent store's investment reduced. The quick handling of the stock in the room, on account of all lot sizes being maintained standard, and the delivery to the shops and through the shops has furnished a considerable amount of our savings.

To sum up the stores situation, the peak has been practically swept off and the employees feel but a uniform burden of effort. We have practically no experience of the "Unexpected Happening." The same features that affected the stores department marked the experience of the purchasing department.

Classification of Stores.

Coincident with the initial planning for the handling of stores, we began the classification of stores and the reconstruction of the clerical methods of handling the accounts so that they would be of prime use to the works as well as to the accounting department.

The accuracy of our stores inventory has increased each year due to this careful work and the particular method employed of checking, until now with a considerably less number of clerks we have a very much greater amount of information. This information is accurate. As evidence of the latter the auditors of our stock company gave us a clearance for the last year of 0.3 per cent. error of stock on hand, and approximately 0.03 per cent. error on the transactions in and out of stores for the year. This clearance was determined by a detailed check of our ledgers and material on hand and of the accounting department records.

Old Order of Things.

The classifying of product, another movement started at the outset, had a marked effect upon our works' effort. Previously our manufacturing orders called for miscellaneous parts or assemblies, and the assembly order contained a specification of the parts which were to be used in that assembly. Parts orders were written independently of the requisition for material. No date was specified for the part to be due in finished stores. The orders were written in quantities of 25, 50, 75 and 100, and in general it did not matter whether the part was small or large, except in the case of automatic and screw machine work or punch-press work, when an order for the full quantity for the season was usually written.

These orders were not apportioned to the material ledgers, and therefore it was a case of the most persuasive foreman getting from stores the material for his parts. He could draw from stores on requisition at any time that he could find some material, and unless he had a shortage could finish his order at any time he saw fit. He had a schedule for parts to guide him. This consisted merely of a schedule of the month's production for the different types of cars, but set back as many months as our progress clerk assumed the works would need and still deliver them safely into the finished stores room in time for the issue to assemble. We had but few small subassemblies. The single group issues for one of our large assemblies might require as high as a quarter of the variety of parts in the finished stores.

After the assembly order was issued it was given to the finished stores keeper, who was supposed to deliver the materials to assembly against that order as rapidly as possible. When first parts of a lot were delivered to the assembly floor the assemblers started to put them together, and from that time on chasers tried to force the parts which were lacking through the shops on the remaining operations, and in and out of the finished stores room to the assembly floor. It was a merry chase.

One result of this was that operation set-ups veried from 1 to 100 pieces, and on the same part might vary in this complete scale. With an average of ten operations on different drawing numbers or parts to each machine, and with the preparation time of the machines uncertain, confusion resulted by interference of orders from the different shortage chasers. Very high costs were thus created. We produced cars, however, for a great many years under these conditions, and still believe that we represented a relatively high order of working efficiency in the automobile industry of the time. Engineering changes were frequent, the demands of the buying public were uncertain, and then it seemed to us to be the only way of solving the problem.

Now we can see how it could have been solved in a very much better way even with the full complication of a variety of models and many changes. When we began the classification of our products the elimination of this confusion and trouble also began. Through the findings by the classification of this product, our whole scheme of control of work has come about. The scheme of classification is briefly this:—

Classification of Products.

The first two parts made which can be fastened together as a part of the finished structure are fastened together and turned into finished stores. This unit and other parts and fastenings are issued from stores, are essembled into a larger group and then turned back into stores. This continues throughout.

In this classification we discover that in the new car, where our lot sizes have been adopted to the standard as used at present, we must make the requisition of our first piece 200 working days ahead of the time that the car can be finished. It is important, therefore, that we not only check by assembling the condition of our product, but that the lot sizes of assemblies be proportioned economically as well as lot sizes of parts. The flow of the different parts into the sub-sections, into sections, divisions, groups, and finished product, are charted, and with detail parts entered with symbols constitute the parts analysis of our product.

On each part we determine the mechanical operations through which it must go. This is also true of the assembles. We study the size and form of the materials to use, also whether patterns, dies or tools must be prepared, and, in fact, all that we can of the product in its last detail from the standpoint of the factory effort upon it. The time element is a very important factor in this analysis, both on account of certainty of delivery and of valuation of material and labor investment. The analysis of the product furnishes the groundwork on which our control rests.

Analysis of Product Discovery.

Upon the first analysis of our product we found the cause of one of the greatest troubles that we had experienced; i.e., our inability to attain a schedule that seemed perfectly possible. Thirty-nine parts in our whole car were the cause of this, and the two longest time parts in this list were two of the cheapest things put into our car, the cylinder flange and the exhaust valve. All of our effort on product analysis alone was well repaid by this one discovery. Standards were made for these parts and the time between the first effort on the first part and the finish of the completed car was greatly reduced. Later discussion of the uniform schedule will show another very important result attained after this study that has to do with the investment of capital.

Moving Materials.

With regard to the method of moving materials on ground floors, concrete pits are sunk in the floors and properly guarded. An electric transportation truck runs into the pit to bring its platform level with the floor. The truckman lifts the material from the shop floor with a power hand-truck and runs the load upon the electric truck; he then withdraws the hand-truck, runs the electric out of the pit to the new destination, where it either goes into another pit on the ground floor or to an elevator, if for the upper floors.

The load is handled from the elevator much as if the elevator were a pit. The electric truck runs in with its side to the sill. The elevator is operated to raise the truck to the particular floor level on which the load is to be delivered. The load is then removed to the floor with a power hand truck, and the elevator lowers the electric truck to the ground floor and releases it. The elevator man returns at his first opportunity and delivers the load to its proper place.

In connection with the bagged materials spoken of and the adoption of a universal size of a particular part lot, economical results of handling materials, as mentioned previously, were obtained. In addition to this, the labor of the movemen has been very much lightened, and one man can deliver a thousand pounds from stores to any place in the works with greater rapidity and ease than he could carry a pail of water over the same path. The lack of fatigue of the moveman allows a high rate of travel throughout the day. Where, before, movemen would ignore a pile of heavy material until they were forced to carry it, now they take whatever comes as it comes.

NEW REAGENT FOR ETCHING STEEL.

A new reagent for etching mild steel for purposes of microscopic examination was offered by Walter Rosenhain and J. L. Haughton in a paper before the London meeting of the Iron and Steel Institute, May 7 and 8. In attempting to etch a copper alloy which was attached to a plate of mild steel, the authors employed the ferric chloride reagent ordinarily used for etching brass or bronze. They noticed that while the steel was exposed to the reagent the copper alloy was not acted upon, as was natural, but that the reagent exerted a distinct etching action on a portion of the attached steel which had been polished. The appearance of this was so interesting that they decided to investigate further. So far as their results have gone, the authors have found that in order to secure satisfactory and uniform action it is necessary that the composition of the new reagent should conform to the following formula:

Ferric chloride (Fe_2Cl_6), 30 grams.

Hydrochloric acid (conc.), 100 cubic centimeters.

Cupric chloride ($CuCl_2$), 1.0 gram.

Stannic chloride ($SnCl_2$), 0.5 gram.

Water, 1 liter.

These proportions have been arrived at after a considerable number of trials in which the composition was rather widely varied. Its use requires considerable care. Thus far the authors have found that in practically pure carbon steels the new reagent yields a pattern which is the reverse of that obtained with the ordinary etching reagents such as picric acid. On hardened steels, especially those of low and moderate carbon contents, the reagent yields very clear results, particularly in the etching of martensite, although in this case the patterns are not reversed as compared with those obtained with picric acid, sulphur dioxode. etc.

The principal interest and importance of the new reagent, however, lies in the fact that it reveals in a clear and striking manner the distribution of phosphorus, particularly in mild steels, yielding results which compare favorably with those hitherto obtainable by the heat-tinting method devised by Stead. It may be stated at once that the action of the new reagent consists in the deposition on the surface of the steel of thin films of metallic copper.

In a mild steel exhibiting the usual pearlite-ferrite structure it is found that whereas the ordinary etching reagents, such as nitric acid, picric acid, etc., rapidly darken the pearlite by attacking and roughening it, leaving the ferrite practically unaltered, the new reagent reverses this procedure. The pearlite is left untouched, appearing white and bright under normal light, while the ferrite is covered with a film of copper having a slightly rough surface texture, and therefore appearing black under normal light, particularly if the period of etching has been somewhat long.

The resulting effect is, however, striking. When applied to quenched steel, the new reagent yields patterns which are of the same kind as those produced by other means, that is, there is no reversal in this case. It, however, develops the structure of martensite, particularly in low carbon steels quenched from a high temperature, in a remarkably clear manner.

HIGH-SPEED STEEL.

By William Abbott.

For a number of years, attempts had been made to improve upon the self-hardening steel first manufactured by the Mushet Co. and afterwards by most of the principal makers in United States and Europe, with more or less success for some years before the discovery of high speed steel in 1898.

Self hardening steel is a high manganese steel with a percentage of chrome, and is high in carbon. Experiments were made by Taylor and White at the South Bethlehem crucible plant of the Bethlehem Steel Co. They began first by adding ferro-tungston, but with no great success, and it was only by an accident that the proper method of heating tools was obtained. It occurred in this way, and what follows is described by one of those engaged in the work. A test piece was made under the following formula;—

Carbon	.50
Molybdenum	10.00
Chrome	4.50
Manganese	.15
Silican	.20

Tools were shaped and given the blacksmith to heat. He by mischance left them too long in the fire, as he thought, as they were apparently overheated, being burnt at the ends, and only fit for scrap; where they were thrown. They were afterwards picked up by a machinist who wanted a lathe tool, and he ground one for his work. This gave such surprising results that inquiry was made and the secret discovered, proving thereby that the high heat given accidently was exactly what the steel required. After this, the evolution from the old self-hardening to high-heating high speed steel was easy and rapid, and after perfecting their discovery, the Taylor-White Co. took out a U. S. patent for the steel process, and then sold it to the Bethlehem Steel Co., who carried it to the Paris Exposition of that year, where it created quite a sensation. They later sold a number of rights to manufacture. In those early days, it was thought that if the steel were made over .40 in carbon and low in maganese it would be a mistake, but such was not the case,

Since then all the principal steel plants in Europe and United States have taken up the manufacture of this high grade steel, under various designations although all using practically the following same analysis;—

Carbon	.70 to .75
Tungsten	18.00 to 18.50
Chrome	4.50 to 5.50
Manganese	.20 to .24
Silicon	.15 to .20

The sulphur and phosphorous contents are kept very low. Some makers now add about .25 to .50 vanadium while others again put in about 4 per cent of cobalt with good results.

It is not for the writer to make comparisons or show any preference, but during his long experience as a representative of high speed steel, having introduced the first of the new steel into Canada, he is of the opinion that those steels are the best which have as a base, Swedish or Norway iron, other additions being equal.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

SCREWING AND TAPPING FIXTURE.

By W. G.

THE drawings herewith illustrate an improved screwing or tapping fixture for threading small accurate repetition work. It is of simple construction, most of the machinery being plain turning. A glance at the accompanying drawings will no doubt give a clear idea of its general features.

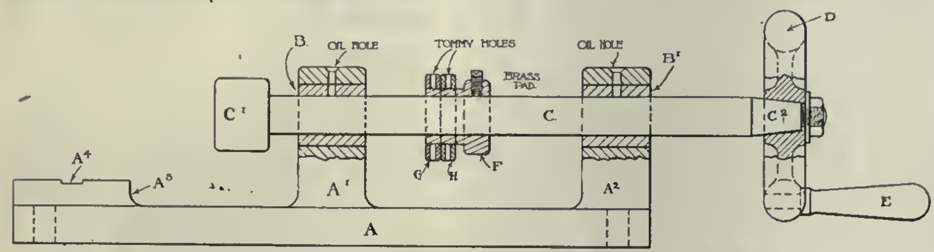


FIG. 1. LONGITUDINAL PART SECTIONAL ARRANGEMENT.

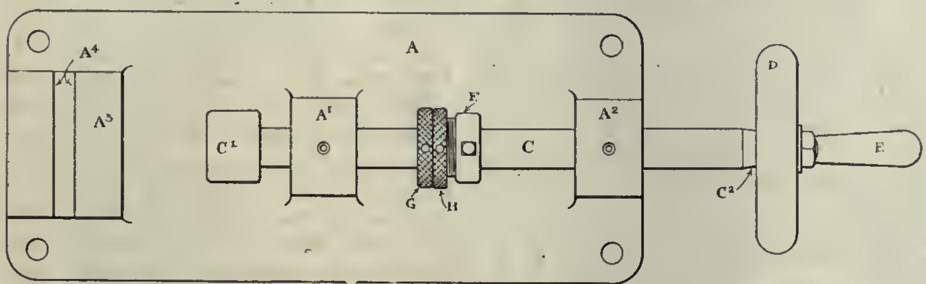


FIG. 2. GENERAL ARRANGEMENT PLAN.

Fig. 1 is a longitudinal part sectional view showing general arrangement of fixture. Fig. 2 is the plan of same, while Figs. 3 and 4 are detail views of the screwing and tapping spindle ends respectively. The fixture body A consists of a rectangular cast iron plate, having formed at one end a pair of uprights or journals A^1 and A^2. It is further provided at its opposite end with a flat projection or facing A^3, through the center of which is formed a tongue groove A^4, this being for the purpose of receiving a corresponding tongue formed on the underside of the tapping or screwing holder, thereby providing means for keeping the said holder quite square with the spindle. It is finally secured to the facing by screws.

The bearing bushes B and B^1 are made from best phosphor bronze, and should be made a good smooth finish in the bore, the outside being a tight fit to the holes in the uprights A^1 and A^2. The spindle C consists of a circular mild steel bar, provided at its extreme end with an enlarged collar or shoulder C^1 for the purpose of receiving the tapping chuck or screwing die, whichever the case may be. The opposite end C^2 is screwed and tapered as shown, for accommodating the handwheel D; this being secured finally to the spindle by means of the nut and washer as shown. Part E is the handle, which is made from mild steel, and should be a tight fit to the hole in the handwheel rim. The adjustable stop consists of a screwed mild steel sleeve F, secured to the spindle C by the set screw as shown. It is further provided with two knurled nuts G and H; these being for the purpose of fine adjustment.

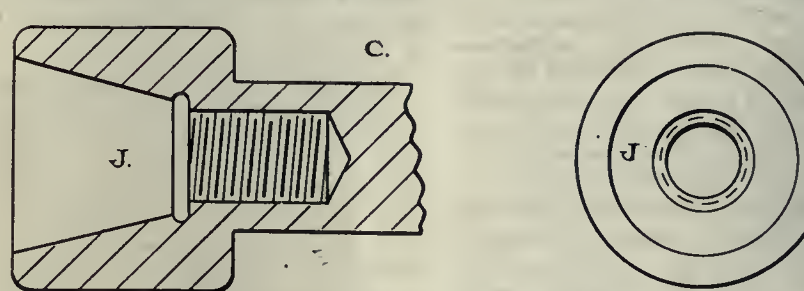


FIG. 4. DETAIL VIEW OF TAPPING SPINDLE ENDS.

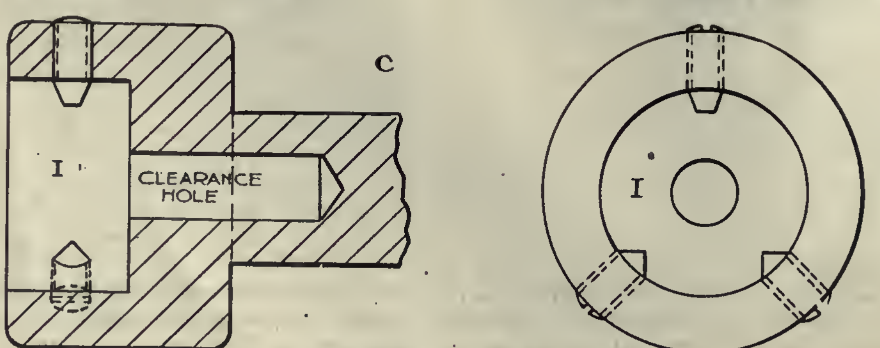


FIG. 3. DETAIL VIEW OF SCREWING ENDS.

Figs. 3 and 4 are detail views of the screwing and tapping spindle ends respectively. In the former, the recess I is bored out to receive a circular screwing die (flat type), and in the latter the hole J is bored out and screwed to receive an ordinary spring chuck. In each case, however, it is very essential that the holes should be bored out quite true with the periphery of the spindle, thus preventing the possibility of "binding" when screwing or tapping.

ATTRACTIVENESS OF BALL BEARINGS.

By N. G. Near.

ONCE in a while we run across men who proudly point to bearings of their own design that are made to run without oil. Oil is not wanted on the bearings, because it might fly off and ruin the product of manufacture. In most cases, however, that have come under my observation, such bearings are not exactly satisfactory. They heat and squeak.

Ball bearings would certainly do the same work and do it much better. They require a little oil, true enough, but just enough to keep the balls and races from rusting, and are now made so rugged as to be almost as durable, and in many cases more durable, than plain bearings, as Thomas' recent tests, presented before the American Society of Mechanical Engineers, plainly indicate. In textile mills, where cleanliness is a decided necessity in order that the product of manufacture will be perfectly free from dirt and grease, ball bearings are being much used.

Ball bearings are quiet, they do not heat, they are consumers of but little space, and they are the closest approach to frictionlessness that we know of.

BORING MILL PRACTICE.—II.

By Albert A. Dowd.

Figure 4 shows the second setting of the blank A which we have partially machined on the periphery in the first setting. The hard jaws shown in Figure 3 are now removed and the soft jaws U substituted for them. Tools K and M in the main head turret are used to bore these jaws to the size of the finished portion of the blank, and it will be noted that tools are the same as those used in the previous setting. The shoulder V in the jaw is made rather shallow so that a part of the surface previously finished will appear above the top of the jaw. It will be seen that no changes in the set-up of either the main or side heads is necessary for this setting as same tools are used in each instance.

Tool K in the main head is started from the center feeding outward while

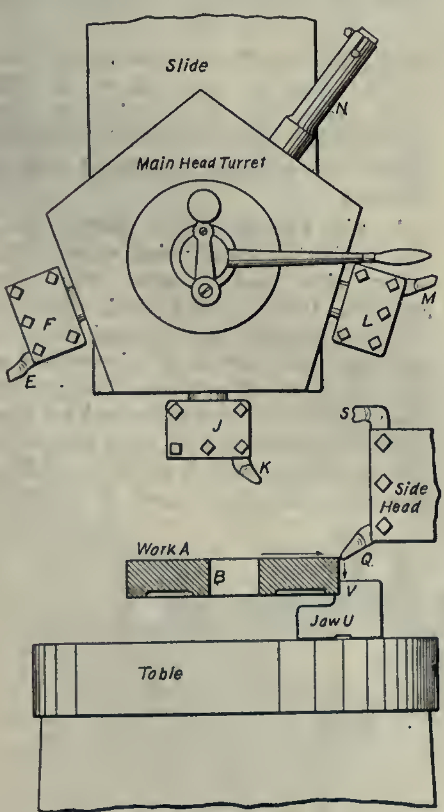


FIG. 4. SECOND SETTING FOR GEAR BLANK.

the side head tool Q feeds inward a short distance on the same surface. The side head is then withdrawn and rough turning is accomplished while the main head tool completes the rough facing. The relieved portion is machined by the

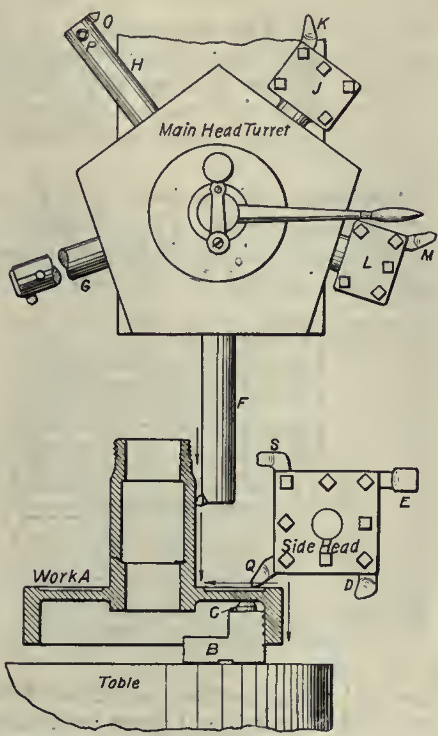


FIG. 5. SET-UP FOR MACHINING FLY-WHEEL PULLEY.

tool S in the side head as in the first setting, while the finish facing is done by the tool M. In completing the outside turning of the blank, considerable care is taken in the first setting. If attention has been paid to the reading of the micrometer dials during the first setting, the same reading will be found of assistance during this operation and less difficulty will be experienced in obtaining the correct diameter. Neither the boring bar N nor the tool E are used in this setting.

Handling a Fly Wheel Pulley With Simple Tooling.

In the machining of the flywheel pulley shown at A in Figure 5, the first step is the reversal of the jaws B and the insertion of raising buttons C so that the work may be gripped from the inside of the rim and supported on the buttons in order to obviate any trouble which might be caused by the fillets in the casting. There are some changes in the tooling also in this setting but five minutes or so is ample time in which to make them. The two holders and tools M and K remain as they were in the main head turret and the two tools Q and S in the side head also remain there. Other stations are occupied by the tools shown.

The first operation consists of rough turning the thread diameter on the upper portion of the hub with the turning bar F, and afterward rough turning the main portion of the hub itself with the same tool. As soon as the roughing diameter of the thread has been started, the tool Q in the side head is started on the facing of the part of the web indicated by the arrow in the illustration. This cut being short is over before there can be any interference with the bar and the tool is drawn back and started on the outside turning of the rim. Speed, of course, must be set for the larger diameter and, as this surface is somewhat shorter than the hub portion, it is obvious that it will be completed before the other. The undercutting tool D is now set at work in underfacing the rim and some care may be necessary at this point to avoid running into the face of the jaws. It is not essential, however, to completely finish this face as the second setting will remove some of the stock.

The main head tool K is next used to face the end of the hub and the tool S in the side head is started on the relieved portion of the web. The finish facing of the end of the hub is done at the same time by the tool M in the main head turret. The boring bar G now begins its work on the recessed hole and, while this process is going on, the tool E in the side head is successively used to finish the thread diameter, the hub itself, the finished surfaces on the web, the outside of the rim and the under face of the rim. Coarse feeds are used for these operations with a very small removal of stock, two cuts being necessary to bring it down to the correct sizes. The rubbing effect or drag of this

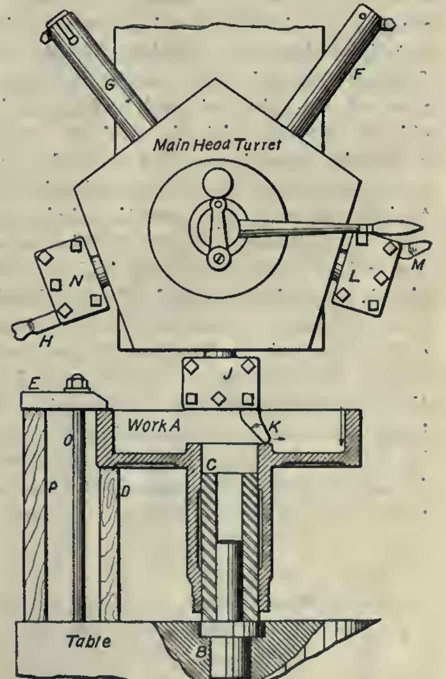


FIG. 6. SECOND SETTING OF PULLEY, SHOWING USE OF LOCATING BUSHING.

wide-faced tool produces an excellent finish. The slip cutter for the reaming bar now finishes the hole leaving nothing more remaining in this setting but the chasing of the thread.

The thread chasing attachment is thrown into gear and the turret indexed until the bar H is in position for the threading operation. This bar is dovetailed across the end to receive the threading tool O which is adjustable. A split in the bar permits the ready clamping of the tool through the screw P which acts as a binder. Several passes are necessary to produce the thread, a special arrangement of the mechanism permitting the rapid power traverse to be used in returning the tool after each cut and picking up the thread without trouble, thus avoiding considerable lost time and the necessity of reversing the machine.

Figure 6 shows the tooling for the second setting of the work A and also the method of setting up by means of a locating bushing on a central plug B. The patternmaker is called on for assistance in this setting and he cuts out some blocking as shown at D and P, three pieces of each kind of equal length. The mark rests on the three pieces D while the clamps E are supported at their outer ends by the blocks P. The long tee-bolts O are used in the table tee-slots for clamping the work firmly in position. It is then indicated in order to make sure that no distortion has taken place during the setting of the clamps.

Another holder N is placed in the main head turret for this setting of the work, this being shown at N with a roughing tool H in position for roughing out the web portion of the casting. The first operation in this setting is that of rough facing the hub and boring the inside of the rim with the tool K used in a previous setting. The second operation consists of facing the web with the tool H, a roughing operation being all that is required. The final finishing of the end of the hub and the inside of the rim is done by the tool M used in the first setting. Correct height from the end of the hub to the face of the rim is easily obtained by setting the tool on the finished rim and then dropping the head the required distance as indicated by the graduations on the hand wheels. It will be noted that the side head is not used at all in this setting of the work.

Escher Wyss & Co., of Montreal, have been awarded a contract by the city of Saskatoon for one four-million-gallon motor driven centrifugal pump to operate against a head of 162 feet, and for one four-million-gallon motor driven centrifugal pump to operate against a head of 40 feet. The motors and switchgear will be made by the Canadian General Electric Co.

Fast Work on Large Centrifugal Pump Castings

By John H. Eastham

The advantages to be gained by the judicious distribution of a bonus among all those directly connected with the production of a piece of work are here well illustrated. The job is one that calls for ingenuity and mechanical ability from a combination of operators.

To insure early delivery of a manufactured product, a bonus was offered the foundry for each day under, and a penalty imposed for each day over a

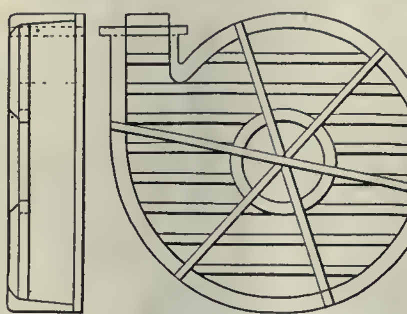


FIG. 1—REVERSIBLE SKELETON PATTERN.

contract time, for the completion of the two sets of centrifugal pump castings of unusually large size. The bonus though not large, was sufficient to stimulate an amount of energy, thought and co-operation that resulted in the finishing of the job in remarkably short order.

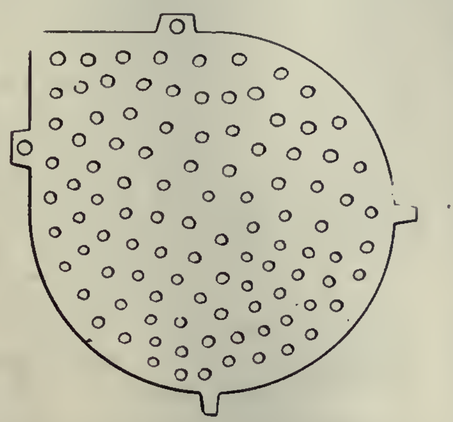


FIG. 2—REVERSIBLE DRIER PLATE.

A pattern of skeleton type shown in Fig. 1 was so fastened together with screws as to permit the cross ribs to be turned over to the opposite side of the flange, thus rights and lefts were easily moulded from the one pattern. The adoption of this plan saved more than a week in the pattern shop. A core frame of similar skeleton design, also reversible, was built, so as to allow moulding and core-making to proceed simultaneously; two shifts of twelve hours each being employed in the foundry on both operations.

As the heavy main core, measuring nine feet in diameter by fifteen inches deep, required at least two nights' drying, the plate shown at Fig. 2 was first cast, both faces being made as smooth as open sand moulding would permit. Right and left-hand core-making would

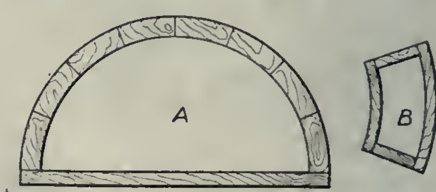


FIG. 3—SKELETON CORE BOXES FOR MAIN CORE AND FLANGE COVER CORE.

have entailed either the use of each side of the driers or extra plates at additional cost. To bring the time and cost of production down to the minimum, the method of moulding employed was as follows:

A pit twelve inches deeper than the casting's lowest point at strengthening ribs and flanges was dug, and on this a coke bed laid to facilitate venting in the usual way. A bed was next struck off above this at the full depth of pattern. The pattern was next lowered into place and set dead level. The runners were then bedded in, and mould rammed up to the floor level or parting line by one set of moulders.

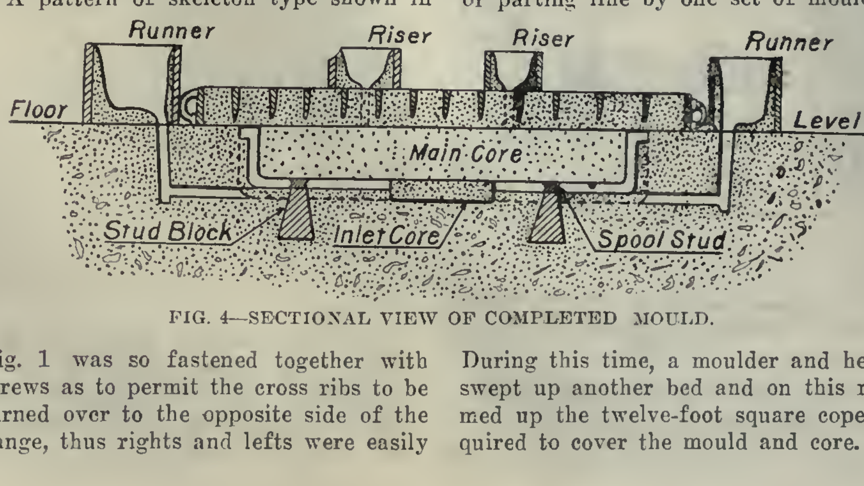


FIG. 4—SECTIONAL VIEW OF COMPLETED MOULD.

During this time, a moulder and helper swept up another bed and on this rammed up the twelve-foot square cope required to cover the mould and core.

The pattern was now cleaned out by means of short strickles cut to fit between the ribs and to give the correct depth. It was drawn out, the mould finished, well nailed at all fillets and corners, blackwashed and fired by the same set of men. In the meantime another gang started to ram up a second mould of same hand before changing pattern over.

When dry, the mould was cleared of ashes, and the intake cores placed in position, a view of this skeleton half core box being shown at A, Fig. 3. Six spool studs $1\frac{1}{4}$ in. deep were next placed on the blocks in the bed as shown in the sketch of finished mould, Fig. 4. It now remained to set the body core, place the cope, add the weights, prepare pouring basins and pour the piece with a tough semi-steel mixture suitable to withstand the heavy pressure thrown on a pump casing of this kind.

In moulding the second and ensuing pieces, a change of method was necessary owing to the amount of floor space covered by the use of two pits, and the twelve-foot bed required on which to ram up the cope. A core box, 1 in. deep, so as to fit easily under the box bars and of shape, shown at B, Fig. 3, was next made. Thirty-six cores, four of them bored to allow of risers, were required to cover the flange after the main core was lowered into place. The empty cope was then lowered over the mould and cores, and was rammed up in that position, all joints being first stuffed

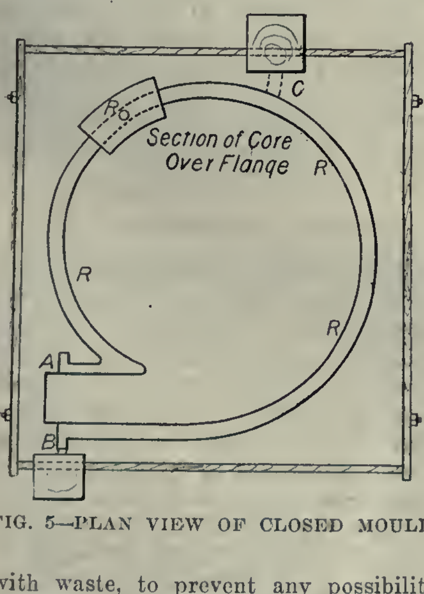


FIG. 5—PLAN VIEW OF CLOSED MOULD.

with waste, to prevent any possibility of sand working through; its removal afterwards being obviously impossible.

As the bed used to ram up the cope was not now required, considerable room was saved, which allowed of the third mould being ready to receive the flask as soon as the second was cast, and the fourth by the time the third was poured.

Fig. 5, is a plan view of the closed mould, showing one section of cover core with riser hole R bored. The position of the runners A, B, and C, and pouring basins are also indicated while in Fig. 6 is shown the style of grating used in the body cores. One and a half inches clearance was left all round between this core iron and casting to facilitate its removal and prevent risk of breaking the casting during contraction.

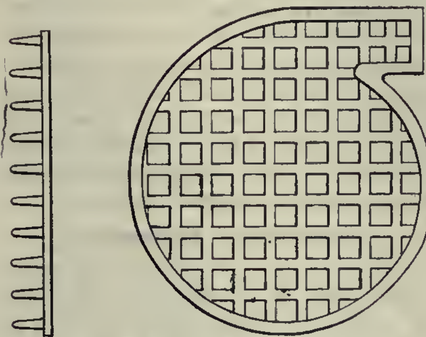


FIG. 6—MAIN CORE GRATING.

Little trouble was experienced in finishing the job in a very satisfactory way well within the specified time and to the credit of all concerned.

MODERN LOCOMOTIVES.

By Henry Bartlett.

TWENTY years ago the express passenger engine was of the eight-wheel type with 18 x 24-in. cylinders, a 58-in. boiler carrying 160 lb. of steam, a grate area of 19 sq. ft., a tractive power of 15,300 lb., and a weight in working order of about 50 tons. Since that time larger eight-wheel passenger engines have been built, then the Atlantic type of locomotive, and now the Pacific type has been reached as the standard express locomotive on many railroads. The standard Pacific type express locomotive of the Boston and Maine Railroad has 22 x 28-in. cylinders, a 68-in. boiler carrying 200 lb. of steam, a grate area of 53.2 sq. ft., a tractive power of 31,600 lb., and a weight in working order of 235,000 lb.

These locomotives have also many improvements, including a superheater, piston vales, Walschaert valve gear, a brick arch, pneumatically operated fire-door, flexible stay bolts, extended use of cast steel, a design of trailing truck permitting the use of a deep wide fire-box.

They show an increase of 83 per cent. in capacity, and at the same time an increase of 80 per cent. in weight over the standard of twenty years ago. This increase in weight in about the same proportion as the power may perhaps suggest a lack of refinement in detail, but upon investigation is will be seen that this apparent disparity does not actually exist, as one of the most characteristic improvements in locomotive design has been the introduction of the trailing truck which makes it possible to obtain ample heating surface and larger grate area, thus enabling the locomotive to deliver its rated tractive power under all service conditions, and to do it with the consumption of less fuel.

Passenger Service Locomotives.

Local conditions have developed larger passenger engines on some other roads, and the introduction of heavier steel cars will require still greater power to handle them. An example is the famous No. 999 on the New York Central Railroad, with which was inaugurated the Empire State express at the time of the Chicago Exposition, and in comparison with this the Pacific type engine which now handles the Twentieth Century Limited between New York and Chicago. In these engines, the increase of 100 per cent. in tractive power and 118 per cent. in weight is a mute testimony to the rapid growth in weight of rolling stock as well as in passenger traffic.

An interesting feature of the old No. 999 locomotive was the water table extending the full length and width inside the fire-box as a substitute brick arch, and there can be no doubt but that the increased heating surface and circulation obtained in this way was an important factor in the phenomenal success of that engine, although to-day we are obtaining similar results in an easier way with the brick arch supported on water tubes.

The development of twenty years on the Rock Island Railroad has been to the use of the mountain type of locomotive, the latter being designed to haul heavy passenger trains over 1 per cent. grade at moderate speeds and yet be capable of attaining speed of from 50 to 60 miles per hour on levels. The increase in tractive power here is 138 per cent. and in weight 156 per cent. One of the best examples of modern locomotive design is a locomotive built by the American Locomotive Co. for the Pennsylvania Railroad for testing out purposes. This locomotive, which is of the Pacific type, has been given a long try-out at the testing plant at Altoona, at speeds ranging up to 85 miles per hour. Notwithstanding the immense power and weight of this engine, it has delivered a horse-power hour on 16.4 lb. of water and 2.66 lb. of coal, establishing a record in this respect; the best performance of twenty years ago was a horse-power hour on about 27 lb. of water and 4 lb. of coal. This remarkable locomotive showed an evaporation of 6,500 gallons of water per hour, and develops a draft in front of the diaphragm of 19.6 in. of water. The maximum coal consumption in these tests was 9,700 lb. (4.8 tons) per hour, which was accomplished with stoker firing; in this manner about 50 per cent. greater boiler capacity was obtained than would have been possible with hand firing.

Freight Service Locomotives.

Twenty years ago, ten-wheel locomotives were in common use for freight service. The standard freight engines on the Boston and Maine Railroad at that time had 19 x 26-in. cylinders, a 58-in. boiler, carrying 150 lb. of steam, a grate area of 19.5 sq. ft., a tractive power of 20,600 lb., and a weight in working order of 116,000 lb. The present standard freight engine of this road is of the consolidation type, with 24 x 30-in. cylinders, a 68-in. boiler, carrying 180 lb. of steam, a grate area of 53.5 sq. ft., a tractive power of 43,400 lb., and a weight in working order of 210,500 lb. This engine has also the latest features of design, such as superheater, Walschaert valve gear, piston valves, a brick arch, pneumatic fire-door opener, etc., the increase in this class of engines being 90 per cent. in power and 81 per cent. in weight.

The transportation of freight is the most important problem that the majority of railroads have to consider, as it produces the largest part of their gross revenue and consumes the greatest proportion of their operating expenses. In considering the best type of locomotives we are confronted with a great variety of requirements which must be met in conducting this traffic. The consolidation type is giving good service where traffic conditions are suited to its limitations, that is, low or medium speed; as a type, it carries a greater proportion of weight on its driving wheels than any other road engine, and in that respect is the most logical type to select for the above mentioned class of traffic.

As the demand came for more rapid movement of freight trains, more powerful consolidations with larger driving wheels were developed, but they did not fill the requirements as expected because of lack of boiler capacity to furnish steam at the higher speed, and also the fact that the larger driving wheels had restricted the depth of the fire-box to such an extent that a large part of the heating surface was valueless. This has resulted in the development of what is called the Mikado type of engine, which is really a consolidation with a trailing truck which permits the application of a boiler large enough to furnish steam for the maximum requirements, and at the same time give ample room for a fire-box of the requisite area and depth. This type is the latest word as a fast freight locomotive, a large number having been built in the last year or two.

The Mallet type or articulated locomotive has made it possible for many roads to increase greatly the tonnage over a division on which a short heavy grade absolutely limits the train load to a fraction of what could be hauled over the remainder of the division, and where it is too expensive to reduce the grade. Some enormous Mallet locomotives have been built of recent years, one being tested out by the Pennsylvania Railroad, which has evaporated 71,000 lb. of water and consumes 15,000 lb. of fuel per hour; in this engine both sets of cylinders are simple, whereas usually Mallet locomotives are of the compound type. The fuel consumed at the above rate was 86 per cent. of two consolidation locomotimes of equal aggregate power.

Superheater Equipment.

The greatest advance in locomotive development in recent years has been the perfection and application of the high temperature superheater. Although introduced extensively only a little over two years ago, it has proved its value so undoubtedly that to-day there are over 7,000 locomotives with superheaters. This device makes it possible to reduce very greatly the amount of fuel consumed, and what is fully as important also, offers a method of obtaining power without exceeding the capacity of the fireman. Among the many attempts that have been made to improve and insure complete combustion, the Gaines fire-box and combusting chamber is an example. In this device, a large volume of heated air is introduced into the fire-box through tuyeres in the vertical wall which materially improves combustion. An important advantage of this type of fire-box is the means it offers of getting ample depth above the grate in designs with shallow throat sheets.

From a paper presented in Boston before a joint meeting of the A.S.M.E., the Boston Society of Civil Engineers, and the American Institute of Elecrical Engineers, 1914.

PROPOSED ENGINEERING AUTHORITY.

By W. J. Dick.

IN Western Canada there are usually a number of coal seams quite close together, and, should the lower seams be the more desirable with regard to quality and ease of working, there is nothing to prevent the operator from mining them first. In fact, this practice is now being followed in a number of cases in the West. As a result, caving of the measures will render it difficult, and, in many cases, impossible, to recover the coal from the upper seams. Owing to the wide distribution of coal, and the granting of leases to anyone desiring to mine it, the operator who looks to the future and mines the coal in a systematic manner, at an additional cost to himself, has to compete with the operator who takes the easiest available coal. There is, therefore, little encouragement to use other than wasteful methods.

A case came under notice where, owing to a great demand for coal, the directors instructed a mine manager to produce an output greater than the development work justified. The mine manager was forced, against his better judgment, to obtain the coal wherever he could. Some pillars were extracted and others were reduced to such dimensions that they were not able to bear the weight of the superincumbent strata. As a consequence, there was a squeeze, and to-day the mine is badly wrecked and much coal has been lost. In this case, the opinion of an engineering authority would have stood between the mine manager and the directors of the company.

It is suggested that an engineering authority be appointed by the Dominion Government to approve of the methods to be employed at all mines operated under a Dominion Government lease, and that the chief inspector of mines of each province be associated with the engineering authority in so far as matters relating to the operation of mines in that province are concerned. It would also be the duty of such authority to investigate all applications for leasing of coal lands and to determine the conditions under which such leases should be granted.

It is of interest to note, in this connection, that the Dominion Government exercises a stricter supervision over the leasing of water powers than that suggested with regard to coal; yet coal is just as important as water power, and, unlike it, can be exhausted.

Steam Raising Development.—A demonstration of the possibility of steam raising by the combustion of liquid fuel directly in contact with water has been made in Bremen, Germany. An apparatus consisting of a cylindrical boiler, provided with a number of pockets isolated and drained by suitable valves and drain cocks, was used. Each of these pockets contains an oil burner, with a pilot burner, by means of which the main burner can at starting be sufficiently heated to effect complete combustion of the oil. When the main burners are well alight, water from the boiler is permitted to flow into the previously drained pockets, and the circulation of heated water commences, the products of combustion as well as the steam generated being used as a source of power in a steam engine.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

TRAINING THE APPRENTICE.

By J. E. Cooley.

ALL the wonderful things seen and done nowadays have become what they are, because mechanical ability with the aid of machinery and tools has made them so. In a word, progress is dependent on the machinist, so when a boy or young man comes into a factory to learn the machinist trade he takes up the most progressive calling and genius-making craft in existence, and industry gains a valuable asset besides. Whether the apprentice takes to this calling and "makes good," and at the end when out of his time can turn a neat job and shows a mechanical bent of mind, will depend mostly on the care and attention given him at the beginning.

Gaining His Confidence.

There are certain rules to be taught him by his instructors, certain methods and routine for him to follow in order to advance, but the chief and most important thing to do at first, and which will be of value to him later, is to gain his absolute confidence and to look out for his safety and welfare at all times. When you receive your introduction to him, and one side of his cheek is not bulged out with tobacco, you have a good chance to keep him from using it. If he uses profane words within your hearing, you can easily teach him that good workmanship is dependent on clean words and clean habits, as well as skill.

Attending to His Welfare.

While his confidence is not gained all at once, but must be acquired, his welfare can be taken in hand the moment of starting. Since the slogan of the present mechanical era is "Safety First," the apprentice is good material to work on. The first thing to do in this line will be to take a glance at his shop clothing and see if he has his "harness" on right. Not that he may have his overalls on, with the back end towards the front, but to see that they are buttoned on the sides; the straps tucked in under the buckles; the jumper on the inside of the overalls and buttoned up; his sleeves, if rolled up, properly done so; and his shoe-strings tucked in the top of his shoes. It is unsafe for a beginner to wear an apron. While it makes him appear like a toolmaker, of course, his safety is of more consequence than his appearance. Running machinery has a peculiar habit of reaching out and catching hold of aprons, especially when these are worn by young apprentices.

The first two or three months may be considered the danger period of a youth's time serving, and after this, if he has not performed any daring feats and been put on the disabled list, he can then be trusted to take care of himself, and the time formerly given in watching out for his safety can be used looking to the quality of his workmanship instead.

Instilling Attention to His Work.

It is found that at the beginning of each young worker's mechanical career there are certain characteristics that crop out in the way of prowess or speed, that only a vigilant eye can expect to hold in check. If he is working on a milling machine, the operation of running the carriage back each time will pall on him, and to break the monotony he will grab hold of the hand-wheel and run the carriage back and forth several times with lightning speed, which exercise is good for him, but bad for the worm and gear under the carriage. If the work he is doing requires a long feed he will need strenuous watching. If there is anything around him to attract his attention his imagination will be sure to get to working elsewhere than at his machine. A four-wheel truck standing idle near him would be just the thing for him to start something. For soon you will hear a rumbling noise from far down the distant end of the room, and coming towards you at full speed you will see that somehow he has started the truck in motion, jumped on it, and is using the truck-handle for a steering-wheel. This is all similar to the way but a few short years ago he rode in a little wagon of his own, on whose sides were painted in glaring colors the word "Flyer."

Remember an apprentice never thinks of the consequences when he starts to do something like the above, so that when he is pulled out from under the bench, or part of his clothing is extricated from between two gears, in either of which location his exhibition will surely have landed him, it will be the "psychological moment" to instruct him not alone in the rudiments of "safety," but to let well enough alone.

Discourage Exhibitions of Strength.

You will notice that after an apprentice takes hold of a shipper-handle a few times to start a machine he soon acquires the habit of slamming it forward with force enough to almost break it, the noise from this often causing those working near him to run for their safety. It will not be necessary to put up a forged steel shipper-handle purposely for him, for he can be led to see that this kind of "push" will be of more benefit if applied to the work in hand.

Care should be given apprentices to see that they do not go to extremes in using their strength in tightening down or pulling against anything, as they are liable to a strain or rupture. An apprentice is sometimes disappointed when denied the privilege of wrenching his side in pulling down on a vise-handle. Sometimes he uses a hammer or babbit to tighten up the vise. This secures the work alright but forms a nice radial curve on the vise-handle for someone to straighten out afterwards. The apprentice should be told not to leave a vise with work fastened in it, especially, if it is a tapping job into which are attached a tap and wrench, for these are liable to get knocked over onto the floor and break the tap, and your own heart, nearly, if you happen to be a witness of a catastrophe of this kind.

One of the "stunts" he often pulls off is to grab hold of an upright belt while it is running, to try and hold it back for a second or two. Sometimes he succeeds in doing this, and also in causing the overhead driving belt to slip from the pulley. Such practices as this should be early discovered and also discouraged. In counseling him against it, he can be told that the engine has enough to do in driving the machinery, let alone having the double task of pulling against the strength of an apprentice.

Change of Work Beneficial.

Changing his work frequently will be of benefit to him and will keep him more interested in it, and less in his muscular development or the clock on the wall. In his work he should be early taught that well-doing is preferable to quantity and quickness in its output. Equally important also it is to let him see you are interested in the outcome of his apprenticeship. This is done by teaching him kinks and rules in regard to thoroughness in good workmanship, to expend less energy than needed and to eliminate as much as possible lost motion. These things when taught him will make each new task he handles an attractive proposition.

As his confidence is gained, his loyalty to his work and employer will increase. The confidence to be had from the apprentice is going to be equal to the amount put in him. If occasionally he is given an intricate piece of work to do, it will flatter him and help strengthen the confidence in himself. Whatever work he may occasionally spoil, he need not be dealt with too harshly even though that has been the common practice in times gone by, because he is going to learn, and "come back" by his mistakes and spoilt work; and he will do so quicker by coaching and encouragement, than by scolding and abusive language.

The successful training of the apprentice is dependent on the amount of care, interest and attention given him. As his heart becomes engrossed in his work a new world gradually opens up to him; he sees new possibilities from a mechanical standpoint; it awakens in him the ability to see into all sorts and kinds of mechanisms, and the profession itself develops his character and makes a man of him. He wants only to be treated fairly and nobly. He looks first, last, and always for a square deal, and these, coupled with confidence and a respect for him, place in your hands the making of a master-mechanic, a future manufacturer, and who knows, perhaps, a great genius.

SHOP TALK TO MACHINISTS.*

By Chas. Stelzle.

WHEN I was in the machine shop I could always tell, without looking at the signature, who made the particular drawing from which I was working. There was something peculiar about the lines and the curves which were characteristic of the draughtsman who did the job. A "Reid" drawing was very different from a "Schmidt" drawing, even though the general subject was the same. It was the same way with a "chipping" job—the marks of the chisel revealed the identity of the machinist who was responsible for it. So it was with file-marks and polishing jobs—the name of the mechanic stood out as plainly as though it were written there in acid.

Every fellow puts something of his own personality into his daily work. He does it in spite of himself, and the way that he does his work reveals his true character. You can always judge of a man by the job that he turns out. Talk about somebody keeping a record somewhere off in heaven of the deeds done on earth! Every fellow is writing his own record with hammer and chisel, with file and pen.

Well-defined Principles to Guide.

One draughtsman I have in mind was given a good deal of liberty in the way that he worked out the details of his drawing. He was original in some very important particulars. You know there's a lot of difference between machines made in this country and those made in some European countries. There's a difference in weight and in shape and in general appearance even in machines that turn out the same product. It's a question of taste and judgment as to detail.

This is true of every successful machine that was ever designed or constructed. It is the same with the plans for your life. You are given considerable liberty as to the details of your occupation; but you can't build up a successful life without obeying the laws of honor and integrity. Your lives are different one from the other—no two of you look alike or act alike in even some of the most important things; but every man whose life is going to count for much must obey the laws of the Almighty.

I had a chum when I was in the machine shop; he was a patternmarker apprentice. I used to eat my lunch with him, and I was always interested in the jobs that he was turning out, because I knew that soon I'd handle the same job, but in a different form. He was making the wooden pattern; I would handle the cast product. There was one thing about his job that always fascinated me—he worked from a "patternmaker's rule."

Now, you know that a patternmaker's rule is different from a machinist's rule; if the casting is to be made of iron, the special rule that he uses is an eighth or three-sixteenths of an inch longer per foot than the machinist's rule, and if the casting is to be made of brass, the rule is about a quarter of an inch longer per foot than the standard scale. This is so because when the pattern is placed in the sand by the molder, and the hot metal is poured in, it shrinks when it cools off just about in proportion to the difference between the patternmaker's rule and the machinist's standard rule.

A Vision All Important.

Beethoven tells us that his beautiful symphony is but an echo of the music he heard in his dream. It lost its divinest charm when he transferred it to the manuscript. It may be easier to build castles in the air than to construct huts upon the ground, but the man who never has a vision—an ideal—can't even build a hut that's worth while. The dreamer has his place in the world's work, for every machine and every great enterprise was dreamed out before it was worked out. A wise philosopher once wrote: "Hitch your wagon to a star." Now that's mighty good advice, so long as you manage to keep the wheels on the ground; but the thought that the philosopher had in mind was that we were to have high ideals—large patterns—because in this practical, everyday world these high ideals are sure to suffer when they are subjected to the commonplace duties of life.

Influence of Our Surroundings

There was a big, fat machinist in my department. He must have overweighed three hundred pounds. Now, you'd think that this big German—his name was Miller—would move around most ponderously; but not much. He ran a little speed lathe that spun around at lightning speed, and to keep pace with that machine Miller had to hustle.

There was another fellow down in the basement who ran a big six-foot lathe. He was a fine, athletic-looking chap. His name was Thompson. You'd expect this man to be a sprinter in his movements; but he wasn't. The reason of it was that his great, slow-revolving lathe had set his pace for life. Sometimes it seemed that his lathe scarcely moved; and so Thompson didn't have to move very fast while he was working. Neither did he move very fast when he wasn't working.

Did you ever notice when a man began to use a hammer at one end of the shop and set up a steady, rhythmic tap-tap-tap, and then some other fellow began to use a hammer within the sound of the first one, that the second chap kept exact time with the other? You see, we are influenced on every side. By the men that we work with and by the very machines of which we are supposed to be masters—actually, the latter frequently master us. There's a lot in the statement that some men are chained to the machine they run.

Big Ideals Necessary.

Now, to overcome these influences when they are bad we need to have big ideals. There are some working men whose motto in life is simply: "Meat, malt, and mattress"—eat, drink, and sleep. Mighty poor ideal; don't you think so? You apprentices and young mechanics, in particular, don't ever permit yourselves to degenerate into commonplace working men. I mean men who become careless of their manners and their dress, and who think of no higher things in life than to drift into the saloon at the end of the day's work, and then go home, half drowsy, and make themselves a nuisance to their wives and children, who may be struggling to maintain some degree of culture and refinement.

We hear a lot these days about "anti-poverty societies," but, take it from me, no society can do for a man what he will not try to do for himself. The successful man does not look "out" for opportunities; he looks "in," for that's where most of the chances come from.

*From "The Outlook."

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

With the further development of this course in arithmetic. it will be found by those who have followed the introductory lessone and profited by them that the various practical applications resulting from the succeeding lessons will be easily observed and their time and labor-saving features so appreciated as to be adopted at every available opportunity.

TAPER WORK.

OFTEN work comes to the milling machine to be shaped on the ends so that the corners or edges will retain or form a specified angle; for instance, pointed drills, square centers, etc. In charts 28 and 29, are shown four cuts of pointed centers, which, when used for centering or rounting, give 60 degrees.

In the triangular point, chart 28, it can be clearly shown by a diagram that the distance d—c = one-half the distance d—a, or d—e = ½ inch.

To find length o—d, use formula:—

Side adjacent = hypotenuse × cosine = 2 × cosine of 30 deg. = 2 × .86603 = 1.73206 in.

To find angle (c o d) of inclination necessary for milling the flat, use formula

$$\text{Tangent} = \frac{\text{side opposite}}{\text{side adjacent}} = \frac{.5}{1.732} = .28868.$$

Looking in chart 15 for corresponding angle, we find it lies between 16 deg. and 17 deg.

To find the fraction of the degree, use formula at foot of chart 15.

$$a_1^\circ = a^\circ + \left\{\frac{d_1}{d} \times 60\right\}^{min}$$

$$a^\circ + \left\{\frac{.00193}{.01898} \times 60\right\}$$

$= a^\circ + b^1 = 16^\circ\ 6' =$ angle (c o d).

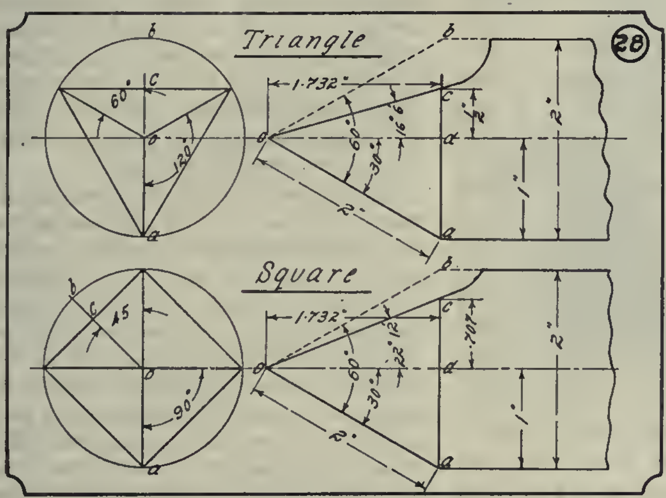
In the square point, chart 28, the length d—c can be found from formula, chart 12, where

$$\text{side} = \frac{\text{diagonal}}{1.414} = \frac{2}{1.414} = 1.414.$$

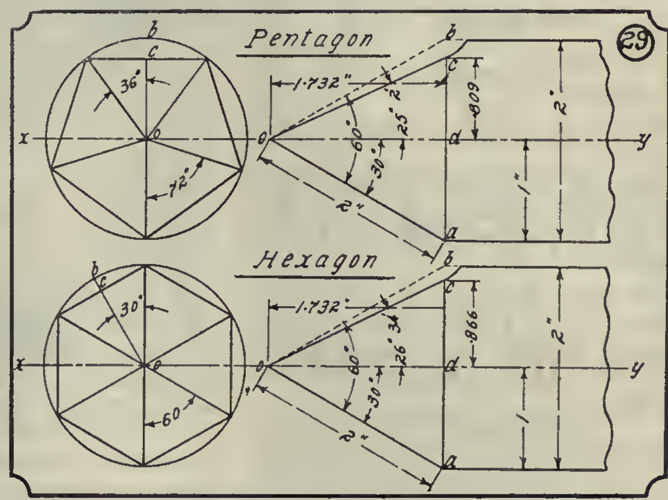
Then length d—c = 1.414 ÷ 2 = .707 in.

Again, by formula,

Side adjacent = hypotenuse × cosine = 1 × .70711 = .707 inches.



ARITHMETIC CHART 28.



ARITHMETIC CHART 29.

To find angle (c o d) of inclination use formula

$$\text{Tangent} = \frac{\text{side opposite}}{\text{side adjacent}} = \frac{.707}{1.732} = .40819$$

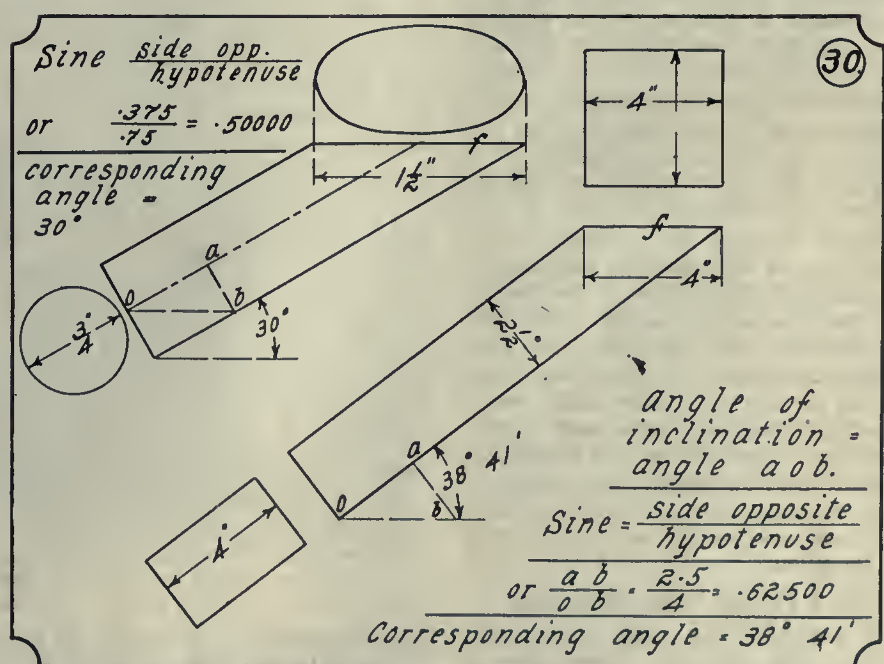
From chart 15 we find corresponding angle to be 22° 12' = angle (c o d).

In the pentagon point, chart 29, the length d—c = the cosine of the angle 36° = .80902 inches; then angle (c o d) is found by formula,

$$\text{Tangent} = \frac{\text{side opposite}}{\text{side adjacent}} = \frac{.80902}{1.732} = .46710.$$

From chart 15, corresponding angle = 25° 2' = angle (c o d).

In the hexagon point, the length d—c



ARITHMETIC CHART 30.

= cosine of 30° = .86603 inches, then angle c o d is found by formula,

$$\text{Tangent} = \frac{\text{side opposite}}{\text{side adjacent}} = \frac{.86603}{1.732} =$$

.50000, and corresponding angle from chart 15 = 26° 34′ = angle (c o d).

In chart 30 are shown sketches of a couple of interesting milling problems. A piece of ¾-in. round stock is required to be milled so that the face (f) will form an ellipse whose major axis measures 1½ in.

From the nature of the question it will be seen that the length o—b (one-half the major axis) will measure ¾ inch. Then, to find angle (a o b), use formula,

$$\text{sine} = \frac{\text{side opposite}}{\text{hypotenuse}} = \frac{a—b}{o—b} = \frac{.375}{.75}$$

= .50000.

From chart 15, corresponding angle = 30°.

Again an oblong block of steel 2½ in. x 4 in. requires milling so that the face (f) will be a square measuring 4 in. on a side.

The length o—b will equal the length of side or 4 in., and the length a—b will be the short side of oblong, or 2½ in. Then angle (a o b) will be found from formula,

$$\text{sine} = \frac{\text{side opposite}}{\text{hypotenuse}} = \frac{a—b}{o—b} = \frac{2.5}{4}$$

= .62500, and corresponding angle = 38° 41′ = angle a o b.

IRON IN BRASS.

By M. Dings.

That iron is a dangerous impurity in brass and copper alloys is now a well established fact. Many attempts have been made to produce a good inexpensive bronze by combining iron with copper and its alloys, but all such experiments have given unsatisfactory results. Metallurgical authorities inform us that carbon is the interfering element that prevents the true alloying of iron and copper. All commercial iron or steel contains more or less carbon. Thus, when iron or steel finds its way into the crucible with brass chips, it does not alloy but produces a dangerous mechanical mixture. The iron forms into small nodules and these nodules seem to absorb all the carbon in the surrounding metal, forming themselves into steel harder than the hardest chilled tool steel. These nodules vary in size from a small pin head to a pea, according to how much the metal has ben stirred while in molten condition.

Tool Trouble When Machining.

In machining brass castings, the edge of any steel tool will break when it strikes one of these nodules. This is one of the reasons why the presence of iron in brass castings is dangerous. Thousands of dollars' worth of tools have been ruined, much valuable time has been lost and a great deal of annoyance has been caused by these troublesome nodules. They are especially dangerous to tools in automatic machines. Often the operator does not notice that a tool has been damaged until many good castings have been spoiled by dulled tools or broken dies. In rolling thin brass sheets, the surface of chilled rolls are sometimes dented by the steel nodules in the brass plates. In polished work, wherever the nodules are close to the surfac, rusty spots will appear upon the brass.

Separation Difficulty

It has been fully demonstrated that with the utmost precaution, it is impossible to keep brass chips free from iron and steel. In shops where both brass and steel are machined, the brass chips always contain iron. No matter how carefully the lathes and machine tools are cleaned between operations on different metals, iron dust and small chips left in the crevices of the machines will contaminate the brass chips. Even in places where brass is worked exclusively, more or less iron and steel find their way into the brass chips. When such chips, supposedly free from iron, are treated with a magnetic separator, there is usually found an assortment of nails, screws, rivets, nuts, washers, small drills, broken taps, pieces of fractured tools, wrenches, pocket knives, etc. If any one of such articles happens to be melted in a crucible of brass, bad castings are to be expected.

Numerous fluxes for removing iron from brass have been sold to the trade, but experience has shown that they are of but little value. Where they appear to accomplish the desired purpose, careful analysis shows that the iron does not slag and rise to the top so that it can be skimmed off, as supposed, but when there is less than 2.75 per cent. of iron, it is really driven into the brass, producing a casting of a dark color, and very much harder than it ought to be. If there be more than 2.75 per cent. of iron in the mixture, steel nodules will appear in spite of any soda-ash, sea sand, or other flux of secret compound. Thus the best informed men rely upon magnetic separators as the most effective appliances for removing iron from brass chips.

Just how much iron can be alloyed with copper is not positively known. It is supposed to be about 2.75 per cent., but this alloy cannot be made by direct fusion unless the iron is free from carbon or the carbon is eliminated by a flux. When it is desirable to introduce iron into a bronze, the best practice is to introduce it in the form of a zinc-iron or ar iron-manganese alloy. Any excess of iron above the percentage above mentioned produces steel nodules.

Magnetic Separation.

Evidently it is not safe to melt brass and copper chips without first treating them with a reliable magnetic separator. As brass founders and metal refiners come to understand more clearly the necessity of melting only such chips as are absolutely free from iron, they realize that a poor magnetic separator is as unsatisfactory as none at all. Therefore metal men are cautioned to purchase only such magnet machines as have been thoroughly proven. Separators having magnets energized by electric coils are considered much more efficient than the old style machines using permanent steel horse-shoe magnets. The electro-magnets are much more intense and do not weaken with age.

Sometimes too much is expected of a magnetic separator. A good separation of any kind depends largely upon having the mixed material to be separated in proper condition. If the brass chips are greasy, or wet, the finer of them will adhere to the large iron chips and be removed by the magnets. Again, the chips may contain long spirals, or be in such curled form as to cause bad mechanical entanglement, by reason of which some of the brass is lifted with the iron and carried into the iron products. In handling metal worth $200, more or less, per ton, it pays to use common sense and give this separation problem some attention. The iron product is usually only a small part of the original bulk. If it be found to contain too much bronze, it can be quickly re-treated under a different adjustment of the separator so as to recover the brass.

A good separator should have a good feeding hopper so that the metal is brought to the separating point in an even steady flow, but a device designed to feed fine chips should not be expected to work well when the chips contain such things, as rejected castings, kindling wood, wads of paper, wrapping twine and other coarse articles. It is often a good practice to screen the chips through a ½ in. mesh screen before shoveling it into the feeding hopper of a separator.—From a bulletin issued by the Dings Electro-Magnetic Separator Co., Milwaukee, Wis.

The Gurney Scale Co., Hamilton, Ont., have been awarded a contract by the Dominion Government for a track scale 108 feet long. When erected this will be the longest scale in use in Canada, and one of the few scales in the world over 50 feet long.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

WARNER SILENT TUMBLING BARREL.

THIS Silent Tumbling Barrel is a product of the Warner Bros. Co., Bridgeport, Conn. The illustrations and description herewith refer to the general constructional and operative features. The drive is by means of a case-hardened steel worm and cast iron gear with cut teeth running in oil, a circumstance which contributes to silent operation and absence of wear of the gears. The driving pulley is equipped with an internal expanding friction clutch, operated by a lever on the same side of the machine as the tilting crank. This eliminates the necessity of going around the machine to start and stop it, and also the danger of shifting belts by hand.

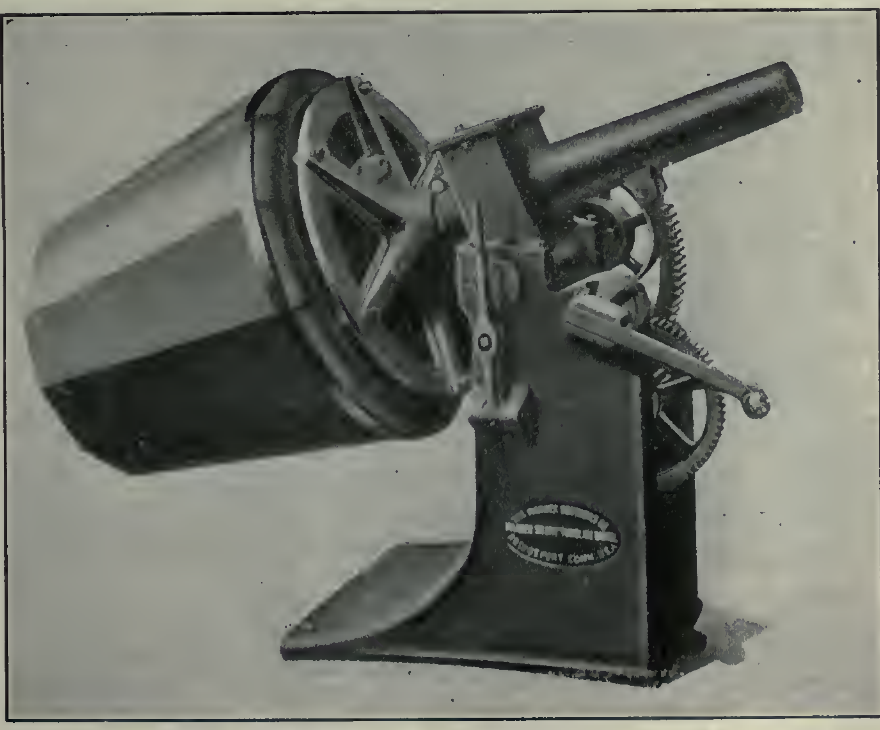
Dust-tight housings enclose the driving pulley and worm and gear mechanisms. This eliminates the wear from dust and grit and adds much to the life of the machine, so much so that machines built three years ago have, we understand, been running continually without overhaul and show no signs of wear.

The revolving the worm and gear in oil in the main housing automatically oils all the bearings in the driving mechanism, thus reducing the care required in keeping the machine properly oiled.

The barrel may be tilted to turn at any position between those shown in cuts, thereby obtaining any degree of tumble for the work. The tilting mech-

SILENT TUMBLING BARREL. DRIVING SIDE.

anism has been so designed that the pawl has been eliminated. By a slightly outward motion of the crank, the barrel is unlocked and the machine is cranked in the same manner as other machines but should the operator accidently let go the handle while raising or lowering the barrel, the handle automatically locks the barrel in the position in which it was located when the handle slipped. This makes accidents by whirling handles impossible and at the same time avoids spilling the work on the floor. The barrel load is carried by a ball thrust bearing.



SILENT TUMBLING BARREL AT LOWEST TILT. OPERATING SIDE.

Coupled with modern construction and design, interchangeability of parts has been arranged throughout.

For grinding and polishing small stampings, forgings, or castings, the cast iron or brass barrel has replaced the old style steel barrels. The cast barrel is polygonal in shape and gives the articles a more violent tumbling and producing a quicker and better finish than did the smooth, round, sheet-steel barrel.

SWING GATE AND CHECK VALVE APPLICATIONS.

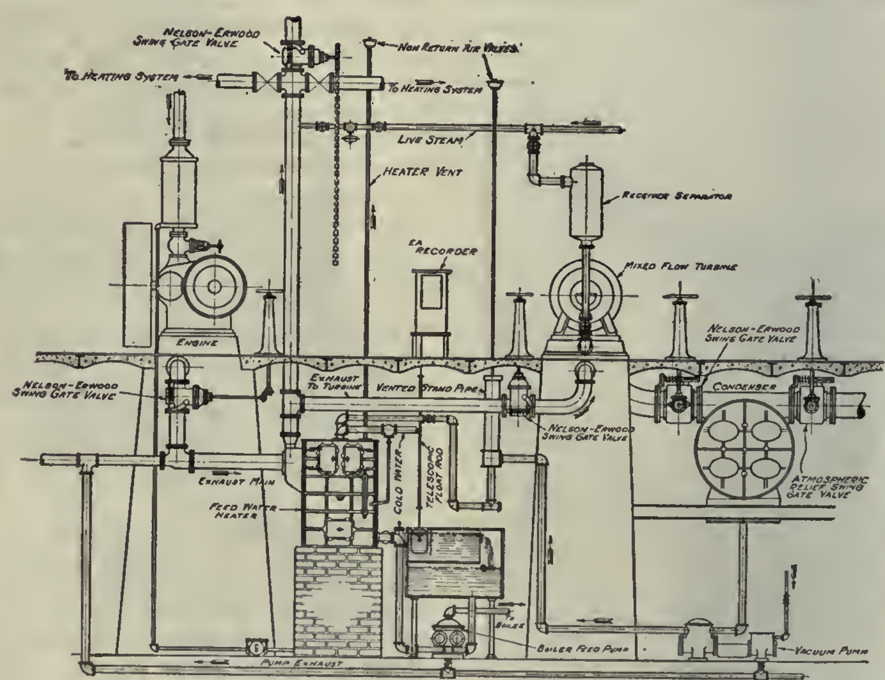
An increasing and promising use for the steam turbine is its application as a secondary or low pressure unit in connection with non-condensing or condensing engines, or, combining with a regenerator, in connection with engines using steam intermittently. At first, the most promising application of the low pressure turbine was to use steam from inefficient non-condensing engines which were found in steel mills and mine-hoists, but its field of employment is now extended to efficient power engines in railway and lighting plants as it has been thoroughly established that the most efficient steam plant to-day consists of a compound unit consisting of a reciprocating engine, acting between boiler pressure and approximately atmospheric pressure, and a low pressure turbine which discharges into a condenser.

It was not until the low pressure turbine had been commercially developed that engineers fully realized the significance of the fact that the available energy per pound of steam, between 150 pounds boiler pressure and 28 inches vacuum was cut practically in halves by the line of atmospheric pressure. Reciprocating engines are incapable of utilizing efficiently the energy below the atmospheric line, because to attain the proper degree of expansion requires an enormous cylinder, the friction within which would consume a large portion of the available energy. The turbine, however, can utilize the energy between 26 and 28 inches of vacuum as effectively as it can utilize the energy between atmospheric pressure and five pounds below. The mixed turbine plant, therefore, gives excellent steam economy over wide ranges of load, it gives considerable elasticity of operation due to the fact that either engine or turbine may be operated separately. Any leakage in the engine due to leaky valves, and improper valve setting is taken care of by utilizing that steam in the turbine; and where exhaust steam is used for heating, the mixed turbine plant allows the required amount of heat to be diverted for heating purposes before the steam enters the turbine. The principal difficulty which must be solved in the practical design of mixed-flow turbines, is the method of regulation, so as to allow the use of all the exhaust steam available; after which any deficiency in the low pressure steam supply can be made up by high pressure steam. In order to obtain the proper efficiency of the turbine under the usual operating conditions, two methods are used.

The first consists of having a turbine so constructed that the high pressure steam is admitted automatically through an auxiliary high-pressure section of the turbine. In this case the high pressure steam goes through the high pressure portion of the turbine and after the steam has been expanded to practically atmospheric pressure, it enters the low pressure part of the turbine in which it expands down to the pressure in the condenser. When low pressure steam is admitted to the turbine it enters the low pressure section of the turbine only. When running as a low pressure turbine the high pressure blades will be revolving idly. The second method consists in utilizing high and low pressure steam on the same turbine wheels, the steam acting on the same buckets in both cases. The low pressure steam is admitted through one set of nozzles and the high-pressure steam through another set. The nozzles are so designed as to properly expand the steam from either source. Whichever system of steam distribution be used, it is very important that the piping be of proper design, and that both the engine and turbine units be protected by means of the proper safety devices, so that no damage be done, if the condenser flood, if the wrong valves are manipulated at the wrong time, or if the valves are not operated in their proper order when starting and stopping.

In order to allow the engine and turbine unit to operate safely under all conditions, the Nelson-Erwood Swing Gate and Check Valve has been designed and constructed. This acts as a safety valve on any pipe line where it is necessary that the flow through the pipe shall be in one direction and where disastrous effects would follow if the steam or condensate were allowed to flow into the engine or turbine in a direction contrary to that for which it was designed.

The general arrangement of piping for a mixed turbine and engine plant is shown in the accompanying illustration. When all the steam is used by the operating units, the steam flows from the boiler into the engine, then through the turbine and into the condenser.



SWING GATE AND CHECK VALVE APPLICATION.

If there be not enough exhaust steam coming from the engine to operate the turbine unit, live steam may be admitted to it as shown. If too much exhaust steam be flowing to the turbine, a portion of it may be diverted to flow into the feed water heater. Again a proper amount of exhaust steam may be used from the engine exhaust to supply the heating system when conditions require. Such a combination of piping as shown makes for flexibility of operation under all conditions of service.

The combined swing gate and check valves, when placed in their proper positions on the pipe, operate normally as an ordinary stop valve, but in addition they protect the power plant should conditions change without the knowledge of the operator. For instance, if the engine be started, without opening the valve on the exhaust, the swing gate check valve will open automatically at a predetermined back-pressure on the engine and stay open until it is mechanically closed by means of the hand-wheel attached to the valve stem as in ordinary gate valve. When the exhaust steam from the engine is used for the heating system, this swing gate and check valve is used on the atmospheric exhaust pipe as a back-pressure valve. With high pressure, any excess of pressure in the turbine, above the back pressure in the engine, is prevented from affecting the latter by the swing gate valve closing automatically. When the pressure on the turbine side decreases, the valve will allow the steam to flow to the turbine in the usual manner. As applied to the condenser piping, the swing-gate valve will prevent flooding of the turbine due to loss of vacuum and also acts as an atmospheric relief valve.

All of the protective and operating features of the swing gate valve are based upon the fact that it is constructed as a gate and check valve in one, and is capable of performing the functions of either. The checking action of the swing gate is controlled outside of the valve casing, according to the pressure desired, while the further action of the gate is controlled by the hand-wheel, which raises the gate above the valve opening exactly like an ordinary gate valve, thus giving a full unrestricted opening. The face of the gate and the seat ring are flat, both being made of bronze. The valve is always positive in its action, as the seat is constantly cleaned by the raising and lowering of the gate, which wipes or shears off any foreign matter which would otherwise interfere with perfect closing.

The Nelson Valve Co., Philadelphia, Pa., are the designers and builders of this swing gate and check valve.

PLANER WITH ELECTRIC FEED AND AND POWER TRAVERSE.

THE accompanying illustration shows a 72-inch Pond reversing motor planer equipped with electric feed and power traverse for all heads. The design of this planer represents very advanced ideas in planer construction throughout and appears to be the last word in simplicity. Reversing motor drive has eliminated all belts, pulleys, clutches, etc., and now electric feed dispenses with the feed box.

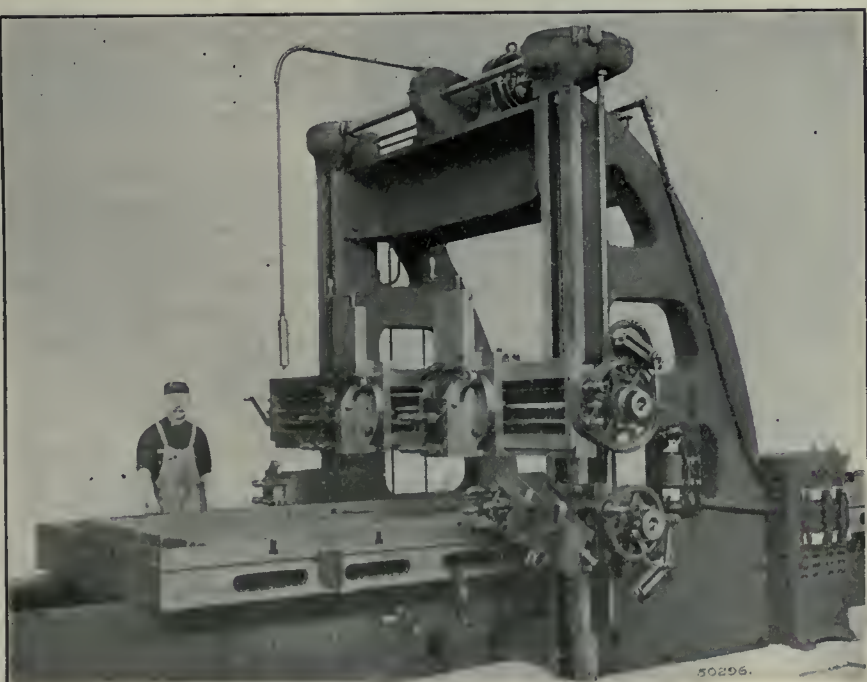
The motor is directly connected to the first driving gear shaft on the back side of the planer, giving the operator free access to the entire control at the front of the machine. There is provided a wide range of cutting and return speeds which may be varied independently of each other while the machine is running by means of the two handwheels on the front of the controller case. The handwheels are equipped with dials graduated for the various speeds. A shaft runs through the bed with levers on either side for control of the table. These levers are same as on the "A" driven planer; hence the operator has no new movements or operations to learn.

A patented pendant switch, carried by a swiveling bracket mounted on the arch, may be moved to any convenient position. By means of this switch the operator can start, stop or reverse the table if the work require him to be in such a position that he cannot readily reach either of the levers on the front and back sides of the bed. At the instant of reversal, the motor through connections in the controller, is disconnected from the line and becomes a powerful dynamic brake, stopping the table at once without drawing any current from the line. To prevent the table from running off the bed and also the breakage of tools or planer, a patented circuit breaker is provided to stop the motor at once by dynamic breaking.

The newest and most novel feature of this planer is the electric feed and rapid power traverse which is provided for all heads. Both the feed and traverse are operated by a separate motor mounted on the arch. This motor is also used for elevating and lowering the cross-rail. The mechanism for the different operations is interlocked in such a way as to prevent accidental engagement of two functions simultaneously. The amount and direction of the feeds for the cross-rail heads can be changed at each end of the rail. The changes of feed for the side heads are made in a similar manner, the feeds for each head being entirely independent of each other and of the cross-rail heads.

The hand adjustment of the side heads is by ratchet crank wrench which is mounted on and moves with the head. All heads have graduated swivels and micrometers on the feed screws. The table is of heavy and very deep box section, without openings through the bottom wall. This gives a very rigid construction and also prevents chips or cutting fluid from reaching the gears or tracks in the bed.

The Niles-Bement-Pond Co., New York, are putting the above machine on the market.



PLANER WITH ELECTRIC FEED AND POWER TRAVERSE.

LABOR ORGANIZATIONS IN CANADA, 1913.

The third annual report on Labor Organization in Canada, covering the year 1913, has been issued by the Department of Labor. At the close of 1913 the numerical strength of organized labor in Canada stood approximately at 176,000, an increase of nearly 16,000 over the figures at the close of 1912. The estimated membership for each of the three years during which reports on organized labor in Canada have been issued has been as follows:

1911	133,132
1912	160,120
1913	175,799

These figures show an increase in membership of over forty thousand during the two years 1912 and 1913, and suggest a quite remarkable development during so brief a period. The figures indicate that the growth of union membership has been fairly distributed as between international bodies and those not international in character. The bulk of Canadian trades union membership is attached to international organizations. Of the total numerical strength of organized labor for 1913, the membership owing allegiance to international organizations reached the large proportions of 149,577, leaving for all other organized bodies a membership of 26,222.

There were in Canada at the close of 1913, just over 2,000 local trade union branches of all classes, 1,792 having international affiliation 199 of a non-international character and 34 independent local bodies. These figures show an increase of 154 in international local union branches, a decrease of 26 in non-international and an increase of six in independent bodies. International organizations having in Canada at the end of 1913 one or more local branches numbered 101, an increase of two during the year. There are thirteen non-international organizing bodies in the Dominion, an increase of three as compared with 1912.

World's Trade Union Membership.

The total trades union membership of the world for 1912 stood at 12,094,490, a slight increase over the number reported for 1911, which was 11,435,498. The union membership during 1912 increased more rapidly in Great Britain than in Germany, the first named country having an increase of over 800,000 and the latter slightly over 256,000, giving Great Britain nearly a half million more of a trades union membership than Germany. The United States stands third, but especially having regard to its much larger population, considerably below Great Britain and Germany.

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A weekly newspaper devoted to the machinery and manufacturing interests, with special reference to machine tool improvement and development, machine shop methods, devices and systems relative to efficiency and economy of production.

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Vol. XII. JULY 16, 1914 No. 3

PRINCIPAL CONTENTS.

PRACTICAL EDUCATION FOR MECHANICS.

WHILE it is true that technical schools in Canada have not reached the state of perfection attained by those in some foreign countries, few mechanics make the best use of the advantages at hand. The school education at best can but teach one to understand that which he reads and observes. The man who expects a university, by some mysterious means, to transform him into an engineer, and the youth who depends upon the technical school to add to him the essentials of a master mechanic have both still to meet their keenest disappointments.

The best and most useful practical education is that which is gained by one's personal experience or which is learned from those nearest to practical work. This education is to-day the cheapest, rarest and most paid for. The price is application and self-sacrifice.

Nearly all reputable builders of machinery publish accurate instructions concerning the operation and sphere of usefulness of their machines which are gladly furnished the interested operative without cost. A great number also publish, at considerable expense, a well-edited and illustrated treatise dealing not only with the methods employed in connection with their particular product, but give a comprehensive exposition of the subject in general. These are also sent free upon application. Many manufacturers, among whom may be mentioned the larger makers of gears and gear machinery, publish tests which are sold for the mere cost of publication and mailing.

How often we see a mechanic spending a number of his hard saved dollars for a book which is so technicalized that he cannot understand it and which contains illustrations copied by the author from the manufacturers' publications which he probably obtained for nothing. The hustling mechanic now has his chance and he who makes use of his opportunities will always be the superior of the spoon-fed mechanic of the school.

ADAPTABILITY OF PRODUCTS.

CANADA has no doubt, profited much by the mistakes of United States manufacturers. Their errors of judgment, in many cases, occurred so long ago that, by the time the lessons are applicable to us, we shall have forgotten about them and their discouraging effects. Our trade in exported manufactures, though comparatively large, is in its infancy, and it is at this time that we can best take to heart the lessons so expensively learned by our neighbor.

In manufacturing for export trade, the product must conform not only to natural and legal requirements of the country in which it is to be sold but must also satisfy the precedents, personal opinions and sensibilities of the buyers. In other words the article must be made to satisfy the peculiar local necessities which created the demand for that class of goods and need not meet the demands encountered in the country of its manufacture.

For many years American steel bridge builders were unable to do business in many European countries because of the lack of artistic effect in their structures. Likewise, many opportunities have been lost by failure to add the desired amount and color of paint. The bulk of the Argentine trade in wearing apparel at present goes to Germany and England. In this connection the two largest American manufacturers of collars refused to number their products according to metric standards in use in that country. In another case a certain Western canneryman captured a large part of the English market by making his cases of much heavier lumber than usual so that the consignees could use them for other purposes when empty.

An interesting case in the implement business may be cited. Australians have long used stripper harvesters to deal with the grain crops while the South Americans have become used to the binder. The grain in both cases is eminently suited to the combined operation of reaping and threshing, yet, similar reaper-threshers cannot be sold in these two countries. The farmer of the Antipodes must have a machine with stripper teeth and the American requires one equipped with binder teeth and knife.

INDUSTRIAL NOTABILITIES--No. 43

NOEL GEORGE LAMBERT MARSHALL, the subject of this sketch, was born in London, England, on December 30, 1852, the son of Kenric R. and Charlotte A. Marshall. Following his arrival in Canada in 1856, he was educated in the public schools of Toronto, subsequently, in 1867, entering the employ of L. Coffee & Co., and remaining with them until 1870.

In this latter year he became associated with the C. J. Smith Coal Co., purchasing an interest therein in 1879. Nine years later, in 1888, he, along with Sir William Mackenzie, bought the business outright, changing its name, in 1881, to that of the Standard Fuel Co., which it still **retains.**

Mr. Marshall is president, the Standard Fuel Co. of Toronto, Ltd.; president, Faramel Co., Ltd., Toronto; president, Magann Air Brake Co.; president, Dominion Automobile Co.; director, Canadian Steel Tool Co.; director, Canadian Lake and Ocean Navigation Co.; vice-president, Imperial Guarantee and Accident Co.; vice-president, Title and Trust Co., and director, Sterling Bank.

He was also a member of the Board of Education in 1890-1891; has been a member Board of Trade since 1889; was for some years a member of the Council; and for the past ten years has represented the Board of Trade at the Canadian National Exhibition, of which he is vice-president.

NOEL GEORGE LAMBERT MARSHALL.

He is president of the Open Air Horse Parade Assn.; honorary president, Toronto Boys' Dominion; vice-president, National Chorus; vice-president, Provincial Council of Canadian Boy Scouts; member, Ontario Parole Commission; treasurer Laymen's Missionary Movement of the Church of England; governor, Western Hospital; vice-president, Hospital for Incurables; member of Board, Children's Aid Society, Orphan Boys' Home, Working Boys' Home, British Welcome League, Imperial Daughters of the Empire, Women's Welcome Hostel, Imperial Home Reunion, Georgina House, Bishop Strachan School.

Mr. Marshall married Harriette Isabel Hogg, daughter of John Hogg, M.P., York Mills, in 1879, there being two sons of the union.

His clubs are the National (president, three years); Granite, Albany, R.C.Y.C., Ontario Jockey, Toronto Hunt, Caledon Mountain Trout(Chairman, House Committee); Burlington Country, Buffalo and Buffalo Country, Canadian Society of New York, Royal Colonial Institute (London), while the societies of which he is a member consist of the A. F. and A. M. (Zetland Lodge), S.O.S., and St. George's, the latter of which he is a life member.

In politics, Mr. Marshall is a Conservative and in religion an Anglican, he having been a warden of St. Matthew's Church, Toronto, for over 20 years.

His town residence is 623 Sherbourne Street,Toronto, and his summer residence, Dunbarton Farm.—Photo, courtesy, The International Press.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		16 00
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	**Toronto.**
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X.......	18 50	17 85
Victoria, No. 2 Plain ..	18 25	17 60

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh............	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh..........	1.15
Beams and angles, Pittsburgh....	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb. off
Nuts, Hexagon, all sizes..	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright ......85, 10, 7½, 10, 10 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70. 10, 7½, 10 p.c. off	

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 50
Casting copper	15 25	15 45
Spelter	5 35	5 25
Tin	35 00	35 00
Lead	4 85	5 25
Antimony	8 50	8 50
Aluminum	20 00	19 00

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15
Lard Oil, per gal.	0.60

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3 45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4.95
1 inch	8.05
1 1/4 inch	12.65
1 3/8 inch	15.30
1 1/2 inch	16.50
1 5/8 inch	19.40
1 3/4 inch	22.50
1 7/8 inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10 3/4 oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

BELTING RUBBER.

Standard	60%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1 1/2-in	$37.50	$30.00	$17.50
33/64 to 3/4-in.	41.25	33.00	19.25
7/16 to 1/2-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

SQUARES.

Disston's 60 and 10 per cent.

Stanley's Try Squares, size 7 1/2 per doz., net $2 85

RABONES BOXWOOD RULES.

No. 1375—2 ft., per doz. (51)	$1 80
No. 1101—2 ft. „ (52)	3 90
No. 1167—2 ft. „ (7)	3 60
No. 1106—2 ft. „ (53 1/2)	4 10
No. 1375—3 ft. „ (66 1/2)	2 50
No. 1112—3 ft. „ hf. round	6 00
No. 1190—With level	8 85
No. 1493—Brass blacksmiths	1 70
No. 1494—Brass blacksmiths	2 20

LUFKINS TAPES.

Ass skin, No. 713, 50 ft., per doz.	$2 85
Ass skin, No. 714, 66 ft., per doz.	3 40
Linen, No. 404, 66 ft., each	1 10
Metallic, No. 603, 50 ft., each	1 40
Rival steel, No. 263, 50 ft., each	2 90
Rival steel, No. 266, 100 ft., ea.	4 90
Reliable Jr., No. 103, 50 ft.	2 70

WASHED WIPERS.

Select white, per lb.	0 08
Light-colored	0 06 1/2
Dark-colored	0 05

RABONES TAPES.

Tape lines, linen, No. 2601 x 50, each	$1 00
Metallic, No. 4011 x 50, each	1 35
Metallic, No. 4011 x 66, each	1 55
Steel, No. 2891 x 50, each	2 70
Steel, No. 4161 x 50, each	3 00
Steel, No. 4161 x 100, each	5 15

RABONES LEVELS.

1369 x 12, Boxwood, per doz.	$4 90
1626 x 9, Walnut pointed	4 50
1628 x 12, Rosewood	7 50
104 x 24, Triple stock (net)	27 00
104 x 30, Triple stock (net)	23 15
104 x 27	22 00

CHALK.

Carpenters, colored, per gross	$0 65	$0 80
Carpenters' lead pencils, per gross	2 40	6 75
Crayons, per gross		0 20

CHISELS.

Cold chisels, 5 x 6 in. doz.	$2 20
Bevel edge, 1 inch, doz.	2 50

WASTE (POLISHING).

Cream, per lb.	0 13
White	0 12

WASTE (WHITE.)

XXX extra, per lb.	0 11
X Grand	0 10 1/2
XLCR	0 09 3/4
X Empire	0 08 3/4
X Press	0 07 3/4

WASTE (COLORED)).

Fancy, per lb.	0 07 3/4
Lion	0 07
Standard	0 06 1/4
Popular	0 05 1/2
Keen	0 05

WASTE (PACKING).

Arrow, per lb.	0 15
Anchor	0 06
Anvil	0 07 1/2
Axle	0 09

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., July 13, 1914.—Dullness is still the outstanding feature in machinery circles and there does not appear at present to be much prospect of an improvement for some weeks to come. The report which appeared in the daily press last week to the effect that the Canadian Northern Railway had placed an order with the Canadian Car & Foundry Co., for about $750,000 worth of cars, created some excitement, but there was keen disappointment when it was learned that this order was for passenger cars only. While this will provide work for the car company for some time to come, it does not have the same effect on the metal situation, as an order for freight cars would have.

There is still a considerable amount of building being carried on locally, but supply men state that the contractors must be using their old equipment as the orders for new stuff are few and far between. There have been some small orders for mixers, and there is also some business being done in road-making machinery, but generally quietness pervades.

Some interest was aroused by the announcement that the contract for building the new Union Station in Toronto had been awarded to a Montreal firm, the Lyall Construction Co. The new structure will cost in the neighborhood of $4,000,000. It is stated that the harbor commissioners of Montreal will erect another two-million bushel elevator on the harbor front, as an addition to the present No. 1 elevator near the White Star wharf.

Metals.

There is little, if any, improvement, in the situation as regards metals. Sales are still of a hand-to-mouth character and no large orders have been placed for some weeks. One authority states that the big car companies who usually take enormous quantities of pig iron, had this year not taken 10 per cent. of last year's amount. Most of the big industrial plants are working with greatly reduced forces and it is likely that this state of affairs will continue for some time yet. An improvement is looked for in the early fall, and it is not likely that any change will be experienced before that time. Metal markets are rather quiet, though the opinion now seems to be that prices will not go any lower. Sterling quotations to-day are: Tin, spot, £146.5; futures, £147.15; copper, spot £61.10; futures, £62; lead, £19.7.6; spelter, £21.10.

Toronto, Ont., July 14, 1914.—No change is noticeable in business conditions this week, but the feeling appears to be gaining ground that the outlook is improving, and that a return to better conditions may be expected in the fall. Outside influences, which are affecting the market unfavorably, have been to some extent discounted, while the crop reports continue favorable, although rain is needed in some districts. This depression, largely the result of over-confidence in the possibilities of the country, and too rapid development, is gradually passing, and more stable business conditions will follow as the result.

The wealth of the country, in its natural resources, is becoming more apparent each year. Trade depression does not affect this vital feature, but only checks development for a more or less brief period. The temporary decrease in the amount of capital coming into the country from abroad for investment, likewise only retarded development, and does not affect the possibilities of further expansion, providing confidence in the future of the country is maintained.

A great deal of satisfaction has been expressed locally, now that the contract has been let for the construction of the new Union Station. The contract, involving the expenditure of over four million dollars, has been awarded to the Peter Lyall & Sons Construction Co., of Montreal. It is expected that the work will be completed in about three years. Not only will it result in a station worthy of the city, but it will also help meantime to relieve the labor situation, which, it is anticipated, will be a difficult problem to solve this coming winter, on account of the general depression.

Steel Market.

There has been no material change in the steel market during the week, and no marked activity is expected this month. Prices have not changed, and it is probable that an improvement may be deferred for some time. The building trade as it affects structural steel is quiet, and building permits continue to show a decrease.

The steel trade in the United States is showing indications of an improvement, while it is reported that manufacturers are confident that the remainder of the year will show a much larger volume of business than the first half. It was anticipated that the majority of the mills would shut down for two weeks, as is usual in July. The fact that operations have been resumed after only one week's idleness is significant.

Pig Iron.

The situation in the pig iron market shows no noticeable improvement, and prices have not changed. Consumers are continuing to buy only such amounts of iron as are necessary to cover their immediate requirements. Manufacturers are not accumulating stocks.

Machine Tools.

The machine tool market is quiet. The occasional sales being booked by dealers are not sufficient in number or in size to alter the state of dullness, which has been prevalent so long.

Metal Markets.

The metal markets are still quiet, although a little more business is passing than was the case last week. Buying is still of the hand-to-mouth order, and consumers are keeping stocks as low as possible. Prices generally rule the same, with the exception of tin, which is weaker.

St. John, N.B., July 13. — Five hundred feet of wharfage has already been completed by the Maritime Dredging & Construction Co. at West St. John, and every effort is being made to have the new berths ready for the early winter with the re-opening of the busy steamboat season. One million five hundred feet of Georgia pine reached the city a few days ago, and two million more feet are on order for delivery early next month. The Construction Co. now has three of the largest reclamation plants available at work with a big crew of men. Two large concrete distribution towers for the better handling of the concrete are to be erected this week. These towers will be eighty-five feet high.

A Board of Trade committee consisting of the chairman, P. W. Thomson, A. H. Wetmore, and J. Hunter White, with the secretary, R. E. Armstrong, last week visited the works under construction at Courtenay Bay, and were pleased with the progress being made, on the breakwater, dredging, and other operations. Three hundred and fifty men are employed. The committee announced that wharf building at Courtenay Bay will be started on or about May 1, 1915.

For some time there has been under consideration a project of closing the gap between Partridge Island and Negro Town Point at the entrance to St. John harbor, and now the engineers of the Department of Public Works, have recommended that the work be done. Tenders are soon to be called by the Department for the extension of the breakwater, following the call for tenders for the construction of steel sheds on the wharves building by the Maritime Co.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Prince Albert, Sask.—The La Colle Falls power development may be taken over by Kittel & Co., London, England.

Tilbury, Ont.—The Town Council will probably purchase water-works equipment shortly. W. H. Hutton, town clerk.

West Lorne, Ont.—The West Lorne Motors Co. contemplates the purchase of equipment for the manufacture of autos and motor fire engines. H. A. Carmichael, manager.

Galt, Ont.—A by-law will be voted on by the ratepayers on July 30 to authorize an issue of debentures for the purpose of providing a loan of $12,000 to the Galt Machine Screw Co.

St. Thomas, Ont.—The city council at a meeting held on July 8, adopted a resolution authorizing the expenditure of $20,000 for repairs and improvements to the present gas works plant.

Sherbrooke, Que.—Sherbrooke Construction Co. has been awarded the contract for the construction of a machine shop for the Sherbrooke Machinery Co. H. G. James, Whiting Block, is the architect.

Kerrobert, Sask.—A contract has been let to K. Pederson for the construction of the Kerrobert Steel & Ironworks, Ltd. The main building will be 60 x 200 feet and two stories high. The company is capitalized at $100,000, and the principal product will be structural steel.

St Thomas, Ont.—Work will be commenced at once on the erection of the big purifying plants in the fields of the Southern Ontario Gas Company at Glenwood, according to G. H. Houston, a member of the engineering staff of Henry L. Doherty, president of the Doherty syndicate, which owns the Southern Ontario and kindred companies in Ontario.

Calgary, Alta.—The Buckeye Engine & Foundry Co., of Joliet, Ill., have purchased from the Alberta Financial Brokers several blocks of land in their new industrial site east of the city. This concern are large manufacturers of gas and steam engines, cement mixers, large steel tanks, building and construction steel, derricks, well and oil drilling machinery, and other such lines.

Sault Ste. Marie, Ont.—It is announced that a factory for the manufacture of their products will be erected here by the Seelye Combination Axe & Tool Co., Ltd. Plans for the building are in course of preparation and it is probable that actual construction will be under way before many weeks have passed. The proposed building will be 60 x 70 feet and two storeys high.

Toronto, Ont.—Preparatory work has been started in connection with the construction of the new $1,700,000 auxiliary plant to the filtration plant at the Island. Under the supervision of Mr. Butler, William Cowlin & Sons have started the erection of blacksmith shops, carpenter shops, storage rooms, offices, stables and other necessary buildings in the vicinity of and just north of the present filtration plant.

VICTORIAN RAILWAY, AUSTRALIA, WORKSHOP TENDERS.

In addition to the tender forms and specifications already forwarded, Commissioner D. H. Ross has added some further details as to equipment required for the Victorian Government Railway Department. Particulars of these requirements are indicated in the following brief summary, together with the dates on which the tenders close at Melbourne:

25755—October 7, 1914—4 motor driven air compressors.

26110—October 7, 1914—80 sets assorted motor equipment

Specifications and tender forms are now available, for the specification of Canadian machinery manufacturers, at the Department of Trade and Commerce, Ottawa, from whom particulars relative to the departure of mails for Australia can also be obtained.

Electrical

London, Ont.—The Hydro-Electric Commission is contemplating the purchase of electrical equipment, including new transformers and generators for new power station.

Belleville, Ont.—The council has approved of a by-law relating to a contract with the Trenton Electric and Water Co. for lighting the streets. Over 500 tungsten lamps will be required.

Toronto, Ont. — At the Etobicoke Township Council meeting held on July 6, a petition was presented by E. S. Scoll and signed by a large number of residents living in the Long Branch district, asking that a Hydro-Electric house-lighting system be installed in the district west of New Toronto and east of Browne's line.

Municipal

Chatham, Ont.—The Chatham Gas Co. has refused the offer of $410,000 made by the city for their plant.

Stettler, Alta.—Extensions are contemplated to the waterworks system. J. Jamieson engineer.

Listowel, Ont.—The town council contemplates installing a new water-works pump, additional mains and equipment.

Montreal, Que.—The Board of Control will call tenders shortly for a 24-million gallon pump. L. W. Senecal, secretary.

Windsor, Ont.—The city has purchased two motor trucks for the fire department from the Menard Commercial Car Co. of Windsor.

Guelph, Ont.—After October 1 the office of publicity commissioner will disappear. Robert McDonald, the commissioner, was appointed four years ago.

London, Ont.—Local improvements to the value of $267,242 are under construction or are soon to be undertaken by this city. An extensive storm sewer system costing $250,000 is also being installed.

Stratford, Ont.—The water commission will likely ask the city council to submit a by-law to the ratepayers in January next for "standpipe accommodation." It has been suggested that a 500,000 gallons capacity standpipe be erected. Mr. C. McIlhargy is chairman of the commission.

St. John, N.B.—The council are in the market for a quantity of galvanized iron pipe, sizes 2 in. to 8 in. diameter, inclusive. R. W. Wigmore water commissioner.

Sherbrooke, Que.—A by-law authorizing the City Council to borrow $200,000 for permanent improvements to the streets was passed by the council last Thursday. The by-law will be submitted to the ratepayers on July 27.

Stratford, Ont.—At its third meeting to consider the matter, the City Council on July 6, gave the third reading to the much-read incinerator by-law. This means that the incinerator plant will be situated on St. Patrick street, and that steps will be taken to expropriate the Burrit property for that purpose.

Newmarket, Ont.—A small vote was polled on July 6, on the two money by-laws submitted by the council, and out of a voters' list of about 1,000, only 370 voted. The by-law to raise $15,000 to extend the water system was passed with the small majority of four, while the other by-law of $5,000 to construct concrete sidewalks was defeated by 15 votes.

Calgary, Alta—The city commissioners agreed a few days ago to submit the new Louis bridge by-law, which substitutes a concrete structure for the iron one recently authorized by the citizens, and the Fourth street subway by-law at an early date. They also agreed that the by-law for the purchase of Hillhurst Park, which was defeated in April should be re-submitted to the ratepayers with these two. Nothing was decided as to parks or publicity.

Stratford, Ont.—The council has entered into an agreement with a Brantford promoter to give this city a street motor bus service. The service will be begun in about fifteen days by a joint stock company which has been awaiting the decision of the City Council before becoming incorporated. The company has been granted the exclusive right to run motor busses on the streets of Stratford on and after July 25, 1914. It agrees to operate three motor busses of between thirty and forty horse-power with a passenger capacity of 14 each.

General Industrial

Windsor, Ont.—J. T. Wing & Co. will build a new factory to cost $36,000. T. C. Pennington architect, Windsor.

Montreal, Que.—Jas. M. Aird, St. Urbain Street, will make extensions to his bakery. Gordon & Aird architects, Montreal.

Port Stanley, Ont.—The Producers Fish Co. has awarded the general contract for the construction of a $7,000 fertilizer plant to L. H. McIntyre. General manager, F. R. Robbins.

Port Dover, Ont.—Fire destroyed the plant of the Port Dover Brick & Tile Co. here last Saturday. The loss is $20,000, with no insurance, and twenty men are thrown out of employment. Mr. C. W. Barwell is the president.

Stratford, Ont.—The names of the promoters of the Stratford motor bus service are Fred Westbrooke, Brantford; W. Schultz, of Schultz Bros. Co., Ltd., Brantford; Dr. Hart, Brantford, and Norman R. Thompson, commercial traveler, Brantford.

Windsor, Ont.—Horlick's Malted Milk Co., of Racine, Wis., has purchased a tract of twenty acres on Tecumseh road, this city, and will erect a large plant for the Canadian trade. It is stated upwards of five hundred hands will be employed. The price paid for the property was about $1,500 an acre.

Montreal, Que.—Hanan & Sons, the large boot and shoe manufacturing firm of New York, are to build a factory here before the end of the year, according to the statement of C. de Forest Smith, agent, on his return from a trip through the Dominion to investigate trade conditions.

Winnipeg, Man. — "If the raw material suitable for the manufacture of fire-clay goods can be found in sufficient quantities near Winnipeg, there is every possibility that my firm will establish a manufacturing branch here in the near future," said W. R. Pickup, of W. R. Pickup & Co., Norwich, England, earthenware manufacturers.

Hamilton, Ont. — It is reported here that the Eagle Knitting Mills and the Eagle Spinning Mills Co., both of which are owned and operated by Col. J. R. Moodie and his sons, will be part of a big merger of similar interests, including the Penman mills at Paris. It is said the Moodie mills here will be accepted at a valuation of $1,500,000, and that they will continue under the present direction for a considerable term.

Estevan, Sask.—At a regular meeting of the Board of Trade recently, the deal between Mr. Bernstein, of Winnipeg, and the Board of Trade was practically closed. The board will transfer to him the half section south-west of town known as the Steele homestead, which will be the site for a large pottery plant. Mr. Bernstein has agreed to erect a $100,000 plant there, and is at the present time engaged in securing the necessary capital for his company.

Contracts Awarded

Port Hope, Ont.—The contract for harbor improvements has been awarded by the Dominion Government to Tompkins & Cunningham, of Ottawa.

New Toronto, Ont.—The village council has awarded a contract to M. J. Curley, Toronto, for laying an 18-in. intake pipe in connection with the new waterworks system. The contract amounts to $7,050.

Toronto, Ont—Peter Lyall & Sons Construction Co., of Montreal, has been awarded the contract for the building of the new Union Station. The amount involved is between $4,000,000 and $5,000,000, and the work will take nearly three years to complete.

Edmonton, Alta.—The contract has been awarded to the American La France Engineering Co., Elmira, N.Y., for the supply of one 4-cylinder combination chemical and hose motor car ($7,370); two 6-cylinder combination pumping and hose motor cars ($23,200), and one 6-cylinder motor service hook and ladder truck ($8,270).

Ottawa, Ont.—The contract for the final link in the Trent Canal system was let on July 9 to the Randolph-Macdonald Co., of Toronto, at $901,141. This is section three of the Severn River division, and the letting of the contract means that in little more than a year the Trent Canal will be completed from Lake Ontario to the Georgian Bay.

Estevan, Sask.—The following contracts have been awarded for supplies required and for the construction of water mains, etc:—Contract (a) for the laying of approximately 10,500 feet of water mains and 16,000 feet of sewer pipe, to W. S. Coffin, of Estevan, at a total cost of $39,126; (d) for the furnishing of cast iron water pipe and specials, to the United States Cast Iron and Foundry Co., of Chicago, at $39.30 for 6 and 10-inch pipe per ton, and $72.50 per ton for specials, totaling $8,870; (e) for furnishing of hydrants and gate valves, to Jenkins Bros., of Montreal—hydrants $41.05 each, 10-inch valves $29.30 each, 6-inch valves $10.95 each, and valve boxes complete $7.30 each.

Calgary, Alta.—Contracts have been awarded as follows:—Cast iron pipe, to the Canada Iron Corporation, Fort William, Ont.; 6-inch steel pipe, to the Western Foundry and Metal Co., for Page Hersey pipe at 57 cents per foot, and to the General Supplies Co., Ltd., for Stewart and Lloyd pipe at 55 cents per foot, each firm to supply 22,100 feet; 8-inch steel pipe, to the same two firms for the same makes, each to supply 2,275 feet at 76 and 77 cents respectively; 10-

Interesting Data Relative to a Gear Testing Machine*

By Wilfrid Lewis**

The machine here described is believed to contain the elements needed for an exhaustive examination of the subject of gearing in all its phases, and the writer expresses the hope that it may appeal to someone with the means to build it and the time to experiment along the lines indicated by Professor Marx.

THE gear testing machine, shown in the accompanying drawing, is the result of the writer's efforts to realize in concrete form an ideal machine for the purpose of continuing the experiments reported to the society by Prof. Guido H. Marx at the annual meeting in 1912.

The possibility of testing heavier gears at higher speeds with comparatively little power occurred at once to Ralph E. Flanders and to the writer, as pointed out in their discussions of the paper, but the problem remained to design a suitable machine which might also be used to supplement the experiments made by the committee on standards for involute gears to determine the friction losses and the running qualities of various types of gearing. After making a number of preliminary sketches, the writer was about to put them in the hands of a draftsman, when he had the good fortune to meet Prof. E. P. Lesley, one of Professor Marx's associates, who accepted the task of preparing the working drawing. The machine as it now appears is due in large measure to his careful attention and skill in the perfection of every detail, and the writer is pleased to acknowledge many helpful suggestions which have broadened the scope of the undertaking and made the design a practical possibility.

The machine proposed is based essentially upon the principle of the machine used in testing by the committee on involute gears, which is to put the teeth under a working load without consuming an excessive amount of power. The design, however, has been modified to facilitate changes in the working load and in the test gears employed. At the suggestion of Professor Lesley, it has also become possible, not only to change the amount of the working load while running, but also to change its direction, thus producing the effect of reversing loads upon the teeth while running continuously in the same direction.

Machine Details.

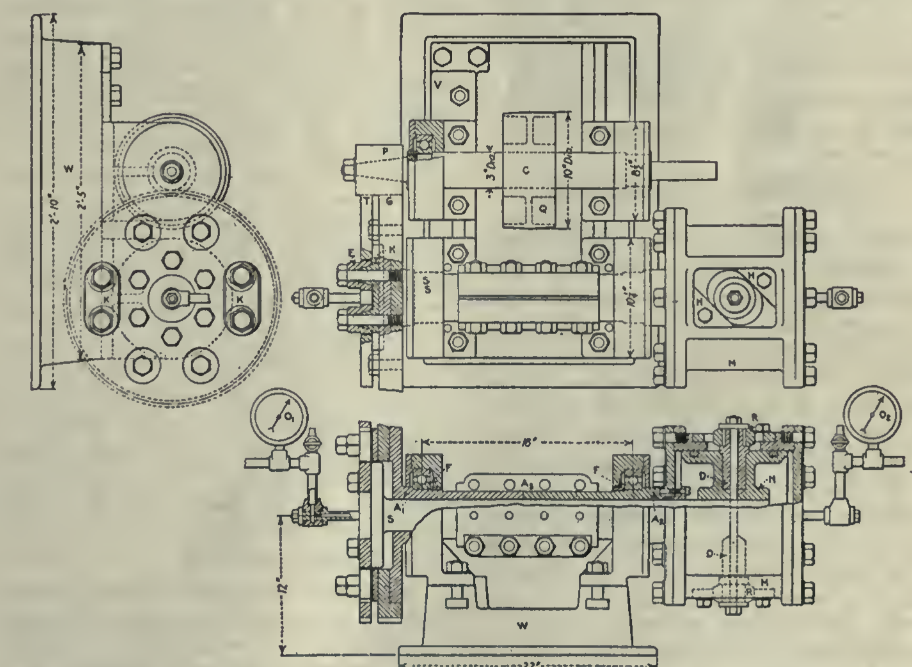
The apparatus has a hollow shaft made in two parts, A_1 and A_2, united by a clamp, A_3, which is also made in two parts to facilitate assembling. At one end of this hollow shaft is a flange to receive the steel gear ring G, which serves as a permanent part of the apparatus, and is strong enough to resist the stresses due to testing. Besides the hollow shaft A, there are two solid shafts C and S, on which are mounted the gears or pinions to be tested. The latter passes through the hollow shaft A and has a flange, at one end of which is mounted the test gear T.

The shaft C, parallel with shafts A and S, carries the wide-faced pinion P, which is in mesh with both the permanent gear ring G and the test gear T.

Shafts A and S are connected at their opposite ends by a novel device through which any desired amount of load in either direction can be applied to the teeth, whether at rest or while running in either direction. To accomplish this purpose, the hollow shaft A is flanged to receive the pneumatic cylinder M, in which is the piston N, firmly secured to the shaft S. Pins D D are driven into the piston N through the openings in the piston N on either side to give a slight amount of end motion to the shaft S and so, through the action of the rollers upon the helical segments, a slight angular motion is produced between shafts A and S, resulting in a pressure between the teeth of the gears upon these shafts and the teeth of the pinion on shaft C. Pressure gauges O_1 O_2 connecting with each side of the piston area are calibrated to record the resulting pressure on the gear teeth, taking account of the piston areas, the pitch of the helical cams H, and the diameter of the gear wheels.

Since but little power is required to drive the apparatus, the pinion P is simply clamped to the shaft C by a nut on its tapered end. The shaft itself is made heavy for the sake of stiffness, and a pulley, O, between bearings, is attached for driving from a countershaft, or if preferred a motor drive may be used in connection with the extended end.

When the gear wheel T is to be tested,



PLAN, END AND SECTIONAL ELEVATIONS OF MACHINE FOR TESTING GEARS.

cylinder M, and, upon the projecting ends of these pins, rollers R R are mounted upon roller bearings. A bolt passing through the pins, piston and shaft secures the whole in place. These rollers R R engage helical segments H H let into the walls of the cylinder M.

Air pressure can be applied to the the intention is to use it in connection with a steel pinion; and when the pinion P is to be tetsed, the intention is to make it of cast iron and cut down the width of the teeth engaging with T by nicking down on either side to a smaller width of face. When a tooth breaks in the wheel T, or in the pinion P, it is im-

*From a paper recently presented before the spring meeting of the American Society of Mechanical Engineers.

**President, the Tabor Mfg. Co., Philadelphia, Pa.

portant, in order to avoid the complete destruction of the apparatus by the jamming of the remaining teeth on their ends, to maintain the wheels G and T in proper relation to each other, and for this reason the stops K K, with their adjustable eccentrics E E, are employed. The block K is clamped to the wheel G through the intervening eccentric bushings E E. The intention is to keep one of the clamping bolts tight while the other is loosened and the eccentric adjusted to a predetermined amount of clearance on either side, after which both eccentrics are to be clamped.

—These stops do not come into action unless a tooth is broken or deformed. Then they cause both gears, G and T, to run together. By means of these stops it is also possible to study the effect of a predetermined irregularity in forming or spacing the teeth. For instance, an abnormally wide space or tooth can be simulated, when broken out or purposely cut away, by the position of the stops and the pounding effect in running will be evident as the result of a certain measured irregularity. The shafts A and C are mounted in ball bearings to reduce friction and as a matter of expediency the scale of the apparatus has been determined by the bearings F F on the shaft A. These are of the largest commercial size, and to make them available the shaft A was cut in two and united by the clamp A. The bearings for the hollow shaft are firmly bolted and doweled to a bed plate, W, while those for the pinion shaft are adjustable to the diameter of the pinion used, a distance piece, V, of proper width being used in every case to prevent movement under load.

Possibilities of the Apparatus.

It will be seen that the apparatus is capable of determining to a nice degree of accuracy a number of unsettled problems of great practical importance at a very small expenditure for wear and tear and power. Jigs will be made for drilling the gears G and T after cutting the teeth, so that the relative positions of the two wheels may be accurately fixed. Friction is practically eliminated in the ball and roller bearings, and what remains must become inappreciable under the well-known influence of vibration when running, except that due to air resistance and the friction in the teeth. With some accurate means for measuring the power consumed, both of these variables can be determined better than ever before.

The apparatus in skilful hands should, therefore, solve the mooted question of the effect of speed on strength, and questions of durability, wear and noise can be studied at a small outlay in power and materials. It is possible that some slight modifications may finally be embodied to facilitate construction.

SIGNED TRACINGS.

TRACINGS, and especially the uncolored cloth tracings which are used for reproduction by photographic process, can, says **The Engineer**, very readily be altered by erasure, as well as by addition, and in either case so as to leave no indication of the alteration which is apparent upon the photographic copies. Indeed, if ordinary care be taken in making the alterations they will more often than not be indistinguishable upon such copies from the original work, unless steps are taken to identify them by means of heavier lines or hatching, and, what is perhaps of greater importance, dating them.

It should be unnecessary to point out that no alteration should be made in a tracing which has been signed or initialled for approval or identification, unless the alteration is dated an so indicated as to be evident that it is not covered by the signature, or, in a case where there are many alterations, a note of revision subsequent to signature is placed where it is not likely to be overlooked.

A Drawing Office Tendency.

Many draughtsmen appear, however, to have a regard for neatness which causes them to overlook the grave impropriety of making such alterations without the necessary indications. They probably do it without thinking. The possibility of such unintentional alterations should, however, make anyone consider well before signing or initialling tracings which are likely to pass out of his immediate control. If, under such circumstances a tracing must be signed, it is desirable to have an immediate blue print taken off it for filing as a record and not for use. Such a print is inexpensive and practically unalterable, and affords—if duly endorsed and dated—good evidence of what has been signed. It will only serve, however, to detect, by a possibly laborious comparison, and not prevent alteration to the tracing, therefore, it is preferable, when drawings are submitted for approval, that they should be submitted in the form of prints in duplicate, one of which is to be retained. By this procedure the risk of signing a tracing is avoided.

To approve and sign a tracing, and let everyone concerned have prints showing the signature of approval is a course which has many convenient features, but there is always the risk of having undated and apparently trivial alterations and additions made to the signed tracing and the supply of prints continued. Where a number of copies or duplicates of the signed drawing is required, a possible procedure avoiding this risk is to sign the tracing in soft black pencil which prints perfectly by most processes, and after the necessary prints have been taken to remove the signature from the tracing. This leaves the tracing free for amendment and future use.

Transparent Cloth Prints.

A further risk arises from the facility with which a print on transparent cloth can now be obtained. These are sufficiently solid to be used as negatives for further reproduction, and as they can be altered by erasure, although not quite so easily as a hand-made tracing, they afford the readiest means of making a new drawing, involving a limited amount of alteration from an old one. They frequently reproduce faithfully the signatures, etc., upon the original, and the first step in making a new drawing in this manner by erasure or undated addition, should invariably be the erasure of any signatures, initials or indications of authorship which may be reproduced from the old tracing. A little consideration will show that this is the only correct thing to do, although the draughtsman may feel some reluctance to erase a respected name. If the previous history or authorship of the drawing demands acknowledgment, an equivalent note should be put in place of the erased signature or indication of authorship.

These may appear somewhat elementary matters, but a little inquiry will show that in the growth of mechanical processes of reproduction and an increasing disregard on the part of younger men for matters which they consider mere legal formalities, instances frequently occur in which they are overlooked. The consequences may not be serious, but it is better to avoid the risk of having an error introduced by a blundering draughtsman, under the impression possibly that he is merely correcting a clerical error, into a signed tracing from which prints containing the error indistinguishable from the original matter may be afterwards distributed.

Edmonds, B.C.—Upon the recommendation of Municipal Engineer McPherson, water pipe contracts to the amount of $23,882 were let to Robertson & Godson, Vancouver. The contract calls for 30,000 feet of 4-inch pipe for ordinary use, and 17,000 feet of duplicate delivery mains on Sperling Avenue. The engineer also recommended that Robertson & Godson's tender for various amounts of 4 and 6-inch be accepted, as well as supplies of 12, 14, 16 and 18-inch. The tender of the British Mannesman Tube Co. for the 10-inch pipe was accepted. A new 10-inch main will be run from North Burnaby to Edmonds once the shipment arrives.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

BORING MILL PRACTICE.—III.

By Albert A. Dowd.

THE present concludes the series of three articles on **Boring Mill Practice.** In our July 30 issue the first of an other short series on **Turret Lathe and Vertical Mill Practice** will appear. The author of these articles is a recognized expert in production methods and devices, and his exposition of modern machine tool operation with a view to efficient and economical output will be found highly instructive by superintendents, foremen and operatives in both large and small machinery manufacturing plants.

Holding and Machining an Irregular Piece.

The work shown at A in Figure 7 is indicated in a plan view at B in Figure 1, and it is clearly apparent that the work must be located from the cored eccentric hole. The conical locating plug E is therefore brought into play to approximate the core. It is brought down into the work before the jaws are set up at all, after which they are set with sufficient power to hold the work firmly and an additional clamp C is used in one of the table tee-slots, being held down by the bolt D, a shim being placed under the tail of the clamp to exercise a slight drawing down tendency. The

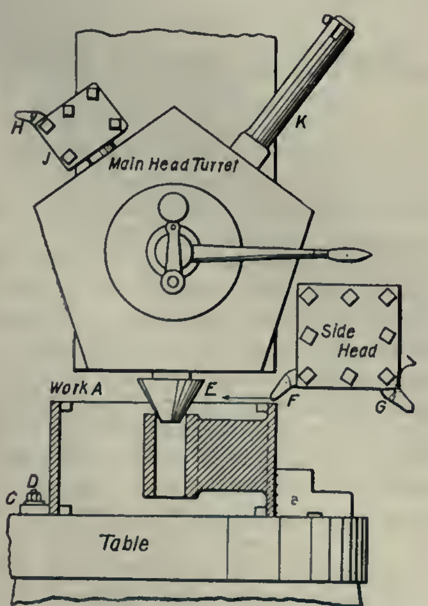


FIG. 7. USE OF CONICAL LOCATING PLUG FOR CORED HOLES.

tools used in this setting are those used in a previous one, no new tools being necessary, but the removal of several being found expedient in order to avoid interferences with the main head and side head.

The side head is first started in facing the rim working toward the center, the tool H in the holder J being used simultaneously in rough facing the hub. Tool G in the side head is next used for finish facing and the turret indexed to the boring bar position K. The table is speeded up and boring and reaming done with this bar by the aid of a set of slip cutters and floating reaming cutter of the proper sizes. The finishing operation for the other side of the piece was done on a vertical milling machine.

Machining a Thin Cast Iron Ring Without Distortion.

Figure 8 shows at A a thin cast iron shell which is to be machined to size without distortion. The method of holding a piece of work of this nature is perhaps more important than the actual machining operations as distortion in the rough casting will be apparent in the finished work. An excellent way of holding work of this kind when a number of pieces are to be machined, is by means of a set of so-called "hook-bolt jaws," i.e. a set of jaws provided with hook-bolts which pass entirely through and which can be drawn up against the surface so as to form an effective metal to metal clamp. Jaws of this kind are somewhat expensive unless the production warrants their use, in which case they will be found invaluable.

For single piece work, however, we must consider a method of handling which does not require a great expenditure. The method shown will give very good results if proper care is used in setting. The work is gripped from the inside in a set of regular jaws B, these being brought up against the casting very lightly so that no distortion will take place due to the pressure of the jaws. The piece is supported on three parallels of cold rolled steel as shown at C in the illustration. A set of standard screw dogs D are fastened in the table tee-slots at points in line with the jaws themselves, but outside instead of inside. After the work has been lightly gripped internally, the angular pointed screws E are set up tightly on the outer surface of the casting thus forming a metal to metal contact which does not distort the work and which serves two other purposes, viz.: holds the work firmly and also tends to prevent vibration which might otherwise cause considerable trouble. While this method is not quite as good as the hook-bolt jaws, it will be found of great service for any work of this character. A heavy boring bar G is used for both roughing and finishing the interior surface, slip cutters being used as in the

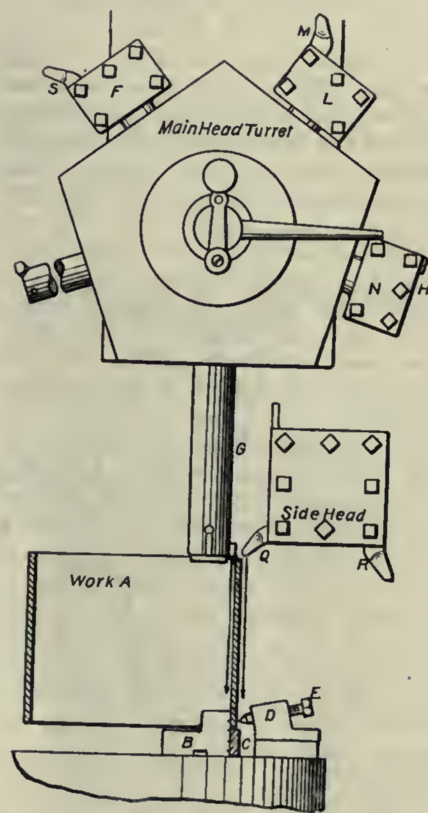


FIG. 8. METHOD OF HOLDING A THIN SHELL WITHOUT DISTORTION.

former instances. The main head turret is obviously set off-center a sufficient amount to obtain the correct sizes. The tool Q in the side head is used for rough facing the end of the shell and for rough turning the outside diameter.

An important point in the machining of this piece is that the turning and boring tools should be working directly opposite each other during the cutting as in this manner sizes will be held much closer and less vibration will take place. Special attention must also be paid to the feeds and speeds for, if feed is too heavy, chatter will probably develop on account of the torsion on the thin shell and the subsequent springing back into position. Speaking generally, a feed of about 1-32 in. per rev. with a speed of 40 feet per min. for roughing with a normal amount of stock to remove will be found about all that can with safety be used. The tool R in the side head is used for finish facing and turning. Feeds may be doubled for this operation without danger, and speeds slightly increased. The final operation is that of cutting of the shell to the proper length with the parting tool in the side head. The casting was made long enough to allow for the waste caused by cutting off.

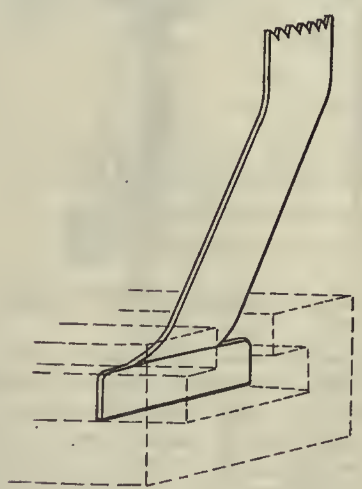
The principles involved in this method of handling thin work will be found to apply equally well to other work of a similar nature.

A TEE-SLOT CLEANER.

By J. E. Cooley.

FOR cleaning out chips from T-slots on lathe carriages, drill-press tables, and planer beds, a cleaner is used, having one end the same shape as the T-slot, as shown in the inclosed sketch. When pushed through the slot, chips are easily removed. This cleaner does not take out the oil or the very fine chips, therefore it is always necessary in order to get the slot thoroughly clean to force a piece of waste through it afterwards. The waste is usually pushed along the slot with the end of a file or screw-driver.

If a number of teeth be filed on the end of the cleaner, as shown here, they will be found very useful as a means when placed down against the waste to



A TEE SLOT CLEANER.

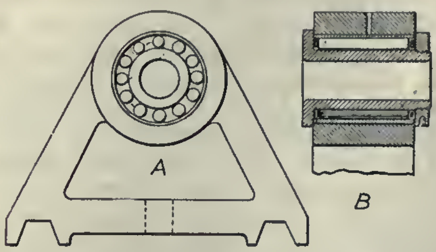
force it through the slot, and thus save the extra handling of something else in the operation. The teeth need not be sharp, as they serve just as well with the ends blunt.

A ROLLER BEARING STEADY REST.

By D. A. Hampson.

ONE of the lathes in the shop worked on cold rolled steel most of the time, and many of the parts turned up required the use of a steady rest. Even when carefully faced off and kept well lubricated, the jaws of the steady rest left a mark on the steel which was objectionable and, when a crease was roughed up on the work, the part had to be thrown away.

To overcome this trouble, a steady rest was made in a single piece—no hinged top section—in the form of an A with the legs resting on the vees and a hub at the vertex, as shown. This hub was bored out in line with the center of the lathe to take the sleeve B of a Hyatt



ROLLER BEARING STEADY REST.

roller bearing. It was proposed to make bushings of several sizes—5-16 in., 7-16 in., 9-16 in. and ¾ in, these being in frequent use, and have them all turned to a common outside diameter that would be a working fit in the cage of rollers. Through these bushings, the cold rolled steel rods would pass and, as the bushings turned with the work, the finished surface would be unbroken. A flange on one end of each bushing and a nut on the other kept out dirt and took care of end play.

The result was more than satisfactory. Not only was the finish preserved but the tools could be brought closer to the work and the latter, having a longer bearing in this steady rest than in the hinged style with jaws, was less springy Absence of the hinged top contributed to the general good, and the time saved in having no bolts to tighten and practically no oiling to do represented a considerable item. It has been said that a single piece design is the acme of mechanical construction, to which might be added, with anti-friction bearings, a statement borne out in the present and numerous other instances.

REPAIR TO LOCOMOTIVE FRAME.

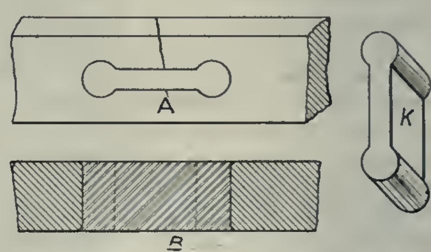
By Richard Bell.

A CRACK was developing in a locomotive frame, and when first observed extended half-way through. The following repair was made, which not only prevented the crack going further, but kept the engine on the road for a considerable time.

The direction taken by the break as well as the method of repairing is shown in the illustration. A hole was cut through the frame, as shown, two 1½-in. holes being first drilled 3¼ in. apart. This allowed for the drilling of three 1-inch holes between them. The metal left between the holes was now cut out, leaving it as shown at A. A key K was next made of sufficient length to go through the frame, which at this point was 5 in. thick. It was necessary in making this key to allow some draw so as to close up the crack and hold it tight.

The distance between the enlargements of the key was made ⅛ in. less than between the corresponding holes in the frame. The ends were made 1½ in. diameter and the connecting part 1 in. thick, these parts being made so as not to have a tight fit sideways. The edges were tapered off slightly so that the key would drive about ½ in. with a hand hammer. A piece of 4-inch shafting suspended from the roof was used as a ram to drive it home.

This form of key or fastening is usually referred to as a **Dutchman**, and is used for many kinds of repair work. Its most extensive use is probably in connection with the repair of circular saws, where by the use of a little draft and by riveting over the edges on both sides the crack and repair can be made almost invisible. A quick and effective way to fasten split wood parts is to bore a couple of holes and cut out be-



REPAIR TO LOCOMOTIVE FRAME.

tween in the same way; then to pour in melted babbit or other soft metal to form the **Dutchman.**—Editor.

HAMILTON INDUSTRIAL EXHIBITION.

An industrial exhibition was held during the past two weeks in Hamilton, Ont., at the Armories, under the auspices of the Y.M.C.A. It differed in many respects from that held last year.

There were only three exhibits this year of interest to readers of Canadian Machinery, these embracing the Pratt & Whitney, Dundas, Ont.; the John Morrow Screw & Nut Co., Ingersoll, Ont.; and the Canadian Hart Wheels, Hamilton, Ont. The Pratt & Whitney exhibit was in charge of G. A. Raynor. Here was to be seen an extensive line of cutters, reamers, twist drills, taps and dies, all of which contributed to a very effective display. Mr. Duncan looked after the interests of the John Morrow Screw Nut Co.. their exhibit consisting of twist drills, machine screws, etc., in all sizes. F. S. Morison was in charge of the Canadian Hart Wheel exhibit, which embraced various shapes and sizes of grinding wheels and other emery and corundum products.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

MOULDING MACHINE FOUNDRY PRACTICE.

By Arthur Smith.

FOR a great number of years it was the practice of a moulder to ram up his job, set the cores, carry iron to the mould in back-breaking bull ladles, shake out the casting, and in some shops cut up the sand before knowing that his day's work was finished. In the modern moulding machine foundry, however, an entirely different practice prevails, and the work is so divided or apportioned that several groups or "gangs" of men each receive the moulds for their share of the operation before the castings are finally delivered to the cleaning-room. This practice has been instituted owing to the tremendously greater output of castings demanded, and the fact that moulding machines can be operated much more economically when the shop is divided into sections.

The System in Practice.

The usual system is to divide the help in the foundry into ramming, finishing and coring gangs. The patterns are properly pinned to the jarring machine boards and brought to the several machines by the pattern handling crew. The ramming gang on the jarring machine proceed to ram the moulds, and, as soon as the patterns are drawn, the flasks are swung out and delivered to the second gang, whose duty is is to finish the jobs preparatory to sending them into the drying ovens. After the moulds are dried, they are delivered to the third floor, where the cores are set and jobs closed and made ready for the iron. Another crew, often night gang, now shakes out the castings and loads them on a car for delivery to the scratch room.

This practice, sometimes with slight variations, is followed in a great many foundries throughout the United States and Canada, and would not warrant mentioning were it not for the fact that the success enjoyed by some shops as compared to others is due to the manner in which the practice is carried out. The make-up of the different gangs requires careful study. The foundry manager must determine how much tonnage each machine should produce to turn out the work at a particular figure, invariably placed lower than he really hopes to reach. Then the jobs must be so arranged that each machine receives a sufficient number of the heavier pieces to bring its total output up to the tonnage required. This is a phase of the work that requires unceasing vigilance. The leader on the machine is usually ravenous for the heavier patterns, and if the selecting were left to his discretion it would be feast to-day and famine to-morrow.

Healthy Rivalry Among Operators.

When two or more machine gangs are working side by side, each aware of the tonnage expected of them to keep down the cost, the keenest kind of rivalry exists. The foreman must exercise rare judgment in giving out the jobs so that one floor may not receive too many "chunks" at the expense of his neighbor, and the facility with which crank disks, main bearing caps, etc., go through the shop forms an amusing contrast with the energy expended to complete an order of gear cases or other work of a similar nature. The leaders of the ramming gangs are naturally picked men, and the interest they manifest in getting out their tonnage seems infectious, and is transmitted to every member.

When the moulds come from the ovens they are taken in hand by several coring gangs under the same conditions as the ramming. Each particular crew has a certain tonnage to put up in order to turn out the work at the figure set by the foreman. They are trained men on coring, and the speed they attain from constant practice is marvellous. The jobs are laid out on the floors as they are taken from the cars, the cores are set, and the facility with which the moulds are prepared for the metal is remarkable. The same good-natured rivalry that exists on the ramming floors is present here, and the same natural desire to select the heaviest pieces is noticeable. It must not be inferred that day in and day out the tonnage sought for is accomplished, but the spirit of constant striving is there, and while on some days the nature of the work makes it impossible to get the tonnage desired, the average is kept up.

Typical Foundry Example.

In a typical jarring machine foundry the work is made in beveled flasks, cast in one piece without bars in copes. The flasks are standardized according to the product, and, of course, the object is to have the smallest number of sizes of flasks possible, so that each machine may have its own particular size of flasks, which it runs day after day, and there be no occasion for delay in rigging up or going into the yard for boxes.

It will be seen from the foregoing that the old method of each moulder personally superintending his own job from start to finish is obsolete so far as the modern foundry is concerned. The moulders of the old school have accepted the altered conditions, and may be seen wherever jarring machines operate, ramming, finishing or coring as the case may be.

EFFICIENCY IN THE ENGINEERING BUSINESS.—II.

By "Onlooker."

SCARCELY of less importance than efficiency in the drawing and designing departments of an engineering organization comes method in the other executive offices. The constitution of such executive will naturally vary between wide limits, according to the size of the concern. From the small repair shop, in which the manager often has vested in his own person the offices of draughtsman, estimator, sales manager, timekeeper and foreman, to the large engineering shop, which has its several departments to care for, these various matters, is a long step, and yet the same principles must underlie the work in every case in order to obtain the best results. In the larger concerns it should be the general manager's duty to exercise a supervision over the various executive departments as well as over the foremen and the shops. His business should be to organize and to study methods of increasing the efficiency of operation of his plant. Under him the various departmental heads should be made responsible for the detail work in connection with their various functions.

Cost-keeping and Estimating.

One of the most significant features of the modern engineering business is the growing attention which is being given to cost-keeping and estimating. Modern competition has rendered this essential. In the past, estimates were frequently prepared in a more or less rough-and-ready manner, without the previous compilation of reliable data of costs. To-day, however, the margin between profit and loss on any job has so narrowed, and quotations have been so finely cut down in order to secure work, that such a practice is no longer feasible. Accurate records must be kept that will show the cost of production, and to-day many elaborate systems are in use to this end. Some of these have involved the expenditure of much time and money in their perfection, and are more or less costly to maintain, but the results more than justify the outlay of time, thought and money.

A number of the methods in use are, perhaps, needlessly elaborate. A system which is found to give results quite sufficiently accurate, which possesses the virtue of simplicity and which is cheap in operation, is as follows:—

The clerk or the timekeeper is detailed off every day to make a round of the shops and to record in a time book the hours which each man has put in on each separate job; to total each man's time on each job at the end of the week, and multiply it by the man's wages rate. The total wages paid to each employee at the end of the week is then apportioned and charged to the various jobs on which he has been employed. In the case of mechanists a fixed sum is added per hour for the use of the machine.

In Scotland it was common practice to reckon 10 cents per hour as a standard figure for all machines, and although some of the larger ones would cost much more than this figure, when all charges came to be summed up, others would cost less, so the amount named was found to give a very fair average. In Canada, however, a considerably greater figure would have to be employed, and, as this will vary somewhat in different localities, it is advisable for every shop to estimate its own machine charges.

In this estimation should be included depreciation of machinery and interest on capital invested, cost of power and a share of rental based on floor space occupied. In some cases the last charge is omitted, being taken account of in the form of a percentage added to actual production cost to cover all overhead expenses.

The exact percentage to add for overhead expenses is somewhat difficult to arrive at. Ground rental or interest on capital invested in ground, interest on capital invested in buildings and the depreciation of the buildings, office and executive expenses, insurance, advertising and selling costs, interest and depreciation on all equipment other than machine tools and a sum for replacing small tools and for miscellaneous expenses should all be considered in estimating overhead charges, and the relation of the total of these expenditures to the gross value of the output of the shop will govern the percentage to be added to the cost of raw material and labor in order to arrive at actual cost of production. General supplies, such as lubricants, red lead, waste and similar materials, are also often taken into account in the overhead charges for the sake of simplicity, and the same thing applies to lighting, water rates and works heating. Power, as already stated, is generally included in the running charges of the machinery.

Cost System Details.

The details of a cost system require careful working out, and can be perfected only after years of experience and trial. No one method can be applied to all cases, and what would be entirely satisfactory in one engineering shop might be totally unsuited to another. The system adopted must be modified to suit individual needs, and in the scope of this article it is impossible to do more than merely emphasize the necessity of an efficient system, and to broadly outline the direction in which such a system may be taught.

So much attention must be given to the producing end of the engineering industry that the buying and selling ends of the business are apt to take a second place and to be neglected to some extent. Yet selling effort is as important to the engineer as to the manufacturer of dry goods or patent medicines. The concern which seeks to widen and to increase its market can, by increasing its production, decrease the cost of production. Repetition work is the keynote of economic manufacture, and the bigger the operation of any engineering concern the greater in most cases is the opportunity of increasing the amount of repetition work. It is, therefore, obvious that well-directed selling effort is of prime importance. Not only will it obtain business of itself, but by cheapening production costs it will enable the firm to quote lower figures, and hence get greater trade. **The importance of advertising in suitable mediums cannot be exaggerated, and such advertisement should be followed up with a vigorous selling campaign. Publicity means bigger business, bigger turnover, cheaper production and larger profits.**

Following the Markets.

In purchasing judiciously, a considerable amount of money can frequently be saved. This department requires judgment and a careful following of market conditions. Just how much material to buy when the market is down is a problem that requires careful consideration. The market may fall still lower or the interest on the investment of heavy purchases for future use may more than outweigh the saving effected by purchasing on a falling market. One British firm known to the writer has made a long study of the business of buying, and its purchasing department has become expert in predicting the probable fluctuations of the market. It has on file the records, in graphical form, of the market changes on copper, pig iron, tin, zinc, aluminum and bar steel for a number of years, and these records prove of great value in predicting the probable fluctuations in the price of these materials from day to day.

A study of the markets is also of value in many instances in the estimating department, especially in shops handling heavy structural steel, where the cost is largely influenced by the price of the raw material. A rise in the price of steel of five or ten per cent. between the time of making an estimate and of ordering the material may, in the case of work of the nature indicated, make all the difference between profit and loss. We have to be content with small profits in these days if we want to get the jobs, and it does not do to trust to luck. Yet if markets are down at the time of submitting a tender for a job the contract for which may not be awarded for some time, it is advisable to reckon the raw material costs in the estimates at something above current prices in case of a rise, while if the market is strong it may sometimes mean the securing of the contract if the estimator makes some reduction in anticipation of the probable drop.

The importance of having full and reliable cost data in the estimating department has already been referred to. Without such data anything like accuracy is impossible. The data should, moreover, be in readily accessible and concise form. The slide rule in the department is essential, as it finds its greatest efficiency in the carrying out of quantities, and every man employed as an estimator should be a rapid and accurate worker on this useful instrument.

Question—A steel boiler flue 12 ft. long and 4 inches in diameter is worked under a pressure of 160 pounds per sq. in. How thick should the metal be?

Answer—The formula is $p = \frac{9,600,000t^2}{l\,d}$

or $t^2 = \frac{p \times l \times d}{9,600,000}$ or $t = \sqrt{\frac{p\,l\,d}{9,600,000}}$.

With a factor of safety of 6, the formula becomes $\sqrt{\frac{p\,l\,d}{1,600,000}}$, where p = pressure in pounds per sq. in. l = length of flue in inches. d = diameter in inches. 1,600,000—a constant which depends on the material, class of workmanship, etc. Substituting values, we have

$$t = \sqrt{\frac{160 \times 12 \times 12 \times 4}{1,600,000}} = \sqrt{.0575}$$

= .24, or about 1/4 inch.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

RELATING TO BEAMS.

Beams are of two principal kinds:—(1), Those supported at both ends and (2), those firmly fixed at one end with the other end unsupported. In determining strength of all beams the same formula, $\frac{M}{S} = \frac{I}{C}$ may be used in which:

M = Total bending moment in inch pounds which depends upon the type of beam and the manner of loading.

S=Greatest fibre stress caused by the loading of the beam, measured in pounds per sq. in.

I=Moment of inertia which depends upon the shape of the section and the direction about which it is taken. For instance, it is much greater about an axis at right angles to the face of a flat board than about an axis parallel to it. The formulae for all shapes likely to be met with can be found in any steel or engineer's hand book, while the values of I for all standard shapes and sizes are given already worked out.

C=The distance from the axis to the outside of the beam section in inches regardless of its shape. The axis is a line through the center of gravity or balance point of the section at right angles to the direction of the load.

* * *

Question.—A steel bar 2 ins. square is supported at two points three feet apart. If the strength of the material be 81,000 lbs. per sq. in., what load applied at its central point would be sufficient to break it?

Answer—Formula,

$\frac{M}{S} = \frac{I}{C}$ or $M = \frac{I \times S}{C}$

For this type of beam centrally loaded

$M = \frac{Pl}{4}$, where P = total load at center, and l = length in inches. We desire to find P, therefore formula becomes

$\frac{Pl}{4} = \frac{I \times S}{C}$ or $P = \frac{I \times S \times 4}{C \times l}$

I for square section $= \frac{a^4}{12}$, therefore I for section 2 in. square would be

$\frac{2^4}{12} = \frac{16}{12}$

S = 81,000; C = 1 in., and l = 36 in., then

$P = \frac{16}{12} \times \frac{81,000 \times 4}{1 \times 36} = 12,000$ lbs. or 6 tons.

* * *

Question.—A 4 in. × 10 in. plank of Georgia pine is supported at points 6 ft. apart. What concentrated load could it sustain at the center. (1)—When placed on edge. (2)—When placed on flat?

Answer.—Strength of Georgia pine is given at 8,000 lbs. per sq. in. for compression and 12,000 lbs, per sq. in. for tension. Use the lower value.

Formula, $M = \frac{I \times S}{C}$

For beam loaded in center,

$M = \frac{Pl}{4}$ or $P = \frac{I \times S \times 4}{C \times l}$

I for (1) $= \frac{bd^3}{12}$, where (b) = breadth and (d) = depth, or

$I = \frac{4 \times 10^3}{12} = \frac{4 \times 10 \times 10 \times 10}{12} = 333.3$

$S = 8,000;\ c = \frac{10}{2} = 5;$

l = 6 × 12 = 72 in, then

$P = \frac{333.3 \times 8,000 \times 4}{5 \times 72} = 29,629.6$ lbs.

I for (2) $= \frac{bd^3}{12} = \frac{10 \times 4^3}{12} =$

$\frac{10 \times 4 \times 4 \times 4}{12} = 53.3$

$P = \frac{53.3 \times 8,000 \times 4}{5 \times 72} = 4,740.7$ lbs.

* * *

Question.—A standard keeps cast iron test bar 1 in. × 1 in. × 12 in. long breaks under an average load of 3,000 pounds apllied at the center, what is the greatest stress in the material?

From formula of previous question,

$\frac{I \times S \times 4}{c \times l} = P$ or $S = \frac{P \times C \times l}{I \times 4}$

In which S = stress required in pounds per sq. in.; C = distance from axis to outside edge of section; l = length in inches, and I = moment of inertia.

In above case, D = 3,000 lbs., C = 0.5 in., l = 12 in., I for square section

$= \frac{a^4}{12} = \frac{1^4}{12} = .0833.$

$S = \frac{3,000 \times .5 \times 12}{.0833 \times 4} = 54,216$ lbs. per sq. in.

This is much greater than the breaking strength of the iron which is 24,000 lbs. per sq. in., and is accounted for by the fact that the stress decreases from 54,216 lbs. at the outside to zero at the center of the bar.

* * *

Question.—How high could a brick wall 17 inches thick be safely built on two 12-inch I beams supported at points 10 feet apart?

Answer.—To find total distributed load, use formula $\frac{M}{S} = \frac{I}{C}$

M for uniformly distributed load $= \frac{PC}{8}$, and formula becomes $P = \frac{I}{C} \times \frac{8S}{l}$

I = 245.9 (from hand book) and for two beams = 245.9 × 2 = 491.8; S = 60,000.

Applying safety factor of 4, this becomes $\frac{60,000}{4} = 15,000$ lbs. per sq. in.

C = 6 in.; l = 10 × 12 = 120 inches.

$P = \frac{491.8}{6} \times \frac{8 \times 15000}{120} = 81,965$ lbs.

One foot of 17-inch brick wall, 10 ft. long, gives $\frac{17}{12} \times 10 \times 1 = 14.166$ cu. ft., and this at 120 lbs. per cu. ft. gives 14.166 × 120 = 1,699.92 lbs. per foot of wall.

Permissible height of wall then is

$\frac{81,965}{1,699.92} = 48.2$ feet.

* * *

Question. — Considering an engine crank pin as being supported at one end and having the load applied at the middle point of the overhang, what would be the diameter of a pin seven inches long if required to take a thrust of 72,000 lbs.?

Answer —Use formula $\frac{M}{S} = \frac{I}{C}$

M for cantilever=Pl, where l=length and P the concentrated load. Length in this case is $\frac{7}{2}=3.5$ in.; $M=72000\times3.5$ $=252{,}000$ lbs.; $S=64{,}000$ lbs. Applying safety factor of 8, this becomes $\frac{64{,}000}{8}=8{,}000$ lbs.

$I=$ Moment of inertia which for a round section is $.049d^4$ where d=diameter, $c=\frac{d}{2}$. It is required to find (d).

Formula becomes $\frac{252{,}000}{8{,}000}\times\frac{.049d^4}{\frac{d}{2}}$

$=\frac{252{,}000}{8{,}000}\times.098d^3$ or $d^3=\frac{252{,}000}{8{,}000\times.098}$

or $d^3=321.4$, or $d=6.85$, or, say, 6¾ in.

* * *

Question.—Considering the load as being applied at a point ½ inch from the root of a 3-pitch gear tooth and the base of the tooth to be ⅝ in. thick, how wide should the face of the gear be in order that the tooth may withstand a pressure of 16,000 lbs.?

Answer—Using the beam formula $\frac{M}{S}=\frac{I}{C}$

M for cantilever $=\frac{Pl}{8}$; $I=\frac{bd^3}{12}$ for a section 1 in. long $=\frac{1\times\frac{5}{8}^3}{12}=\frac{1\times.625^3}{12}$ $=.0203$.

$S=20{,}000$, which, for a safety factor of 10, becomes 2,000 lbs. per sq. in.; $c=\frac{.625}{2}=.312$.

$P=\frac{I\times8\times S}{1\times C}=\frac{.0203\times8\times2000}{.5\times.312}=2{,}082$ lbs.

If each inch of tooth length sustain 2,082 lbs., the length necessary to sustain 16,000 lbs. will be $\frac{16{,}000}{2{,}082}=7.68$ in., say, 8 in.

* * *

Question.—What load would a steel tube, 4 in. outside diameter and 3 in. inside diameter, support at the centre of a span of 4 ft.? What difference would it make if this same amount of metal were given the form of a rectangular beam of the same depth?

Answer.—Formula $\frac{M}{S}=\frac{I}{C}$

$M=\frac{Pl}{4}$ and formula becomes

$P=\frac{I\times S\times4}{C\times1}$

$I=.049\ (d^4-d_1^4)$ where $d=$ outside diameter and $d_1=$ inside diameter $I=.049\ (4^4-3^4)=8.575$.

$S=60{,}000$; $C=2$ in.; $1=4\times12$ $=48$ in.

$P=\frac{8.575\times60{,}000\times4}{2\times48}=21{,}437.5$ lbs.

Cross sectional area $=5.497$ sq. in.

Thickness of beam having same sectional area and height would be $\frac{5.497}{4}$ $=1.374$ in.

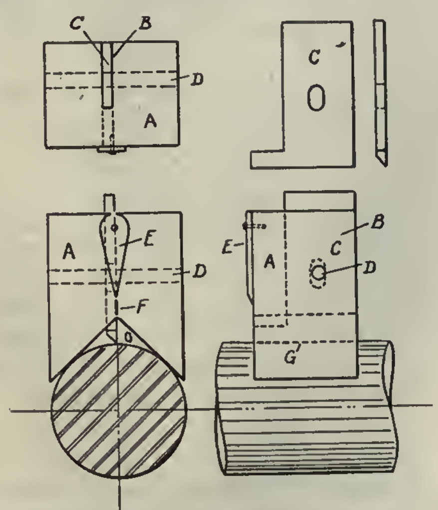
For a cross section 1.374×4, $I=\frac{1.374\times4^3}{12}$ $=7.328$.

$P=\frac{7.328\times60000\times4}{2\times48}=18{,}320$ lbs., or the latter is 15 per cent. weaker.

A SUGGESTED CENTRE FINDER

By James E. Cooley.

A VERY useful device for finding the centre for splines, broaches or holes in shafts or any cylindrical piece when set up in a machine vise, etc., is here described .In the accompanying cut, A, is a small V-block, 1 in. wide, ¾ in. thick, and 1½ in. long, having a slot 1/16 in.



CENTER FINDER FOR KEYWAYS.

wide cut through it, as at B, into which is fitted a sheet steel blade, C, 1/16 in. thick and 1¾ in. long. The blade is held in the block through an elongated hole with a pin D, on which it can slide up and down. On the front side of the block A is hung a small pointer, E, which swings on a pin, as shown. A short indicator line is made on the block, as at F.

The method of using this to find the centre of the work is to place the block on the shaft so that the pointer E is directly central with the line F, and then with a long sharp-pointed instrument, as a scratch-awl, scribe a line along the edge of the blade, as at G.

EXPERIMENTS WITH CASE HARDENING.

A PAPER by Professor R. Baumann, read before the meeting of the German Naval Architects, referred to the fact that the superficial addition of carbon to parts of machinery subject to wear produced conditions similar to those of the encasing of a soft tough core of metal in a sleeve of harder but brittle metal. The object in view was the combination of these qualities in a finished working part, but it was a matter for investigation in how far the one quality suffered at the expense of the other. If the hard exterior cracked under tension, the inner material had not only to do all the work, but extra local strains were set up in it at the crack.

Test Features.

Tensile tests had been made on metals with and without case-hardening and at different temperatures. The tests had been extended to materials heated and quenched at temperatures of 200° C., 400° C., and 650° C respectively, and to others that had been slowly annealed. The materials treated were ordinary steel, nickel steel for case-hardening, and chrome nickel steel also for case-hardening. The tensile test samples were 15 mm. in diameter and were case-hardened to a not very uniform average depth of 1 mm. to 1½ mm. Notched bar and other tests were applied.

Under the bending test, pieces of sufficient length and of not very deep cementation, developed numerous cracks. Where the material was not tough, the sample broke directly a crack appeared. In the tensile tests made at ordinary temperatures, the cracking of the cemented outer layer caused the sample to break. Contrary to previous expectation, the same thing happened in tests at high temperatures also.

In most of the case-hardened samples, the fractures were at right angles to the axis, but in samples in which quenching had taken place at 40° C. they were generally diagonal. One of the latter reached a test load several times as great as those withstood by any of the other samples, and to what favorable circumstances this was due was a matter for speculation.

Several of the samples, polished and etched, showed the carbon gradually increasing in quantity towards the edges without any sharp line of demarcation. The special steel samples showed a much finer grain than the iron samples, the transition from the case-hardened layer to the unhardened core being here still more gradual and regular. The Brinell ball pressure test, which in some cases had a tendency to break through the hard crust, gave good results with the special steels also. Under the tensile tests, the uncase-hardened samples that were annealed had an elongation of 31.8 per cent., and when hardened and quenched, they stretched from 5.4 to 5 per cent. only, this being due to the circumstance that the surface cracked and the resistance of the whole then collapsed. The hardened samples thus showed less tensile strength than the unhardened samples. In the diagrams of stress and elongation shown to the meeting, the lines for the case-hardened samples curved upwards to the point of fracture without the appearance of rapid yield. Diagrams for case-hardened and uncasehardened materials showed permanent set at points for the former at something like half the loads at which it appeared in the annealed, but otherwise untreated, material.

Permanent Set Point.

To keep the permanent set point as high as possible, the quenching must be done at sufficiently high temperature. Case-hardened nickel steel quenched at 400 deg. C. broke at 8,000 kilos per square centimetre, and up to 4,000 kilos per square centimetre showed little permanent set. When annealed it broke at 4,000 kilos per square centimetre, the permanent set being, up to this point, only slight. Quenched at 200 deg. C. it showed considerably more permanent set, and broke at 3,500 kilos per square centimetre. Uncase-hardened nickel steel broke at 3,500 kilos per square centimetre when annealed. When quenched at 200 deg. C. it broke at about 8,000 kilos per square centimetre, with little more than half the permanent set of the case-hardened sample quenched at 400 deg. C., which broke at about the same load. Comparative tests with case-hardened and uncase-hardened chrome nickel steel showed peculiarities similar to those of the nickel steel. The former broke at loads between 3,000 kilos and 4,000 kilos and the latter at loads between 3,000 kilos, and a little above 5,000 kilos per square centimetre.

Reduction of Ductility.

A series of diagrams giving the units of work required in the notched bar test at various temperatures illustrated the considerable reduction of ductility due to case-hardening. At temperatures of about 500 deg. C., the upper limit in the diagrams, a considerable improvement was, in the case of the steel samples, observable.

Noteworthy was the brittleness at low temperatures. Case-hardened nickel steel samples quenched at 200 deg. C. again showed greater elongation than the mild steel samples. Brittleness at low temperatures was not here manifested; in general, the samples broke after a much greater expenditure of work. Samples quenched at high temperatures —up to 650 deg. C.—in several cases behaved remarkably well. The results for chrome nickel case-hardened steel samples were much like those given by nickel steel. The fractures showed the coarsest grain to belong to the mild steel samples. Their appearance seemed to show that the treatment accorded to them had not been the most suitable. Spare samples subsequently heated up to 880 deg. C., cooled again in water and quenched at 200 deg. C., gave better results. Bending tests gave results which also enabled a judgment to be formed as to the toughness of the material treated. In general, the various tests carried out were thought to show:

(1)—The superiority of the special steels for the purpose in view.

(2)—The importance of the treatment of the material.

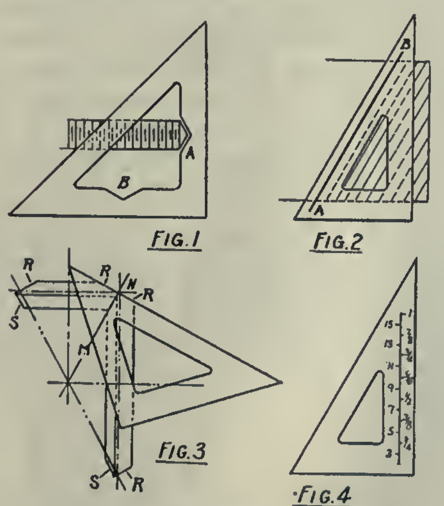
(3)—That the toughness of the core material came into play only to a limited extent.

In conclusion, the author recommended that tests be made in particular cases to ascertain whether case-hardening or the choice of a special steel material would be more suitable for parts subject to considerable wear.

TRANSPARENT TRIANGLE KINKS

By J. E. Cooley.

WHEN inking in the bottom of a hole or the end of a screw on a drawing it is necessary to draw one line first, and



TRANSPARENT TRIANGLE KINKS.

then wait till the ink dries before drawing the other, as the triangle has to rest on one of the lines. If the angle of the point, 30°, is made on the triangle, as at A and B, Fig. 1, for both horizontal and vertical holes and screws, the two lines can then be inked in without any trouble.

A simple method for penciling-in even-spaced section lines is shown in the sketch at Fig. 2. Instead of drawing-in lines one back of the other, these are drawn one ahead of the other. This is accomplished by making an inked guide line on the triangle, as A to B. This line is placed over the corner or starting point on the drawing, and the first line is drawn along the front edge of the triangle. The triangle is then moved forward till the guide-line is even with the first line, and the second line is then drawn. As seen in the sketch, the first line made is C, then D, and so on. The lines can be inked in or traced over in the usual way.

When laying out bevel gears on a drawing it is quite difficult to draw the bevel line R on the back face. This line is at right angles to lines that intersect the pitch circle, not the line S, or the front face. It is on this line that the top and bottom of the tooth is determined. If an inked guide-line, M to N, be made on the triangle at right angles to the straight-edge and placed on these interesecting lines, the line R is easily drawn.

Another suggestion is shown in Fig. 4 An inked line is marked off into several divisions, as 3/16, ¼, etc., and used for setting dividers, compasses, etc.

Workmen's Goggles.—An effort to secure the proper goggle for workmen subject to the intense glare of incandescent metals has been undertaken by the F. W. King Optical Co., Cleveland, Ohio. It has been found that the smoked and blue glasses commonly used defeat their very purpose of minimizing eye strain. Two kinds of light rays are regarded as particularly injurious to the eyes, the chemical or ultra violet rays, which have a deteriorating action on the tissues, and the heat or red rays which by their intense energy are probably the chief cause of eye fatigue. Smoked or blue glasses offer no resistance to the former, it is claimed, and are therefore of no benefit except to exclude much of the glare; while red, orange and similar glasses transmit the very harmful heat rays. In order to make the ideal goggle, it is held to be necessary first to cut off the invisible violet rays and then reduce the visible spectrum so as to absorb heat or energy rays to a point that produces no eye strain whatever. Of all the colors, a yellow-green seems best to accomplish this. It not only reduces the light to the limits desired, but it also distorts images less than any other. Moreover, the variation of brightness of incandescent metals with temperature appears relatively the same through this kind of glass as through uncolored glass.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

COPPER COIL FORMING MACHINES

THE machine shown in illustration was designed to coil copper field coils for automatic lighting systems, taking the copper in strips and coiling it together with a strip of insulation on a rectangular arbor. The copper strip is not only cut to length, but has a right-

COPPER COIL FORMING MACHINE.

angle bend at one end, which is used for dogging purposes. A powerful spring keeps the work against the arbor and is controlled by a foot treadle. The machine trips automatically on the completion of three revolutions of the spindle. Coils are stripped off the arbor by the turning of the crank handle shown in center of spindle. The next strip is put in place and the machine will start immediately on removing foot from the treadle. Other metals can be used in place of copper, and the number of coils and shape can be changed to suit other work.

The machine is manufactured by the Garvin Machine Co., of New York City, and weighs 66 lbs. crated.

ROTARY CENTER INDICATOR.

THE Rotary Center Indicator is an instrument designed to quickly and accurately indicate the center or axis of any rotating spindle or shaft. It is a small and compact instrument, strongly built and not likely to be injured by careless handling. It is a positive and accurate tool and will be found useful by those engaged in laying out and boring holes in jigs, tools and machine parts. When used in connection with the Casler offset boring head it enables the operator to accurtely locate holes without removing the boring head from the spindle of the machine.

It consists of a body or shank A which may be gripped in the chuck of the boring head or a drawing in collet in the spindle. A pointer B is held against the face plate C by a coil spring concealed in the body of the tool. The contact surfaces between the pointer and face plate are hardened, ground and lapped to a true flat surface. The pointer is free to float or slide in any direction over the surface of the face plate, and the head D is ground to a diameter of ¼ in.

When used in the chuck of a boring head, the chuck is brought concentric with the head. It is not necessary that the body A of the indicator run true as it is designed for just such conditions. The pointer B is brought next to a finished surface F near the center of the hole to be bored, being moved to one side of the face plate C, so that when the spindle is rotated the pointer will "wobble" or describe a circle.

The spindle is allowed to rotate, and as the table E carrying the work W is raised the head D of the pointer will alternately strike the finished surface F of the work and then recede, the distance which the head D recedes growing less and less as the work is raised. At the same time, the pointer B approaches nearer to the center or axis of the spindle on which the indicator is mounted. The table is raised until the pointer runs true or does not recede from the work. If the table is raised 1-10,000 in. too far, the pointer B will quickly creep

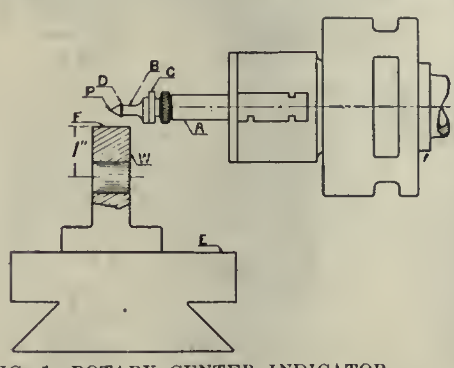


FIG. 1. ROTARY CENTER INDICATOR.

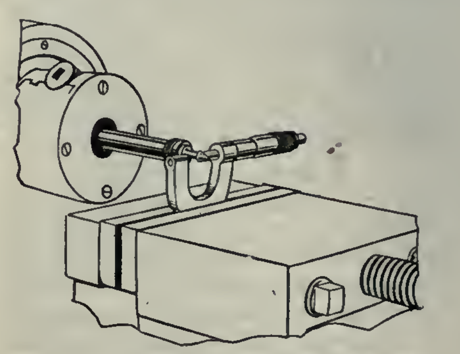


FIG. 2. ACCURACY TESTING DEVICE.

to the left or right depending on the direction of rotation of the spindle. When this happens the table is lowered, the pointer moved toward the edge of the face plate and the table raises again until the pointer runs true.

The graduated dial indicating vertical movement of the table can now be set to zero, and as the diameter of the head D is ¼ in., the table can be raised ⅛ in., which will bring the the center of the spindle in line with the finished surface of the work and a further movement of 1 in. will bring the spindle on a horizontal line passing through the center of the hole to be bored as indicated by the illustration. It is obvious that lateral distances can be gauged in like manner by setting the pointer B with any vertical finished surface on the work.

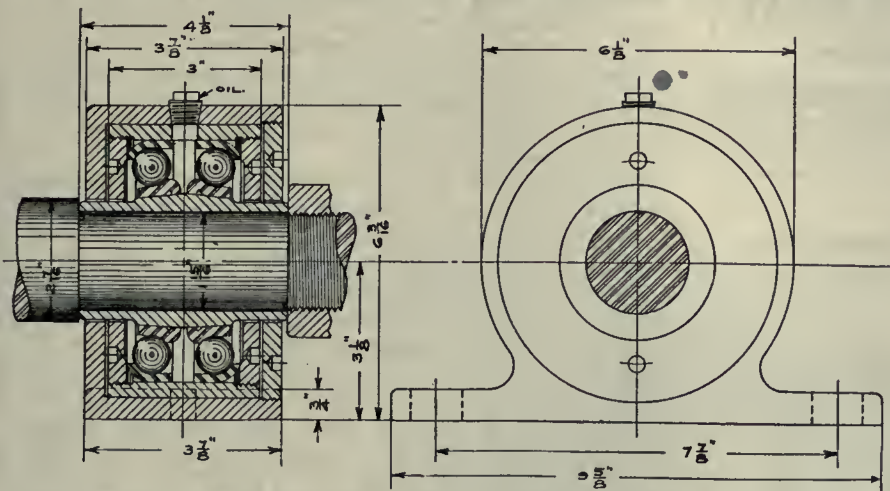
The point P is intended for use when a hole is to be bored concentric with a center punch mark on the work. The pointer C is then made to run true by bringing it against any flat surface on the table or work, and afterwards bringing the pointer concentric with the center punch mark on the work. When used in this manner the face plate B has a limited movement in the body A against a compression spring which allows the point P to be forced into the center punch mark without danger of injuring the indicator.

Fig. 2 shows a means of testing the accuracy of the device by use of a micrometer. The micrometer is opened about ¾ in.; and the screw can be gradually brought towards the pointer until it runs true. A slight additional movement of the screw will throw the pointer to one side as explained above. In testing the accuracy, it should be borne in mind that it is sensitive to 1-10,000 in., and if the spindle bearings are worn or the machine gear driven, it may be necessary to run the spindle at a low speed, otherwise the vibration of the spindle will destroy the accuracy of the device.

The Marvin & Casler, Canastota, N.Y., are the manufacturers of this apparatus.

18-IN. DOUBLE BALL BEARING DISC GRINDER.

THE Ford-Smith Machine Co., Hamilton, Ont., have recently put on the market a new 18-in. disc grinder equipped with ball bearings as made by the Chapman Double Ball Bearing Co., Toronto, instead of the regular adjustable phosphor bronze bearings. It will be noted from the line drawing that each bearing has a double ball race and is adjustable for any slight wear that may take place, while a good idea of the general design of the grinder can be had from the half-tone illustration. The tables are of the regular standard swing type, and call for no special mention, except that they are supplied with lever feed or otherwise to suit customers' special requirements.



SPECIAL DISC GRINDER BALL BEARING.

A full line of disc grinders has now been added by the company to their previously complete line of bench, floor, tool and swing grinders, and their early production of a new line of ball bearing grinders, ball bearing countershafts and loose pulleys we hope to record in an early issue.

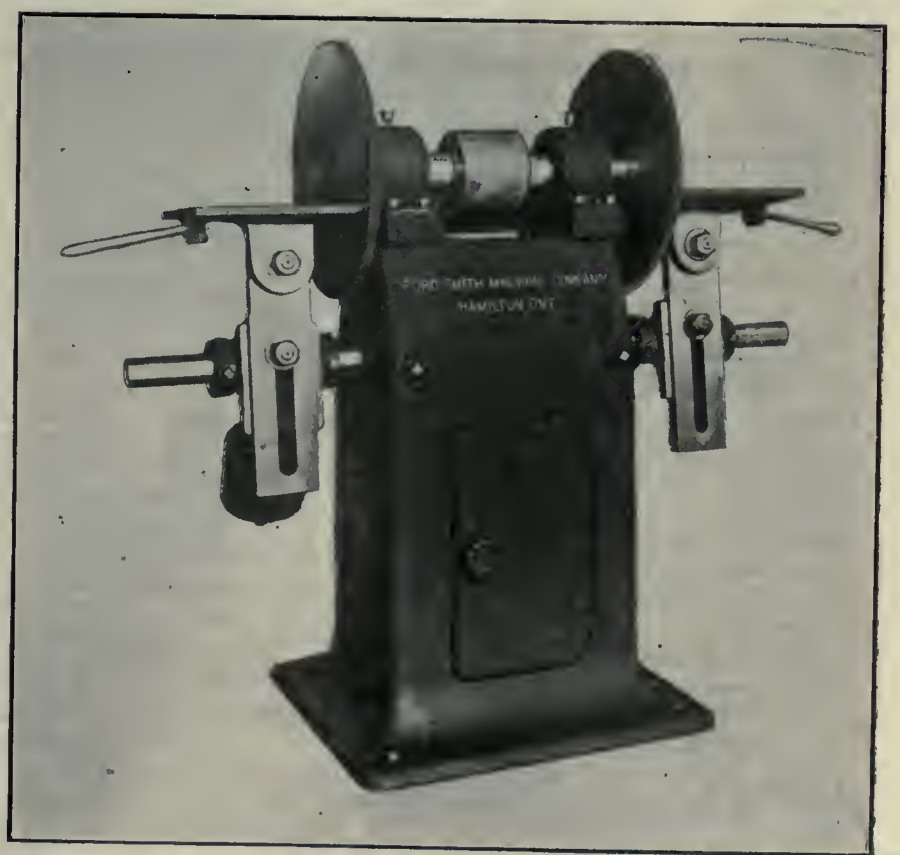
Miscellaneous

Alexander Gibb, St. Nicholas Building, Montreal, has secured the Canadian agency for Anti-Corrosive Paints and Anti-Fouling Composition, manufactured by Suter & Rathjens Composition Co., London, Eng. Several large orders of same have been sold already to be used on railway construction and marine work.

The Independent Pneumatic Tool Co., of Chicago, Ill., and New York, have leased the two-storey building at No. 334 St. James Street, Montreal, Que., and have arranged to open a branch store, where their Canadian business will be transacted after August 9. A complete line of "Thor" pneumatic tools, electric drills, accessories, and spare parts will be carried in stock for immediate delivery on orders in Canada. W. H. Rosevear, who has been prominent in the railway supply and machine tool business in Canada, has been engaged as manager.

The Canadian Steel Products Co., 227-229 Wellington Street, Montreal, announce that they have completed the equipping of their factory for the manufacture of sheet steel, flush and service cabinets for switches, cut-outs and panel boards. The factory will be under the general managership of S. A. Ungerleider, who has had extensive experience in the United States. The machinery and tools are all of the most modern and improved type. They will also manufacture time switches, sheet steel shop equipment, steel shelving and lockers, portable garages and other sheet steel and electrical specialties.

U.S. Firms Oversea.—To be in a better position to satisfy an increasing number of European customers, the Potter & Johnston Machine Co., Pawtucket, R.I., and the Windsor Machine Co., Windsor, Vermont, recently decided to erect works at Tyseley, Birmingham, England, under the name of Potter, Johnston & Gridley, Ltd., for the manufacture of Potter & Johnston automatic chucking machines, automatic center turning machines, automatic milling machines, automatic cutting-off machines, universal shaping machines and shaving machines; also the Gridley four-spindle automatic bar machines and automatic multiple spindle drilling machines, all of the above machines being covered by British and foreign patents. In addition to the manufacture of the machines mentioned, there will be a specially organized tool-making department for the rapid supply of tools required by European customers, which will avoid the delays caused in transport when shipped from the American shops. The new works are now in course of construction and will be ready for occupancy in the coming fall.



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PRINCIPAL CONTENTS.

THE EDUCATION OF THE FOREMAN.

IT has been truthfully said that judicious travel gives the broadest education possible. It should also be realized by plant owners and managers that no education is too broad for a foreman worthy of the name. No man is more confined to a narrow sphere than the foreman who is kept at home and thoroughly impressed with the fact that the wheels would cease to hum were he to leave his post. Friction with men and dissatisfaction with work can, in a majority of cases, be traced to a lack of diplomacy or a chronic disagreeable narrowness of the foreman.

Several of the larger Canadian manufacturers have gone so far as to send representatives to conventions of men engaged in similar classes of work. The writer has in mind one case of a foreman who had not been more than 140 miles from his shop in nine years and who, upon returning from a gathering involving the whole of America said there was nothing there for him to learn. Is it surprising that this man's manager should be discouraged with the instructive advantages of conventions or the broadening effect of travel?

The experience of men whose business it is to find out the newest and best methods of accomplishing mechanical ends as well as to keep abreast of improved manufacturing processes has proved that conventions and, particularly, conventions alone, do not furnish the best returns for the least expenditure of time and money. By far the most fruitful sources of education for foremen are visits to similar plants and association with technical journals. The visiting should be carried out systematically and in a way that will keep the visitor thoroughly in touch with himself as others see him.

To derive the full benefit of the money thus expended, the manager must choose his direct subordinates wisely and must have powerful means of holding them, for this manner of education not only increases their usefulness of their own firm, but makes them a valuable acquisition to others. This is done by different corporations in as many different ways. The granting of a share of stock or a superior financial remuneration has been successful to a degree, but far more important than these will always be those personal qualities of the management which to the utmost degree have characterized all great leaders of men.

PRACTICAL MANAGEMENT.

OUT of the recent researches into scientific management, cost engineering, production engineering, motion study, etc., there will, no doubt, survive a practical application which will be as familiar to the foreman and mechanic as the present appellations of economical manufacturing are mysterious. Already the simplifications are beginning to appear which promise that, in the near future, a large part of scientific management will be resolved into a remarkably few comparatively elementary rules of procedure on the part of operatives and their direct superiors.

Manufacturers have perfected and solved the scientific problems of the unit system. Examples of this may be seen in the dispatch with which a mighty steamer can be turned out by some of the British ship yards. The multiple system of to-day to which so called scientific management has been applied, has by no means, reached the stage of comparative perfection which has been enjoyed by the unit system for a number of years.

Production engineering, in the case of the unit system, has become part of the natural and prescribed procedure of workmen and supervisors, and just as the rational habits of men necessitated by the multiple system become part of their natural course, so the production engineer will become superflous and will disappear. Efficiency of the workman, in the former case is measured more or less by the number of different branches of work to which he can successfully apply himself, while in the latter, the economical workman concentrates his faculties upon the smallest element possible.

INDUSTRIAL NOTABILITIES--No. 44

HON. Erskine Henry Bronson, president the Bronson Co., Water Powers and Manufacturers of Ground Wood Pulp, Ottawa; president Ottawa Improvement Co.; vice-president Ottawa Light, Heat and Power Co.; president Ottawa Power Co., and director Ottawa Electric Co., was born at Bolton, Warren County, N.Y., Sept. 12, 1844, son of the late Henry Franklin Bronson, Warren County, N.Y., who, in 1853, came to Ottawa where he was the pioneer of the sawn lumber trade with the American market, and Editha (Pierce) Bronson.

He was educated at the Grammar School, Ottawa, and at Sandy Hill, N.J., after which he joined the Bronson & Weston Lumber Co., acquiring therein an interest in 1867. On the death of his father in 1889 he became president of the Company.

HON. ERSKINE HENRY BRONSON.

Among the many activities to which the Hon. E. H. Bronson has devoted himself may be mentioned the following:—An originator of the Ottawa Electric Co.; member Ottawa School Board for 14 years; ex-Trustee Queen's University, Kingston, Ont; member Ottawa Council, 1870-1878; chairman Finance Committee Ottawa City Council; member Ontario Legislature for Ottawa 1886-1898; member Mowat and Hardy Governments without portfolio, 1890; and unsuccessful candidate to House of Commons for Carleton in 1882. His name has been mentioned several times in connection with a Senatorship.

In 1874 he married Ella H. Webster, daughter of the late professor N. B. Webster, of Norfolk, Va., one son and one daughter being born of the union.

Hon. E. H. Bronson is a Presbyterian in religion, and the family residence is 75 Bronson Ave., Ottawa, Ont.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 65
Lake Superior, charcoal, Chicago	.....	16 00
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X	18 50	17 85
Victoria, No. 2 Plain	18 25	17 60

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.00
Steel bars, f.o.b., Toronto	2.00
Common bar iron, f.o.b., Montreal	2.05
Steel bars, f.o.b., Montreal	2.00
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs.	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in.	75%
Finished Nuts over 1 in.	72%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh	$20 00
Open hearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	24 00
Wire rods, Pittsburgh	25 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	72	62
7, 8, 10 in.	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload	$15 75	$15 75
Electrolytic copper	15 50	15 50
Casting copper	15 25	14 50
Spelter	5 35	5 25
Tin	35 00	34 00
Lead	4 85	5 15
Antimony	8 50	8 50
Aluminum	20 00	18 50

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15
Lard Oil, per gal.	0.60

CHAIN.

¼ inch	$5.65
5/16 inch	4.70
⅜ inch	4.00
7/16 inch	3.65
½ inch	3.45
9/16 inch	3 45
⅝ inch	3.35
¾ inch	3.25
⅞ inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1½-in	$37.50	$30.00	$17.50
33/64 to ¾-in.	41.25	33.00	19.25
7/16 to ½-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	95c lb.
Leather in sides	85c

BELTING RUBBER.

Standard	60%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

¾ inch	$ 4.95
1 inch	8.05
1¼ inch	12.65
1⅜ inch	15.30
1½ inch	16.50
1⅝ inch	19.40
1¾ inch	22.50
1⅞ inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

WILL OIL REPLACE COAL AS FUEL?

By W. J. Dick.

THE world's production of crude petroleum in 1912 amounted to about 52,921,750 tons; the sources, respective quantities and percentages were as follows:

Country.	Net Tons.
United States	32,897,060
Russia	10,174,560
Mexico	2,910,000
Roumania	1,987,360
Dutch East Indies	1,672,000
Galicia	1,298,620
India	1,101,450
Canada	38,750
Other countries	841,250

If the whole of this crude petroleum were employed as fuel in steam-raising it would not replace, allowing for its higher thermal efficiency, much more than 5½ per cent. of the world's output of coal, whilst if used in internal combustion engines it would be equivalent, as a source of power, to about 16 per cent. of the coal. Only a small proportion, however, of the crude petroleum can be regarded as available for use as a source of power, for by far the larger part is in demand as an illuminating agent and as a lubricant for machinery.

As the United States produces over 62 per cent. of the world's production of petroleum, it is interesting to note that Dr. Day, of the United States Geological Survey, considers that, at the present rate of increase of the output of petroleum, the known oilfields of the United States will, on the basis of the minimum quantity of oil obtainable, be exhausted by the year 1935, while, even if only the present output were maintained, the supply would, on the same basis, not last more than nineteen years.

In many countries there are, no doubt, vast tracts of undeveloped petroliferous territory, but only drilling can determine this. Even if the available deposits were far larger than there is reason to believe them to be, the cost of doubling the present output would be great. In view of these circumstances, it is not probable that there can be any general substitution of petroleum for coal as a source of power, although there is undoubtedly opportunity for making provision for a large use of liquid fuel for certain purposes in which its advantages are conspicuous.

Toronto, Ont.—Two of the lighters designed and constructed for the Department of Railways and Canals left Polson's Iron Works on July 14 for Port Nelson, on Hudson Bay. The journey is over 4,000 miles, and when the boats reach their destination they will be used for lightering ocean-going vessels which draw too much water, to allow them to discharge cargoes at the present wharf.

Windsor, Ont.—The Dominion Government has just completed a new 655-ft. cement wharf here at a cost of approximately $60,000, and has begun the erection of a reinforced cement warehouse on it at a cost of $10,000

Ottawa, Ont.—The rather unusual expedient of forwarding a Government boat by train is being resorted to in the case of the George H. Bradbury, the new boat to be used for departmental services on Lake Winnipeg. The Bradbury has been built at the marine yards at Sorel, and is being shipped west in sections. The parts will be reassembled and erected at Selkirk under direction of the marine superintendent from Sorel.

Montreal, Que.—An elevator with a capacity of two million bushels is likely to be erected in the port of Montreal at an early date. It is understood that plans are being made for the erection of another huge concrete structure to relieve the congestion which is apparent in the port every summer. The new elevator will be an addition to No. 1, the elevator near the White Star wharf. It will give No. 1 a capacity of over 4,500,000 bushels.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., July 20, 1914.—There has been very little change in the business outlook, and things generally are just about the same as last week. Trade is still very dull in machinery lines especially. While there is a disposition on the part of most people to look hopefully to the future, it has to be admitted that there is not much likelihood of conditions improving for some time yet, certainly not before the fall.

During the week nothing big in the construction line has materialized, but, considering the condition of business, local contractors have had a good year. There has, however, been very little doing in construction machinery, the tendency being to make use of old equipment for this year's work.

Metals.

There has been little or no change in the metal market. Small orders are still the rule, although one house reports a couple of big contracts booked last week. Sterling quotations to-day are:—Tin, spot, £145 17s. 6d.; futures, £147; copper, spot, £61 2s. 6d; futures, £61 10s. 7d.; lead, £19; spelter, £21 10s.

Other prices remain unchanged.

Toronto, Ont., July 21, 1914.—There is little change in business conditions this week, although signs of a revival are becoming more evident, and prospects for an improvement in trade this fall appear brighter. Some authorities consider that the outlook is more encouraging now than it has been for some time past. This optimism may perhaps be accounted for to some extent by the crop reports, which continue to be, on the whole, favorable. Many manufacturers are still operating their plants on short time, and in some cases with a reduced working force. A spirit of caution must of necessity be adopted until the outlook improves and the development of the country proceeds on its normal course. It is more than probable that the natural development, which has been retarded by the depression, will, when once resumed, progress on even a larger scale than formerly, and we hope on a sounder basis.

There have been reports circulating recently to the effect that the C.N.R. has placed an order for passenger cars, amounting to $500,000, with the Canadian Car and Foundry Co., Montreal, and an order for ten baggage cars with the National Steel Car Co., Hamilton. While we understand that the C.N.R. will place substantial orders for cars, we do not believe that any contracts have actually been signed as yet.

Steel Market.

Little improvement is noticeable in the steel market this week, conditions generally being quiet. A more optimistic spirit, however, is becoming general, and there are indications that business will improve somewhat in the near future. A better condition of affairs seems to be prevalent in the United States, where a distinct improvement has come over the iron and steel situations. It is thought by some that the turning point has been passed, and that the steel market is recovering, anticipating a return to more prosperous conditions. Although some contracts have been placed at slightly better prices, the mills do not expect much advance this year.

An interesting situation has been revealed in London, England, recently. The R. D. Wood Co., of Philadelphia, quoted 25 cents a ton less than an English syndicate on a large quantity of cast iron pipe for the city of London. Public sentiment and pressure was, however, brought to bear on the authorities, with the result that the order was not placed with the R. D. Wood Co., notwithstanding the fact that they were the lowest bidders.

Pig Iron.

The pig iron market is quiet, although there are signs of a slight improvement materializing by the fall. Prices are nominally unchanged, and it is hardly probable that there will be much of an advance for some time. The pig iron market in the United States is quiet, and production has, if anything, been curtailed.

Machine Tools.

The condition of the machine tool market has not changed to any appreciable extent, and current business is still confined to small sales. Some dealers report an improvement in the number of inquiries being received. The Canada Wire and Cable Co. are in the market for a number of tools for their new plant at Leaside, near here. The possibility of the railways coming into the market this year is getting remote, and the ultimate realization of accumulating prospects is about the only hope left.

Metal Markets.

The metal markets have an improved tone this week, and more business is passing, which is satisfactory, as July is usually a very quiet month. There has been no change in prices, the majority of metals keeping steady.

Ottawa, Ont., July 20, 1914.—The Canadian Northern trust deed is now finally signed, and Sir William Mackenzie is in a position to go on the market for needed money. It is believed that it will have a tendency to relieve the general business depression. The Grand Trunk trust deed, by which the Government guarantees bonds for that road to the extent of $16,000,000, is still hanging fire. There is a general impression at Ottawa that the Government is using pressure to have the Grand Trunk Pacific accept the award of the arbitration board in regard to its machinists in its western shops. The Government can scarcely indefinitely refuse to close up the transaction on this ground, but it can postpone the matter for a while with a view to exerting pressure on the company. This is apparently what is being done.

With a continually decreasing revenue the Finance Minister will evidently have to do some pruning if he is going to come out on the right side of the ledger this coming year. The drop in revenue for the month of June was some two million dollars. For the twelve months this would mean a decrease in revenues of some twenty-four million dollars. However, the difference between the receipts for the latter part of this year and the corresponding period of last year will not likely be so marked. The first part of 1913 everything was booming as far as revenues were concerned, and the financial depression had not started to affect the custom receipts. It was about this time last year that revenues commenced to drop, and it would not be surprising if the revenues from now on for 1914 would be higher than the same months of 1913.

Sir George Foster left to-day for Rimouski, where he meets the members of the Dominions' Royal Commission, who are to hold sessions in Canada and Newfoundland. They go first to Newfoundland, landing at Sydney on August 3, when they start a tour of the Dominion, closing about the middle of October in Victoria.

The Dominions' Royal Commission was first suggested by Sir Wilfrid Laurier at the last Imperial conference held in 1911. Sir Wilfrid moved a resolution suggesting the appointment of a commission to study the trade problems of the Empire and allied questions with a view to closer co-operation. The commission was appointed the following year by the Imperial Government, and at once started its inquiry. It was given a wide scope. It first held sittings in England and then visited New Zealand and Australia, and this spring went to South Africa. Canada will be the last place visited, as only the self-governed parts of the Empire are included. The report will be prepared this winter, and will be presented to the Imperial Conference being held next year.

The itinerary of the commission in Eastern Canada is as follows:—Halifax, August 5; St. John, August 11; Charlottetown, August 17; Quebec, August 20 to 22; Montreal, August 24 to 26; Ottawa, August 28 to 29, and Toronto early in September. The commissioners will travel westward via the Great Lakes and Winnipeg, concluding their sittings in Vancouver about October 10. Ocean freights, shipping and harbor facilities and cable and postal communication will form the chief matters of consideration. Every effort will be made to prepare an interim report before their departure.

The importance of the inquiry to the business and commercial interests of Canada can scarcely be over-estimated.

CANADIAN PULPWOOD EXPORT DECREASE.

STATISTICS of the pulpwood consumption during 1913, compiled by the Forestry Branch of the Department of the Interior show that the forty-eight active firms in the Dominion consumed in their mills a total of 1,109,034 cords of pulpwood valued at the mill at $7,-243,368. A total of 1,035,030 cords of unmanufactured pulpwood, valued at $7.070,571, was exported to the United States bringing the total production up to 2,144,064 cords, valued at $14,313,939. The following table shows the distribution of the manufacturing trade in the various provinces, value, etc.:—

	Active Firms.	No. of Cords.	Total Value.
Canada	48	1,109,034	$7,243,368
Quebec	26	629,934	4,107,689
Ontario	12	321,244	2,297,389
Brit. Columbia	2	84,173	401,218
New Brunswick	4	53,121	342,243
Nova Scotia.	4	20,562	94,829

The total quantity showed an increase of 28.1 per cent. over that of 1912, and average price of raw pulpwood at the mill increased by 51 cents a cord, making an increase of 38.9 per cent. in the total value of the material used in the industry. Quebec and Ontario still led the other provinces in 1913, but the feature of the returns so far as New Brunswick is concerned was that the province was in 1913 displaced from third place by British Colnmbia. There was an increase in each of the provinces except Nova Scotia, where the closing of four mills caused a decrease of 21.4 per cent. The increase in New Brunswick was 2.1 per cent. British Columbia showed an advance of 140 per cent.

The following table shows the kind of woods used and the values:—

	No. of Cords.	Total Value.
Total	1,109,034	$7,243,368
Spruce	754,858	5,104,221
Balsam Fir	283,292	1,806,911
Hemlock	47,360	201,480
Jack Pine	19,383	101,675
Poplar	4,141	29,081

The export of wood pulp from Canada decreased from 1912 to 1913 by 22.4 per cent. in spite of an increase of 25.2 per cent. in the quantity manufactured. This would seem to indicate increased activity in the domestic manufacture of paper. Decreases are to be noted in the exports of pulp to the United States, Great Britain and China. New Zealand did not import Canadian pulp in 1913. The only increase reported was in the export of chemical pulp to Japan. The United States still takes about two-thirds of our pulp, of which about 70 per cent. is ground wood. Great Britain takes a little less than a third of the total and her importations are almost entirely ground wood or mechanical pulp.

More Wood Pulp Imported

The imports of wood pulp into Canada in 1913 were valued at $356,862, as compared with $172,797 for 1912. This is an increase of over 100 per cent., the imports from the United States having more than tripled during 1913. The importation from Great Britain more than doubled, and those from Germany increased by over half those in 1912. The importations of wood pulp from Sweden decreased by 42.8 per cent. Pulp was imported from Norway and Switzerland in 1913, but not in the previous year. No pulp was imported from Austria Hungary in 1913. The United States in 1913 supplied over four-fifths of the total, as compared with over a half in 1912.

U.S. FOREIGN TRADE COUNCIL.

JAMES A. FARRELL, president of the United States Steel Corporation, has been named as chairman of the American Foreign Trade Council, and all sections of the country and many branches of industry, transportation and finance are represented among the members. Outlining the purpose of the council, Mr. Farrell said:

"The next great era in the economic development of the United States will be the extension of our foreign trade, and the formation of the Foreign Trade Council is a necessary preparation for this evolution in our business life. By gathering active and representative business men into such a body and co-operating with all elements in our oversea commerce, it is hoped to encourage every practical and sound policy designed to secure for us our share of the trade of the world's markets.

"The foreign trade of the United States is now valued at four and one-half billion dollars a year, of which two and one-half billion dollars represent exports. This trade has developed largely by reason of our natural resources and the individual enterprise of American industry, but without an American merchant marine, comprehensive national policy or commercial and industrial co-operation. The foreign trade is important as affecting American industrial enterprise and labor at home. On the other hand, it is not large enough to absorb all our manufacturing potentialities."

Trade Gossip

Laurie & Lamb, Montreal, have received an order from the Abitibi Pulp & Paper Co. for four 500 brake-horse-power Bellis & Morcom engines, to drive their paper machines by rope drive. The Alberta Government have also ordered a 180 brake-horse-power Bellis & Morcom engine, to be installed at the Ponoka Asylum.

Butterfield & Co., of Derby Line, Vt., and Rock Island, Que., are building an addition to their factory at Rock Island. The new building will be 185 feet long, 60 feet wide, and three-storeys high, of brick and concrete construction. A portion of the new building will be used for manufacturing twist drills and milling cutters. It is hoped the factory will be in operation by January 1, 1915.

Trade Commissioner's Report. — The report of his Majesty's Trade Commissioner to the Dominions of Canada and Newfoundland for the year 1913 has just been published. The report contains a survey of all lines of merchandise, as well as statistical tables dealing with the various trades, showing the value of the importation under the trade heading of the articles which are component parts of that particular trade. The report should be of considerable value to those dealing with British manufacturers and merchants, as well as to agents having or contemplating connection with United Kingdom manufacturers by reason of the comparison made in dollars of Great Britain's trade with the Dominion in comparison with the trade of other countries. Useful information is also given regarding the appointment of agents and the handling of products of British manufacture. The edition is limited, and application for copies, which will be supplied at the nominal fee of $1 each, postage paid, should be made immediately to his Majesty's Trade Commissioner, 5 Beaver Hall Square, Montreal, Que.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Smith's Falls, Ont.—T. G. Kyle has bought the foundry and other manufacturing establishments of the P. Kyle estate.

Kingston, Ont.—Fire in the engineering buildings at Queen's University on July 16 did $1,500 damage. It started over the boiler. One motor was destroyed and another damaged.

Stratford, Ont.—The Stratford Water Commissioners have decided to fall in line with the suggestion of the Hydro-Electric Commission and supplant the steam boilers with gasoline engines.

Weyburn, Sask.—Dr. E. M. Gratton, of the Dominion Odic Co., reports that an early start will be made on the construction of the foundry for this company. The building will be of brick, 50 x 50 feet.

Redcliff, Alta.—The Redcliff Ornamental Ironworks are supplying a considerable amount of ironwork to the new Regina College and the Douglas Building at Moose Jaw. Other industries in Redcliff are reported to be doing good business.

Redcliff, Alta.—The headquarters of the H. Kelly Heating & Plumbing Co. of Calgary is to be moved to Redcliff at once. This company employs 150 men, and now has some of the largest heating and plumbing contracts in the Western Province.

Woodstock, Ont.—Messrs. Wallace Gibson, W. S. Skillen, E. W. Mair, W. S. Sutton and E. R. Teed, all of Woodstock, are applying for incorporation as the Woodstock Foundry, Ltd., with an authorized capitalization of $40,000 and head office at Woodstock.

Hamilton, Ont.—An announcement was made on July 15 by Basil Magor, vice-president of the National Steel Car Co., that his concern had let the contract for an extensive addition to its passenger car department. It is reported that the company has secured large orders for equipment and passenger cars.

Victoria, B.C.—Damage estimated at between $4,000 and $5,000 was done to the pipe fabricating plant, operated by the Burrard Engineering Co., at Thetis Cove, Esquimalt Harbor, recently, when the inflammable material in the dipping tank became ignited. For an hour the fire raged, destroying the hoisting machinery, caulking shed, dipping tank and a large quantity of dipping compound, as well as several lengths of fabricated pipe.

Redcliff, Alta.—The Imperial Brass Mfg. Co., of Chicago, has closed a contract for a factory at Redcliff, and will commence construction at once. The buildings will be similar in equipment to the Chicago plant. They will be built of brick, and the plant will be in operation before winter sets in. The main buildings will be 40 x 150 feet, and employ at the start 50 men. The product will be brass and hardware specialties, pumps, valves, faucets, self-heating flat irons, etc.

CALL FOR NEW EQUIPMENT.

The Canada Wire and Cable Co., Toronto, Ont., are in the market for the following tools for their new plant at Leaside, near Toronto:—

One 2-spindle sensitive drill press.

One 2-wheel emery stand.

One 23-in. disc grinder, with press.

One No. 2 Brown & Sharpe universal milling machine, complete with attachments

One 18-in. crank shaper.

One 14-in. power hack saw.

One 14-in. Pratt & Whitney tool makers' lathe, complete with grinding attachment.

One 18-in. x 12-ft. engine lathe, complete with face plates and chucks.

One 24-in. planer.

One gap lathe to swing in gap 36 in., motor driven direct connected.

One power pipe threading machine, with complete set dies up to 6 in.

One drill grinder.

One arbor press.

One electric portable drill, 110 volt., 25 cycle, single phase.

One milling cutting grinder.

Walkerville, Ont.—The Ford Motor Company will erect a six-storey addition to the main factory building at a cost of $300,000. The new structure will be 195 x 200 feet and will be of similar construction to the main buildings. The first five floors will be used for factory purposes, while the top floor will be used for additional offices. The new addition will be erected on the site occupied by the old factory, now used as a shipping warehouse, fronting on Sandwich street. Work will begin at once.

Toronto, Ont.—A meeting of the creditors of the Berg Machinery Mfg. Co. was held at the office of James P. Langley McKinnon building, Toronto. The statement presented by the assignee showed nominal assets, after payment in full of its creditors, of $214,294.18. Messrs. Melville Bertram, J. Hardy, W. G. More, W. A. Hare and Fred Miller were appointed inspectors to co-operate with the assignee in winding up the estate. The creditors expressed themselves as anxious that those interested in the company should continue the business.

Vancouver, B.C.—An industry likely to prove of substantial value to Vancouver is about to be launched under the name of the British Columbia Steel Works, Ltd. The company, capitalized at $500,000, has associated with it as directors a number of well-known Vancouver business men consisting of the following:—Francis L. Leighton, general manager of the Vancouver Engineering Works, Ltd.; J. J. Banfield, Nicholas Thompson, David A. Smith, president of the D. A. Smith Co.; Geo. E. Graham, general manager of the Coquitlam Terminal Co. Arthur M. Valentine is secretary-treasurer. On a site of five acres, giving 300 feet of water frontage at Bridgeport, Lulu Island, the works will manufacture merchant bar. angles, rounds, flats, bolts, nuts and light rails from scrap which will include wrought iron, steel scrap, turnings, pipes, plates, shearings, etc. The new enterprise will require buildings and machinery to cost $100,000, and will give employment to a considerable number of hands when in full operation.

Electrical

Windsor, Ont.—The Hydro Commissioners have made arrangements to turn on the hydro current here on September 12. the opening day of the local industrial exhibition.

Developing Shop Efficiency Without Outside Expert Aid*

By H. Westbrook **

The study of shop efficiency has of late been so decked with the results of scientific research and the names of new professional callings as to be largely uninteresting to the average foreman and mechanic. The writer of the following paper, however, handles the subject from the practical man's point of view, and introduces, by the way, some simple and novel suggestions.

AS an introduction to the subject matter of this paper, the author wishes to point out that he does not pose as an efficiency engineer, business expert, industrial doctor or similarly titled individual, the idea being rather to deal with matters which every foreman can accomplish in his own organization in the direction of betterment, without the expenditure of large sums of money or the calling together of a board of directors to sanction some new policy. A number of the suggestions are, no doubt, painfully obvious to many, but I can assure you there are still many shops where some of them can be employed with profit.

What Does Efficiency Mean?

Efficiency means keen self-criticism; it means going into your shop and finding nothing there which is sacred or fixed; it means that methods employed six months ago may to-day be ancient history; it means forgetting traditions and the questioning of everything, including yourself, your methods and your knowledge. It means to make the work easy by doing away with unnecessary motions, thereby enabling a workman to employ all his time in doing productive work and not tiring himself performing labor not actually required or that can be equally as well or better performed by other means.

True efficiency is more interested in the study of the man than of the machine. Required to produce certain results, and given a choice between a factory equipped with modern tools, up-to-date appliances and a staff of disinterested men, or with an out-of-date equipment and a staff of good, loyal men, ready to co-operate and show what result from such a combination, I would most certainly choose the latter; but given the loyal men, the up-to-date equipment, and men directing things who could and would create and keep this attitude alive, then we would obtain the greatest efficiency.

The first requisite, then, for greatest efficiency, is to create a condition among your men where each one is as anxious as yourself to reduce to a minimum all unnecessary work, to be more willing to call attention to improvements than to have them pointed out to them. This is not an impossible condition, or even difficult to attain. I have in mind one shop, a piece-work one at that, where men are frequently suggesting that, if their particular job was to have the pattern slightly altered, or a certain tool or device supplied, they could do the job for 10 or 20 per cent. less. To have such a condition there must exist the greatest confidence between the foreman or superintendent and the men. We must get it into our heads that it is only possible to obtain the greatest degree of efficiency where we have the greatest degree of co-operation If the employer feels that greater efficiency is only a method by which he makes his workmen exert themselves very much more, entirely to the employer's gain, he had better stick to his present methods whatever they may be.

No Knowledge Monopoly.

The foreman should understand that the fact of his being foreman does not imply that he knows all there is to be known about everything that he is supposed to be boss of or supervisor over. He must not think or permit his men to believe that he thinks he has no more to learn. On the other hand, the machinist, blacksmith, carpenter, etc., must not be permitted to think that, because he is such, he knows everything there is to know concerning his branch of the trade; so I say again that the man most closely in touch with the directing of his men is the one to whom we must look to obtain the foregoing desirable results and the more successful he is in this, the more real value he is to his employer, and the better prepared he will be for advancement should it come to him.

I became more interested in this subject than I had hitherto been, although for years I had found myself being gradually attracted to it, on receiving a letter from a friend of mine, who at that time was superintendent of a large machine shop in another city. He had known that I was interested in the subject. For reference, I quote the following part of his letter:—

"Things are so busy in the shop, I must either ask for more mechanics, more machines, work overtime, or go after my men harder. Now while I am sure they are just as fast a bunch if not faster than the average, my speeds and feeds up to the limit of high-speed steel, and they are loyal to me, and I do not wish to recommend engaging an efficiency expert, can you arrange to come over and visit me and knock around the shop for a week or two. I believe you could see things that I may have overlooked in my familiarity with them. Don't disturb things in the shop, but keep your eyes open, and ask questions, make notes, and we will talk it over at the end of the week. If you see room for improvement, just tell me where, and don't spare my feelings in the least. Let me know when to expect you.

(Signed) BOB".

Being in a position at that time to take a vacation, I did as suggested, and trusting I may be pardoned for my apparent egotism in describing the conditions found there, and suggesting to readers who are desirous of making improvements in their own shops to arrange for a similar exchange of visits with friends in the same line of work. Just imagine on your visit that you are a highly paid expert procured to make a report of conditions as they appear to you, not sparing your friend's feelings at all, and as these reports need not be seen by others than yourselves, they can do you no harm in the estimation of your employers, and the experience will be of great value to you both.

A First Impression.

My first impression of the shop in question was that his estimate of conditions was correct. His speeds and feeds were as described, his men above the average in ability and willingness, the machinery well kept up, and apparently everything possible was being done; but, continuing the investigation, it was noticed when a belt broke, the operator repaired it himself, wire lacing being kept in the tool-room for the purpose. The practice resulted in a general run-down condition of the belts, each man having his own idea of what was the proper way to repair a belt, and apparently having his own opinion of the proper time it should take to lace a belt. Some very poor specimens of belt lacing were found throughout the plant.

*From a paper read before the Central Railway and Engineering Club of Canada, March 24, 1914.

**Foreman, G. T. Ry. Shops, Battle Creek, Mich.

One particular belt took eighteen minutes to get into service again.

A special belt-repair man can repair a 4-inch belt in less than four minutes, and I would recommend that a special man be appointed for this work who would care for, lace, and watch all belting, working during the noon hours inspecting belts overhead, and not waiting until they break before being repaired. This man would also inspect all split pulleys and counters during cessation, see that there are no indications of nuts, etc., becoming loose, dividing the shop into sections and going over each one in its turn, dressing the overhead belts with a good reliable dressing when found necessary.

A sticky substance should never under any circumstances be placed on a belt, but a dressing that goes into the belt, and put on both sides so that it will lubricate the fibres more quickly. Place in his hands some belt literature and see that he is intelligent enough to understand it by questioning him occasionally on the subject dealt with, and also see that he **knows** just what every foot of each size belting **is worth**. When he knows that a piece of 3-inch belting 3 inches long costs ten cents, his efficiency will be much greater than before he was so instructed.

It has been stated on reliable authority that it requires fifty per cent. more horse-power to operate a plant or shop equipment of tight belts than it does when they are in good condition and running slack. In shops where belting receives but little attention, the upkeep of countershafts, motor and other bearings, machinery, etc., is a matter not to be treated lightly.

High-Speed Steel.

While plenty of high-speed tools were in use throughout the shop, no high-speed drills were being used for the reason that they had such a large supply of carbon drills on hand. I advised procuring a 1-inch high-speed drill of a certain make, and that we would make a demonstration next day, which we did with the following results:

The best results with the carbon drill were obtained at a speed of 35 feet peripheral speed per minute, and feed 0.018 per revolution. The drills required grinding every ten holes. With the high-speed drill on the same class of work, we ran 90 feet per minute, feed 0.0250, and drilled 53 holes without grinding. On reducing feed to 0.018 several hundred holes were drilled without changing drills.

Lathe Work on Drill Presses.

Work was being performed on lathes with boring bars and threading tools by high-priced labor that could have been done equally as well and at much less cost, and in some cases in one-half the time, on drill presses by the use of special cutters and taps, the only changes necessary being altering the patterns so that instead of coring the holes almost the proper size which resulted frequently in the lathe hand being obliged to cut on the scale, they were left solid, the high speed drills and special cutters making much better time cutting from the solid than the lathe hand could possibly do by his methods. This condition seems to exist wherever I have had occasion to visit machine shops, and is well worthy of consideration.

Non-productive Periods of Machines.

When a change of jobs was to be made on the planers and boring mills particularly, much loss of time resulted in the operator either waiting for the traveling crane which was usually working elsewhere when wanted, or if at hand, the operator alone unloading or reloading his machine, cleaning cuttings out of bolt slots, bolting down and setting the new job himself, when a sufficient amount of help should have been available to do the necessary unskilled part of the work, thereby getting the full benefit of a skilled man's services with the least possible amount of delay. A mechanic's pay is only earned while doing work requiring a mechanic's skill.

This feature alone, of neglecting to obtain the most of a skilled man's time by allowing him to perform much labor that should be performed by helpers, is a most common form of shop inefficiency, and the importance of it was easily appreciated when the number of hours lost by machines and mechanics while changing jobs was pointed out. It is the idle hours of the machines, the non-productive minutes of each, which soon reach an appalling amount, if not carefully watched. Each machine depending on the traveling crane should be equipped with an individual crane and hoist, either electric, pneumatic or differential chain. These cranes are of so simple a form that they can be designed and built in an ordinary machine shop, and will pay for themselves in a short time.

When we consider that, if the traveling crane had but two machines to serve, there would arise occasions when one machine would be obliged to wait while the other was being attended to, then how much more delay occurs when forty or more are to be served. The lack of means, independent of the traveling crane for loading and unloading machines, is another all too common and neglected form of shop inefficiency.

Tool Grinding.

Each man was doing his own tool-grinding, the reason being to keep down discontent through having some dub do the grinding for good machinists. Just here, some will take issue and say he should have put in a tool grinding system if he thought well of it, whether the men liked it or not, that he was running the shop, etc. It must, however, be borne in mind that the business was paying well. His employers were not complaining on that score, but were well pleased with the results. Under the circumstances, having surrounded himself with a number of excellent mechanics, can we blame him for not wishing to deliberately create discontent?

As many of the men were on special work, each one having his own idea regarding the best form and shape of tools most suited to produce the best results, we decided, instead of installing all at once a general tool grinding system, to have a pattern maker construct exact models in wood of each kind of tool that had proved most satisfactory, consulting with the men themselves who had developed them as to details. This immediately got them interested as their ability was thus recognized.

The tool-smith then forged some of each shape, and a special man was appointed to grind them to the correct forms and keep them in the tool room, to be taken out as wanted, being called for by number, which was shown on framed blue-prints having reference to the class of work they were for. The men, seeing that these were their own design of tools that were being kept up, and soon learning that operating a machine was easier work than grinding rough forged tools, fell in with the idea, and I have since learned that the system now extends over the whole shop, having the hearty support of all. This, accomplished in a few months with the co-operation of all, would have created discord and other undesirable conditions, had it been attempted all at once.

Oil Distribution.

Considerable loss of time was noted, owing to each man going to the store room for small squirt cans of oil when required, occasionally some six or eight standing at the wicket at one time. This was another instance of the skilled man doing an unskilled man's work. One of the laborers was given charge of the oil distribution each morning going the round of the shop with a large can and filling all small cans that were left in a given place on machine or bench. No conversation with the men was necessary, and he now serves those of one hundred and fifty users who require it, in three-quarters of an hour each day. He is also supplied with a record book, so that a tab is kept on the amount of oil being used daily, and should the amount appear to be too large at times, an inquiry can be made at once.

We will now close with Bob's shop, as I am not going to say what the result of correcting the inefficiencies we found was in actual output, but no overtime was worked, only one machine was purchased, and the men were not chased any harder; while locating these inefficiencies was done in such a manner, that instead of the men being led to believe they were going to be shown up, instructed how to run their machines or made to work harder, they were induced to co-operate; most of them taking pride in offering suggestions with a view to increasing the efficiency of the shop, which spirit, I am told, still continues in evidence.

Pneumatic Tools.

The care of pneumatic motors is often neglected to the extent of amounting to a very glaring inefficiency, and to quote Mr. Kingman's remarks in "Ideal Power" who says, that after his locomotive has run 150 miles, a trained engineer proceeds to feel all the rod connections, see that they have had oil, see that all nuts and bolts are perfectly tight, etc., although the locomotive in that time has only made about 30,000 revolutions. Now, a pneumatic drill is some machine, when compared to a ponderous locomotive, and, in the hands of the most inexperienced help will, when used on drilling staybolt holes in this big locomotive's boiler, exceed 1,000,000 revolutions in a day of ten hours. When a locomotive makes a million turns it would have run 3,300 miles, and spent about two weeks doing it, and about half the time in the round-house receiving expert care and attention. The pneumatic drill is as fine an engine as any other type, and why not give it a little of the care that railroads are expected to give their locomotives. It would amply repay us in service.

I have seen many of the varieties of care these tools receive, thrown from the front end of a locomotive on to the floor, hammered to release the drills, run without lubricant of any kind for days at a time; this treatment mostly occurring when they are placed in the hands of unskilled labor, as the nature of the work these little engines can accomplish is such that the most unskilled employees can handle them successfully.

We must face these conditions, and I would suggest that the best way to overcome the misuse of these tools is to have the operator go into the tool room when a motor is being taken apart, and receive instructions as to the need of frequent oiling, and be shown the light construction of the cylinder walls, explaining that they were purposely made light for their welfare, so that they would not have the heavy weight to constantly handle, were they constructed so as to withstand rough usage. They should also be shown, while the cover is removed, the speed the inner works revolve at.

I have demonstrated, to my own satisfaction at least, that they will then have a much greater regard for these wonderful little engines, and the repairs found necessary will soon be those only due to regular wear and tear, which should be performed regularly each week; the motor being examined, adjusted and oiled, even if no repairs are necessary.

The Safety Movement.

The safety movement is now becoming nation-wide, and is recognized as an important factor of shop efficiency, but until quite recently, I think there has been no more neglected feature of shop efficiency than the consideration of such rules of safety as would insure the minimum amount of time lost through accidents.

I well remember the words of one superintendent I worked for in Canada who, in addressing the employees after an unusual frequency of casualties occurring in the works, said: "While you men have a perfect right to injure yourselves if you wish, you have no right to impair the efficiency of these works in doing so, for it is not only the loss attendant upon your own personal injury with your enforced absence from your work, but one serious accident in a plant affects the efficiency of the whole organization." While this seems to be somewhat of a heartless argument to advance as a reason for not getting hurt, still we must admit that the contention is correct.

The New Man.

Another important shop problem affecting its efficiency, and the last one I will deal with, is that of the **new man.** It is fair to assume that you need the new man quite as much as he needs the job, but too often he is discouraged the first morning by the manner in which he is introduced to his new job, which frequently is about as follows:—

A small boy from the office escorts him through many devious ways, past whirring machinery, among strange and perhaps unfriendly faces to a busy foreman, with a note instructing him to start this man as a lathe hand, we will say. This foreman, who perhaps is, unintentionally, out of sorts that morning, gives him a cold look and takes him to a lathe, shows him the material to be worked up, hands him a blue print, telling him to whale in and that the job is in a hurry. This sort of an introduction is enough to discourage the average man at the start, and do not be surprised if your new man will within a few hours come up, tap you on the shoulder, and ask you for his time, especially if work happens to be plentiful elsewhere, in which case you need his services all the more yourself.

Now, I hold that it is just as essential that a foreman be competent to fulfil efficiently that part of his duty which calls for getting the new man properly started as in getting the new machine properly installed, and quite frequently it is just as necessary. The new man should be received cordially, questioned in a friendly manner, to ascertain what he is most accustomed to work at, and learn what class of work he considers himself most competent to perform. Make a note of this information for future reference, as it will be of value when certain vacancies later occur, then explain to him just how the work should be handled. Should he be placed on a class of work for which it has been practical to make an operation sheet, hand him one. From a series of motion studies taken previously, each operation is numbered, shapes of tools decided upon as being the best so far discovered, and feeds and speeds that have been found the most effective printed plainly.

The man, on starting, should be told that the sheets describe the best method that so far has been evolved for performing that work, and that if, after acquainting himself with it thoroughly, he can improve upon it in any way by making any change, that you will be pleased to consider it, advising him that you are looking for the class of men who can improve upon existing methods. You thus succeed, as it were, in challenging the new man to do even better than his predecessor, and have made him feel that he has an opportunity. He does not have to approach a new and strange job with nothing to guide him. His standard practice card tells him just how his predecessor went about it, how long he took to arrange his tools or fasten his chuck, which part to machine first and why, styles of tools he used and total time it took to complete the job. Should he find himself falling behind he can, without asking questions, ascertain just where he is losing.

The time of these operations should not be the best that is possible to obtain under the most exceptionally favorable conditions, but should be based on the time taken to do a number, to which has been added the necessary time taken for grinding tools and personal needs. Make the sheet a fair and straightforward one, and your new men will soon get to appreciate the value of it to themselves as well as to the efficiency of your shop.

Securing a Motion Study.

I would call attention to the steps taken in securing a motion study which has been extensively adopted.

1—Make time study of motions as at present.

2—From the time study ascertain the proportion of idle time and amount of productive to non-productive motions.

3—Determine present motions that are unnecessary.

4—Study each motion separately and its relation to the preceding and succeeding one to determine the easiest and quickest manner in which each may be performed.

5—Group motions into unit operations.

6—Assemble unit operations in proper sequence.

7—Re-establish total time for one complete cycle.

From this data you may then construct your shop standard practice cards, making the allowances I have already spoken of. Many operation sheets are treated with deserved ridicule by the men, owing to the assumption that a machine can be operated all day long at the same rate, that one single piece can be machined under the most favorable conditions of newly ground tools, and no allowance made for distorted, hard or bad castings.

While looking at this standard practice card, attention is called to the advantage of the extended use of various size chucks fastened to the regular tables of boring mills over the method of attempting to do all classes of work on the one large chuck or four independent jaws usually furnished with these machines.

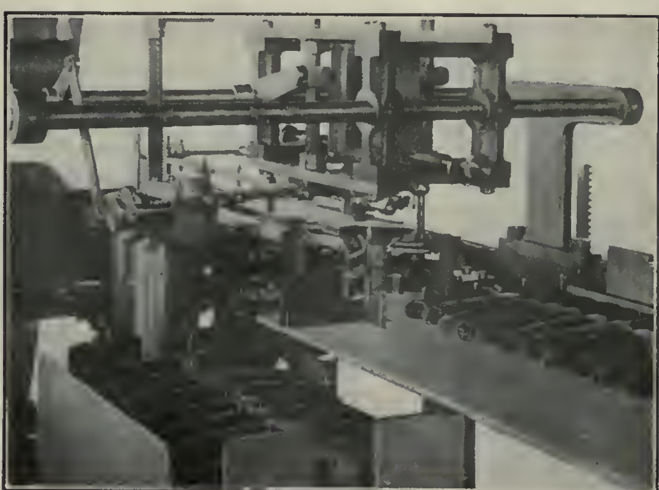
I have left untouched many forms of shop efficiency that could profitably be discussed also, but, if I have succeeded in showing that, after all, shop efficiency is not so much a matter of modern machinery, not so much strict discipline, and not so much complex organization, although these are all very desirable, as the thorough understanding of **men**, I shall feel repaid for my labor.

The Mechanical Banding of Box Packed Cigars

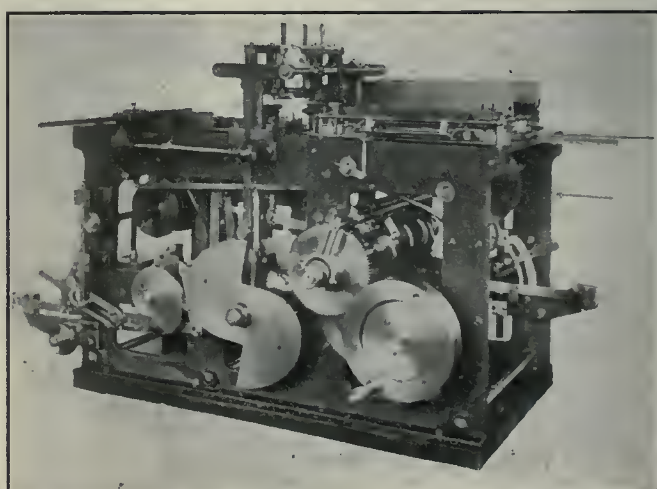
By J. E. Pruden

Cigar smoking has long since ceased to be a luxury, except perhaps in the matter of quality. In any case most all of us have often been chagrined to find with the removal of the band that the wrapping has been injured. The accompanying article deals with an equipment to not only prevent such a trouble, but is also more rapid than hand banding.

WHEN a man tears the band off his cigar and finds that with it he has flaked off a piece of the wrapper he is apt to vent his exasperation in no mild terms against the whole system of pasting paper seals about cigars. Yet the very next cigar he buys will be a banded one, for he has no confidence in brands that do not bear a mark of identification. As a matter of fact it is not the band that he objects to but the careless way in which so many of them are applied. Unless he knows something about the cigar business he is inclined to blame the manufacturer for employing "cheap help" and antiquated machinery that cannot put on a band without gumming it fast to the cigar. No doubt, it will surprise him to learn that all packed cigars, that is, the product packed in boxes, have to be banded by hand at an expense that is estimated at over two million dollars per annum.



BANDING MECHANISM IN THE ACT OF REVERSING.



REAR VIEW OF MACHINE.

Difficulties of Machine Banding.

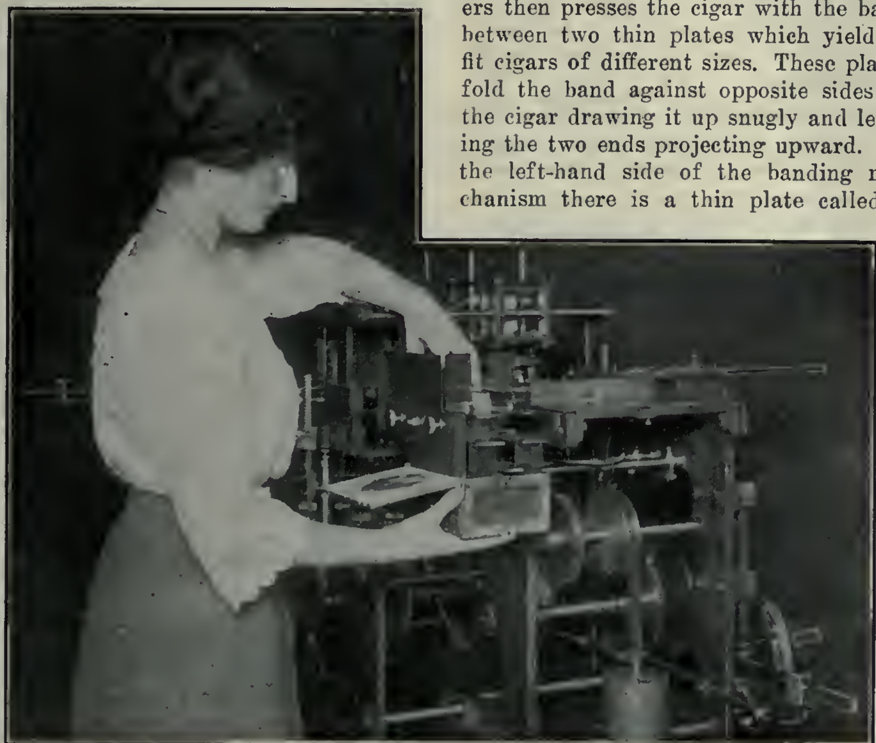
Manufacturers will explain to him that it is impossible to band cigars by machine for the following reasons: Cigars that are packed in boxes must fill the box tightly so that the customer may be satisfied that he is receiving full measure. The cigars are fitted into a box and placed under a press where they remain for several hours until they have been compressed sufficiently to permit of closing the lid upon them. It would not be a very difficult matter to band these cigars before they are placed in the box for then they are of uniform size, particularly if made by machine, but in the process of compressing, the paper bands cannot be made to contract with the cigars and so would be too large for the cigars. They would also be badly creased and generally dilapidated when the box was removed from the press.

It is therefore evident that the banding must be done after the packing; but then the cigars are of irregular form. No longer are they round, but flattened in many sides by their contact with the other cigars in the box and otherwise twisted and bent out of their former shape, while some of them have been compressed more than others. It is because of this irregular form that it is difficult to devise a machine that will band the packed cigars. Added to this difficulty is that of preserving the original order which the cigars occupy in the box otherwise when they are returned to the box they cannot be made to fit.

Machine Banding Superior.

Nevertheless, despite all these difficulties a machine has been developed which will perform the work of banding packed cigars, meeting all the requirements of the industry and turning out a product far superior to that obtained by hand. This machine was devised by a mechanical engineer who was thoroughly familiar with the conditions that had to be met. He was aware that a cigar is a very delicate article of manufacture and must be handled with the utmost care lest the thin tobacco wrapper be injured.

With this in mind the mechanism was adapted to pick up the cigars on rubber stems connected with a suction pump so that the cigars were held not by mechanical means but by atmospheric pressure. The fingers for applying the band snugly to the cigar do not touch the wrapper but press upon the paper only. Hence, although the band is drawn very snugly about the cigar there is not the slightest possibility of tearing the wrapper.



PACKING PROCESS AFTER BANDING.

It is the practice in hand-banding to invert the cigar box upon a table, keeping the cigars in the same relative relation to each other as they were in the box. The bottom row of the box is now the top row, so the operator start banding with the bottom row, replacing each cigar after the operation in the precise position it formerly occupied.

Machine Banding Process.

The same process is employed in the machine. The cigars are removed from the box by inverting it upon a tray. This tray is placed in the machine and the cigars are removed from it one row at time; but instead of removing the top row first, the bottom row of the tray passes first into the machine, for the banded product is discharged by the machine not directly into the box, but into a second tray. The row of cigars is fed to the banding position with a step by step movement, the length of each step being equal to the average width of the cigars. As the cigars are fed forward they are picked up one by one by a suction device which draws them away from the rest of the row and carries them over to a pair of rubber stems upon which they are individually supported and transferred to the banding mechanism.

The cigar bands are held in a bracket directly above the banding point. Immediately before the arrival of the cigar a suction tube rises and removes a band from the bottom of the pile, drawing it down to such a position that the cigar will be centered over it. A pair of plungers then presses the cigar with the band between two thin plates which yield to fit cigars of different sizes. These plates fold the band against opposite sides of the cigar drawing it up snugly and leaving the two ends projecting upward. At the left-hand side of the banding mechanism there is a thin plate called a "tucker" which moves over the cigar, tucking the inner end of the band down in place and holding it there for a moment while the outer end of the band is being folded down by a roller, then receding before the advance of the roller. While the roller is pushing the overlapping end down, it presses it into contact with a gumming plate located just above the tucker plate. The gumming plate is connected by a flexible tube having a cylinder filled with gum and at the proper instant a plunger in this cylinder is depressed one ten-thousandth of an inch causing a minute quantity of gum to be forced out upon the plate. This is wiped off on the outer end of the band immediately before it is pressed down by the roller. The latter withdraws at once and the cigar is picked up on a second pair of rubber suction stems and carried over to a delivery table.

The process of banding each cigar occupies but a second of time. When the entire row has been banded a second row is pushed from the tray into the machine while the banded row is ejected from the delivery table into the discharge tray. The latter immediately moves down a trifle so as to receive the next row of banded cigars above the first. When the entire box-full has been banded, the cigars will be found in the delivery tray all neatly banded and in precisely the same order as they occupied in the first tray. The box is now inverted and fitted over the end wall of the tray, after which tray and box are both turned over and the cigars are pushed out of the tray into the box by means of a bar.

Caring For Packing Methods.

If this were all that the machine did it would mark a decided advance in the industry, but it has been carefully devised to meet all the special requirements. For instance, cigars are packed in rows of ten and ten or of twelve and thirteen. In order to adjust the machine for these variations, the cam shaft that governs the feed of the rows into and out of the machine is driven by a ratchet mechanism. It carries two ratchet wheels,one of which is formed with 20 teeth evenly spaced, while the other has 13 teeth on one half of the wheel and only 12 on the other. When the latter wheel is thrown into operation, the machine will band 12 cigars before the pusher slides operate, then 13 cigars, then 12 and so on. Again if the other ratchet wheel be in action, the pusher will always operate at the end of ten operations of the banding mechanism.

Some boxes are packed with alternate rows reversed end for end. When banding a box such as this, the bands must also be reversed for alternate rows. The machine is arranged to do this automatically. After a row of cigars has been banded in the normal way, a spiral cam comes into play which causes the banding mechanism to turn through an angle of 180 degrees as each band is picked off the pile, returning the parts to noraml position the instant the cigar has been banded.

Boxes of different makers are apt to vary in size, but in order to make the machine universally applicable, a scale is provided by which measurement of the length and depth of the box may be taken. Corresponding adjustments are then made, one of which controls the feeding of the cigars toward the banding mechanism, while the other controls the drop of the delivery tray after each row has been delivered to it. A ratchet wheel is provided which has 100 teeth, and a ratchet mechanism may be set to move the wheel to a space of one, two or four at a time depending upon whether there are to be a hundred, fifty or twenty-five cigars to the box.

The machine requires but a single operator and its capacity is 3,600 cigars per hour, or ten times as many as the average girl can band by hand. Out of an annual output of eight billion cigars there are two billion put on the market without bands, merely because hand-banding is too expensive. These could all be banded profitably by machine.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

TURRET LATHE AND VERTICAL BORING MILL PRACTICE.*

By Albert A. Dowd.

HUBS and flanges for automobile work present certain problems in machining which are solved by various manufacturers in ways differing considerably on account of the difference in production required. The flanges are not specially difficult to machine, but the hubs require careful handling, and the tooling for these parts must also be carefully considered, for in many cases inserted bearings are used at each end, and it is essential that these should line perfectly one with the other in order to avoid any possibility of "cramp" in the bearings. Hubs are somewhat varied in design according to the class of car on which they are to be used, but the important points in the machining operations have a strong family resemblance. The flanges do not differ greatly in design. As there are at least four each of hubs and flanges used in each car, to say nothing of extra parts required for repairs and replacements, it is evident that the production is a matter of some moment and that both rapidity and accuracy must be carefully considered in the machining operations.

Means of handling have been developed and improved so that very accurate

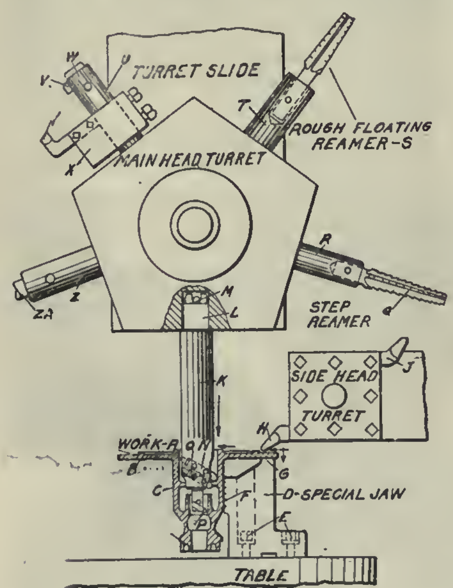


FIG. 1. FIRST SETTING OF STEEL REAR HUB, A.

and rapid production methods are now in vogue in nearly all factories where the yearly output warrants the expenditure. When ball or roller bearings are used, the bearing seats must not only be machined within limits of .00025 to .0005, but they must also be in alignment. It is obvious, therefore, that very accurate tooling and holding devices are necessary in order to produce the desired results.

In the machining of such work as hubs and flanges, considerable trouble may be experienced when facing the thin portion of the flange unless the fixture or holding devices are arranged so that good support will be given and "chatter" thereby avoided. The horizontal turret lathe is frequently used for work of this character, and special holding devices, expanding arbors, and special tooling give rapid and accurate results.

The vertical turret lathe is a machine tool which is also strikingly well adapted to the work, and the examples here given represent holding devices and tooling for this machine.

Machining a Rear Hub on the Vertical Turret Lathe.

The first setting of the steel rear hub A on the vertical turret lathe is shown in Fig. 1. A set of special jaws D are fastened to the sub-jaw in the table chuck by the screws E. The hub C is gripped by the portion F and the flange B is supported by the upper part of the jaw G. Vertical location is also assured by these points. The tooling is as follows:—The boring bar K is of .040 carbon steel and fits the turret hole at L, being driven by the pin M in the usual manner. Three cutters are used in the bar and are shown at N, O and P. The first two of these are fitted with backing-up screws for adjustment and are used to rough-bore the bearing seat and the clearance hole respectively. The lower tool P is used to break the scale in the taper hole and generate a true hole for the other taper tools.

All tools used in this bar are of high speed steel. A high speed steel step reamer Q is fastened into the shank R, which is of .040 carbon steel and obviously fits the turret hole. The reamer S shown in the upper turret face is also of high speed steel, with a left-hand thread cut along the flutes in order to break the chip. This reamer is of the floating type and is held and driven by the holder T. The finish boring and reaming bar U is furnished with a slip cutter V and two flat floating reamers W, thus ensuring great accuracy in the finished hole. A special tool holder X is fitted to the shank of the boring bar and contains a bent sizing tool Y for the shoulder. A finish floating reamer ZA is held in the holder Z and is much the same as the reamer S, except that no grooves are cut in the flute. The two roughing and finishing tools respectively

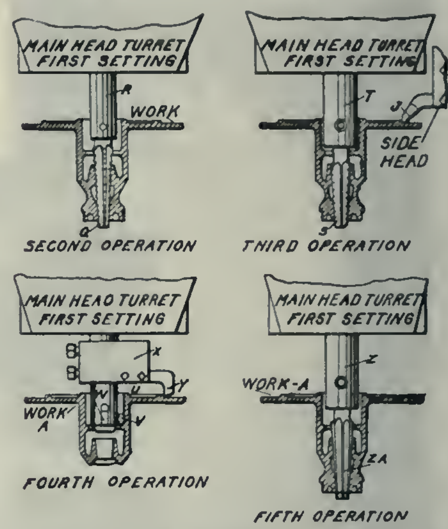


FIG. 2. SECOND OPERATION—SECOND SETTING.

are of high speed steel and are securely held in the side head turret.

Sequence of Operations.

First operation:—The tools shown in Figure 1 in the cutting position are those used for the first operation, and it will be noted that during the progress of the boring the side head tool H faces the end of the hub and rough faces the flange as far as the shoulder, after which it trues up the outside of the flange. The boring bar and side head turret tool are working simultaneously during this operation. An important feature of this tooling is the generating of the rough trued hole in the tapered portion by the tool P, for unless something of this kind is done, any tools which follow will have a tendency to be thrown out of alignment on account of the inequalities in the tapered core. A method of this kind provides a true hole for the tapered reamers to start in, and the natural tendency is to follow it, so that final results are much more accurate than would be the case if tools were started in the rough cored hole.

Second operation:—Fig. 2 shows the second operation on the piece, which consists of roughing out the tapered portion with the step reamer Q. The action of this tool is such that it leaves the inside of the taper in the form of a series of steps and breaks the chips up

*First of a series.

into small pieces so that they are not troublesome. Easy cutting is also a feature of this type of tool, and subsequent operations on the same surface are also assisted. The side head is idle at this time.

Third operation:—Another taper reamer S is now used to take out nearly all the remaining stock in the tapered hole, leaving a very little for the finishing reamer. This reamer is ground to the correct taper, but has a left-hand threaded groove, about 4 pitch, cut along the flutes in order to break up the chip and make cutting easier. While this reamer is working in the hole the side head tool J finishes the flange, hub and shoulder, leaving a few thousandths at the latter point for the final sizing.

Fourth operation:—This consists of finish boring the bearing seat with the tool V and reaming the same with two flat floating reamers W; both the boring tool and the two reamers are of the slip variety and may be readily removed by the aid of the fingers alone. It is obvious that the reamers are not placed in the slot until after the boring tool has been removed. The bent tool Y is set at the correct distance from the center of the bar to properly size the shoulder on the work. The side head is idle during this operation. Attention is called to the fact that the method of sizing the shoulder gives very accurate results because the main head is in its fixed central position and the required diameter is therefore assured.

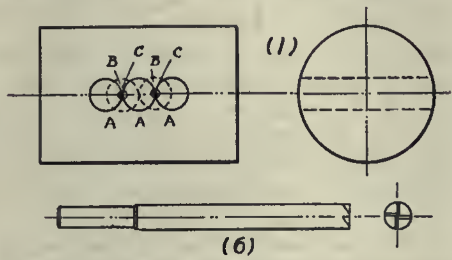
Fifth operation:—The final operation is that of reaming the hole with the reamer ZA. This reamer may or may not have straight flutes depending on the angularity of the hole. If taper is very acute, it is sometimes well to make the spacing of the flutes unequal and to give an odd number of teeth to the reamer, in order to obviate any chance for chatter. It is also sometimes advisable in cases of this kind to mill the flutes left hand at an angle of from five to seven degrees in order to avoid a pulling-in tendency. This operation completes the first setting of the work.

Between the first and second settings on the vertical turret lathe, a drill jig is used for the flange holes, but as this jig may be of a comparatively simple nature, no description seems necessary at this time.

SIMPLE FIXTURE FOR DRILLING OUT A BROACH.

By James E. Cooley.

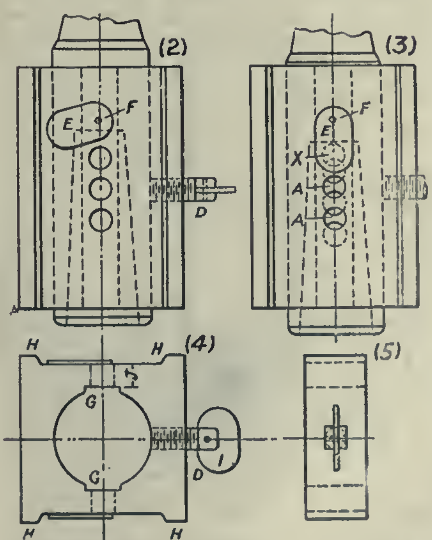
THE usual method for making a broach in a spindle, shaft, collet or boring-bar, is to drill a number of holes on a line as close together as possible, as shown in the sketch at A, Fig. 1, and then chisel out the remaining stock, as at B. Where no jig is used for drilling the holes they have to be layed out. As the work to be drilled has to be stright to run true before the broach is finished, it does not help it any to pound on it to chisel away the stock at B. A better way is to plug up the drilled holes, A, with similar material, and then drill new holes at B, which will cut the stock away. The remaining parts of the plugs



FIGS. 1 AND 6. BROACH DRILLING FIXTURE.

can then be forced out. If holes are first drilled in a short depth at the points C C with a small drill, they will guide the larger drill to run central. The jigs commonly used for drilling out a broach are similar to that shown by Figs. 2, 3 and 4. In these particular sketches a number of improvements are suggested and described in the course of this article.

These jigs are made from square-stock, planed up and hardened. Ordinarily three holes are sufficient to complete the work of drilling out a broach. The work is placed in the jig and fastened in by the screw D. When drilling into work having a taper-hole, one side only



FIGS. 2-5. BROACH DRILLING FIXTURE.

at a time is drilled, then the jig is turned over and the other side is drilled. This is necessary, as the drill will glance off on the taper if put clear through from one side of the jig. When the three holes have been drilled, the screw D is unfastened and the jig is moved along till the undrilled portion of the broach is half-way between the holes A A, Fig. 3. A four-toothed butt-mill is used in place of a drill when cutting away this stock, as a drill will break if run between two holes. A butt-mill is shown in Fig. 6, and is made from drill-rod and hardened, the teeth being filed in by hand.

When preparing to use the butt-mill, the third hole in the jig as X, Fig. 3, should be covered up as there is no stock there to be cut away and there is danger of running the tool into it. The usual practice is to stop up this hole with a round wood-peg or dowel-pin, but as this sometimes gets mislaid, there is danger in not replacing it when needed. A suggestion to prevent using this hole by mistake is shown in the caps E, that are fastened to the jig by the pins F. Figs. 2 and 3 shows the cap in its respective positions. The one in Fig. 2 is swung back out of the way in order to drill the third hole, and in Fig. 3 it is pushed forward over the third hole to prevent running the butt-mill down into it.

Another suggestion shown is the grooves at G, Fig. 4, splined through the length of the jig on both sides of the hole. The purpose of these is to allow the drilled work to be moved along or taken out easily from the jig, as the top burrs made by the drill cause the work to stick. The four projections as at H is another improvement, as it allows the jig to set down flat when there may be chips under it. A square head set-screw is cheaper than a thumb-screw, but, since it requires lifting and handling a wrench each time to fasten and unfasten one, it is more economical to convert a square-head screw into a thumb-screw, as shown at I.

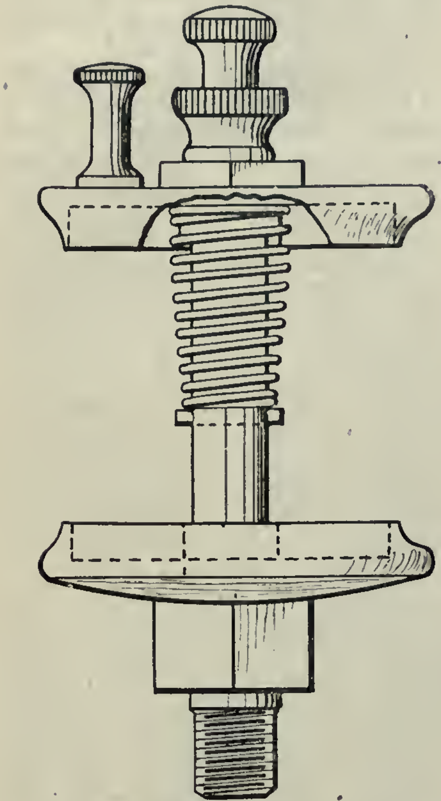
When the stock to be drilled is very long, such as a drill-press spindle, etc., it will require a support of some kind to hold it up on its outer end. A support for this purpose can be made up similar to that shown in Fig. 5, of the same size stock as the jig. When making a jig for drilling a broach, it is advisable to make the stock large enough, so that the space at J is at least ½ in. thick, in order to have a long bearing in the holes for the drill and butt-mill. Usually the thickness at J, on most jigs, is only ⅛ of an inch.

AN IMPROVED OIL CUP.

By F. A. Wright.

THE oil cup herewith illustrated is a standard patented article for oiling engine crank pins. It is arranged to supply the proper amount of oil to the bearing while the engine is running, and to shut off the supply when it is stopped. The one fault with the apparatus was forcibly brought to the attention of the writer upon several occasions.

When the glass was accidentally broken, the heavy brass cover became loose and unmanageable, and it was but a



AUTOMATIC CRANK PIN OILER.

short time before the complete apparatus became a wreck and had to be replaced. By drilling a small hole in the shank and placing the stop pin and spring, as shown, the repairs necessary were minimized. The spring furnished a strong and elastic support for the cover upon the glass being disabled, so that in case of breakage further damage was prevented and the renewal of the glass alone was required.

ANCHOR BOLT FOR CONCRETE.

By Alfred McCormack.

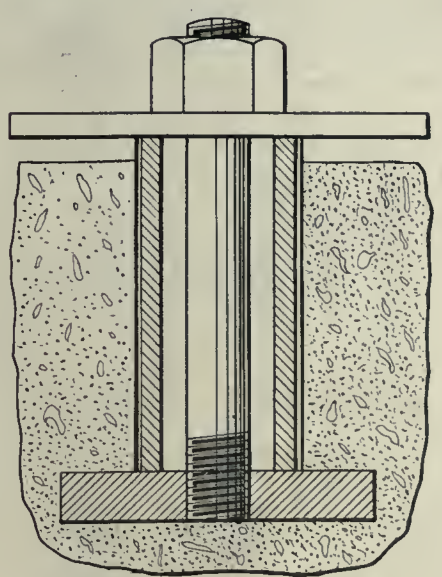
WITH the passing of the use of brick, stone and wood for the foundations of buildings and machinery and the substitution of concrete, there arises the necessity of devising new means of placing the holding-down bolts. Many different ways have been tried and adopted. The most natural, probably, is to simply bed the shank of the bolt solidly in the concrete. This has many disadvantages, most of which are known to the man who has to do the setting up of the machinery or superstructure.

The most convenient method which has been met with by the writer throughout a wide experience is shown in the accompanying cut. It consists of a central tie-rod fitted with a standard nut at the top and a special cast iron nut or tapped steel plate for the bottom. A piece of standard W.I. pipe large enough to leave a space as shown around the bolt is next clamped between the two nuts and outside of this again and fitting fairly closely across is a galvanized iron tube.

The bolts are hung in the templet in the usual way at the required elevation, all burrs having been first removed from the ends of the pipe, and the nuts are tightened up. After the concrete has been run in and has set, the templet can be removed, and the pipes are drawn out by means of holes drilled near the top for the purpose. The galvanized iron tube holds the bolt with plenty of clearance for adjustment of the machine or column.

The pipes may now be used as rollers for moving the machine into place and can afterwards be cut to suitable lengths, replaced and used to support the machine in the proper place while the grout is setting.

Some of the advantages of these anchor bolts are, that if the bolt be originally made too short or too long, they can easily be removed and made right without disturbing the machine. The millwright can easily satisfy himself that the bolts are gripping tightly and in the proper places. Then again, there is no danger of injury to the bolts by careless lowering of a heavy column upon them.

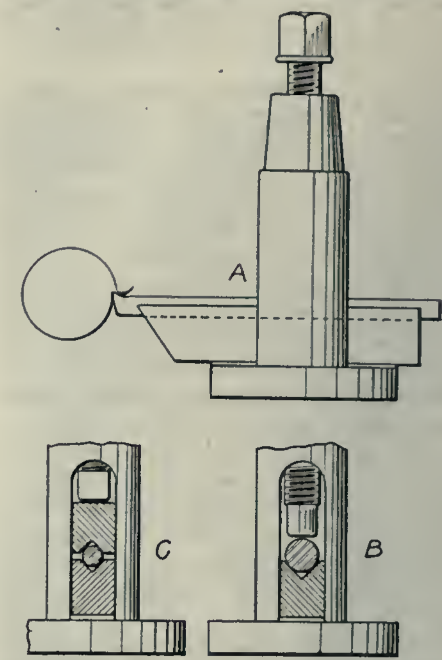


ANCHOR BOLT FOR CONCRETE.

TOOL HOLDER FOR LONG LENGTHS.

By N. G. Near.

IN the accompanying sketches is shown a very simple means for quickly clamping long lengths of self-hardening steel in the lathe tool post, and which the writer has not seen elsewhere than in a shop where he once worked. There is less waste of steel when long lengths such as this can be intelligently used and the



TOOL HOLDER FOR LONG LENGTHS.

tool post screw clamps the whole in a single operation.

In the figure, A shows the arrangement as applied to the regular square high-speed steel. The supporting block is tool steel and, in this case, has a square groove planed in its upper side to fit the size of bar used. At B is shown the same method applied to the larger sizes of round steel which will be found especially useful by tool makers in boring long holes. For small bars the arrangement shown at C has been found most successful.

The tools after being used up to lengths suitable for the regular patented holders are transferred to them and a great economy in tool steel has thus been effected. For small or inconvenient turning or boring this method has proved very flexible as it possesses the greatest degree of adjustment.

FORD MOTOR CO. SHUTS DOWN.

FOR the first time in its history, says a Detroit dispatch, the Ford Motor Co. on July 25 suspended operations for a period of ten days, and the entire force of employees, approximating 20,000 men, will be idle for that length of time. Officials of the company announced that the shut-down was for the purpose of taking an inventory.

When those at work during the light season laid down their tools on the previous evening they were informed by the heads of the various departments that their services would not be needed again until Monday, August 3.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

THE COLLEGE GRADUATE—I.*.

D. S. Mann.

WITH the close of the 1913-1914 session a month or two ago, another crop of college graduates has been put on the market by our progressive universitins and colleges to perchance transform the industries of the lond and to eradicate the evils thereof. The writer, while perhaps not as competent to discuss the advantages of a college education in the business world as many others, yet being a college graduate himself, and also employing college graduates, feels that he would like to register his views upon this important subject, these ideas being based upon practical as well as on theoretical college work.

Entrance on Practical Work.

Each year a larger number of students are turned out, and the problem of their absorption becomes more and more vital, both to the employer and to the college graduate himself. The student of to-day is the manager and superintendent of to-morrow and as such must be reckoned with. Most college graduates leave school with an exaggerated idea of the importance of their education and of their intrinsic value to large corporations and manufacturing concerns, but when, at the completion of their course, they are finally hired and put to work under a three-dollar-a-day gang boss, some of their ideals are rudely shattered. They find that practical experience is placed far above a mere college education, and they are called upon to endure the gibes and sneers of their fellow workmen, who never fail to take advantage of their ignorance and unfamiliarity with the work in hand.

However, the man who is downed by such small matters as these is not worthy of the name. The college man who has taken advantage of every hour put in at his work, who goes into a shop with the determination to get ahead, to keep his mouth shut when he does not know, who keeps his eyes open, who grasps every opportunity to add to his theoretical knowledge with the practical work before him, will soon pass the man who has not had his kind of education. In other words, of two men with the same amount of brains and calibre in every respect, and with the same determination, the college man should win out, for he has the knowledge to apply, to enlarge and to improve every part of the work in the factory or vocation with which he comes in contact; but this is only so when he brings with him good common sense and is willing to start at the bottom and depend upon his merit to get to the top, and not merely upon the fact that he has a college education.

*First of a series.

Colleges Lack Touch With Actual Labor.

The writer has always felt that there was something lacking in the college education as found in the colleges themselves. While colleges are not expected to turn out practical men, yet they should turn out men who are fit to take their places in the world, at least as well as those who have had less favorable opportunities. Of course, some occupations demand preliminary training and the employee must first familiarize himself with certain details and routine regardless of his previous exparience or education. However, that is no reason why a man should be turned out after four years college training with hardly any of the rudiments so necessary in the world of labor. We usually find the majority of technical graduates located in drafting rooms, and for some reason a high percentage of this majority remain there; whether it is because as draftsmen their work is clean and they are enabled to leave the shop with white collar and cuffs or because they have not the ambition to pry further into the details of business than that entailed in mere planning rather than in execution.

The writer was extremely fortunate in having it impressed upon him during his college career by a certain professor who was a consulting engineer, and who certainly possessed a thoroughly practical as well as theoretical education that it was necessary for a man to imbibe the spirit of the times and that this could only be done by actual association. To this end a great portion of the time was devoted to making visits to manufacturing plants and branch houses, power plants and every other source whereby information could be gained along the lines of study followed. In the mechanical drawing classes we were compelled to laboriously draw in the curves of all the teeth of a gear, for what reason I have never been able to divine, unless it was that too many drawings might throw too much work upon the professors who then were devoting most of their spare moments in the daytime to playing billiards, and at night to preparing lessons for a correspondence school.

Upon obtaining blueprints from firms that had use for such, the discovery was made that three dotted circles around the circumference indicated the presence of gear teeth, while all the data necessary for the production of these teeth was neatly summed up in a little note at the side giving the pitch, pitch diameter, and the outside diameter. The time consumed in producing the latter drawing was probably only about one-twentieth of the time taken up in the college drafting room on the much-drawn artistic, but hardly as useful one. Numerous instances such as this could be mentioned, but it is necessary? Is it any wonder that some of the draftsmen turned out each summer are glad to get at least two dollars per day for turning out artistic but impracticeable work? Would it not be much more profitable for the student to be turning out drawings such as are in actual shop use, and if time permitted, to turn out a larger number and thus increase his working knowledge to that extent?

Ignorance of Shop Drawing Requirements.

In most cases, however, the student is hardly to be blamed, but rather to be pitied. A certain student, after graduation, considered that he was fortunate in getting into the drafting room of a large gas engine factory in which an instructor in mechanical drawing from one of our leading State Universities was to be employed for the summer. The opportunity of his career seemed now to be opened before him; here he would have the advantage of daily intercourse with an instructor and under his tutelage would surely make great strides along this line of work. The drawings produced that summer were almost without number, and drawing paper, tracing cloth and blueprint paper disappeared as if by magic. They sat on stools for ten long hours per day, but not once during that time did they visit the shop to see how those engines were being actually produced, or to determine whether jigs and tools were in use for the duplication of parts.

Many of the engines had been built merely from a single sketch and an explanation from the designer, and the majority of the dimensions had only been scaled off the original drawing. However, our friends, by carefully measuring from the rough surfaces of a single casting were able to get within a thirty-second of an inch; holes which had been laid out on the circumference of a circle were dimensioned from center lines; diameters of bosses were given as distances from the edge of a hole and various other liberties taken with the art of drawing. The professor in charge who was drawing $125 per month, was supposed to be well up on the subject, and, as far as the writer knows, his work was never checked. When the toolroom and the machine shop foremen came to use some of these drawings later, after the professor had left, the language used would hardly look well in print, while about five bushels of tracings were afterwards scrapped.

Train for Practical Work at Start.

Was this the fault of the instructor or the instructed? Neither, it seems, knew very much about the particular subject of gas engine design and hardly anything about machine shop work, or even the proper method of dimensioning drawings so that they might be useful for reference later on, yet this instructor was drawing a good salary for the very purpose of teaching the proper method of making working drawings. College mechanical drawing courses would be very much more useful if the men at the head were forced to have a few years' practice in a machine shop instead of only three months in the college workshop. Since a man's college education is supposed to fit him for the activities of a business life, why should not his training be such as to fit him for this work, rather than in many cases making him a laughing-stock and causing him to begin at the bottom and learn all over again. Of course, there is no doubt but that his training prepares him for much more rapid advancement than the man who has not had such training, but if it is possible to so train him that he is able to fit into active work at the start, why should this training be denied?

It is well understood that our colleges are not meant to turn out specialists, but to so prepare a man that he may be able to enter any particular line and, in a short time, adjust himself to his surroundings, and advance himself accordingly. However, it must not be forgotten that we live in a practical age and for this a man should be prepared. An instructor should be a man who has both practical and theoretical knowledge, so that he can appreciate the obstacles which are to be met in both directions and be able to train the student in such a manner as to avoid a goodly portion of them.

Do the work you are fitted to do. If you are a pumpkin-vine, do not try to become a morning-glory.

THE SUBURBAN MIGRATION OF INDUSTRIES.

By J. P. S.

THE continually changing conditions of life and progress are nowhere more in evidence than in the industrial field. On account of poor transportation facilities and inefficient means of power transmission the tendency has been to concentrate manufacturing activities and processes into as small space as possible. With this end in view and thoughtless of other consequences the great manufacturing institutions of ten or twenty years ago huddled themselves about the sources of power and the supply of materials, the result of this being the Manchesters, the Sheffields and the Pittsburghs of to-day. The unattractiveness and degrading conditions of all great centers have bevome bywords with us. It has been shown that, of men from the country who go to work in the factories of London, ninety per cent. die out in the third generation, while competent authorities allege that were it not for the continual addition of immigrants and their children, the population of the United States would scarcely hold its own, a condition also which can be directly and indirectly traced to the working and living environments of great manufacturing centers.

In marked contrast to this are seen the conditions developing throughout the industrial area of Ontario. The harnessing of sources of hydraulic power, the rapid perfection of means of power transmission and the increasing efficiency of the small motor are doing much towards bringing about such working conditions as we have long sought and considered feasible only in a residential sense. Our cities are endeavoring to provide the suburban advantages within their borders to as great an extent as possible and perhaps for the small manufacturers they are still the most suitable locations in which to carry on operations, in spite of the burden of high taxation.

Just as close confinement and crowded conditions are conducive to physical weakness and disease, so does the atmosphere of large manufacturing centers lead to social unrest, industrial discontent, friction and strife. In the same way that sunshine and fresh air are the enemies of microbes and parasites, freedom to move around and room to think for oneself are the most effective antagonists of the agitator and similar fraternity.

An investigation of a number of Canadian machine plants has shown few labor disputes in the suburban shops, and when the extra expense of city life is taken into account, the wage advantage is bound to be very much in favor of the suburban mechanic. If peace and contentment be considered as productive of economy and efficiency in manufacturing, then the natural location of the plant is away from congestion and contagion.

In contrast to the near past when our manufacturing institutions sprang up in certain locations like mushrooms round a dunghill, the industries of the immediate future will be found seeking the broader, healthier and more vigorous usefulness of the suburban life.

THE STATUS OF TECHNICAL SCHOOL EDUCATION.

By "Observer."

MUCH has been said through the press and otherwise concerning the inefficiency and narrow scope of technical schools in Canada, and the Province of Ontario in particular. From a general standpoint, criticism of this import is no doubt merited, but the Canadian who hears it should know also of a notable exception to this condition. The new central technical school at Toronto has reached a point in its construction where a somewhat comprehensive idea of its immense size and perfect completeness in detail can be obtained from a properly guided two hours' inspection.

The building of this great institution was made possible and its success is assured by the hearty co-operation of capital, labor and business men generally, in an effort to raise the standard of craft intelligence among our great body of mechanics and tradesmen. The criticisms of those who decry the money devoted to increasing the attractiveness, the completeness and the efficiency of this institution are best answered at its head.

Our Government spends millions in teaching Greek, Science and Higher Ethics to the few, while in the schools for the masses the necessity of attractive and inspiring surroundings has not heretofore been practically recognized. The youth who applies himself conscientiously and earnestly to attaining perfection in the mastering of a trade should feel himself on a par with him who devotes probably less time and effort to a profession or some social attainments, for the usefulness of the workingman to society is as important as that of the man higher in the social scale. The degree of usefulness or annoyance is proportional largely to the culture, the character and the ideals that the worker associates with his trade.

The effect of these tenets, continuously applied by an institution as great and influential as Toronto's new technical school will be, cannot but react upon the social status of the mechanic to raise him in the estimation of himself as well as of those who may now despise him and with whom he is periodically at variance.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

RELATING TO SHAFTING.

THE calculation of the strength of shafting is met with at every turn of shop experience, yet few mechanics are even able to satisfy their own curiosity regarding results. There are many formulæ for the purpose, each one being largely a different means to a common end. The purpose of this article is to give a clear understanding of the fundamental formula as well as instruction in the use of a few of the popular ones.

The beam formula $\frac{M}{S} = \frac{I}{c}$ also applies to shafting. M is the greatest twisting moment and is equal to the force in pounds which tends to turn the shaft, multiplied by its distance from the center in inches. In a particular case this would be the belt pull multiplied by the radius of the pulley.

S is the stress per square inch in the material, which in the case of shafting is entirely that of shearing, and, in calculating the strength, the shearing strength must be used.

I is the moment of inertia, as in beams, but, instead of being taken about a line through the section, it is taken about a point in the center or center of gravity. This is called the **polar** moment of inertia and will be denoted by J. The polar moments of inertia for different kinds of shafts, such as square, round, hexagonal, etc., cannot be found in the regular handbooks, but can be found by adding together the moments of inertia taken about two axes at right angles to each other and passing through the center of gravity.

c is the distance from the center to the outer surface, and hence is the radius of the shaft. The formula, therefore, becomes $\frac{M}{S} = \frac{J}{c}$.

Question.—What force acting at the circumference of a 4 ft. pulley will be sufficient to twist off a 3-inch shaft?

Answer.—Formula $\frac{M}{S} = \frac{J}{c}$ becomes $M = \frac{J\,S}{c}$, M =. The acting force P multiplied by its distance (r) from the center, and the formula becomes $Pr = \frac{J\,S}{c}$ or $P = \frac{J\,S}{c\,r}$.

$J = .0988d^4 = 7.938$. d = diameter. S = shearing strength of steel = 50,000 lbs. per sq. in.

c = radius = 1.5 in. and r = 24 in., therefore

$$P = \frac{7.938 \times 50000}{1.5 \times 24} = 10{,}848.8 \text{ lbs} =$$

5.424 tons.

Question.—If a pulley be keyed to a 4-inch shaft, how long must a one-inch steel key be in order, that the shaft and the key be equally strong? Consider the shaft as unaffected by the key-way.

Answer.—Every inch of the key will stand a shearing load of 50,000 lbs. This will give a moment of 50,000 $\times$ 2 = 100,000 inch pounds.

From formula $\frac{M}{S} = \frac{J}{C}$, $M = \frac{JS}{c}$

$J = .098d^4 = 250.88$.

S = 50,000 lbs. per sq. in. and c = 2 in. M or moment necessary to shear the shaft is $M = \frac{25.088 \times 50000}{2} =$ 627.200 inch pounds.

As each inch of key takes 100,000 inch pounds, the length of the key will be $\frac{627{,}200}{100{,}000} = 6.27$ inches.

Question.—A 10-inch shaft has a 4-inch hole bored through its center. What would be the size of a solid shaft to sustain the same twisting force?

Answer.—For a hollow shaft $J = .098(d^4 - d_1^4)$, where d = outside diameter and d_1 = diameter of hole.

For a 10-inch shaft, this becomes 947.9.

$$M = \frac{J \times S}{c} = \frac{954.9 \times 50000}{5} \quad .. (1)$$

For a solid shaft, $J = .098d^4$, and $c = \frac{d}{2}$, or

$$M = \frac{.098d^4}{\frac{d}{2}} \times S \text{ or } M = .196d^3 \times S.$$

That is, $d^3 = \frac{M}{.196 \times S} = \frac{M}{.196 \times 50000}$.

Substitute for M its valve for a 10-inch hollow shaft—(1), and we have

$$d^3 = \frac{954.9 \times 50000}{.196 \times 50000 \times 5} \text{ or } d^3 = 4871.93$$

and d or diameter = 9.24 inches.

Thus it is seen that the 0.76 inch added to the outside diameter is equal in strength to the 4 inches taken from the center.

Question.—A machinist uses a 48-inch double-ended tap wrench to tap a 1¼-inch hole. If he can exert 75 pounds pressure with each hand, what size square would be required on the shank of the tap?

Answer.—Formula $\frac{M}{S} = \frac{J}{c}$. Consider effective length of wrench on one end to be 22 inches, then

$M = 22 \times 75 \times 2 = 3{,}300$ inch lbs.

S for tool steel = 80,000.

J for square shaft $= \frac{1}{6} a^4$ where a = length of side, and $c = \frac{a}{2}$. Formula becomes $\frac{M}{S} = \frac{\frac{a^4}{6}}{\frac{a}{2}}$ or $\frac{M}{S} = \frac{a^3}{3}$.

Or $a^3 = \frac{M}{S} \times 3$, or $a^3 = \frac{3300}{80000} \times 3$, $a^3 = .12375$, and a = .498, or say ½ inch.

For safety this should be doubled or should be 1 inch square.

Question.—A 4-inch shaft has two keyways at right angles to each other 1 inch wide and ½ inch deep. What per cent. of the strength of the shaft would be removed in cutting these keyways?

Answer.—The strength of the uncut shaft can be represented by $M = \frac{J}{c} \times S$ inch pounds, and for a 4-inch shaft this would be $\frac{.098d^4}{2} \times S$.

$$= \frac{25.088}{2} \times S = 12.544 \times S.$$

A little observation will show that cutting a key-way $1 \times \frac{1}{2}$ inch is practically the same as cutting out a section 1 inch long from a ring 4 inches outside diameter and 3 inches inside diameter. The mean diameter of this ring is 3.5 inch. Its length, therefore, is $3.5 \times 3.1416 = 10.995$. The length cut out by two key-ways is 2 in. This is $\frac{2}{10.995}$ = .1819 of the strength of the ring.

The strength of the complete ring may be represented by $M = \frac{J}{c} \times S$ inch pounds.

Where $J = .098\ (d^4 - d_1^4)$,

d = outside diameter and d_1 = inside diameter; or,

$J = .098\ (256 - 81) = .098 \times 175 = 16.450$, and $c = 2$.

Therefore, $M = \frac{16.450}{2} \times S = 8.225 \times S$, and strength removed by key-ways $= 8.225 \times S \times .1819 = 1.496 \times S$.

Strength of whole shaft is represented by $12.544 \times S$, and the percentage that 1.496 is of 12.544 is $\frac{1.496}{12.544} \times 100 = 11.98\%$. Ten per cent. is usually allowed for key-ways.

Question.—An arm, rotated by a solid cast-iron shaft, is required to lift 360 pounds at a point 8 ft. from the center of the shaft. What should be the diameter of the shaft?

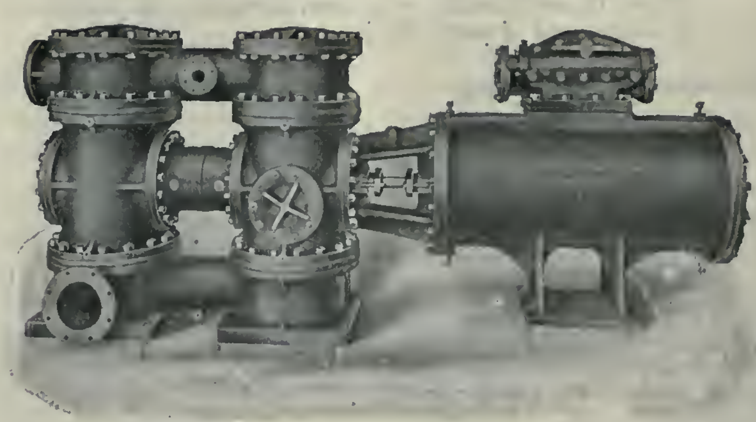
Answer.—Use formula $\frac{M}{S} = \frac{J}{c}$.

$M = 360 \times 8 \times 12 = 34{,}560$ inch pounds.

Average ultimate shearing strength of cast-iron is about 18,000 lbs. per sq. in., and allowing a safety factor of 4, the working stress or "S" becomes $\frac{18.000}{4}$ = 4,500 lbs. per sq. in.

J for round shaft $= .098d^4$, where d = diameter of shaft and $c = \frac{d}{2}$.

Formula now becomes $\frac{M}{S} = \frac{.098d^4}{\frac{d}{2}}$,



BAWDEN PATENT COMPOUND SINGLE-STROKE DOUBLE-ACTING STEAM PUMP.

or $\frac{M}{S} = .196d^3$, or $d^3 = \frac{M}{S \times .196}$.

Putting in valves, $d^3 = \frac{34{,}560}{4{,}500 \times .196} = 39.184$.

Diameter or $d = \sqrt[3]{39.184} = 3.39$ inches, or approximately $3\frac{3}{8}$ in. shaft.

FIRE TUG PUMP TEST.

FOR fire protection purposes along Toronto harbor front and across the bay at the Island, the tug T. J. Clark has had installed a Bawden patent compound, single stroke, double-acting steam pump, having high pressure group valve type water end. The duty requirement was 1,000 gallons per minute against 580 ft. head; with steam of 135 pounds per sq. inch on the piston of the high pressure steam cylinder. The pump cylinders are 14 in. and 24 in. diameter at the steam end, 12 in. diameter at the water end; the stroke of all being 20 inches. Bawden steam operated piston valves are fitted to the steam cylinders.

TESTS OF BAWDEN PATENT COMPOUND SINGLE-STROKE DOUBLE-ACTING STEAM PUMP AT TORONTO ISLAND.

Tests of the pump were made at Centre Island on May 13, in the presence of Fire Chief Thompson and other officials, the results of which were highly satisfactory to all concerned; the required capacity being attained against a head of 635 feet. Test No. 1 consisted of pumping through two 500 ft. lengths of $2\frac{1}{2}$-in. hose, fitted with $1\frac{1}{4}$-in. nozzles. Test No. 2 consisted of pumping through two 750 ft. lengths of $2\frac{1}{2}$-in. hose, also with $1\frac{1}{4}$-in. nozzles; each of which threw a steady non-pulsating stream of 164 feet.

Although this type pump was illustrated and described in a former issue of Canadian Machinery, it may not be out of place to again draw attention to the more prominent features of this Bawden pump. The high and low pressure pistons work in one steam cylinder, while the steam ports are short and so arranged that the exhaust from the high pressure cylinder to the low pressure cylinder never leaves the main cylinder casting. Radiation and condensation are thereby reduced to a minimum. Only one steam chest is required, one valve distributing the high and low pressure steam. Owing to the absence of all external valve gearing, a high piston speed may be got if required, and during the progress of the foregoing tests as high as 172 ft. per minute was recorded.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

STEAM OR AIR LIFT DROP PRESS.

SHEET metal construction ras developed so much in the past ten years as to call for a class of machinery of much greater capacity than was formerly required, and much originality has been necessary to meet the new condi-

STEAM OR AIR LIFT DROP PRESS.

tions. Sheet metal machinery of varying type and size is now built, embracing many special types.

The drop press has developed from very small size hammers up to very large machines capable of producing such work as automobile bodies, burial caskets, kitchen sinks, plates for ceiling and wall covering, as well as many other articles that were formerly castings. In smaller sizes of drop presses the lifting of the hammer was usually done by means of a belt hung over a flange pulley which ran continuously. A slight pull upon the belt by the operator enabled him to lift a considerable weight of hammer. The rope also has been used extensively, it being coiled several times around a drum which runs continuously.

These methods of lifting are quite satisfactory when the hammer is of light weight, but the friction in either case on the drum or pulley generates an amount of heat that on the larger sizes burns out the belt or rope; very considerable power is also consumed. In the larger sizes, water circulation is used in an enclosed drum for the purpose of carrying off as much heat as possible, but even this method does not save the rope or belt, and the cost of replacing same is a very considerable item of expense. In all cases the consumption of power is large for the work done.

In order to meet these objection the Henderson Machine Co., of Philadelphia, Pa., have designed a drop hammer to lift by means of steam or air. A special design of steam cylinder is employed, while a special valve is used for the admission and escape of steam or air. The rapidity of lift of hammer is entirely under control in the matter of speed. The operator can, therefore, throw the admission valve wide open and the hammer will lift only at the speed at which the device is set, making operation absolutely safe in the hands of the most careless.

These machines, we understand, have been thoroughly tested out, and give proof that under ordinary conditions they are capable of more work than the frictional lift hammer, and with less than one-third the consumption of power. In coaxing operations where the hammer is raised and dropped a very small amount repeatedly, in order to gradually bring up a design in sheet metal, rapidity of handling is a feature.

The hammers are made up to 46 ins. x 72 ins. face, weighing in the latter size about 10,000 lbs., with an entire weight of about 60,000 lbs. The accompanying cut shows a size of which the hammer is 36 ins., x 60 ins., and total weight about 40,000 lbs. It will be noticed that, in the design of the bed of the machine, all projections are tapered so as to avoid shrink strains that would otherwise occur in so large a mass. The upper works are made massive for the purpose of absorbing shock due to the fall of the hammer. The latter is an open hearth steel casting, designed with large fillets in all corners. The piston rod is attached to the hammer in such a manner that no shock is transmitted to it when the hammer falls. Radical improvements have been made in these machines by which durability of the working parts, quick action, and ease of handling have been secured.

NEW ENGRAVING MACHINE.

SCHUCHARDT & SCHUTTE, New York, are about to put on the market an improved machine for all forms of engraving on different metals. It is particularly suitable for the cutting of trade-marks, name-plates, letters and figures, as well as the making of small dies and similar parts.

The machine operates on the pantograph principle, a pattern of the required design being slipped into a slot in the pattern table and strapped in place. At one end of the pantograph there is a guiding point which is brought into contact with the pattern and run over it, and the engraving tool is carried by a spindle at the opposite end of the pantograph. The movement of the guiding point over the pattern causes the engraving tool to follow exactly the same course. Three of the arms on the pantograph are provided with scales by means of which the relation between the lengths of the arms can be adjusted to obtain any desired size for an engraved design, the limit of the machine being from a ratio of 1 to 1 between the size of the work and the pattern down to a ration of 1 to 10 between the work and the pattern. Where only a few pieces are to be engraved, the design drawn on Bristol board can be used for a pattern.

In addition to having the engraving tool guided over the work by means of the pantograph, the tool must rotate at a high speed.

A brief consideration will suffice to show that the movement of the tool by

FIG. 1—SCHUCHARDT & SCHUTTE ENGRAVING MACHINE.

means of the pantograph makes it necessary to provide a flexible system for supporting the driving pulleys. The way in which this is arranged through three sets of pivoted arms is clearly shown in Fig. 2. One of the difficulties which has been experienced with engraving machines working on the pantograph principle, is that the bearings supporting the tool spindle become worn through the belt pull, thus causing a serious inaccuracy in the work produced by the machine. In the new Schuchardt & Schutte engraving machine, this difficulty has been overcome by employing the extended sleeve construction which has been successfully applied in various classes of machine design, for eliminating unnecessary strain on the bearings. This sleeve extends up from the main spindle housing, between the spindle and the driving pulley, so that the belt pull is supported by the sleeve rather than the spindle bearing, and, in this way, unnecessary wear of the bearing is avoided.

In Fig. 1 a small grinding attachment is shown bolted to the pattern table. This attachment is used for grinding the engraving tool. It will be seen that there is a two-step cone pulley at the right-hand side of the machine, which is not shown with a belt running over it. One of the steps on this pulley is connected to the source of power which drives the machine, and the other is used for carrying the belt which transmits power to the grinding attachment. One of the engraving tools is shown set up in the horizontal chuck, with its point in contact with the grinding wheel.

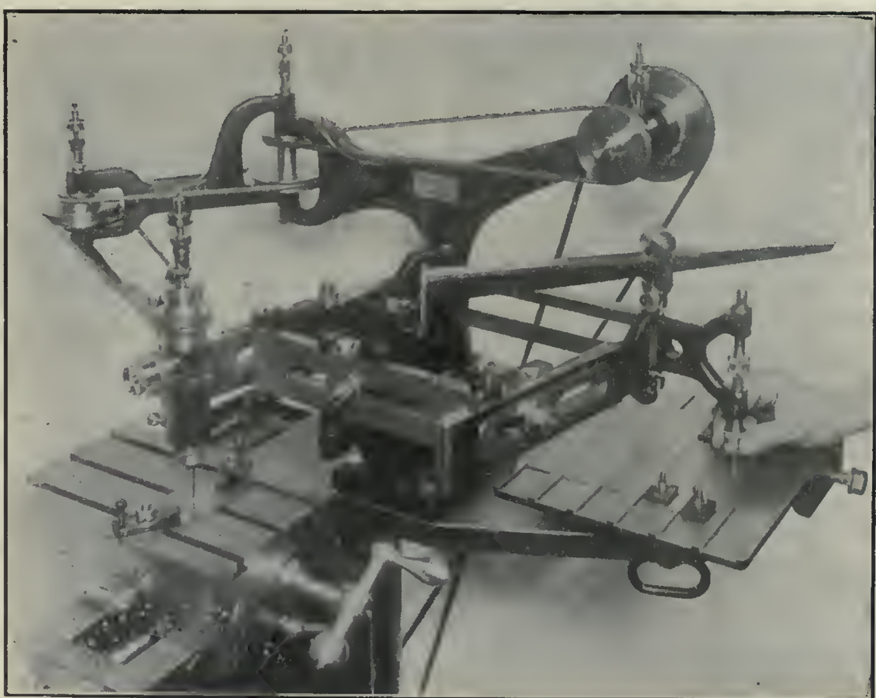


FIG. 2. TABLES AND MECHANISM OF MACHINE SHOWN IN FIG. 1.

In setting up this tool ready for grinding, the first step is to have it accurately centered. This is done by bringing the point of the tool into contact with an index point on the end of a pin, which is set up in the bed of the grinding attachment. The engraving tool is cylindrical in shape and, for about $1\frac{1}{2}$ inches at its lower end, a flat is ground which

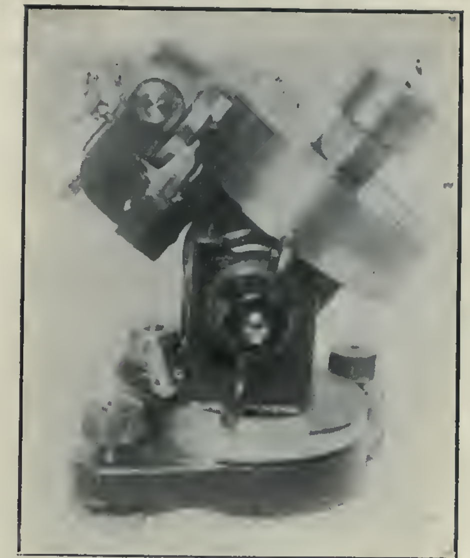


FIG. 3. DIVIDING HEAD FOR USE ON ENGRAVING MACHINE.

removes about one-half of the metal. The tool is not ground, however, by merely rotating it about its axis with the tool in contact with the wheel. Experience has shown that the best results are obtained by having the ground surface of the tool of an elliptical section instead of circular, and this special form is obtained by controlling the motion of the tool when in contact with the grinding wheel, by means of a cam located at the far end of the tool-holder. The grinding attachment is bolted to a lug on the under side of the pattern table and may be quickly removed by simply loosening one bolt.

Fig. 3 shows an attachment for use on this machine, which provides for engraving on cylindrical or conical surfaces or on flat dials on which it is required to engrave at equal intervals. The attachment is essentially an arbor on which the work can be mounted, with provision for rotating this arbor through any required angle between successive engraving operations.

For engraving on cylindrical or conical surfaces, it is obviously necessary to have the element of the surface on which the engraving is to be done held in a horizontal position. This is done by loosening the wing nut and then swinging the arbor down to the required angle. In most cases, where engraving is to be done on such surfaces, the pattern itself is flat and strapped to the pattern table in the usual way.

Another useful attachment for use on this machine is one for use in engraving on concave or convex surfaces. For work of this nature it is necessary to have the engraving tool work to a constant depth, but the tool must also follow the contour of the work. This is done by having a master blank of the required form located on the lower support of the attachment. A guide point runs over this master blank and controls the movement of the engraving tool, which is in contact with the work carried on the upper support of the attachment.

The design of the machine has been carefully worked out to give it the necessary rigidity for withstanding hard service. When desired, three different styles of pattern letters and pattern numbers can be supplied. Many manufacturers, however, prefer to use some other style of patterns, and these can be made direct on the machine. The same statement, of course, applies to the production of patterns for trade-marks, name-plates, and similar designs. The operation of the machine is so simple that it has been found that a boy or girl of average intelligence can be taught to use it and obtain very satisfactory work. These machines will be marketed in Canada through the Canadian office of the company at 42 Adelaide Street, Toronto, Ont.

THE SHAW ELECTRIC MONO-RAIL SYSTEM.

QUITE an interesting application of the overhead mono-rail system to the requirements of inter-factory transportation, coal and ash handling, and like service is to be noted in a recent development by the Shaw Electric Crane Co., New York. The distinctive feature of the Shaw mono-rail system is the absence of any moving part in the track switch.

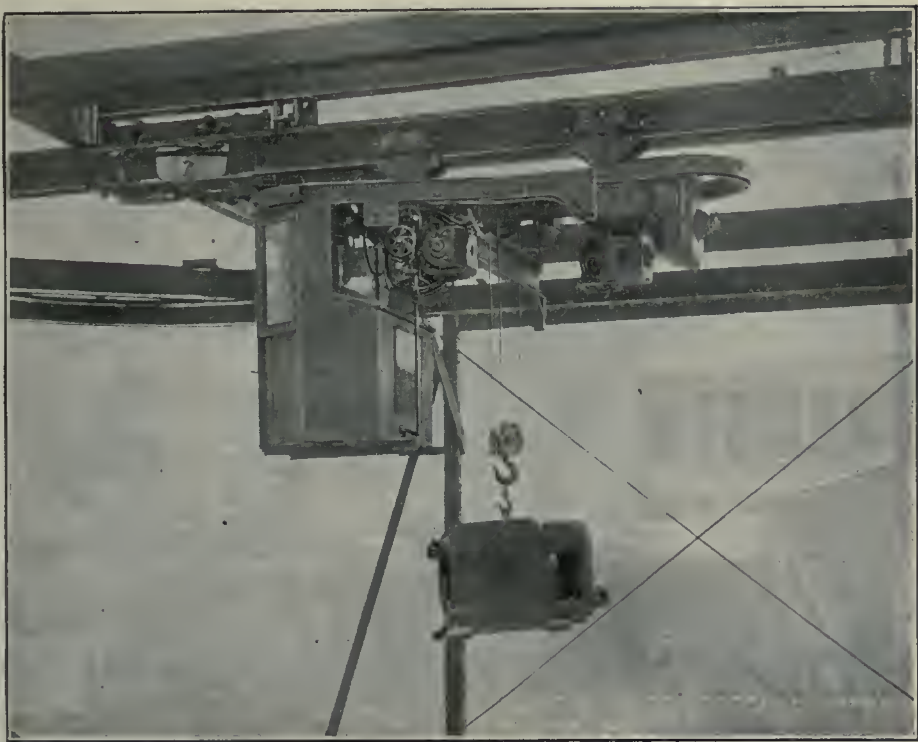


FIG. 1. TYPICAL TWO-MOTOR MONORAIL HOIST.

The main advantage claimed for the Shaw fixed-tongue track switch lies in the fact that it does not have to be set for the desired direction of travel, consequently there is neither delay nor expenditure of effort for this purpose. The operator in the cab selects his route and the trolleys run through the track switches in all directions and without stopping. There being no open ends of the track to be protected, and it is therefore impossible for the trolley to break through and fall. Safety as well as increased range of service are thereby secured, while the operator in the cab has independent and absolute control, both of the route, hoisting and travel operations. A typical two-motor monorail hoist of the type under discussion is illustrated in Fig. 1.

Negotiating the Fixed Switch.

The cast-steel "fixed-tongue" track switch, illustrated in Figure 2, shows clearly the two slots in the switch through which one truck side passes, the slot at the left, A, when the trucks run through the switch, and the slot at the right, B, when the trolley is diverted to the spur track. In either case, the truck wheels run over the gaps, but the

FIG. 2. CAST-STEEL FIXED-TONGUE TRACK SWITCH.

wheel-base of the truck is so proportioned with reference to the slots that three wheels always ride on the runway flanges, and furthermore, the wheels bridge the gaps at such an angle that the break is only nominal.

The manner in which the leading truck is steered off on the spur track is shown in Fig. 3, which is a sectional plan at the level of the lower flanges of the I-beam track. This shows a right-hand switch and also the truck sides of the trolley. When approaching the track switch with the intention of running off on to the spur, the horizontal roller, T-2, located in the front of the leading truck, is raised by the steering lever in the cage and engages the curved flange B on the under side of the central tongue of the switch (the advance end of the guide flange is shown in Fig. 2). In this manner the leading truck is swiveled and diverted on to the spur track, but no steering operation is necessary to return from the spur to the main track nor to run through the track switch in either direction on the main line.

Keeping the Train Intact.

The scheme whereby the trailing truck is compelled to follow so that the trolley cannot possibly split the switch, is equally interesting. Referring to Fig 4, the smaller diagram, drawn to a larger scale, is also a sectional plan, but at the level of the trolley frame which joins the two trucks and supports the hoisting machinery. It shows only the rear truck and a portion of the trolley frame.

Lines L, R and F represent the centre lines respectively of the leading truck, the rear truck and the trolley frame. The trucks swivel on the trolley frame through an angle, A in the case of the rear truck, and as indicated in the lower diagram, angle A is limited by an adjustable set screw S-1 in truck side R-1.

Assuming both trucks to be on the main track and approaching the switch, the centre lines L, R and F would then lie in a straight line, and the angle A would be zero. As the leading truck proceeds around the curve of the spur, the trolley frame swings around with reference to centre line R of the rear truck and the angle A increases. When the rear truck reaches the point where the curve begins (as shown in the diagram), the set screw S-1 engages the frame casting and angle A has attained its maximum value as the trolley proceeds beyond the position shown in the

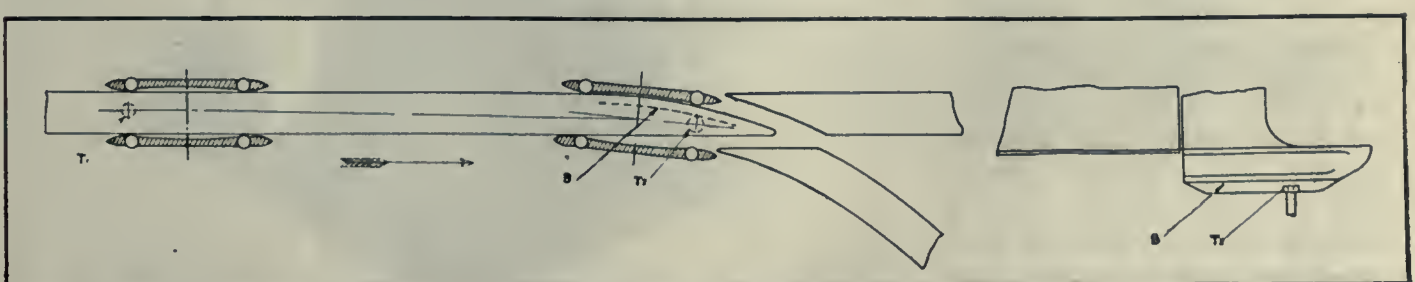


FIG. 3. SECTIONAL PLAN AT LEVEL OF LOWER FLANGES OF I-BEAM TRACK; MAIN ILLUSTRATION SHOWS RIGHT-HAND SWITCH; AT THE RIGHT, TRUCK SIDES OF THE TROLLEY.

sketch. The frame casting slews the rear truck around and compels it to follow on to the spur track.

Independent of Steering Gear.

It should be noted that the arrangement is positive and independent of the initial steering operation. The only essential condition is that all curves on the same track system must have the same radius for an arc whose chord is the center line F, as this arc determines the angle A, for which the set screw S-1 is adjusted; beyond this arc any longer radius may be employed.

The diagram shows a right-hand switch, but it will be noted that set screw S-2 in the truck side R-2 provides for left-hand switches. It is, of course, understood that the trolley travels either end ahead, that both trucks embody the steering feature, and likewise that both trucks have the set screws as described.

While this mono-rail is comparatively new, we understand several successful installations in capacities ranging from two to six tons have been made. The hoist is built either with the single lift, as shown in Fig. 1, or with a double hoist for handling the ordinary "two-line" clam-shell grab-bucket, two separated holding lines being employed to prevent swiveling of the bucket.

Manning, Maxwell and Moore, New York, are sales agents for the Shaw Electric Mono-rail System.

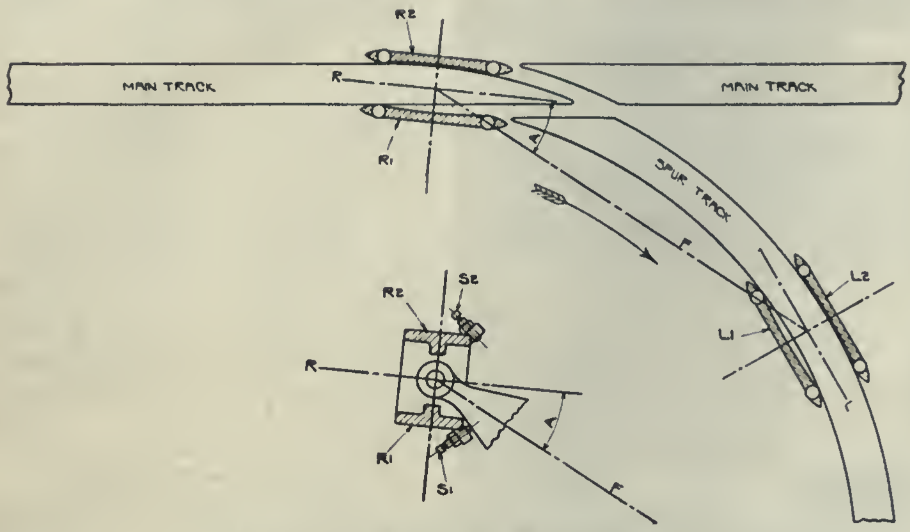


FIG. 4. DETAILS OF SWITCHING ARRANGEMENT, SHOWING METHOD OF KEEPING TRAINS INTACT.

DIRECT CONNECTED MOTOR-DRIVEN GRINDER.

MORE or less difficulty has been experienced in devising a lubricating system which will automatically oil the radial and thrust bearings in disc grinders. Charles H. Besley & Co. of Chicago have designed a machine which through an ingenious system of ring oilers appears to have overcome the problem.

The grinder has been thoroughly standardized and all the working parts are renewable. The bearing bushings are of cast iron lined with heavy metal, while the backs of the liners are ground, and fit into carefully bored and reamed holes. The motor shaft is made from hard crucible machinery steel, and the wheel collars are drop forged from hard machinery steel. The end thrust in both directions is taken up by hardened and ground tool steel thrust collars of large area running at each end of the right hand bearing bushing. One of these collars is threaded on the spindle and the end thrust is thus taken care of.

The motor, of 7½ h.p., is fully enclosed, and can be operated on 60 cycle alternating current or on 25 cycle. Suitable discs are supplied to give the correct abrasive speed in each of the two cases. The machine illustrated is equipped on the right with a geared lever feed table, and on the left with plain tilting-table.

The general dimensions of the machine are:—

Spindle—2 in. diam. by 29½ in. long.

Length of each bearing bushing, 6 in.

Rockershaft—2½ in. diameter by 57½ in. long.

Height to center of spindle—40 ins.

Floor space of bed casting, 28 in. by 28 in.

Weight complete with all equipment, 2,000 lbs.

SQUARE END PIPE CUTTER.

IN placing this new 2½ in. to 4 in. pipe cutter on the market the Borden Canadian Co. of Toronto have made a radical departure from the standard design of pipe cutting tools.

The tool consists of two sections, the gripping part, which when in operation has no motion relative to the pipe, and the cutting part, which revolves about the latter. Figs. 1 and 3 show these two

DIRECT CONNECTED MOTOR-DRIVEN GRINDER.

sections respectively. To cut off a piece from a pipe, the first operation is to clamp the tool to the pipe. In Fig. 1 the gripping jaws seen are closed by a right and left hand grip screw which is operated by a wrench fitting over its square end. In Fig. 2, showing the cutting section, a similar right and left hand screw sets the knives up against the pipe under tension. The cutting section has a ratchet fitted to it, and by means of a handle fitted into a link on the gripping section, the cutting part is thus made to revolve about the pipe, being actuated through the lever and the ratchet. The knives are fitted with little blocks, and when placed up against the pipe under tension, coil springs behind these blocks are compressed and keep the knives uniformly against the pipe as the cut proceeds. The knives are so shaped that part of the cutter forms a guide which allows the feed never to exceed that for which the cutter was designed. The springs pressing against the little blocks keep the tool always cutting; thus when once set against the pipe the feed is automatic and constant. The tool is a complete unit of cast steel, and a bronze bushing is provided for a bearing surface upon which the cutting section revolves.

FIG. 1. PIPE GRIPPING SECTION A.

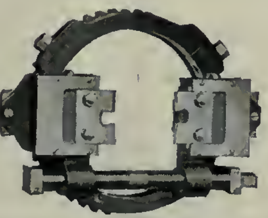


FIG. 2. CUTTING SECTION B.

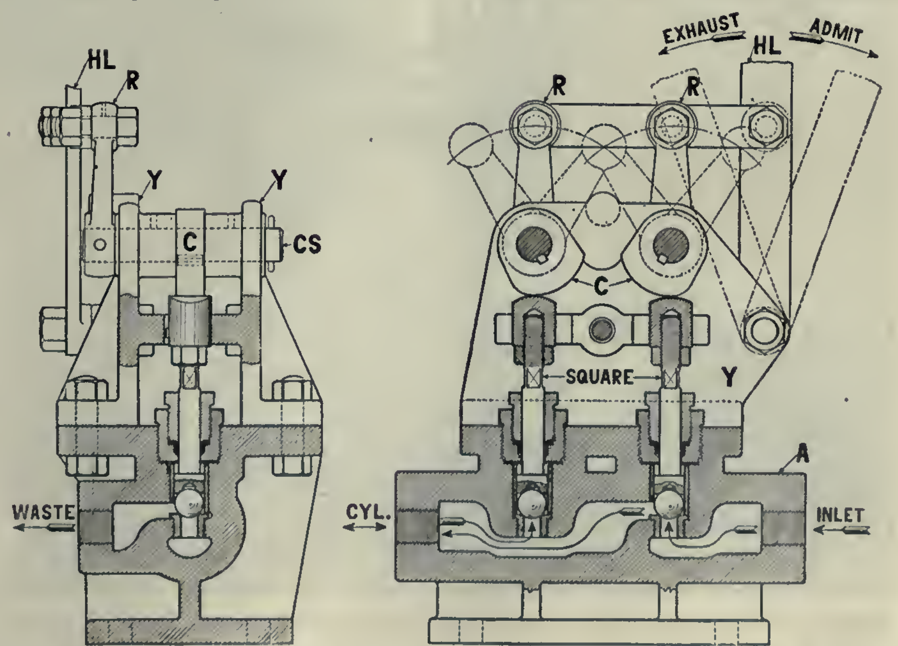
FIG. 3. 2½-4 IN. SQUARE END PIPE CUTTER.

Fig. 3 shows the assembled tool. When the jaws are clamped to a pipe they automatically center the cutting knives so that the pipe is cut off square. As the cutting is done by means of a ratchet, pipes may be cut off in cramped places which would otherwise prohibit the use of an ordinary tool. One man can work the pipe cutter to advantage. In fact, the tool, we understand, is capable of cutting off a 4-in. pipe in four minutes by a man using one hand only. The cut is particularly clean, there being a conspicuous absence of burrs inside and outside. There is, further, little tendency to strain, distort or split the pipe, while the cutter can be quickly adjusted to fit any size from 2½ in. to 4 in. The tool will also cut through a thread as quickly and squarely as a piece of straight pipe.

Two extra sets of cutters are supplied with each tool and also a template for grinding. The knives are easily and quickly removed by simply taking out two cap screws. There are practically no parts to get out of adjustment.

SCHNICKE HYDRAULIC OPERATING VALVES.

FROM time to time operating valves for hydraulic machinery have been designed and placed upon the market. In the Schnicke type the idea of a ball valve has been employed, which makes the operation very simple and reduces the chance to a minimum of any working part becoming damaged.



SECTIONAL VIEW, SCHNICKE THREE-WAY HYDRAULIC OPERATING VALVE.

The valve is most easily described by referring to the accompanying cut. The horizontal valve chamber A is provided with pressure and waste ports and is machined to receive stuffing boxes, bushings and slot rings. To the top of the valve chamber are bolted the yokes Y, which form the bearings for the end of the cam-shafts, CS. To these cam-shafts are securely bolted the cams C, and the rocker arms R.

The cams are operated by the hand lever, H L, which is attached to the rocker arms. Seat rings of proper proportions are screwed into the pressure and waste ports of the valve chamber. Between the seat and the stem, a hard bronze ball is employed, the motion of which is controlled by the cam. The upper end of the stem is threaded into a bearing nut, and is also provided with a jam nut and square. These bearing nuts travel through a web in the yoke castings, while the lower part of the stems are held in position by the stuffing box glands and bushings; thereby ensuring proper alignment of the stems at all times. The cams are so designed and are keyed to the shaft in such a manner that when in operation the pressure port is closed before the waste port opens and vice versa.

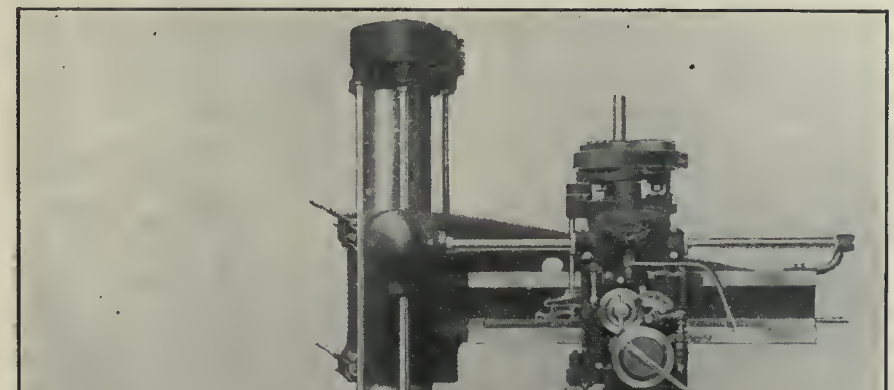
When the hand lever HL is thrown in the direction to admit the fluid under pressure the ball in the admission valve is forced off its seat and the fluid passes to the machine. To open the waste port, the hand lever HL is thrown in the opposite direction, and then the fluid escapes through the exhaust valve, which is opened by the fluid pressure in the machine. The square section on the valve stem, as well as the bearing nut and locking nut, being on the outside of the valve, are all readily accessible and permit of rapid and easy valve adjustment under working conditions. This allows the operator to keep his valves tight and thereby prevent leakage and to reduce repairs and upkeep to a minimum.

For pressures up to one thousand pounds, the bodies are made of air-furnace iron, and for pressures in excess of this, open-hearth steel or hydraulic bronze is used. The Schutte & Koerting Co., Twelfth and Thompson streets, Philadelphia, are marketing the above product in sizes from ¾ in. to 2½ in., and in three and four-way form with either screwed or flanged connections.

CENTRAL THRUST RADIAL DRILLING MACHINES.

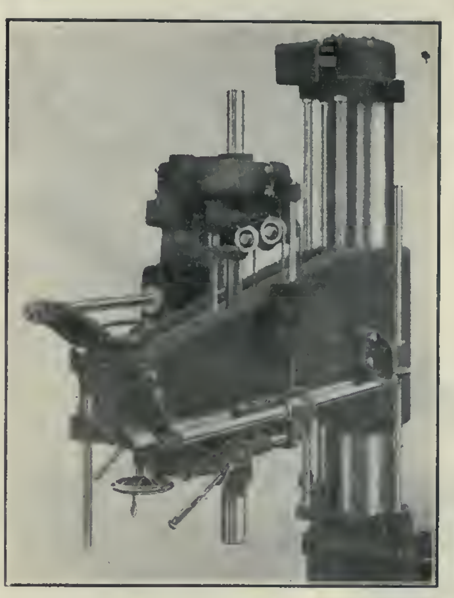
IN the design of radial drilling machines the central thrust type seems to be a universal favorite. The Selson Engineering Co. of Coventry, England, have placed upon the market an attractive design of this type of machine, which they are building in two sizes; one with a radial arm of 4 ft. 6 in., and the other with an arm of 6 ft.

The principal feature of these machines is that the thrust of the spindle is in line with the center of the arm, and column. Thus all side twisting strains are entirely avoided. The carriage is in the form of a right angle, and is securely gibbed to the front and underside of the arm. The front plate carries the top bearing of the spindle,



SELSON 4' 6" RADIUS, PATENT CENTRAL THRUST HIGH SPEED RADIAL DRILL.

driving gears, and feed mechanism, while the under plate forms the lower bearing and takes the central thrust of the drill. The back gear is placed directly on the spindle, as also are the reversing gears. These latter are driven by powerful, specially designed clutches,



BACK VIEW OF ARM, 6' 0" SELSON RADIAL DRILL.

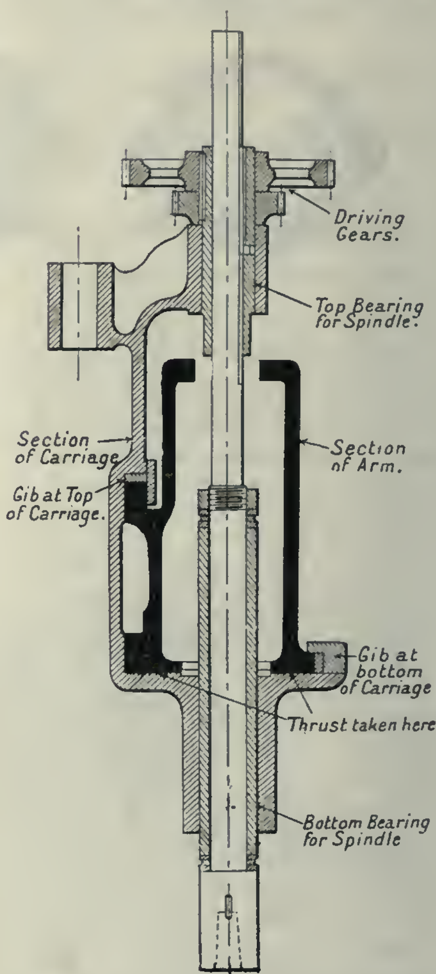
which can be thrown in and out when running at any speed.

The carriage is moved along the arm by a hand-wheel, and the arm has an extra long bearing on the column to prevent deflection, while its own cross section is so designed that great strength is obtained without having an abnormally heavy arm.

The spindle is of high carbon steel and runs in a long sleeve of large diameter, which prevents any deflection when in its lowest position. Both spindle and sleeve pass throuh a slot in the arm, and thus all the side twisting strains are avoided, because the thrust is directly in the center of the arm.

The starting, stopping and reversing operations are effected by one hand-lever in front of the carriage and the machine can be reversed at a greater speed than that at which it works; thus taps can be quickly withdrawn. All thrusts are taken by ball bearings, and hand traverse is provided as well as quick withdraw motion.

The column is of large diameter and



SECTION THROUGH ARM AND CARRIAGE.

rests on ball bearings, while the swivelling can be easily accomplished and the column locked in any desired position. The driving gear is extra powerful and arranged for taking heavy cuts at high speeds. Another feature is that the double back gear is placed directly on the spindle avoiding the undue torsion of long driving shafts. Every locking motion is provided with a handle, therefore spanners are superfluous.

The three outstanding advantages of this machine are:—

(1)—Central thrust eliminating all torsional strain.

(2)—The arm slot is of minimum

width between walls giving greater stiffness without unnecessary weight.

(3)—The carriage is gibbed to the arm at front as well as at the bottom, thus giving greater rigidity to top spindle bearing and preventing vibration.

The British Manuacturers' Association of Canada, Limited, are the sole agents for the Dominion of the Selson Engineering Company.

Miscellaneous

The Hare Engineering Co., Ltd., 78 Duchess Street, Toronto, manufacturers of mechanical stokers and power plant equipment, have appointed Frank Darling & Co., 1142-1144 Homer Street, Vancouver, B.C., as their British Columbia agents.

The Engineers' Supply Co., 123 Bannatyne Avenue East, Winnipeg, have been appointed agents in Western Canada for Belmont packings, manufactured by Clement Restim Co., Philadelphia. They are also agents for the Hill safety gauge glass.

Canadian Exports.—The revised summary of Canadian trade for the twelve months ended May 1 shows an aggregate of $1,096,883,675, as against $1,079,-934,000, an increase of about $17,000,000. There is a big increase in exports and a falling off in imports. Imports in the twelve months totalled $621,822,564, a decrease of $57,000,000 compared with the last year. Exports totalled $475,-061,111, an increase of nearly $74,000,-000. The biggest increase was in agricultural produce, totalling $38,000,000, while manufactures exported increased $14,000,000. In imports there was a decrease of $12,000,000 in purchases from the United States and $40,000,000 in purchases from the United Kingdom.

The John Bertram & Sons Co., Ltd., Dundas, Ont, and its associate company, **Pratt & Whitney Co. of Canada, Ltd.,** will on July 31 discontinue the arrangement with the Canadian Fairbanks-Morse Co., who have acted as sales agents for the above two concerns for the past few years. The John Bertram & Sons Co. have organized a sales staff, and will establish offices in several different centres. The head office will remain in Dundas, as formerly, while the principal Eastern sales office will be at 723 Drummond Building, Montreal, in charge of Colonel Alex. Bertram, who will hold the position of general sales manager. The Ontario section will be handled from Dundas. An office has been opened at Winnipeg, in charge of Alfred Martin, formerly of Mussen's, Ltd., Montreal. Colonel Bertram is at present in Vancouver arranging for an office there, and particulars of this will be announced at a later date. The product of John Bertram & Sons Co. and Pratt-Whitney Co., of Canada, will be handled by these various sales offices.

THE LATE DEAN GALBRAITH.

WITH the passing of Dr. John Galbraith, Dean of the Faculty of Applied Science of Toronto University, the Dominion of Canada has lost a noted educationalist, scientist and citizen. Born in 1841 at Montreal of Scotch descent, his life work has been closely identified with the growth of the Dominion. The year of Confederation was the beginning of Canada's great industrial and railway development, into which Dr. Galbraith entered as a factor upon his graduation in the following year.

He studied engineering and surveying under Geo. A. Stewart, Chief Engineer

THE LATE PROFESSOR JOHN GALBRAITH

of the Midland Railway; was employed on the construction of the Intercolonial Railway and the Midland Railway extension to the Georgian Bay, and for several years was engaged on the construction of the Canadian Pacific Railroad. He, along with H. D. Lumsden, who is now chief engineer of the National Transcontinental Railway, became the division engineers of the Georgian Bay branch.

Dr. Galbraith made many trips through the wilderness of Ontario and Quebec and few were better able to equip and guide exploring parties than he. In the summer of 1881, unattended and for recreation only, he made the trip from Lake Superior via Michipicoten to Hudson's Bay, then via Rupert's River to Lake Mistassini and across the height of land to Lake St. John, reaching civilization by way of the Saguenay River.

Dr. Galbraith's academic career, though connected almost entirely with the University of Toronto, has been brilliant. Graduating from Port Hope grammar school in 1862, he went to Toronto and, finding that there was no school of engineering available, entered the university as a freshman in arts. He finished his college training in 1868 as Gold Medalist in honor mathematics and Prince's Prizeman of the University of Toronto. The Prince's Prize was a special prize for highest general proficiency, established by the Prince of Wales—Edward VII.—during his visit to Canada.

In 1878 he was appointed to the Chair of Engineering of the School of Practical Science which he largely organized himself. Dr. Galbraith was at first the only instructor, and his first class numbered less than 30 pupils. He was appointed to the principalship in 1889 and later became Dean of the Faculty of Applied Science and Engineering. He was one of the founders of the Canadian Society of Civil Engineers and was long a councillor thereof. He was elected to the presidency in 1909. He was also a member of Institute of Civil Engineers and has served as vice-president of the Canadian Institute of Toronto.

As Dean of the Faculty, Dr. Galbraith devoted himself almost wholly to the upbuilding of the School of Practical Science, steadfastly refusing to undertake any consulting or other work whatever that would in any possible way interfere with its welfare. Being a practical man himself, his policy has been, even against continued opposition, to equip his students with a thoroughly practical education. As a teacher he was strict and even stern in his admintration of discipline and justice, but succeeded in winning the hearts and love of all with his inexhaustible humor and kindness of heart. The esteem and respect in which he was held by the students was best shown at the last annual dinner of the School of Science, when 600 engineers gathered from all over America in honor of the 50th anniversary of his association with the university.

His character was simple and rugged and his personality such that every student was wont to emulate him. To meet him was to feel in him a personal friend, and he never was so busy that he could not give his personal attention and counsel to the youngest student in need of it. The best evidence of his character and work is the high moral and professional standing of the graduates in all parts of the world and the fact that the most active supporters of the "School" are his former students. The secret of the regard in which he was held was aptly told by President Falconer in the few words, "A thoroughly trustworthy man, thorough in training, honesty and patience."

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests, with special reference to machine tool improvement and development, machine shop methods, devices and systems relative to efficiency and economy of production.

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Vol. XII. JULY 30, 1914 No. 5

PRINCIPAL CONTENTS.

SELECTION OF A MANUFACTURING SITE.

PROSPECTIVE Canadian manufacturers have the advantage of much of the best experience of others in the selection of localities in which to carry on operations. The practice of foreign firms who have already won success in their home country is well worth a considerable amount of study. A large number of these now have branches located in Canada and are almost invariably successful.

The importance of choosing a site is at once apparent, for once located and built upon, it fastens the industry permanently to its conditions and surroundings. The great rise in values of real estate in the cities of late years has made it possible for many Canadian firms to sell out and remove to more advantageous locations without serious loss.

Outside of the usual considerations of the availability of power, supplies and transportation, and the value of public utilities and corresponding taxation there are other things which, though seemingly inconsiderable, will have a large aggregate effect upon ultimate success. Canada has possibly a greater variety of climatic, social and labor conditions to choose from than any other country and, while we may never experience extreme labor legislation as seen in some parts of the United States, it will be found that the labor conditions vary considerably, but in proportion to the cost of living, average better for the working man.

The effect of extreme climate is not usually considered, although the matter of heating runs from a few cents to fifty dollars per day. A single storm last winter cost a Michigan firm $6,000 in general damage and in the same plant an average of five days were lost from the same cause by every employee during the year.

Just as the character of the industry strongly influences the life of the place in which it is located, so the reverse is the case. One company having plants in two different parts of Canada has found that, in one of them the average working week is fifty-one hours as compared with fifty-four in the other under the same regulations. The difference in output per man is also noticeable.

THE VISITING OF FOREMEN.

THE article by Mr. Westbrook on another page of this issue strikes several important and original points in the efficient management of machine shops. There is nothing to prevent the making of arrangements among foremen for the interchange of visits for mutual benefit. The essential feature is, of course, a strictly friendly spirit of criticism and assured privacy of discussions. The management of a machine shop or foundry involves so many considerations that what might be considered perfection by one man could easily be much lacking in the eyes of another.

The personalities of different foremen are nowhere better seen than by visiting their different shops. It is astonishing to note how each place reflects all through the characteristics of a single man. Neatness or slovenliness, order or discord, and above all, application or delinquency of the "boss" are easily seen in the shop by the casual visitor. In fact, the shrewd seeker of employment can readily pick up some valuable hints on how to approach his prospective superior by noting the character of the place upon which that worthy has unconsciously placed his mark.

The few cases instanced by Mr. Westbrook go to show what can be done by one man, after another equally able has done his utmost. How shortsighted a policy it is, then, to place the earnings, character and reputation of a large investment irrevocably in the hands of a single man.

The greatest stumbling-block to the carrying out of the idea is, of course, the natural disposition of men, particularly in competitive institutions, to shun intimacy, a condition for which the management is often responsible. The writer is aware of cases where foremen of a common organization have never seen the plants of their company situated in different cities.

INDUSTRIAL NOTABILITIES--No. 45

WILLIAM FOSTER COCKSHUTT, M.P., merchant and manufacturer, ex-president Cockshutt Plow Co.; director Brantford Roofing Co., and director B. & O. Road Co., Queen St., Brantford, was born at Brantford, Ont., Oct. 17, 1855, the son of I. and Elizabeth (Foster) Cockshutt; of English descent, his father coming to Canada 1826. He was educated at the Brantford and Galt Collegiate Institutes.

In matters of trade and commerce, Mr. Cockshutt has been a member of the executive and councillor of the Toronto Board of Trade for 15 years; a former president Brantford Board of Trade; member Ontario Power Commission; was appointed a commissioner to investigate the development of electric power at Niagara Falls for distribution in Ontario, 1903; was six times delegate to Commercial Congresses of the

WILLIAM FOSTER COCKSHUTT, M.P.

Empire, 1906; delegate to British Imperial Council of Commerce, 1911; and has traveled throughout the Empire lecturing on "Empire Unity and Preferential Trade." As member for Brantford in the House of Commons, Ottawa, he has done effective work in debate and otherwise for the Conservative party. He is an ardent Imperialist as the foregoing amply indicates.

He is chairman the Laycock Orphanage; president Bell Telephone Memorial Association; member Executive Committee, Bible Society of Canada; member of the General Synod; member Huron Synod of the Church of England; was presented to King Edward in 1906, and represented Brantford at funeral in London, England, of His Majesty King Edward in 1910.

Mr. Cockshutt married Minnie Turner Ashton, daughter of Rev. Robert Ashton, Brantford, Ont., Aug., 1891, and there are four sons and two daughters of the union.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		16 00.
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X.......	18 50	17 85
Victoria, No. 2 Plain ..	18 25	17 60

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh............	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh..........	1.15
Beams and angles, Pittsburgh....	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

			Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...			$2 20	$2 20
Heads, per 100 lbs.			2 55	2 55
Tank plates, 3-16 in.			2 50	2 50
Tubes, per 100 ft.,		1 inch	9 50	9 00
"	"	1¼ in.	9 50	9 00
"	"	1½ "	9 50	9 00
"	"	1¾ "	9 50	9 00
"	"	2 "	8 75	8 75
"	"	2½ "	11 15	11 50
"	"	3 "	12 10	12 50
"	"	3½ "	14 15	14 50
"	"	4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes..	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 50	$15 65
Electrolytic copper	15 25	15 40
Casting copper	15 00	15 25
Spelter	5 35	5 35
Tin	33 50	34 00
Lead	4 85	4 85
Antimony	8 50	8 50
Aluminum	20 00	18 50

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15
Lard Oil, per gal.	0.60

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3 45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10 3/4 oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1 1/2-in	$37.50	$30.00	$17.50
33/64 to 3/4-in.	41.25	33.00	19.25
7/16 to 1/2-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	95c lb.
Leather in sides	85c

BELTING RUBBER.

Standard	60%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4.95
1 inch	8.05
1 1/4 inch	12.65
1 3/8 inch	15.30
1 1/2 inch	16.50
1 5/8 inch	19.40
1 3/4 inch	22.50
1 7/8 inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, July 27, 1914.—During the past week there has been little change in machinery circles; most of the supply houses here, however, looking for improved conditions shortly. Orders are still very scarce, but several dealers are figuring on the machinery for the Grand Trunk Pacific Railroad, details of which are to be found on page 111.

Building operations continue about the same. There are practically no large contracts, but small work seems fairly plentiful. During the week contracts totaling about $700,000 have been let by the different Roman Catholic authorities for church and educational buildings.

This city will shortly call tenders for 200 lamp standards, with cable connections. The new standards will be of the single lamp type, and will be placed 120 feet apart, with two at all street corners. These lamps are for connection with the underground conduits now completed. There is considerable of this work under construction, which when completed will require several hundred additional lamp standards.

Figures issued by the building inspector's department at the City Hall show a decrease in the value of building permits for the first six months of 1914, as compared with the same period in 1913.

Metals.

There has been little change in the position of the metal market. For the past week or ten days dealers here had been reporting that prospects looked brighter; in fact, they seemed very hopeful of the future, but developments in Europe at the week-end cast a shadow over an otherwise promising situation. Already there is a slump in some prices, copper being quoted this morning 25 cents less than a week ago.

Sterling quotations to-day are:—Tin, spot, £136 15s.; future, £136 10s.; copper, spot, £58 10s; future, £59 17s. 6d.; lead, £18 10s.; spelter, £21 12s. 6d.

Toronto, Ont., July 26, 1914.—Generally speaking, business conditions do not show any marked change this week, although a more optimistic spirit is noticeable. There is no improvement in external political conditions, which are still having an adverse effect on the money market. Crop reports vary according to the districts from which they emanate, but they are on the whole favorable, and are giving a certain amount of buoyancy to conditions generally.

There is not much doubt but that we are passing through the dullest times in business that have been experienced for years, and as we have gradually come to the condition, so must we gradually emerge until normal times are again reached. Reports from various points indicate that business is improving and that prospects are brighter. An immediate return to normal conditions is not to be expected, but rather a continuance of the gradual improvement that is already taking place.

Steel Market

No improvement is as yet noticeable in the iron and steel trades, although a return to better conditions in the near future is anticipated by many. A prominent official of the G.T.P. stated recently that large orders for equipment have been considered and arranged for, but not issued. It is highly probable that these orders will be held up for some considerable time pending a completion of the necessary financial arrangements. The building trade continues quiet in so far as it affects the steel trade. A considerable amount of steel will be required for the new

Registry Office building, tenders for which were opened here last Thursday.

Interesting news comes from Pittsburg this week to the effect that all the leading mills have advanced their prices on bars, plates and shapes $1 per ton, making the new quotations on these products $1.15 per hundred pounds f.o.b. Pittsburg. This announcement does not appear to have created much stir, it being generally considered that trade conditions were not responsible, but rather a desire to place the market on a better price basis. Business has however improved a little, and the United States Steel Corporation has increased production to 70 per cent. and blown in two more furnaces, with a third to follow shortly.

Pig Iron.

The Pig Iron market is particularly quiet, and production averages about the same tonnage as during the past few weeks. Prices are being maintained, with no immediate prospect of an advance. Buying is still only for immediate requirements, and consumers are carrying as light stocks as possible.

Machine Tools

Business in machine tools is very quiet, few sales being recorded this week. Consumers are still waiting for an improvement in trade before laying out money on tools.

Metal Markets.

A weaker tendency is noticeable in the metal markets this week, accounted for by reason of reports of unsettled conditions in Europe. Tin is down ½c a pound, and copper 10c a hundred pounds. There is no change in other metals. The demand generally is, if anything, slightly better.

Ottawa, Ont., July 27, 1914.—The trade figures for the twelve months ending April 30, just issued by the Trade and Commerce Department, are very interesting when analyzed. They show that the country cannot be in such a bad way commercially, as trade for the twelve months showed an increase of some twenty-three million dollars. The total trade for the twelve months ending that period was $1,096,883,675, as against $1,079,934,018 for the corresponding period in 1913. The growth of Canada's trade since 1911 has been enormous. For the same period of 1911 the total trade was $757,542,382, or an increase since then of over three hundred million dollars, or more than the total trade a decade ago.

The striking feature of the trade figures is the decrease in our imports and the increase in our exports. The balance of trade, which has been so unfavorable against Canada for fifteen years, is apparently tending to right itself. This balance of trade against Canada has been a continual subject of comment among our political economists. Whether it has been a bad or a good sign is a question for argument, but the ordinary Canadian will be inclined to feel that a condition such as has existed in recent years, where we purchased abroad over $250,000,000 more than we sold, is not altogether as it should be. Whatever the cause, for the twelve months ending April 30 our exports increased by nearly $75,000,000, while our imports decreased $57,000,000. The decrease in imports, of course, accounts for the decline in customs revenue. The decline in imports is evidently largely due to the financial stringency—we are not purchasing so much.

Two reasons are given for the increase in exports. One undoubtedly is the new American Underwood tariff admitting agricultural products. The trade figures also show an enormous increase in the sale of cattle, especially to the United States. In addition, Canadian manufacturers with a restricted market at home, owing to the depression, have very evidently turned abroad. This is shown by the fact that the increase in export of manufactures is no less than $14,000,000.

The imports of metals, minerals and manufactures thereof for the twelve months of 1914 and the corresponding period of 1913 were as follows:—

	1913.	1914.
Brass and mfrs. of	5,357,384	4,271,387
Copper and mfrs. of....	7,666,047	6,351,887
Iron and steel and mfrs. of	139,178,336	114,556,252
Tin and mfrs. of	7,169,767	6,220,244

The exports of metals, minerals and manufactures thereof for the same two periods were:—

Aluminum in bars, blocks, etc.	1,390,180	1,924,758
Asbestos	2,530,294	2,862,577
Copper	9,940,549	9,488,778
Gold-bearing quartz, dust, etc.	11,514,518	13,197,182
Iron and steel and mfrs. of	9,734,474	11,402,544
Nickel	5,010,023	5,459,530
Silver	20,401,660	20,776,093

Winnipeg, July 25, 1914.—Quite a number of educational institutions have been buying machine tools during the past week. The School Board of Edmonton, Alta., have placed an order, amounting to over $1,500, for several lathes to be used in the technical school, the bulk of the order going to the A. R. Williams Machinery Co. Another firm secured an order for an air compressor also from the School Board. The Western Canada College, Calgary, have placed an order with the A. R. Williams Co. for several woodworking machines, while the School Board of Medicine Hat, who are building a technical school, have invited tenders on a complete outfit of machine tools. The A. R. Williams Co. have also supplied tools for a jobbing machine shop at Nokomos, Sask., started by Rankin & Hodson, and an electrically-operated air hammer, of medium capacity, for use in the forge department of the Vulcan Ironworks, Winnipeg.

The Stuart Machinery Co. are selling quite a number of heating boilers in the city, and have recently received an order for two from the Qu'Appelle Sanitarium. They also received an order this week for two motor-driven centrifugal pumps from the C.P.R., to be used at Fort William. They report inquiries for machinery rather light.

The Centrifugal Pump Co., Chicago, are reported to have chosen Winnipeg as the site of a Canadian branch plant. M. T. Chapman, president, and L. W. Bodinson, chief engineer, paid a visit to Winnipeg last week, and their factory, if built here, will employ a hundred men.

Trade Gossip

Canadian Rails—The shipments of steel rails which have come to hand from Sydney, Nova Scotia, and those which are booked for delivery in the near future, are a source of good advertising for Canada, in South Africa, and all the newspapers are giving this item of Canadian export considerable prominence. The rails are being delivered at Durban, as they are all for the Natal main line.

Canada Car and Foundry Co—About a third only of the usual staff of the Canada Car and Foundry Co. is now manufacturing cars and railway equipment. Ordinarily about 1,500 employees are at work at each of the three big plants located at Amherst, Turcot (Montreal), and Dominion (Montreal). At the present time there are less than 1,500 hands employed at all three plants. Present prospects for freight car orders are extremely slim, and the freight department is scarcely operating at all. It was hoped that the Canadian Northern and Grand Trunk Pacific Railroads would require a great deal of rolling stock for immediate delivery; but it now turns out that the former intends to buy only passenger cars at the present time, and the latter to order nothing at all. One of the officials of the company is reported to have stated that they believed the worst was over, and "that the turning point has been reached, and that normal conditions will return by fall." Orders on hand and the recent C.N.R. order ensure satisfactory employment in the passenger car departments till the end of January next. It is rather an unfortunate thing, however, that no freight orders are immediately in sight, as this comprises the great bulk of the company's business.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Woodstock, Ont.—The Wayne Oil Tank and Pump Co. will now receive the final payment on their loan from the city, the new factory being completed.

Fenelon Falls, Ont.—The Seymour Power Co. has completed the construction of its new dam near here. The plant is capable of developing about 1,500 horse-power.

Sarnia, Ont.—It is understood that Hon. W. J. Hanna, who is in England at present, is endeavoring to secure for this city the proposed Canadian branch of a large British smelting concern.

Port Arthur, Ont.—The new plant of the Conley Frog & Switch Co. is expected to be completed and in operation by September 1. About thirty men under E. H. Baumgarten are at present employed on the plant.

St. Catherines, Ont.—The first carload of steel for the new factory of Lord & Burnham, Vine Street, arrived recently. More material is expected next week. Work on the construction of the new building is progressing steadily.

Berlin, Ont.—The plant of the Berlin Central Heating Co. has been purchased by a syndicate of Toronto men, headed by C. H. Thompson, who will take charge. It is proposed to double the present equipment and increase the patronage along streets where mains have been laid.

Hamilton, Ont.—The Stanley Works of New Britain, Conn., have decided to locate a Canadian branch here. They have absorbed the Canada Steel Goods Co., and will make large additions to the plant. Among other extensions, they will install a rolling mill. Arthur S. Hatch will be manager of the new concern.

Winnipeg, Man.—M. T. Chapman, president of the American Well Works, Chicago, has been in Winnipeg recently in connection with a proposition to establish a plant in the city. The company manufactures well sinking and drilling machinery, and has recently acquired important patents on pumping machinery.

New Westminster, B.C.—Permission has been given the Heaps Engineering Co. to assign their twenty-year lease of city property to the North-West Trust Co., so that debenture bonds to the amount of $300,000 might be issued in order that the local engineering concern would be enabled to carry out the terms of their original agreement with the city, which was to build a plant on Lulu Island.

Cobourg, Ont.—Mr. Cole was in town from Owen Sound recently with Mr. Hollinrake of the A. R. Williams Machinery Co., Ltd., with a view to promoting a company to operate the Provincial Steel Works here, the plant and machinery of which is now the property of the A. R. Williams Co. It is understood that the town will be asked to guarantee bonds to a certain extent and to grant certain exemptions.

MACHINE TOOL REQUIREMENTS.

The Grand Trunk Pacific Railroad are in the market for the undernoted machine tool equipment for installation at McBride, B.C.:—

One 800-lb steam hammer.
One hydraulic wheel press.
One coach wheel lathe.
One motor-driven driving wheel lathe.
One portable boring bar.
One 36-in. motor-driven planer.
One 30-in. vertical motor-driven drilling machine.
One 20-in. vertical motor-driven drilling machine.
One 20-in. motor-driven high-speed engine lathe
One 30-in. motor-driven high-speed engine lathe.
One 20-in. hand planer and jointer.

Further information regarding the foregoing can be had from George W. Cay, purchasing agent, the G.T.P. Railroad, Winnipeg, Man.

New Liskeard, Ont.—The Wabi Iron Works Co. are installing a steel plant in connection with their foundry, and for that purpose they have a building, 35 x 40 feet, in the course of erection. A tilting electric steel furnace will be used, and when this department is in working order the company will be enabled to manufacture all kinds of steel castings, and will more particularly compete for the supplying of shoes and dies used in the concentrators at Cobalt.

Edmonton, Alta.—Sanderson & Porter, of New York and San Francisco, financiers and builders of hydro-electric plants, have submitted a proposal to the city to furnish power from a plant to be erected at Moose River, B.C., in the Yellowhead Pass of the Rocky Mountains, 250 miles west, at prices ranging from one cent. per k.w.h. for the first 50,000,000 to a half cent. per k.w.h. when 120,000,000 is reached. The plant to be installed on a branch of the Fraser River, will cost $3,500,000. Its minimum capacity is placed at 300,000,000 k.w.h., transmitted to Edmonton over cables. The transmission lines will follow the railroad. Stanley Washburn, of Chicago, and G. B. Waesche, one of the company's engineers, who made the surveys, presented the proposal to the council on July 14, when the matter was referred to the Board of Commissioners, headed by Mayor McNamara, for consideration.

Electrical

Galt, Ont.—It is proposed to extend the ornamental street lighting by the addition of standards and lamps.

Dresden, Ont.—By an overwhelming majority, the Hydro-Electric by-law was carried here on July 21. There were but fourteen votes against the measure.

Berlin, Ont.—Steps are being taken by the Light Commission and the Fire and Light Committee of the City Council to instal an up-to-date lighting system for King Street. The members of these municipal bodies visited Brantford and are favorably impressed with the illumination of the main streets of that city, where the Magnetite system has been adopted.

Cornwall, Ont. — The Conservation Commission has directed the chief engineer to make a survey and profile of the St. Regis River from its headquarters to its mouth at the St. Lawrence River, including such lakes, ponds and streams as are tributary to the St. Regis. He is also ordered to make preliminary plans of dams and possible water storage basins, with estimates of the cost thereof, together with a description of existing power developments and census thereof. The power of the St. Regis yet undeveloped is extensive and important.

General Industrial

Tilbury, Ont.—The F. S. Carr Rubber Co. is installing new machinery which will increase the output of their plant.

Preston, Ont.—The Board of Trade are considering a proposition from a company who propose building a factory for making overalls.

Stratford, Ont.—The Mayor has been authorized to sign the final agreement with the company which is to run a motor bus system in this city.

Chatham, Ont.—The Wm. Rennie Co., of Toronto, will erect a large seed warehouse on a two-acre plot located on the industrial spur here. Work is to be started at once.

New Denver, B.C.—The power plant of the New Denver Light & Power Co. was destroyed by fire on July 20. The origin of the fire is unknown, but it may have been caused by lightning.

Winnipeg, Man.—A Cabinet Council has decided to accept the offer of the Grain Growers Grain Co. to renew the lease of the Manitoba Government elevator system for an indefinite period.

Toronto, Ont—The John Warren Real Estate Co. have purchased five acres of land at Wychwood on behalf of a company, which proposes to build a plant for making cement bricks and tiles.

Irma, Alta—The construction work on a new 40,000-bushel elevator to be operated by the Farmers' Co-operative Elevator Co., has been started. The contract has been awarded to F. W. McDougall, of Calgary.

Winnipeg, Man.—Knechtel's furniture factory, on Henry Avenue, was struck by lighting on July 24 during the storm, and as a result $40,000 damage was done to the stock and building. About $19,000 was carried in insurance.

Sydney, N.S.—It is reported that a project is on foot here to establish a factory for the manufacture of overalls, the promoter being the representative of a large overall manufacturing concern in Ontario. It is understood he has selected a site.

St. Catherines, Ont.—The Board of Health on July 21 at a special meeting received a deputation from the Garden City Dairy Co., which proposes to establish a $100,000 plant here to supply consumers with pure milk. The plan was endorsed by the board on resolution.

Ottawa, Ont. — Plans filed at the Marine Department on July 22 provide for increasing the grain elevator capacity of Montreal Harbour Commission to six and a half million bushels. The increase at No. 1 elevator of capacity by 1½ million bushels will cost $800,000.

Port Dover, Ont.—At a recent meeting of the Board of Trade, a committee was appointed to ask the council to submit a by-law to loan the Port Dover Brick and Tile Co. $10,000 for ten years without interest. The company lost everything in the recent fire, and did not carry any insurance.

Walkerton, Ont.—A large section of R. Truax & Son's new factory is now completed, and a number of machines moved from the old structure to the new are installed and in operation. There is still some forty feet of the new building to be erected, and the old factory is being razed to make room for this.

AUSTRALIA RAILWAY WORKSHOP TENDERS.

Additional tender forms, specifications and drawings for equipment required by the Victorian Government, Australia, railway workshops continue to be received from Commissioner D. H Ross, and are now available for the inspection of Canadian machinery manufacturers at the Department of Trade and Commerce, Ottawa. Particulars of these requirements, together with the dates on which the tenders close at Melbourne, are outlined in the following brief summary:—

27,048—September 9, 1914—725 cast steel wheel centres.

27,049—September 9, 1914—6,800 cast steel wheel centres.

27,000—September 16, 1914—1,843 tons steel channel bars.

The last mail available to Canadian manufacturers is that which leaves Vancouver on August 5, and is due to arrive in Melbourne on August 30. The contractor must deliver a portion of the service, in each case, within four months from the date of acceptance of his tender.

Fort William, Ont.—A party of Pittsburg business men interested in the iron trade arrived here recently and left to investigate and look into the iron deposits in the neighborhood of Savanne, a point on the line of the C.P.R. about seventy-five miles west of Fort William. It is understood the party are working in the interests of the Pickands Mather Co., of Cleveland.

Toronto, Ont.—The Provincial Government has granted to Duncan Chisholm, a local capitalist, a concession to erect a pulp and paper mill at Smooth Rock Falls, on the Metagami River, and to expend $1,750,000 thereon. The daily output of paper will not be less than 150 tons, and the inauguration of the concern means employment for at least 250 hands for ten months of each year.

Personal

R. J. MacKenzie, of the C.N.R., has arrived in Winnipeg on a general trip of inspection.

James Carruthers, president of the Canada Steamship Lines, Ltd., has returned from Bermuda.

Gordon Perry, the general manager of the National Iron Works, Toronto, has returned from Germany.

Sir William Mackenzie sailed from New York on July 23 on the Aquitania for London. He hopes to return about the end of August.

A. M. Nanton, of Winnipeg, has been appointed vice-president of the Winnipeg Electric Railway, to succeed the late Sir William Whyte.

A. Gore, in charge of the Customs Department, Canadian Fairbanks-Morse Co., Toronto, has returned from a six weeks' vacation in Europe.

The Manitoba Bridge and Iron Works, Ltd., Winnipeg, have been awarded the contract for a bridge, to cost $250,000, by the city of Winnipeg.

C. R. Medland, manager of the Winnipeg branch of the General Supply Co. of Canada, Ltd., has returned to the West after a two weeks' visit to Toronto.

Rutledge & Davis have erected a building on Cedar Street, Newmarket, Ont., and have installed an oxygen welding plant. They are prepared to do any kind of repair work.

Archibald Currie, city engineer of Ottawa, has placed his resignation in the hands of Mayor McVeity. Mr. Currie, who came to Ottawa from Westmount, has been incapacitated for some months through illness.

Archibald Blue, chief officer of Census and Statistics for the Dominion of Canada, died somewhat suddenly at his home in Ottawa on July 27. He was a native of Oxford, Ont., and was in the 75th year of his age.

Ralph Modjeska, consulting engineer, Chicago, and a member of the board of engineers of the Quebec Bridge, has been retained by the Burrard Inlet Tunnel and Bridge Co. to report on the tenders which the company has received for the construction of the Second Narrows

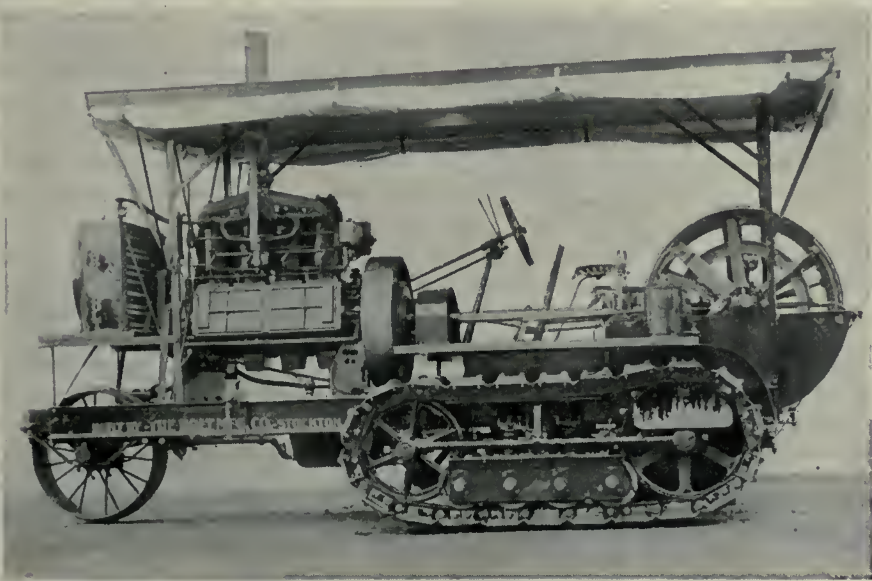
Description of a Gas Tractor Being Built in Canada

Staff Article

The Canadian market for this product of American design and manufacture has assumed such dimensions that a branch office has been opened at Calgary, Alta., and the John Inglis Co., Strachan Avenue, Toronto, are building a number of these tractors to help supply the demand.

ON the large wheat farms in Alberta and the Canadian West it has been felt that the general use of machinery was nothing less than an absolute necessity. The difficulty of obtaining sufficient and competent help during the harvest season has always been a source of worry to the Western farmer. Then, again, as wheat fields are being pushed farther and farther north, the early frosts become a greater menace. Thus, the importance of getting the seed grain in the ground at an early date. With these facts in view, the large steam tractors were designed, and these machines were a great success, in as far as their ability to accomplish their work was concerned, their only drawback being that of obtaining fuel. Water and coal are scarce commodities on the Western Prairies.

Appreciating these difficulties which beset the farmer, the engineers of the Holt Manufacturing Co. of Stockton, California, have designed and built a tractor of the internal combustion type. The liquid fuel is much more easily obtainable than coal and, although the engine is water cooled, the amount of water evaporated from the cooling system in a day of ten hours averages about one gallon. The fuel used generally in this machine is **Distillate,** which is cheap and easily obtainable. Thus, it would appear, that the difficulty of obtaining fuel for such machines is greatly lessened.



CATERPILLAR TYPE GAS TRACTOR, MANUFACTURED IN THE UNITED STATES BY THE HOLT MFG. CO., STOCKTON, CALIFORNIA, AND IN CANADA BY THE JOHN INGLIS CO., TORONTO, ONT.

General Observations.

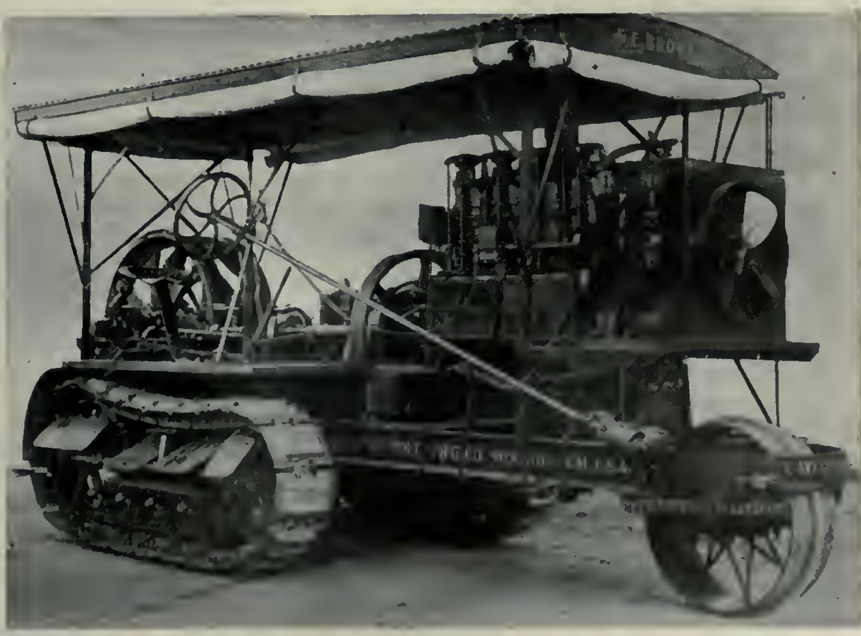
The tractor is driven by two caterpillar type drivers, which support the whole weight of the machine, except that which the single wheel at the front carries. This wheel is very wide, as also are the drivers, and in spite of the fact that the machine weighs nearly ten tons, the pressure on the ground per square inch is not greater than that under a man's foot. The tractor, it is claimed, can very easily go over the softest kind of ground.

The commonest use of the machine is for early spring plowing, and on average ground it will plow twenty furrows at once, running at a speed a little over two miles per hour. There are, of course, many other uses to which the tractor can be put, among them being that of a stationary engine. The clutches transmitting the power to the tractors can be thrown out and the entire power be transmitted to a pulley mounted on the frame of the engine.

The Motive Power.

The power plant of the machine is a four-cylinder, four-cycle, internal combustion engine, with cylinders 7 in. bore and a stroke of 8 in. The cylinder heads are cast separately and bolted. Both the intake and exhaust valves are in these heads. The cylinders are also cast separately, and are bolted to a cast iron crank case.

The crank shaft is supported by five main bearings, and in the sides of the crank case are four large hand hole covers, and so large are these hand holes that the main bearings, cam shaft bearings, oil pump and connecting rods are readily accessible. In fact, the pistons



CATERPILLAR TYPE GAS TRACTOR MANUFACTURED IN THE UNITED STATES BY THE HOLT MFG. CO., STOCKTON, CALIFORNIA, AND IN CANADA BY THE JOHN INGLIS CO., TORONTO, ONT.

and connecting rods can be removed from the engine through the hand holes.

A Splitdorf Magneto is mounted on the cam shaft side of the motor, and to make starting easy, a set of batteries and a Splitdorf coil are also connected to the system. The spark plugs are located on the side of the cylinders, while the spark control lever is situated just above the steering wheel.

Lubrication.

The lubricating system is efficient, yet at the same time not complicated. There is a main oil sump in the bottom of the crank case, from which a gear pump discharges the oil through four sight feeds to four oil wells located one under each connecting rod. A small overflow carries the surplus oil from each well back to the main oil sump. In this way the oil in the four wells is always at a constant level, and the connecting rods dip the proper amount under all conditions of operation. The main oil sump will hold about seven gallons of cylinder oil. The splash oils the connecting rods, main bearings and the cam shaft bearings. There is also an auxiliary oiling system which consists of a McCord oiler. In this mechanism is a small plunger pump driven by a little coil spring belt. This pump forces oil through four copper tubes to the wrist pins and cylinder walls.

The Fuel Feature.

The full tank is located in the frame of the machine, and the fuel is pumped from this tank to a well near the carburetor, the overflow returning to the tank. The carburetor takes its fuel from this well. It is a single jet, 1¾ in. Schebler make. The intake manifold is so arranged that each cylinder has to suck its mixture the same distance.

The throttle valve lever is located beside the spark control lever above the steering wheel, and the engine develops its rated power at a speed of 650 r.p.m. A simple governor is attached to the motor, which throttles it when its speed becomes greater than 650 r.p.m. The air intake of the carburetor is so arranged that, if desired, air can be used directly from the atmosphere, or warm air can be taken from a chamber surrounding the exhaust pipe.

The Cooling System.

The cooling system is highly efficient. A tank located in the frame of the tractor is capable of holding sixty gallons of water, and a belt-driven centrifugal pump delivers water to the water jackets in the cylinders, and thence through a sight feed to a spring-mounted radiator and back to the tank under the tractor. In front of the radiator a fan is located, which forces cool air through it. To make the system capable of accommodating itself to the slight flexibility of the steel frame many lengths of rubber hose are inserted in the pipe lines.

Operating Conveniences

The driver's seat and the steering wheel are located on the right side of the machine, while the spark and throttle levers are directly above the steering wheel. In the flywheel at the rear of the engine is located the main clutch. This is of the disk type, and is operated by a hand lever immediately to the left of the driver's seat. Each of the caterpillar tractors has a separate clutch, the operating levers of which are also located to the left of the driver's seat. The reversing device is operated by two levers located also to the left of the driver's seat, but a little more toward the rear.

The Power Transmission.

The power is transmitted from the crank shaft to the flywheel, thence through the clutch to the crank shaft extension shaft, on the rear of which is located a steel bevel pinion with thirteen cut teeth 3½ in. face, 1.46 diametral pitch. This pinion meshes into either of two steel bevel gears of 106 teeth. These gears are mounted on a countershaft. Two sprockets of seven teeth each are keyed to this shaft, and are connected up by chains to two sprockets of twenty teeth, each keyed to the platform wheel rear shaft. This shaft drives the tractor. The two bevel gears on the countershaft comprise the reversing apparatus. When the pinion meshes into the left-hand gear, the tractor goes ahead, and it reverses when meshing into the right-hand gear. A universal joint takes care of the slight amount the crank shaft extension is out of alignment when reversing.

Manoeuvring Features.

By means of the two independent clutches for the caterpillar tractors the machine is able to turn in a very small space. The single wheel in the front, of course, is the main steering link. The weight carried by this wheel is not excessive, and is supported by a roller thrust bearing, being thereby quite easily operated by the steering wheel. As the motion is transmitted through a worm, it is irreversible, and the steering is very simple. The front wheel can be removed, and all the weight will be taken by the tractors. Thus the machine can cross ditches and holes with comparative ease.

The Caterpillar Tractors

The caterpillar tractors are very ingenious devices. There are three shafts, i.e., platform wheel rear shaft, platform wheel centre shaft, and platform wheel front shaft. The first of these three shafts carries the driving sprockets, and thus propels the tractor. The centre shaft supports the entire weight of the machine, while the principal duty of the front shaft is to keep the caterpillar tractors in their proper place and shape. The distance between centres of the rear and front shafts can be quiet easily adjusted so as to keep the tractor link in its proper place. This tractor link consists of a chain which, on the back of each link, has a drop forged steel cap riveted. These steel caps are about 15 in. wide, and are so arranged that they closely overlap one another, whether they are flat or are on the sheaves. There are sprockets on the platform wheel rear shaft which engage in the chain, and thus transmit the power to the caterpillars.

There is a small truck mounted on each end of the platform wheel shaft centre, and on each truck are four rollers—two above and two below, which deliver the weight of the machine to the tractors. These trucks are mounted on springs, and on that account lend a great deal of flexibility to the tractors. Large and cumbersome obstacles can be run over without sudden jar or jolt to the mechanism. On the platform wheel shaft front, two rollers are mounted, which simply guide the chain and keep the tractors in alignment.

Miscellaneous Details.

The chain in the tractors is naturally strong. The pins are steel, case-hardened, 1¼ in. diameter, and work in manganese steel brushes. The various links in this part of the mechanism are oiled automatically from an oil tank on the platform of the machine. The shoes in the tractor are made so that little or no earth is allowed to get into the working parts.

The whole machine is in itself a very complete unit. The engine develops about 75 brake horse-power on the pulley used for stationary work, and, running to full capacity, the engine consumes about 65 gallons of distillate in a day or ten hours. The distillate retails in Canada at something less than ten cents a gallon. Two men only are required to operate one of these foregoing tractors.

The Turbine Equipment Co., Ltd., Toronto, has recently obtained the following orders from the Cobalt Lake Mining Co., Ltd.:—One 12-in. De Laval centrifugal pump, having a capacity of 5,000,000 gallons per day, and one 6-in. De Laval centrifugal pump, having a capacity of 875,000 gallons a day; both will be driven by induction motors.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

TURRET LATHE AND VERTICAL BORING MILL PRACTICE.—II.*

By Albert A. Dowd.

THE introductory portion of this article dealt with the first setting and sequence of operations in machining the rear hub of an automobile on a vertical turret lathe. In the present instance, the second setting and sequence of operations are dealt with in detail.

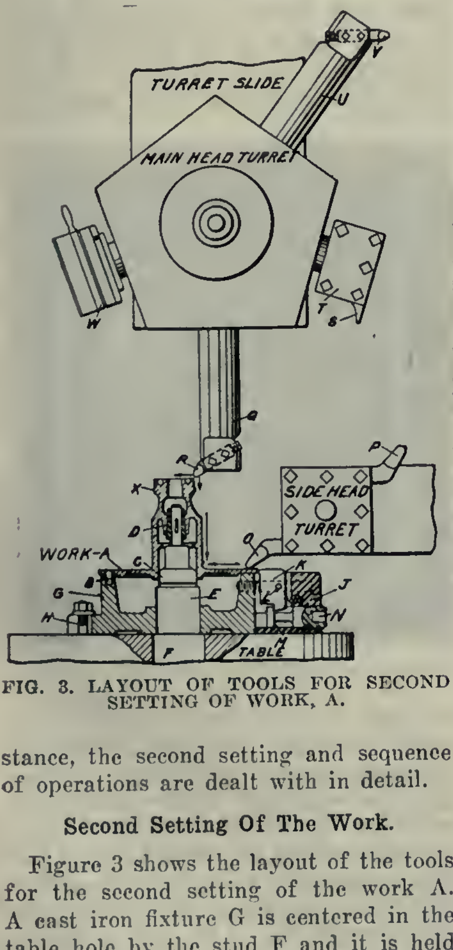


FIG. 3. LAYOUT OF TOOLS FOR SECOND SETTING OF WORK, A.

Second Setting Of The Work.

Figure 3 shows the layout of the tools for the second setting of the work A. A cast iron fixture G is centered in the table hole by the stud F and it is held in position on the table by means of the tee-bolts H. A tool steel pin B is used as a driver in one of the flange holes. The portion E of the stud fits the fixture body and extends upward to form the cylindrical locating surface C, which fits the bearing seat in the work. A taper sleeve D is hardened and ground to a sliding fit on the upper portion of the stud, and it is forced upward into the taper seat by the coil spring below it. It will be seen that this construction gives very accurate locations, the compensating action of the taper sleeve equalizing any slight variation which may take place between the face of the flange and the taper.

In order to guard against uplift of the work during the process of machining, the swinging clamps K are thrown into engagement with the edge of the flange by means of the shouldered operating screw M. Provision is made at N for a socket wrench. It will be noted that due to the position of the pin L on which the clamp swings its action is downward and inward, thereby tending to hold the work down on its seat firmly. The blocks J in which the clamping mechanisms are located are of steel and are fastened to the fixture by means of screws. These blocks are placed 120 degrees apart around the outside of the fixture. The reason that these blocks are not integral with the fixture body is that they may be more easily machined if formed up separately and afterward attached. The special turning bar Q is of .040 carbon steel and is provided with a high speed tool R, and it will be noted that the tool extends below the end of the bar, and that it is provided with a backing up screw for fine adjustment. Attention is also called to the shape of the tool, this being such that it may be used to cut in two directions, horizontally and vertically. A nicking tool S of high speed steel is held in a standard tool holder T in the turret hole. The bar U in the next hole is of identical construction with the one previously described, and the tool V is used for finish turning and facing. An opening die head W completes the turret tooling.

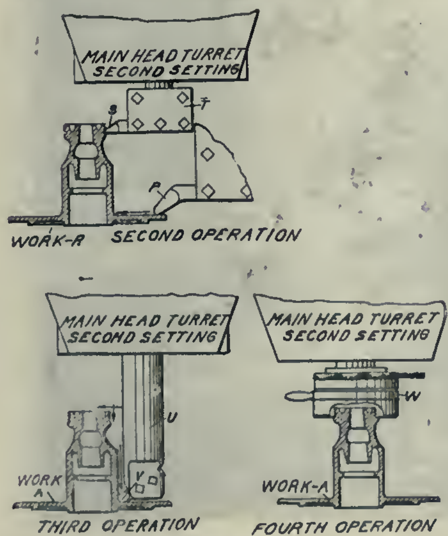


FIG. 4. FOURTH OPERATION—SECOND SETTING.

Two tools O and P in the side head are used respectively for roughing and finishing. They are both forged from high speed steel.

Sequence of Operations—Second Setting.

The tools shown in the working position in Fig. 3 are used for the first operation on the piece, the bar Q being used to face the end of the hub, rough turn the thread diameter, and turn the straight portion of the hub. The tool O in the side head faces the back of the flange while the other operation is taking place.

Second operation:—The second operation consists of nicking the threaded portion of the hub, the tool S being used for this purpose. The side head tool P is started on the finish facing of the flange as soon as the nicking has been accomplished with the mainhead. A very coarse feed and a light cut is used for the finish facing, which is therefore completed in about the time taken to index the turret for the next operation.

Third operation:—The turning tool V in the bar U is now brought into play to face the end of the hub, turn the thread diameter, and finish turn the straight portion of the hub. Coarse feeds are also used for this finishing, so that the time required is very short. The side head is not used in this operation.

Fourth operation:—The threading of the hub is accomplished by means of an opening die shown at W in the illustration of the fourth operation. In using a die head of this sort on the vertical turret lathe, the turret is brought down to a fixed point which allows the chasers to start on the work. The head now travels downward, generating the thread as it proceeds until a predetermined point is reached at which the opening mechanism operates. The use of a die head of this sort saves much time in the operation and precludes the necessity of reversing the machine as might be found necessary if a solid die head were used. This operation completes the piece.

A NEW LATHE CARRIER.

By H. Womersley.

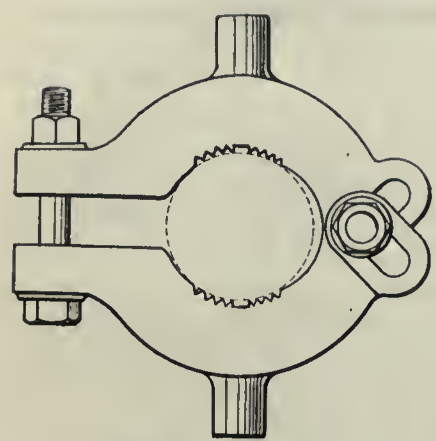
ALONG with the continuous development of lathe pulling power, there has been noted the failure of many of the ordinary lathe carriers or dogs. The illustration shows one that has successfully met the severest requirements of our shop and, for other reasons, has won more or less popularity among the men.

The body is made of steel and the serrated grips are hardened. The device, being made in two pieces, can readily be replaced or removed without taking

*Part I. of this series appeared in last issue.

the work off the centers, a useful feature for heavy work.

The capacity of this type of driver is fairly high. One size can be made to take from 2 to 4 inches, another will take work from 3 to 6 inches, and a third will accommodate from 5 to 9 inch diameters. If the dogs be made for special sizes of shaft, they will be found to be particularly light, strong and compact, considering the hard service to which they can be put.



A NEW LATHE CARRIER.

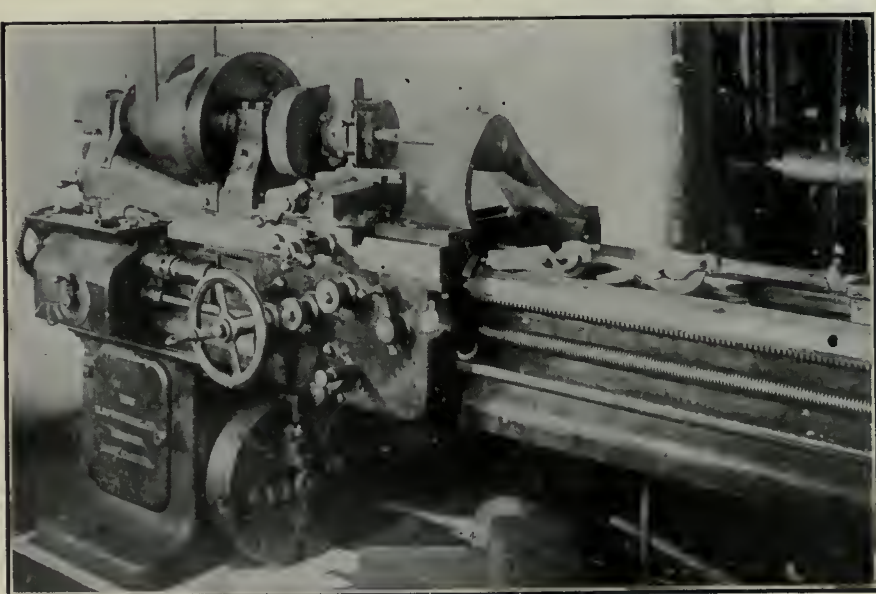
TURNTABLE FOR HORIZONTAL BORING MILL.

By C. I. B.

THE horizontal boring, milling and driling machine shown in the accompanying photo was used mainly for milling and boring two-cylinder opposed gas engine beds and gas tractor parts such as axle housings, gear cases, etc. This was the busiest machine in the shop and at one time a similar machine of another make was purchased to assist, but was later thrown out due to light construction.

The machine shown is of the floor type with sliding vertical column. A great amount of time was lost in the setting up of certain jobs and especially in re-locating after each operation. Much of the work was symmetrical with respect to center lines, and so it was decided to enlarge the scope and capacity of the machine by the addition of a turntable. The table itself was 52 inches in diameter and remained on the machine as a permanent fixture, as it was possible to use the rotating table on nearly all the jobs. The four clamps were placed beneath the table proper which was carried on a separate base casting bolted to the main machine table, and which carried the index pin. The index pin is operated by the lever shown at the front, the pin having teeth milled on the one side. A long bar was used for turning the table, this being inserted in bushed holes in the edge.

In order to locate the boring spindle centrally over the table for the various operations, this position was first determined, and then a large taper dowel pin was put through the base of the column and into the base proper on which the column slid. A stop was placed at the top of the vertical column and gauges of the various lengths placed between this stop and the top of the sliding head for locating vertical distances. It was thus an easy matter to locate the spindle position for any boring operation after previous milling. For boring, the regular outboard bearing was used, being placed just outside the turntable on the regular machine table. The outboard bearing for the boring bar in the view shown was located directly on the turntable in order to bring it as close to the work as possible, the table not being indexed for this particular job. This casting was used for the axle housing of a gas tractor and was faced on both ends and bored for roller bearings.



TURNTABLE FOR HORIZONTAL BORING MILL.

It will be found that the addition of a table of this sort will very greatly increase capacity of a machine of this style and, in fact, a plain milling machine as well. There is hardly a job on which milling and boring is done that cannot be turned around to some extent, thereby saving another setting-up.

A GRAVITY CLOCK

By D. O. Barrett.

THE clock shown in the accompanying photo is called by its owner, an old gentleman living in the City of Mansfield, Ohio, a **Gravity Clock**, being only one step removed from perpetual motion. The clock has been viewed by numerous parties, and various conjectures advanced as to the method of operating. The minute hand of the clock may be removed and placed upon a pin of the proper size in any position, and it will immediately come back to the position corresponding to the proper minute, and its movement will then be in synchronism with that of the minute hand of a clock. This is often demonstrated by painting the hours on a door or wall and placing the hand in a nail in the centre. The hands are at present supported upon a bicycle spoke attached to the back of the glass frame, and have absolutely no connection whatever either with the pivot or the case.

A GRAVITY CLOCK.

The small piece hanging vertically contains the proper gears for operating the hour hand, and the actuating mechanism is contained in the enlargement at the end of the minute hand. A small weight is moved about in such a manner that the balance of the arm is disturbed and the actuating force is, therefore, in reality gravity.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

THE COLLEGE GRADUATE.—II.*

D. S. Mann.

INITIATIVE is a quality which is almost entirely overlooked in the average college man's education, and it is only after he has been knocked around on the wave of competition that he realizes that this side of his character needs development. The man who leaves college with the desire to go ahead and with the quality of stick-to-itiveness is a find indeed, and the man who feels that he is not above taking a situation or even a job beside those who have not been as fortunate as he in the matter of education should, without any trouble, rise head and shoulders above his fellow workers. If he does not, then he should feel that something is wrong, or that there is no chance of advancement in that particular place and should move on to where opportunities are brighter, but he should first satisfy himself that the fault is not his own.

Recognizing Opportunity.

Does the average college man recognize opportunity when it appears before him? Many of them are so egotistic and have such a puffed-up-idea of their own importance (or at least of their superiority over the working man without the college education) that opportunity means to them a sudden rise to heads of departments, managers, and various other exalted positions with large salaries. They seem to imagine that opportunity is trailing along on a leading string which they have only to pull. Others, again, are so meek and unassuming that they do not realize their own merits and look upon opportunity with fear and trembling, and are afraid to grasp the hand which it extends. It is said that opportunity comes at least once to every man, but in the writer's opinion it comes several times a year to most men, and with some it is continuous, but is always sent away empty-handed. The average college graduate feels that what is offered is beneath him or that the road to success is too long.

The writer has often noted that where many men are employed and things are not going just as they should, there is always quite a discussion as to who will get certain executive positions as soon as changes are made, but how many of these same men do we find striving for something better, who are fitting themselves for that particular position in case there should be a vacancy.

As an example, an instance occurred recently in a shop in which several college men are employed—men who have been out of college from one to three years. This shop had rather an elaborate system of shop management, commonly known to-day as scientific management, and these men were employed in various departments, such as drafting room, stock keeping, stock room, planning, etc.

Two changes in department heads were made, one in the drafting room, and one in the machine shop. Both of these had been common topics of conversation for some time because of the inefficient manner in which they had been operated, but it seemed never to have occurred to any of these men that there was any possibility of their obtaining either of the positions. When the time came to choose a new chief draftsman, it was necessary to pass up our college friends and pick out a young man scarcely more than an apprentice, but who thoroughly understood some of the details of the work which had been passed up by the others as relatively unimportant. In deciding upon a machine shop foreman, a fine toothcomb was applied in efforts to obtain a suitable man; but not a man could be found to whom the work could be entrusted, yet all had been quite busy discussing how soon the occupant would lose his job.

This would have been a golden opportunity for some of our college friends, and would have yielded them experience for which they had been waiting for years in vain. The opportunity came, knocked, and not only was refused admittance, but was kicked out, and how often do we hear the cry that department heads are not picked from men in the shop, but rather that outside men are invited in. Is it any wonder that such conditions exist?

Instruction In Dealing With Men.

Our colleges do not seem to impress upon students the qualifications necessary for the successful holding of various positions which they will, in all probability, be expected to fill. In order to handle men, one must study men, must bring himself to understand them and be able to put himself in sympathy with them, and, perhaps the most important of all, he must understand just what a good day's work is and be able to appreciate the difficulties and the stumbling stones encountered by the man himself.

The only way in which this can be properly brought about is by actual contact with both the men and the work. Would it not be more profitable, then, to put in a course of lectures on this most instructive subject in our colleges rather than try to impress upon the minds of engineering students the elements of logic and other abstruse subjects?

*Part 1. appeared on July 30.

CONFERENCES OF DEPARTMENTAL HEADS.

By P. W. Blair.

IN all manufacturing establishments the idea of regular periodical conferences of the heads of the various departments is one that is rapidly gaining in popularity.

A large manufacturing concern in Ontario who have adopted this idea, hold meetings on the first Monday in every month, under the direction of the president. The men attending consist of those in charge of the office staff, receiving department and stock rooms, the order routing clerk and the various foremen. The practical adoption of many proposed schemes is discussed, and their relative effects examined before trying out, so as not to upset the shop routine uselessly. Of course, many valuable ideas are discovered and put into practice, while in addition, healthy criticism is made of the company's policy. Thus, quite often the efficiency of the plant is increased and the production cost lowered.

It has been shown in one or two instances that the appointment of committees to investigate situations is a very excellent way to obviate the initiation of many costly practices. The members of these committees pride themselves on their appointment, and strive earnestly to adjust matters to the mutual advantage of the firm and the employees.

Moreover, foremen learn to respect the interests of other foremen, and the company becomes a large co-operative unit. The machine shop learns how to accomplish their work so that the assembling department will experience the least trouble at their end. Likewise the moulder studies the needs of the machine shop, and the draughting and designing departments study the needs of the whole plant.

The conference idea seems to stimulate the departmental heads to work to greater efficiency, and the management as a result operates to vastly better advantage, and can, therefore, be more liberal with its employees.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

RELATING TO BEAMS.

IN the previous problems in which this subject was involved it was endeavored to give solutions for problems concerning simple beams likely to be met with by the average foreman and operator. An effort was also made to show the relation of beams to revolving shafts and how the same fundamental formula could be applied in both cases. By understanding this formula the strength of beams and shafting can be calculated, no matter what the material of which they are made, providing that the shearing, compressive, and tensile strength of this material be known.

The values given by handbooks are usually those of the ultimate strengths per square inch, or for any material, is the load sufficient to part a bar 1 inch square. To get the working load, it is necessary to apply a factor of safety. For dead loads, such as buildings, this is usually not less than 4; for varying loads, such as bridges, from 4 to 6; and for loads varying from maximum in one direction to maximum in the other direction, or in the form of shocks, the safety factor ranges from 6 to 10, according to judgment of the engineer. This means that it would require from 4 to 6 times the working load of a new bridge to break it down.

So far we have dealt with problems in which the beams were either uniformly loaded or were subjected to single loads acting at the central point. The effect of the loading is simply to change the value of M, the maximum bending moment, in the formula $\frac{M}{S} = \frac{I}{c}$. For a central concentrated load, $M = \frac{Pl}{4}$ where P is the total load in pounds and l the length of the span in inches. For a uniformly distributed load, $M = \frac{Pl}{8}$. Thus it is seen that a beam will sustain twice as much uniformly distributed load as concentrated load. The bending tendency of the load subjects the beam to compression on the upper side and tension on the lower side, hence whichever happens to be the weaker value should be used. The weight of the load tends to shear the beam or break it apart. The shearing action is greatest at the supports, and consequently is equal to the loads on the supports.

Question—A beam has a span of 50 inches and is loaded at three points as follows:—1,200 lbs. at 12 inches from the right hand end, 1,400 lbs. at 24 inches from the same end, and 2,600 lbs. at a point 18 inches from the other end. Find the loads on each support.

Answer—The load on either support is equal to the sum of each load multiplied by its distance to the other support, divided by the total length of the span. The reaction of the right hand support would therefore be

$$\frac{1200 \times 38 + 1400 \times 26 + 2600 \times 18}{\ } = 2{,}576 \text{ pounds.}$$

2.576 pounds.

The weight on the left support would be

$$\frac{2600 \times 32 + 1400 \times 24 + 1200 \times 12}{50} = 2624 \text{ pounds.}$$

This could also be found by subtracting the load on the right hand support from the total load, or 5,200 — 2,576 = 2,624 pounds ans.

* * *

—**Question**—In the above problem, determine the bending moments (M) at the three points.

Answer—The bending moment at the 1,200 lb. load would be the reaction of the right support multiplied by the distance of the 1,200 lb. load from the right hand end, or $= 12 \times 2576 = 30{,}912$ inch pounds.

The bending moment at the 1,400-pound load is the right hand reaction multiplied by the distance of the right hand support from the load minus the 1,200 pound load multiplied by the distance between the two loads. Thus, $2{,}576 \times 24 - (24 - 12) \times 1200 = 2576 \times 24 - 12 \times 1200 = 618.24 - 14400 = 47424$ inch lbs.

In the same way the bending moment at the 2,600 lb. load is $2576 \times 32 - 1200 \times 32 + 1400 \times 8 = 83432 - 38400 - 11200 = 34832$ inch pounds.

The greatest bending moment is at the middle load, and is therefore the moment used as the value of M in calculating the size of beam.

* * *

Question—A horizontal tubular boiler weighing 18,000 pounds is hung from two I beams in such a way that the weight is equally divided between them. The span of the beams is 8 feet and the points of support of the boiler are 4 feet apart, 2 feet either side of the center. What size I beams would be suitable?

Answer—Formula, $\frac{M}{S} = \frac{I}{c}$.

M is greatest at either point of loading and is the same at both. M is therefore the load on one support multiplied by the distance from the support to the nearest load, or is $\frac{18000}{4} \times 24 = 4500 \times 24 = 108{,}000$ inch pounds.

Using a safety factor of 4, S becomes 15,000, substituting values in formula, $\frac{108000}{15000} = \frac{I}{c}$, or $\frac{I}{c} = 7.2$. Now, looking in the handbook we find for 6-inch beams at 12.25 lbs. per foot I = 21.8; c for 6-inch beam $= \frac{6}{2} = 3$; $\frac{21.8}{3} = 7.27$; 7.2 only is required, therefore the 6-inch 12.25 pound beam would be sufficient.

* * *

Question—A 10-inch I beam at 30 pounds per foot is loaded in the center between supports 12 inches apart. Would it fail by shearing or bending?

Answer—The moment of inertia for this beam is 134.2 and its cross sectional area is 8.82 sq. in.

S = 60,000 pounds per sq. in. $M = \frac{Pl}{4}$; $c = \frac{10}{2} = 5$.

Formula $\frac{M}{S} = \frac{I}{c}$, or $\frac{Pl}{4S} = \frac{I}{c}$, or $P = \frac{I}{c} \times \frac{4S}{l}$, $P = \frac{134.2}{5} \times \frac{4 \times 60000}{12} = 536{,}800$ pounds.

Shearing strength of steel = 50,000 pounds per sq. in. Area of this section is 8.82 sq. in.

Load necessary to shear it is then $50{,}000 \times 8.82 = 441{,}000$ pounds. The piece would, therefore, fail by shearing. Beams of any considerable length fail by bending.

* * *

Question—A number of I beams are to be placed to project 6 feet from the wall of a building and at right angles to it for the purpose of hoisting a 7-ton piece of machinery to an upper floor. What combination of beams could be used?

Answer—Formula, $\frac{M}{S} = \frac{I}{c}$.

$M = 7 \times 2000 \times 6 \times 12 = 1,008,000$ inch pounds.

$$S = \frac{60,000}{5} = 12,000 \text{ lbs. per sq. in.}$$

$$\frac{M}{S} = \frac{1,008,000}{12,000} = 84 = \frac{I}{c}.$$

Using 2 beams $\frac{I}{c}$ for each would be $\frac{84}{2} = 42$.

From the handbook we find I for the heaviest 12-inch I beam = 245.9 and c = 6.

This gives $\frac{I}{c} = 41$, a little too low; but as we use a safety factor of 5, two 12-inch beams at 40 pounds per foot would do the work. If we used three beams, the $\frac{I}{c}$ for each would be $\frac{84}{3} = 28$.

I for a 10-inch 30-pound beam is 134.2; $c = 5$; $\frac{I}{c} = \frac{134.2}{5} = 26.8$, which is too low.

For a 10-inch 35-pound beam I = 146.4; $\frac{I}{c} = \frac{146.4}{5} = 29.3$, which is a little large. Therefore, three 10-inch 35-pound beams would do. In the same way it will be found that four 9-inch 30-pound beams will do the work.

The minimum monthly pension in no case shall be less than $15, and the maximum monthly pension not greater than $100. Reasonable restrictions are attached to the system so that an employee cannot abuse these privileges. Also, reasonable measures are taken to protect the company, and pensions may be increased, reduced, or forfeited, according to the discretion of the Welfare Committee, which must be guided by regulations set forth by the company.

The Insurance Feature.

The insurance policy of the company is also of a most generous nature. Every employee who has been in the continuous employ of the company for three years is entitled to benefit by the insurance scheme. Any employee who has been in the continuous service of the company for three years, and less than ten years, shall be insured for six months' wages, while those who have served over ten years will be insured for one years' wages. The continuity of service is computed similarly to that of the pension method. How the insurance is paid, and to whom, is clearly outlined, and conditions which would lead to the forfeiture of the insurance benefits are also definitely stated, so that it is difficult to imagine that any controversy could arise.

Vacation Allowances.

The system of vacation allowances is also very liberal. It simply states that any shop man, who on May 1 of each year shall have been in the service of the company continuously for at least two years and whose record of attendance and faithful discharge of his duties during the twelve months of each year ending with the first Wednesday in May, shall have been satisfactory to the foreman of his department, will receive a vacation allowance of one-half week's pay. If, however, his service shall have extended over a period of five years or more an allowance of one week's pay will be made.

The company expects to close its shops for the first week in July each year, but should it be desired to have the shops working during that week, a vacation at another period may be given. Further, if business conditions are such that no vacation can be taken, the company reserves the right to keep its shops working and to give the equivalent allowances to its employees. The company intimates, and it must be so understood by its employees, that this welfare system can be maintained only during the profitable operation of its business.

The whole plan is highly praiseworthy and might be profitably emulated by many other concerns, as its action is sure to bring the employer and employee together in a common interest.

J. H. Williams & Co. Employees' Welfare Assn.

For some time past this firm have been developing a plan whereby they could make available to their employees' pensions, life insurance and vacation allowances. Announcement of the completed scheme was recently made, and further that it went into operation on July 1. Each employee was given a neat little folder, setting forth in detail the various provisions and conditions.

THE J. H. Williams Co., of Brooklyn and Buffalo, N.Y., has since its inauguration always been to the front in looking after its employees welfare, and this latest idea is one which clearly represents the character of those at the head of the institution. The benefits outlined in this recent announcement are to be distributed through a committee known as The J. H. Williams & Co. Employees Welfare Committee. This will consist of five members, two of whom will be appointed by the company. These, in turn, will appoint a third, who must be a shop employee, while two others will be named by the J. H. Williams & Co. Mutual Aid Association. This welfare committee is to be chosen every two years; the present company will, however, only hold office until Dec. 31, 1915. Every other December, beginning with 1915, a new committee will be appointed.

The Pension Feature.

Those men who are eligible for pensions are such as have reached the age of 65 and have been for 25 years continuously in the service of the company. The company also reserves the right to retire any man on a pension after he has reached the age of 55. In the forge, blacksmith, polishing and case-hardening departments an employee may be retired at the age of 60 after serving the company for twenty years. This retirement at 60 years after twenty years service also applies to any female employee of the company. Further, any employee with not less than 15 years' continuous service, whatever his or her age, claiming to be unfitted by reason of permanent physical or mental disability from following his or her employment in the Company's service, may be retired at the discretion of the welfare committee.

In computing the period of service, it is reckoned from the date since which the person has been continuously and exclusively in the service of the company to the date when retired. Temporary lay-off on account of reduction in the company's force, or absence on account of illness, or dismissal, if followed by reinstatement within one year, shall not be considered as a break in the continuity of service, but if for any reason absence exceeds six months, such length of absence shall be deducted in computing the length of service.

The amount of pension is computed on the following basis:—For each year of active service, one per cent. of the average annual pay during the ten years next preceding retirement. However, at the discretion of the Welfare Committee, this may be altered, in such cases as they see fit, to read "one per cent. of the annual pay of the ten consecutive years of service during which the retired employee was paid the highest rate of wages."

PROGRESS IN NEW EQUIPMENT

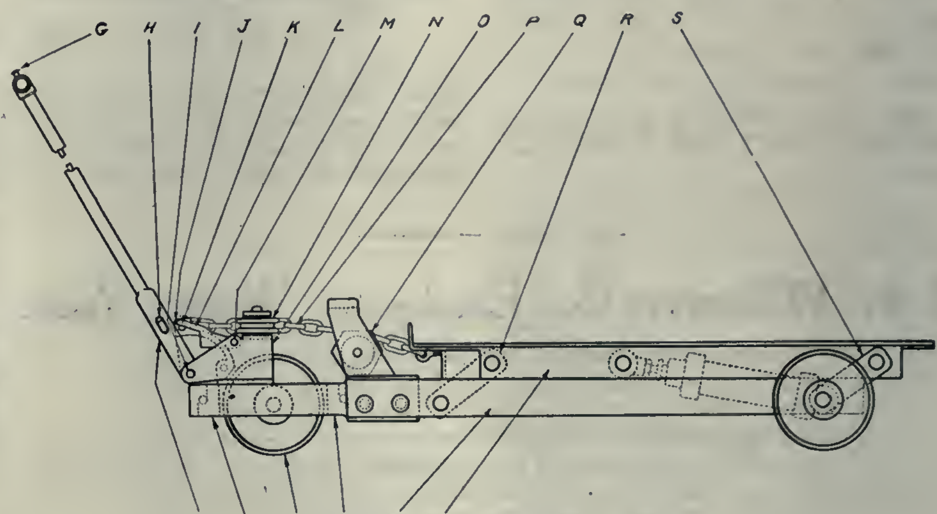
A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

A SIMPLE ELEVATING TRANSFER TRUCK.

THE problem of materially reducing manufacturing costs without impairing the quality of the finished product is one that constantly engages the attention of every live manufacturer to-day. Wonderful developments in machinery steel, high-speed tool steel, and improved designing have all tended toward an ever-increasing efficiency. Thus, while improvements along these scientific lines were being developed, some of the simpler ideas have been lost sight of. So it happens when one runs across some simple yet important development, in other than scientific spheres, it is, to say the least, highly refreshing.

Of such a nature is the new elevating transfer truck that the Chapman Double Ball Bearing Co., of Toronto, are about to place on the market. This truck is of one-ton capacity, with a lift of two inches. The entire control is in the steering handle, which, being made from ¾-inch standard pipe, is hollow.

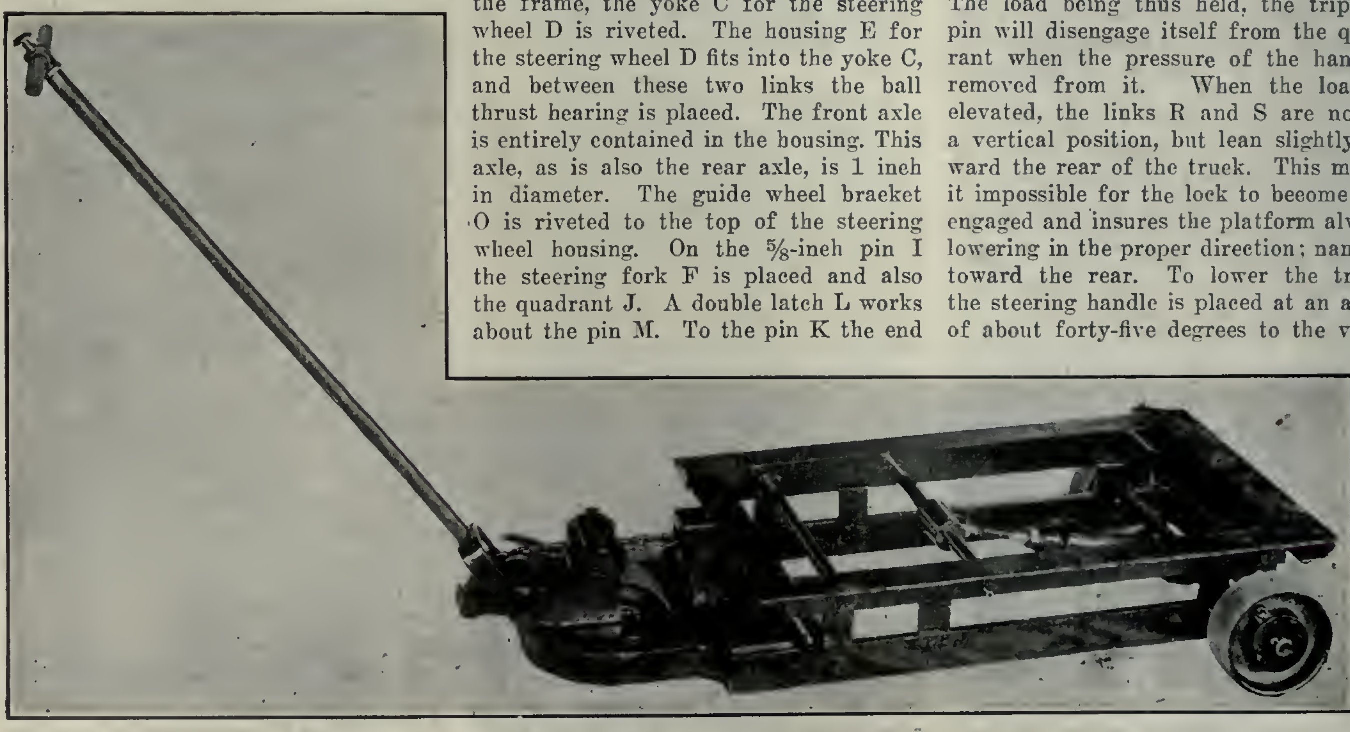
The principal feature of this truck is that it may be operated when the steering handle is turned in any direction. It is mounted on three 7-inch wheels of 2½-inch face, each wheel being equipped with a double ball bearing. In addition to these, there is also a ball thrust bearing in the steering wheel housing, thereby making the truck very easy to turn when loaded. To start to lift the full load of one ton from the floor, it requires something less than a pull of 125 pounds. As soon as the load is **started,** the pull required rapidly diminishes.



OUTLINE SKETCH OF SIMPLE ELEVATING TRANSFER TRUCK.

The over-all length of the truck is 53 inches and the width 24 inches. The platform A is 36 in. x 24 in., and the frame B is made from a bar of machinery steel ⅝ in. x 2½ in., bent in the shape of a U. In the open end of the frame, the yoke C for the steering wheel D is riveted. The housing E for the steering wheel D fits into the yoke C, and between these two links the ball thrust bearing is placed. The front axle is entirely contained in the housing. This axle, as is also the rear axle, is 1 inch in diameter. The guide wheel bracket O is riveted to the top of the steering wheel housing. On the ⅝-inch pin I the steering fork F is placed and also the quadrant J. A double latch L works about the pin M. To the pin K the end link of the chain P is attached. This chain passes between the two sheaves N in a horizontal plane, and on over the vertical sheave Q to the platform A.

To elevate a load, the steering handle is placed in a vertical position and the button G is pressed, engaging a tripping pin H with the quadrant J. By lowering the steering handle toward a horizontal position, the load is lifted from the floor. When off the floor two inches, the latch L engages with a locking pin. The load being thus held, the tripping pin will disengage itself from the quadrant when the pressure of the hand is removed from it. When the load is elevated, the links R and S are not in a vertical position, but lean slightly toward the rear of the truck. This makes it impossible for the lock to become disengaged and insures the platform always lowering in the proper direction; namely, toward the rear. To lower the truck, the steering handle is placed at an angle of about forty-five degrees to the verti-



NEW ELEVATING TRANSFER TRUCK OF ONE TON CAPACITY.

cal, the button G is pressed, and the steering handle pushed up to a vertical position. As a hydraulic check is fitted

VIEW OF ELEVATING TRANSFER TRUCK LOADED.

to the truck, the load quickly, yet gently, lowers itself to the floor. The elevating and lowering operations can be executed when the steering handle is in any direction. This is made possible by the two horizontal sheaves N which cause the pull of the chain to be properly directed when the steering handle is turned out of line with the truck.

The platform is constructed from steel angles 2½ in. x 2½ in. x ¼ in., and its covers are securely bound together by steel straps. Small steel guides are riveted to the frame, and these cause the platform to ascend and descend in a manner such that it will never bind and cause undue friction and wear. Pieces are also riveted on the truck platform of such shape as to guide it under the portable wooden platforms. Stops are also provided to prevent the truck from passing too far under these wooden platforms.

The truck is substantially built throughout, and all the working parts are simple and not likely to get out of order. The fact that the truck can be operated from the steering handle entirely, and also when that handle is turned in any direction, is a distinctive feature and greatly increases its field of usefulness.

E. G. Buckwell, secretary of the Cleveland Twist Drill Co., Cleveland, left for Europe on a business trip August 1st.

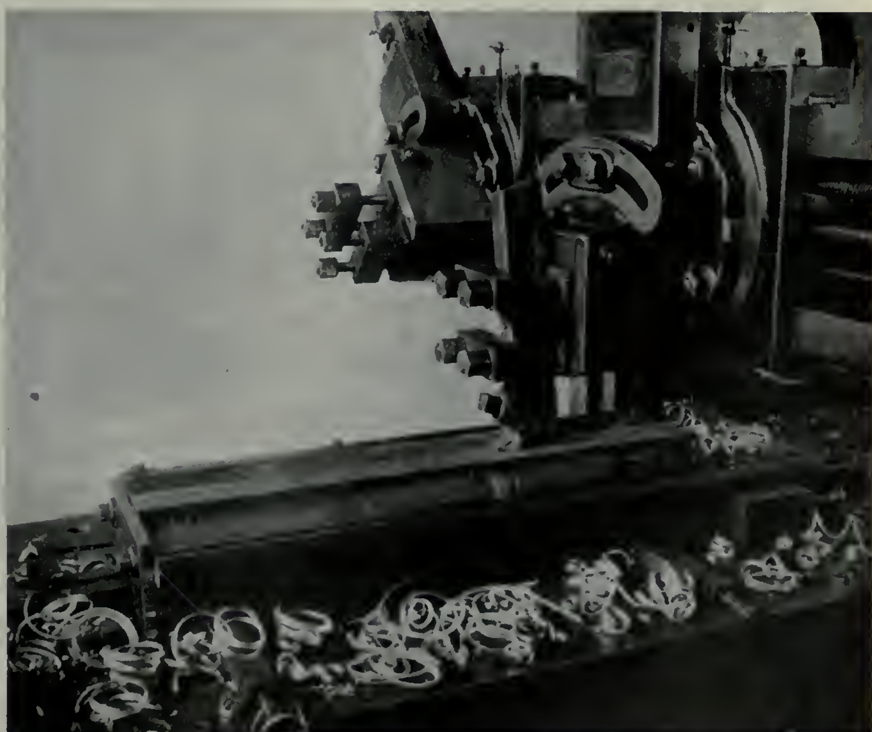
NEW MAGNETIC CHUCK.

THE use of magnetic chucks for holding work to be machined has very much increased of late years. This is due to a number of contributory causes chief of which are the improvements in the chucks themselves. The convenience of chucks in which all labor of clamping and fastening has been done away with can hardly be overestimated particularly for flat and fragile work. Besides this, the magnetic chuck has opened up a large field for itself in work considered practically impossible by the ordinary means.

The time occupied in setting up work occupies from one to seventy per cent. of the total time on the job. Some pieces also require to be specially designed to provide means of fastening in the machines in which they are to be worked up. When the elaborate outfit required for other work is taken into consideration, it can easily be seen that many plants could afford a fairly expensive device to eliminate this work and expense.

The illustration shows the coil arrangement of the new Heald magnetic chuch for planing, milling and grinding machines. The holding power of these chucks has been greatly improved, being 112 lbs. per sq. in. from actual test. This, of course, could be varied if desired by decreasing the current. Uniformity of holding power has also been greatly increased, the maximum variation between any two poles being 5 per cent. The shallow arrangement of the coils as well as their concentration has practically removed the magnetism from the body of the chuck, a very objectionable feature of the earlier types. A very desirable feature is that the chuck may be entirely demagnetized when the current is turned off. This the Heald people claim to have accomplished to such an extent that it can be guaranteed.

The water proofing and non-heating qualities of these machines have made them available for a very wide range of work, making possible the use of any of the cutting and grinding compounds. The unit coil system used makes electrical repairs extremely simple and inexpensive, and the small consumption of



"HEALD" 10 IN. X 32 IN. FLAT MAGNETIC CHUCK ON PLANER WORK TAKING A CHIP 5-16 IN. DEEP WITH A 5-32 IN. FEED, AND WORK SPEED OF 60 FT. PER MINUTE ON MACHINE STEEL.

energy is remarkable when the holding power of the device is considered.

The top plates are made thick enough to allow of truing up several times and when worn out can be easily replaced. Attention is particularly called by the makers to a planing job done on one of their regular chucks. This consisted of a cut 5-16 in. deep with a feed of 5-32 in. at a working speed of 60 ft. per minute on mild steel. The magnetic holding power was sufficient to prevent any tendency of the work to rise throughout the whole job. The above developments have been worked out by the Heald Machine Co. of Worcester, Mass., who manufacture both round and rectangular chucks in various sizes.

THE ZOELLY STEAM TURBINE.

IN 1898 Mr. Zoelly designed a new type of steam turbine which resembled in many respects a water turbine of the impulse type. This machine was designed on the radial flow principle, the blades not being curved. A second machine with curved blades, however, gave better results, the steam in this case striking against the rotor blades in radial direction. The principle of the impulse type has been adopted as being the best, and the only alterations that took place were in the manner of guiding the steam onto the wheels. The Zoelly turbine has gone through many stages of improvement which, however, have been solely of a constructional character, no departure from the adopted principle having taken place.

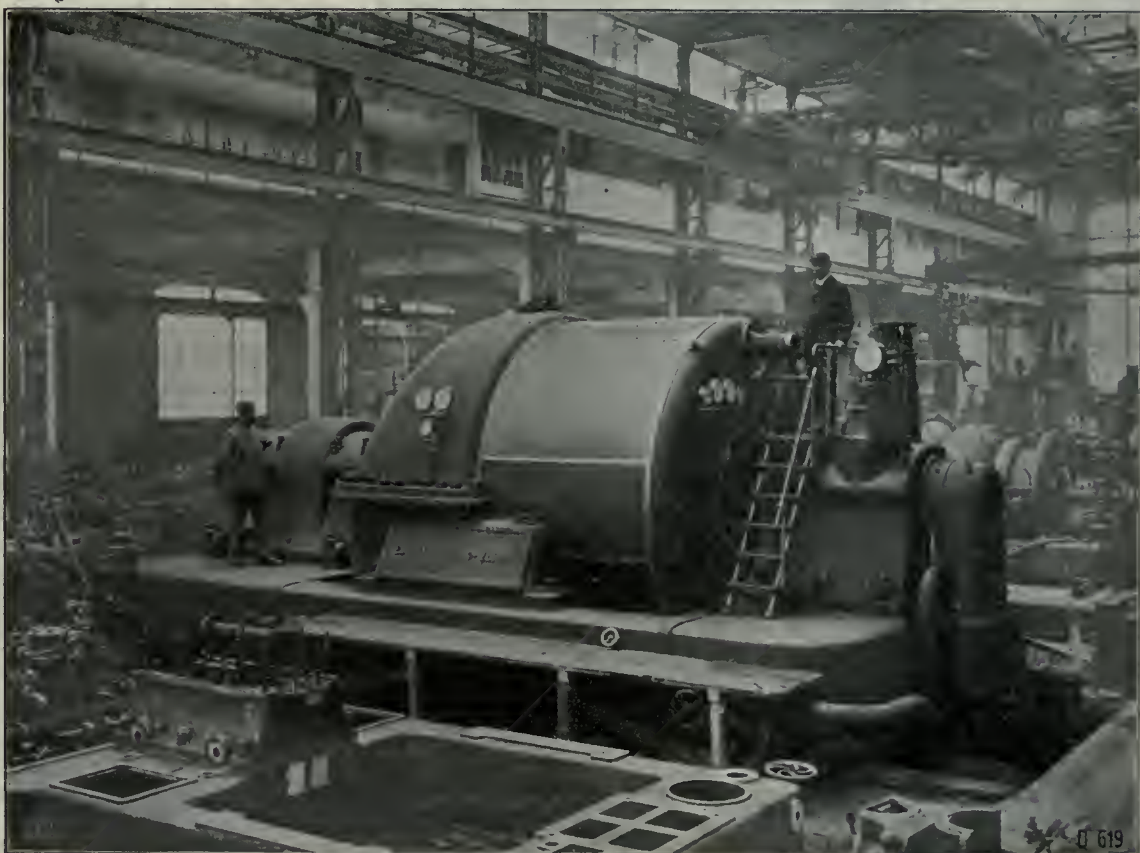
The Zoelly turbine has, in the past, been subjected to a good deal of criticism respecting the steam pressure and temperature in the first stage which were considered to be excessively high and were supposed to have a deleterious effect upon the stuffing boxes. In the case of the present Zoelly machine these criticisms are without foundation as in the first stage a greater pressure drop and likewise a correspondingly higher steam velocity is made use of than previously. This velocity equals or even surpasses that of sound corresponding to the steam conditions of this particular stage.

In order to be able to construct large units without having to employ too large blades in the last two stages, these stages are provided with a greater drop of pressure, so that they also work with steam velocities which may be 5 and even more per cent. higher than the velocity of sound. The intermediate pressure stages work with steam velocities which do not or only in a very slight degree exceed the velocity of sound belonging to the conditions of these stages. At any rate, the excess of velocity over that of sound is in the intermediate stages never so great as in the first and last stages.

The total drop of pressure available has been divided up in such manner that it has been possible to reduce the number of stages and thereby shorten the turbine by an appreciable amount. If necessary, these stages are constructed with expanded guide channels or nozzles. This expansion is not, however, designed for full load, but only part load, i.e., about half or a quarter of full load, in order to insure a good efficiency even at part full load. Such types of Zoelly have been built since the year 1908. The characteristic feature of the Zoelly turbine has always been the design of the runner wheels and guide channels in the diaphragm, the former of which in spite of the high factor of safety required, are enabled to give a relatively high circumferential velocity. Consequently greater latitude is permissible in regard to the number of stages and speed of the steam in each case.

Construction of the Zoelly Turbine.

The Zoelly turbine has from the commencement always been constructed with a horizontal shaft; experience with water turbines having shown that by this method the simplest form of bearing can be used, permitting an easy inspection at all times. In the case of turbines running at 3,600 revolutions per minute a flexible shaft is used, so that the critical speed is sufficiently below the working speed; but in the case of turbines running at 1,800 revolutions per minute and under, the contrary is the case, the shaft



15,000 K.W. ZOELLY STEAM TURBINE.

is rigid and the critical speed is above the working speed. The shaft is supported by two bearings which are lubricated by oil under pressure, and is connected by means of a rigid or flexible coupling (usually rigid) to the generator or machine to be driven. The casing is built up in two halves, the joint being horizontal, so that the rotor can easily be inspected without dismantling the bearings. An idea of the accessibility of all the important parts can be gained from the illustration shown.

The impulse type allows large clearances in radial and axial direction. The axial clearances of the runner blades as well as the radial clearances are about 2 inches., nevertheless, the steam consumptions obtained with the Zoelly turbine is claimed to be lower than that of any other make, particularly for the large size high speed units. It is what can best be called a commerial machine, that is a machine giving, with the greatest reliability, best economy and least wear, with a minimum of attendance required. The total thermodynamical efficiency obtained has been as high as 74 per cent.

Twenty firms are at present licencees of the Escher Wyss Co., of Zurich, who built the first machines and have since supplied the bulk of those put on the market.

Up to 1913, Zoelly turbines of 3,350,000 horse power have been supplied by the Zoelly Syndicate, of which those built by Escher Wyss & Co., had a capacity of over 800,000 horse power. The largest size machine was 15,000 k.w., equal to 28,000 horse power. Two of these units were supplied to the Rheinisch-Westfaelisches Elektrizitaetswerk (Germany)—one in 1911, and the second as a repeat order in 1913. A number of machines of similar size have been built for other concerns, a plant of four 10,000 k.w. units for the Chile Exploration Co., of New York, being a pertinent example.

IMPROVING THE ENGINE LATHE

By D. O. Barrett.

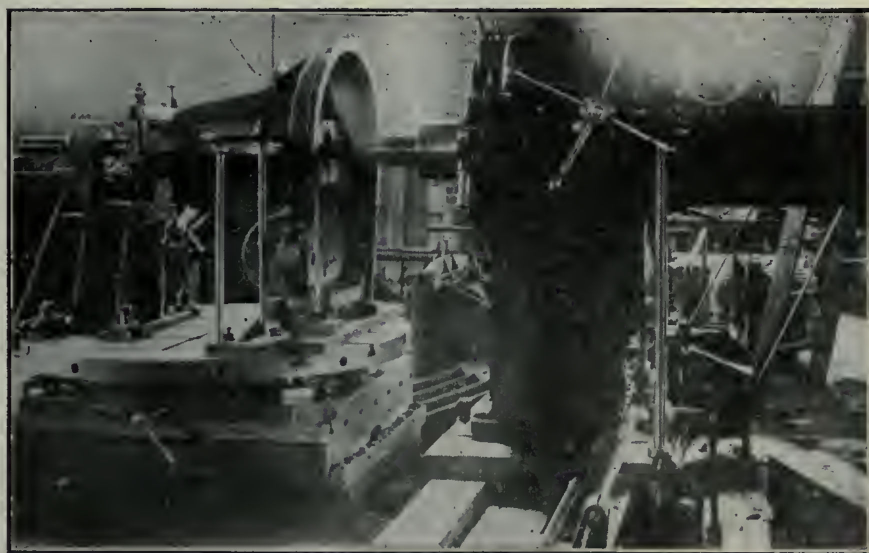
IN these days of competition it is highly important that each manufacturer keep as nearly as possible all of his tools working at the very maximum, and while it is not always possible, and sometimes, perhaps, not desirable, to have the very latest type of machine tools suitable for the work, for various reasons peculiar to each manufacturer, it is highly desirable that the tool producing a certain class of work shall do so at the minimum cost as regards the capital invested, the labor expended, upkeep and depreciation. Of course, in the lathe field, the turret lathe for the greater majority of jobs is acknowledged to hold supremacy, yet in a good many cases the old, despised engine lathe will often produce results not obtainable by even the best of turret lathes.

For certain classes of work the engine lathe is without a peer. The main difficulty for the man in charge is to so assign the work that both the turret and the engine lathe may operate most advantageously. In many instances it is possible for one turret lathe to serve as a feeder for several engine lathes; that is, the second or third operation upon certain pieces may be done upon less expensive machines, as well as by less expensive help, also being done somewhat quicker in point of time, thus effecting a double saving. Again, the amount of money invested in a first-class turret lathe is, in many cases, sufficient to install three or four engine lathes.

The purpose of this article is to show a method devised by the writer for improving the engine lathes under his supervision. In this case he was not fortunate enough to have any kind of a turret lathe at all, and consequently the desire was to make the engine lathe perform as nearly as possible all the adjuncts of the turret lathe, and the labor and expense involved were amply justified by the results obtained. In this particular shop there were several engine lathes of practically the same capacity, and the only difficulty was in refraining from overloading these machines.

The cut shows the style of cast iron bridge which was mounted across the back of the carriage and took the place of the turret. This bridge was dowelled on each side of the carriage back of the tool slide, and the hole for holding the boring bars was bored by means of a bar between the lathe centres, so that it came in exact alignment with the lathe spindle; the bridges on the different lathes were bored the same size, so that the tools of any one lathe could operate, if necessary, on any other. The bars were held in position by means of a shoulder on the bar, slightly larger than the bored hole.

In the cut, in which a cam box for a gasoline engine is shown, the bar was slotted and the boring tools held in place by means of a wedge at the front, these being removed and replaced again at each operation. A bushing was provided in the holding fixture for guiding the bars at the outer end. After the hole was bored the carriage was run back until the bar came entirely out of the case, when a reamer was slipped on the tapered end and then fed through by hand. For facing, the ordinary cross slide was used, but this does not show in the cut, as the tool was removed to get a better view of the method of holding the piece. It was not necessary to remove the tool post at each operation, as the cross slide could be run back out of the way when boring.



IMPROVING THE ENGINE LATHE.

In this particular case there is, of course, one disadvantage to this method which cannot be overcome, and that is that facing and boring cannot be done simultaneously; but in the shop where a turret lathe is at hand this work would probably not be done on this machine.

The cost of these bridges and tools is in most cases very insignificant in comparison with the results which can be obtained, and the writer would recommend this method to anyone who desires to further increase the field of usefulness of the engine lathe.

The Canadian Westinghouse Co., Ltd., Hamilton, has opened an office and warehouse in Fort William, Ont., with B. James, of Hamilton, in charge.

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Vol. XII. AUGUST 6, 1914 No. 6

PRINCIPAL CONTENTS.

THE VALUE OF A WORKMAN.

A SHORT time ago the American firm of Niles-Bement Pond Co. were awarded a contract involving some millions of dollars for the equipment of new arsenals in China. Although other considerations than the amount of the bid, such as time, quality and capacity of the machinery involved, were large factors in bringing the work to this aggressive firm, the whole transaction furnishes some food for thought on the part of all patriotic citizens of Canada and the United States.

This business was secured in the face of the keenest competition of Britain, Germany and other great manufacturing countries who specialize in this kind of work. Machinists and tool makers of Belgium are said to receive less than one dollar per day, while the corresponding employees on the American continent receive as much as four dollars for the same period of work. Taking into account the recognized fact that the American workman is the highest paid artisan in the world, it would seem that under certain conditions at least, the size of the wages paid in the process of manufacture does not materially affect the cost of the product.

It can hardly, however, be fairly assumed that the American mechanic can do at least four times as much work as his foreign competitor, even though he obtain about this proportion of results. The greater part of this achievement must be charged to other factors than physical stamina and endurance. There exists in America as in no other land, a condition of free competition among employees as well as employers. This rivalry is without ill-will, and is towards the attainment of methods of reducing labor and bettering working conditions as well as to obtaining a greater amount and better quality of the product.

The manufacturers encourage this by rewarding the more productive employees with increased pay and promotions in positions, and even though the remuneration is often complained of, the American workman, more than any other, is paid in proportion to his accomplishments. The employers have shown considerable daring in making the goods and creating the market for them afterwards, and results have shown that, just as sure as the condition of the demand affects production, so production will set up a demand.

By far the greatest element in the enlargement of the scope of our workmen is the universal spread of broad and practical education. America is the home of the correspondence school, the cheap technical journal and the greatest attainments in university education. The application of trained mechanics' brains and unhindered personal effort to the production of the necessities and comforts of life have enabled the workman of this continent to produce, in comparison with all others, the most for his employer, to be of the greatest value to his country and to obtain the most out of life for himself.

ROOM FOR IMPROVEMENT IN THE FOUNDRY.

IN nearly all branches of the mechanical trades a very large part of the gray matter has been devoted to reducing, if not practically eliminating, the physical and mental effort required of the operatives. This has particularly in some branches of the machinists line, resulted in practically making it a sedentary occupation, and what so-called skilled labor is left, is not calculated to severely tax the brawn of the mechanic. In the pattern shop, the addition of the universal saw, jointing and grinding machine is working towards the same end, the stool or chair now being a necessary part of the patternmaker's equipment. In the foundry alone the progress of mechanical improvement is having the reverse effect, if any.

A number of companies have put forth creditable efforts in the direction of making life easier for the moulder but much remains to be done in this direction. The cutting of the sand by machinery and feeding it to the moulds from overhead hoppers; the transference of the moulds to a pouring floor to be poured by a separate crew of men, and the extended provision of improved lifting and handling machinery have been inaugurated completely or in part by a number of progressive firms. The improvement of conditions in the foundry, heretofore more or less neglected, requires and is worthy of the best brains of mechanical engineers.

INDUSTRIAL NOTABILITIES--No. 46

HON. GEORGE A. CLARE, M.P., was born at Preston, Ont., June 6, 1854, of German descent, the son of John and Marguerite (Beck) Clare. He was educated at Preston Public School and started in his father's stove business in 1875. With his brother Frederick, and Henry C. Hilborn, he acquired the business in 1881, and operated under the name of Clare Bros. & Co., being later incorporated under the present name in 1901.

In matters commercial, Hon. George A. Clare is president, Clare Bros. & Co., manufacturers of stoves and furnaces, Preston, Ont.; president Galt Stove & Furnace Co., Galt, Ont.; president Clare & Brockest, Winnipeg, Man., manufacturers of stoves and furnaces; president Canadian Office and School Furniture Co., Preston; president Solid Leather Shoe Co., Preston; director Preston Car & Coach Co., Preston; director

HON. GEORGE A. CLARE, M.P.

Stamped & Enamelware, Hespeler, Ont.; and director Wellington Mutual Fire Insurance Co., Guelph, Ont.

He was councillor of Preston for two years; Reeve ten years; first mayor in 1900, when Preston was incorporated a town; member County Council of Waterloo, 1888-1898; warden County of Waterloo in 1895; elected Member of House of Commons, 1900; re-elected, 1904, 1908 and 1911, and appointed Member Privy Council of Canada, Jan. 1st, 1913.

He married Catherine Fink, daughter of Paul Fink, Waterloo, on April 19, 1876, there being one son and three daughters of the union.

In religion, Hon. G. A. Clare is a Lutheran, while his club life embraces the Albany, Toronto; Waterloo, Waterloo; Waterloo County Golf and Country; Galt, Galt; and Deutscher Verein, Toronto. His residence is at Preston, Ont.—Photo, courtesy the International Press.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh	.....	$13 65
Lake Superior, charcoal, Chicago	.....	16 00
Ferro Nickel pig iron (Soo)	.....	25 00
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X	18 50	17 85
Victoria, No. 2 Plain	18 25	17 60

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.00
Steel bars, f.o.b., Toronto	2.00
Common bar iron, f.o.b., Montreal	2.05
Steel bars, f.o.b., Montreal	2.00
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

		Montreal.	Toronto.
Plates, ½ in. 100 lbs.		$2 20	$2 20
Heads, per 100 lbs.		2 55	2 55
Tank plates, 3-16 in.		2 50	2 50
Tubes, per 100 ft.,	1 inch	9 50	9 00
" "	1¼ in.	9 50	9 00
" "	1½ "	9 50	9 00
" "	1¾ "	9 50	9 00
" "	2 "	8 75	8 75
" "	2½ "	11 15	11 50
" "	3 "	12 10	12 50
" "	3½ "	14 15	14 50
" "	4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in.	75%
Finished Nuts over 1 in.	72%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh	$20 00
Open hearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	24 00
Wire rods, Pittsburgh	25 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	72	62
7, 8, 10 in.	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload	$15 25	$15 65
Electrolytic copper	15 00	15 40
Casting copper	14 50	15 25
Spelter	5 35	5 35
Tin	45 00	45 50
Lead	4 85	4 85
Antimony	9 00	8 50
Aluminum	20 00	18 50

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15
Lard Oil, per gal.	0.60

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3 45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10 3/4 oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1 1/2-in	$37.50	$30.00	$17.50
33/64 to 3/4-in.	41.25	33.00	19.25
7/16 to 1/2-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	95c lb.
Leather in sides	85c

BELTING RUBBER.

Standard	60%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4.95
1 inch	8.05
1 1/4 inch	12.65
1 3/8 inch	15.30
1 1/2 inch	16.50
1 5/8 inch	19.40
1 3/4 inch	22.50
1 7/8 inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., August 3, 1914.—The prevailing dullness of the last few weeks in machinery circles still continues. The European crisis seems to have overshadowed the optimistic outlook, and business is now at a complete stand still. Prospective buyers hesitate to close any deals, and a general anxiety is very evident; all cables from the seat of the trouble being received with feverish interest. For the past week, however, small orders have been continuing to pour into the machinery supply houses. This business serves the purpose of keeping their organizations intact, although representing but a small turnover.

The intense gravity of the situation seems to impress everyone. To what extent the Canadian and American markets and commerce will be affected is a matter of conjecture, and the outlook seems to be generally far from bright. Banks have practically ceased to advance money on even the best of security, and business is thus additionally crippled. Nevertheless, as far as the month of July is concerned the returns issued by the civic building department show that the number of permits granted totaled 354, valued at $2,521,520, an increase of nearly a million dollars over the permits issued in the same month last year. The figures for July, 1913, were 352 permits, valued at $1,555,665. The reason for the increase was that there were issued permits for three churches and for the large Loyola College that is to be erected in Notre Dame de Grace.

Dealers in steel and iron, who aim to supply largely European products, and on account of the uncertainty of receiving further shipments, prefer rather to conserve their stock and await developments. On account of the low prices of this class material all dealers have a pretty large stock on hand, and feel certain that they can supply all demands for some time to come. However, should it become necessary, these goods can be imported from the United States.

Metals.

The metal market is also very dull. Little or no change in prices has occurred, and all orders are of the hand-to-mouth variety. A fair advance in the price of tin is about the only change of note in the price list.

On August 1 the London Metal Exchange was closed until further notice.

Toronto, Ont., August 4, 1914.—It is impossible to form any definite opinion as to what will be the effect on business in Canada of the international complications in Europe. The extent of the effect will depend upon the length to which the powers concerned will go in prosecuting their respective causes. It is unthinkable that such a calamity as a general European war should become an accomplished fact, but the situation is very grave and signs are not wanting this will happen. Even if better counsels prevail and peace reigns once more, the effect already produced will leave its mark on business conditions for some time. Great difficulty will be experienced in obtaining funds for financing new works, as banks will be obliged to conserve their resources to the utmost. The improvement in trade which we were beginning to enjoy will receive a serious set-back, and it is highly probable that construction work of any magnitude will be stopped until the trouble has subsided and confidence is restored in financial circles.

The crop reports are not quite so satisfactory, and indications are that about an average crop will be gathered this year. If the war continues, better prices will be obtained, which will offet to some extent the disappointment occasioned by the reduction in yield.

The Steel Market.

No change of any importance is noticeable in the iron and steel markets as yet, although the outlook of hostilities in Europe is bound to have a serious effect on the steel trade here. It is difficult to say how serious the situation really is, but it will no doubt call a halt to any large expenditures as railway exto any large expenditures, such as railway extensions and on public works.

European war news has not yet affected the steel trade in the United States except in the rise in price of some imported products, such as galvanized sheets, etc. An effect will no doubt be felt on account of the increased difficulty in financing. Up to the present time a slight improvement in the situation had been noticeable, July proving practically as good a month as June both as regards tonnages booked and production. The United States Steel Corporation statement for the June quarter shows a falling off in earnings of 50 per cent. over the corresponding quarter last year, but an improvement over the first quarter of this year.

Pig Iron

The pig iron market is dull, and does not show any indication of improvement. Reports from the United States indicate that the pig iron market generally is quiet, although in some districts better conditions prevail. Prices continue stationary.

Machine Tools.

The demand for machine tools is quiet, and shows no tangible improvement. In view of events in Europe it is highly probable that the demand will fall off still further, and the market become quieter than it has been for months.

Metal Markets.

The European crisis is affecting the metal market, and a general slowing up in business is noticeable. Prices are fairly steady, with the exception of tin, which has taken a big jump, having advanced 20 cents a pound, with the prospect of a further rise. The New York Metal Exchange will reopen to-day after being closed for several days.

Personal

T. R. Perkins, assistant manager of Toronto branch of the Pedlar People, Ltd., has been appointed manager of the Winnipeg office.

A. F. Hatch, formerly president of the Canada Steel Goods Company, of Hamilton, Ont., has been appointed general manager and treasurer of the Hamilton branch of the Steel Goods Company, of New Britain, Conn., the latter company having absorbed the former. Operations will be commenced without delay on the erection in Hamilton of an extensive new plant.

Captain Alex. Cameron died on July 22, at Owen Sound, Ont., at the age of 84. Captain Cameron was born in Scotland and came to Canada at the age of 7.

Trade Gossip

The Eberhard & Wood Mfg. Co., have purchased two Wright & Wood motors from the Dominion Machinery Co., Toronto.

The Turbine Equipment Co., Ltd., Toronto, has recently obtained an order from the J. W. Danforth Company for two De Laval 125 h.p. steam turbine-driven centrifugal pumps.

The Crescent Machine Co., Ltd., 20 Longueuil Lane, Montreal, are going to manufacture the "Warner" silent tumbling barrel, described in Canadian Machinery issue of July 16 as a product of the Warner Bros. Co., Bridgeport, Conn.

The Refrigeration & Engineering Co., of Winnipeg, have been awarded a contract for a Campbell oil engine by the town of Shoal Lake, Man. The Canadian General Electric Co., Toronto, was awarded a contract for the electrical equipment.

Mussens, Ltd., Montreal, have received an order to equip the shop of the Cook Construction Co., of Halifax, N.S., with a complete line of machine tools, including lathes, planers, drills, and pipe machines. The Cook Construction Co. is engaged in the extensive improvements now being made to Halifax harbor.

Representation Discontinued.—We are advised that the arrangement whereby the Canadian Fairbanks-Morse Co. have been exclusive agents in Canada for the Niles, Bement, Pond Co. ,and their Canadian subsidiary, the John Bertram & Sons Co., Dundas, Ont., has been discontinued as at August 1. The Canadian Fairbanks-Morse Co. will continue to represent the product of the R. McDougal Co., Galt, Ont., as also the Brown & Sharpe line of milling machines, grinders, screw machines. Arrangements have further been made with William Seller & Co., Philadelphia, who for many years have been manufacturers of railroad machinery, etc. In lieu of the representation of the Pratt & Whitney line of small tools, which was also discontinued at August 1, the following lines will be carried by the Canadian Fairbanks-Morse Co.:—Cleveland twist drills and reamers, Brown & Sharpe milling cutters, and Wells Bros., of Canada, Ltd., taps and dies.

Tenders

Ottawa, Ont.—Tenders will be received until Monday, August 31, 1914, for the construction of harbor improvements, being a wharf and approach at the foot of Wentworth street, in the City of Hamilton. Plans and forms of contract can be seen and specification and forms of tender obtained at the Department of Public Works and at the offices of the District Engineers, Confederation Life Building, Toronto, Ont.; Windsor, Ont., and on application to the Postmaster at Hamilton, Ont. Blue prints can be obtained at the Department of Public Works by depositing an accepted bank cheque for the sum of $20, made payable to the order of the Honorable the Minister of Public Works, which will be returned if the intending bidder submit a regular bid. R. C. Desrochers, secretary.

Toronto, Ont.—Tenders will be received up to Monday, October 5th, 1914, for constructing across the Don Valley a bridge consisting of five steel arch spans, with piers and approaches, the width being eighty-six feet and the length, approximately, sixteen hundred and eighteen feet. Bidders may obtain specifications, including plans and form of tender, on application to the Commissioner of Works, Toronto, after paying to the Commissioner of Works, $25 for each set, this sum to be refunded upon return of plans. The engineer's estimate of quantities will also be sent on request. Specifications, including plans, may be seen at the offices of the Commissioner of Works, Toronto; the Commercial Intelligence Department of the Board of Trade, London, England. Those desiring to submit tenders on reinforced concrete construction for the above bridge are hereby notified that they may prepare and submit, without any expense whatsoever to the city, their own plans and specifications, based on the loading given in the specifications for steel construction, and may tender on the same. These tenders will be received up to noon on Monday, October 5th, 1914.

Refrigeration

Regina, Sask.—The buildings and plant of the Regina Cold Storage Co. have been sold for $27,000.

Lethbridge, Alta.—Delany's, Ltd., have installed a $5,000 ammonia cold storage plant in their market on Fifth Street.

Montreal; Que.—R. E. Bostrom, McGill Building, Montreal, is the architect for the proposed artificial ice plant for the Montreal Arena Co.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Pembroke, Ont—James Sarsfield is in the market for 800-gallon fire engine.

Shawinigan Falls, Que.—The Belgo-Canadian Pulp and Paper Co. will install a new power plant.

Kincardine, Ont.—The Water and Electric Light Commission has purchased a boiler from Hunter Bros. of this town.

Rigaud, Que.—The Rigaud Granite Co. are in the market for a stone crushing plant, cars, electric motors and other equipment.

Weyburn, Sask.—Keely Bros., of Omaha, Neb., have established a temporary plant for making boilers and will later build a modern shop.

Berlin, Ont.—A Toronto syndicate has purchased the plant of the Berlin Central Heating Co. It is proposed to make considerable extensions to the plant.

Montreal, Que.—Damage estimated at $5,000 was done on July 29 when the main building of the Bordeaux Foundry Co., at 6332 Bordage Street, was gutted by fire. The origin of the blaze is unknown.

Prince Rupert, B.C.—Mr. T. W. Sheffield, formerly Industrial Commissioner of Regina, is reorganizing the Rupert Marine Iron Works, an industry which promises to be of great importance to this city.

Stony Mountain, Man.—Good progress is being made on the power house and station for the street railway, which is being built in Oak Park. The steel is already laid to this point, ready to bring in the machinery.

Medicine Hat, Alta.—The Saskatchewan Bridge and Iron Co. is now employing a large force of men in the completion of their new plant, the steel work being already up. By fall, according to the plans of the directors, the factory should be in full operation. About one hundred hands will be employed in the new plant, and a capital investment of something like $100,000 is involved.

Penticton, B.C.—The Okanagan Valley Electric and Power Co. has completed the purchase of the Oroville electric light plant from the Similkameen Power Co. It is stated from a reliable source that the company intends to develop the power at the Similkameen Falls to the fullest extent, with the purpose in view of operating an electric line, the northern terminus of which will be Penticton.

Edmonton, Alta.—Six million dollars is the estimated cost of a hydro-electric plant which may be installed in the Saskatchewan River, fifty miles west of here, by Sir John Jackson & Co., of Glasgow, Scotland. The plan contemplates the development of 40,000 horsepower. Representatives of Sanderson & Porter, of New York, submitted an offer to the municipality two weeks ago to install a plant, costing $3,500,000 to supply electrical power to the city on a sliding scale, ranging from one cent to a half cent per k.w.h., according to the quantity used. Under this plan the minimum guarantee is 5,000,000 k.w.h. a year. The council will deal with these propositions within the next two or three weeks.

Electrical

Bolton, Ont.—Result of voting here last Monday on Hydro-Electric by-law was 120 for and 4 against.

Strathroy, Ont.—Hydro power, it is expected, will be turned on here early in September. Wiring operations are now being rushed along.

Weston, Ont.—Now that the matter of electric lighting on Scarlett road has been completely dealt with, the Weston Hydro Commission will take up the extension of a line into York Township.

Toronto, Ont.—Plans, submitted by the Toronto Hydro-Electric Commission, for a one-storey brick and stone addition to the Macpherson Avenue sub-station, have been approved by the city architect's department. The addition will cost $15,000.

Walkerville, Ont.—The town is to have light and power competition, the same as Windsor, the Hydro-Electric Power Commission offering to pay $75,000 for the plant and stores equipment of the Walkerville Light & Power Co., while the company held out for $9,500 more.

Brampton, Ont.—In response to a petition of Robert Noble Co., Ltd., millers of Norval and twenty other ratepayers of the village, the council of the township of Esquising has passed a resolution to the effect that the council contract with the Hydro-Electric Power Commission to obtain a supply of power for Norval.

Brantford, Ont.—Work on the hydro-electric branch line between Brant substation and Port Dover is to be commenced immediately, and in a short time power will be available for Burford, Scotland, and elsewhere. Engineers have been over the ground and have laid out a route. The construction of the line will be gone ahead with as rapidly as possible.

Waterloo, Ont.—The demand for hydro power in Waterloo and vicinity is constantly increasing. The Hydro-Electric Commission is taking steps to supply the farming community west of the town and have a number of men engaged in the erection of a line from Waterloo which will supply the farmers with current for lighting and power purposes. It is expected that it will be completed within two weeks.

Windsor, Ont.—In connection with the extension of the main transmission line—St. Thomas to Windsor—it is reported that the Provincial Hydro-electric Commission were able to deliver power in Windsor on August 1. It is understood, however, that Windsor is not quite ready with its distributing plant, and that a week or two may elapse before such is available. The new line between Dundas and Niagara is expected to be completed by the beginning of September. About eighteen miles of concrete footings have already been carried through, and thirty men are working at the rate of about a mile of footings in a day.

General Industrial

Wingham, Ont.—The Bell factory, of the Canada Furniture Co., is at present undergoing repairs.

Hull, Que.—The machinery and plant of the Canada Cement Co. has been badly damaged by fire. A loss is estimated at $25,000.

Galt, Ont.—It is announced that purified gas will be delivered to Galt by September 1. Construction of the purification plant at Glenwood is proceeding in a satisfactory manner.

Sarnia, Ont.—It is understood that Hon. W. J. Hanna, who is in England at present, is endeavoring to secure for this city the proposed Canadian branch of a large British smelting concern.

Hamilton, Ont.—Mayor Allan announced that it is almost certain that the United Gas & Fuel Co. will build a $1,500,000 coke and gas plant here, as was first announced several months ago.

Iroquois Junction, Ont.—The first pulp ever manufactured in Timiskaming was made on July 29 in the big machines at the plant of the Abitibi Pulp and Paper Co. Regular production and daily shipments of pulp started last Monday.

Cobourg, Ont.—Geo. Thompson, of the Thompson-Macdonald Co., is promoting a new industry here for the manufacture of drain tile. The project is to form a syndicate to purchase a drain tile machine and make tiles here.

Windsor, Ont.—The Ideal Concrete Machinery Co. has closed the contract for its new factory branch on McDougall Avenue. The building will be started without further delay and the company expects to be in operation in September. The manager of the company will be C. F. Pulfer, formerly of Walkerville.

Port Arthur, Ont.—A brick plant is to be established on the property of the Canadian Resources Development Co. At first the plant will turn out 5,000 bricks daily, which will eventually be increased. It will be in operation this fall, the material for the erection of the plant having been already shipped from England.

Brantford, Ont.—Operations are now going on for the reconstruction of the Canada Glue Works at Echo Place, after the fire that destroyed the plant there last April. Work has been going on now for the past six weeks. Construction has now begun on the walls of the new building which will be larger and better equipped than the old plant. Up-to-date machinery will be installed.

Beamsville, Ont.—President Jas. Ross of the Dunnville, Wellandport and Beamsville Railway has announced that the Hydro Commission has agreed to take over the D., W. & B. Railway and complete it to Beamsville. The plan, according to Mr. Ross, is to make this line a feeder for the main line ,which the Commission is now surveying for between St. Catharines and Hamilton.

Bridgeburg, Ont.—A branch of the Hard Mfg. Company, of Buffalo, may be located here, providing negotiations at present under way are consummated. The company ask that fifty thousand dollars stock be subscribed locally. This, it is thought, can be arranged for without any serious difficulty. An option has been secured on five and one-half acres of land adjacent to Crook Street.

Estevan, Sask.—F. W. Newcombe, manager of Estevan Brick & Coal Co., is at present in Mason City, Iowa, making arrangements for the installation of new dies at the brick plant here for the making of hollow brick and other kinds of hollow ware. The change will also necessitate some new kilns being built, as a special process is required in the drying different to the method now being used at the plant.

Granby, Que.—Work on the installation of the new power plant at the Empire Tobacco Factory is expected to commence very shortly. There is much work to be done, including the excavation of a tunnel and the placing of new machinery, so that it will be several months before the new building is occupied and the extra plant in active operation. About four hundred hands are at present employed, which will be increased as business improves and the new additions to this establishment are completed.

Dundas, Ont.—In the course of the next few weeks Dundas will have another manufacturing plant added to its list. The Mercury Mills, Ltd., of Hamilton, has taken a two years' lease of one of the plants in the old cotton mill, now used by the Chapman Engine Works, and intends establishing a branch factory here. Workmen are now engaged in making extensive alterations and repairs, and as soon as these are completed the machinery for carding and spinning of the finer classes of woollen yarns will be installed.

Toronto, Ont.—The incorporation notice of the National Explosives, Ltd., a company capitalized at $2,000,000, with head office at Toronto, appeared recently in the Canada Gazette. Mr. Gerard Ruel, solicitor of the C.N.R., states the company is being formed in connection with a reorganization of the Olympic Powder Co., which has a dynamite and explosive manufacturing plant at Deseronto. The incorporation of the new company is merely a financial reorganization, and does not mean that the plant will undergo any changes.

Municipal

Rosetown, Sask.—The ratepayers have passed a by-law for the purchase of fire-fighting equipment.

Ottawa, Ont.—The Board of Control have decided to purchase road repairing equipment immediately.

St. Thomas, Ont.—The City Council has authorized the expenditure of $20,000 on repairs and improvements to the gas plant.

Guelph, Ont.—The new artesian well near the pumping station is supplying about 50,000 gallons of water per day to the reservoir for city use.

St. Thomas, Ont.—The City Council has authorized the expenditure of $20,000 on repairs and improvements to the present city gas works plant.

Montreal, Que.—The city will shortly call tenders for 200 lamp standards with cable connections. The new standards will be of the single lamp type.

Stratford, Ont.—The Fire, Light and Cemetery Committee of the City Council signed the contracts for its new fire fighting apparatus last Friday.

Outremont, Que.—The purchase of road-making equipment, including concrete mixer, steam drill and a tar kettle, has been sanctioned by the council.

Regina, Sask.—The City Council has awarded to the Regina Foundry Co., Ltd., Regina, the contract for fabricating the steel work for the new 5,000,000 gallon reservoir.

Dutton, Ont—By a unanimous vote the ratepayers last Friday endorsed a by-law which provides for a supply of gas for the municipality from the Southern Ontario Gas Co.

New Toronto, Ont.—Plans for the new pumping station in connection with the waterworks system have been approved by the Board of Health, and as a result tenders will be called shortly.

Vernon, B.C.—The city will spend $100,000 on improving the sewage system. A new disposal plant will be erected. Cummins & Agnew are the engineers.

Courtright, Ont.—Great progress has been made under direction of O. M. Post, of the Union Gas Co., in laying the pipe lines into this town, and this week will likely see this part of the work completed.

Montreal, Que.—Tenders for the erection of a fire and police station for the town of Maisonneuve, at a cost of $70,000, will be called shortly by the architect, Marius Dufresne, Ontario Street, Maisonneuve.

Winnipeg, Man.—Two sets of preliminary plans for better traffic facilities at the St. James subway have been placed before the works and property committee by the Winnipeg Electric Railway Co.

Sarnia, Ont.—City Engineer McLean states that if nothing goes wrong, the new waterworks, under construction at the lake shore, will be pumping water by the

Electrical Equipment for Motor Driven Machine Tools-I

By C. Fair *

The importance of motor drive for the machine shop is every day becoming more evident and more thoroughly appreciated, and it is worthy of note that in practically all new industrial plants where power is required, electrically-driven machinery has been installed. Little trouble is now experienced with either motors or control for the ordinary type of machine tool, due largely to a better understanding of the situation between machine builder and user.

ORIGINALLY, lighting was the principal, if not the only, advantage claimed for electricity. Little was known of shop equipments as we now see them. It is doubtful if there were any electrically operated cranes or if there was any electrical transportation in shops. The first few motor drives were scattered and confined practically to line shaft drives and to portable drills with flexible shafts, while the individually driven machine tool was about as much of a curiosity then as an individually steam engine driven machine tool is to-day. When motors were installed to replace the numerous engines scattered about the shops or to break up the long mechanical transmission lines, a great saving in power and improvement in continuity of service were noticed, and it was during this period that many of the claims of saving in power were made that now appear rather extravagant.

It will be seen how enormous were the power losses when one considers that steam was often transmitted to numerous engines for long distances, from one or more power stations, through small pipes which were often uncovered, or else the power was distributed by long shafts transmitting power from one building to another or from one shaft to another, around corners, by quarter turned belts and to various floors, etc. When the long shaft or any part of the long transmission system was broken, it often tied up a large part of the plant until key-ways could be cut and the shafts re-coupled or a section of the shaft replaced, or the belts repaired, as the case might be.

The Manufacturers' Attitude.

To-day the two important questions continually before the manufacturer are how to increase production and how to decrease cost. In the majority of cases labor is the greatest cost of production. Thus, where machine tools are a considerable factor in the production, the importance of obtaining a maximum output from the tool is evident. Tools that are limited in their productiveness because of the lack of power at the tool are a source of expense to the manufacturer, not only on this account, but on account of the excessive labor due to the additional time required. The power cost of production is comparatively small, roughly, varying from one to three per cent., while the labor cost is usually a very large item of the production cost, often amounting to 50 per cent. and upward. If, therefore, by increasing the power on a given tool its output can be increased, the conclusion is obvious.

Motor Drive Importance.

The importance of motor drive for the machine shop is every day becoming more evident. Recent tariff legislation is causing American manufacturers to see, as never before, the necessity of using the most modern methods in order to compete with manufacturers of other countries where labor is cheaper; hence the continuous growth in the installation of electrically driven machinery. In practically all new industrial plants where power is required, electrically driven machinery has been installed. Due to the great improvement in motors, accessories, and methods of application, and owing to the large number and variety of motor-driven tools in service to-day, the relationship of motors and control to machine tools is much better understood by the machine builder and the user than heretofore. Consequently, comparatively little trouble is experienced with either motors or control for the ordinary type of machine tool. Misapplications of both motor and control occur occasionally, due largely to insufficient or unreliable information regarding the characteristics of the machine, but the number of these misapplications is relatively small.

The tendency for both over and under-motoring machines is constantly growing less, owing to the large number of tests which have been made, to the accurate information available, and to the great number of motor-driven machines now in service. There is still, however, a slight tendency on the part of some machine builders to over-motor their machines either with the mistaken idea of the strength of the machine or with the idea that possibly prospective customers will be impressed with the enormous power required by their "heavy type" machines.

Conversely, other manufacturers want to show how little power it takes to operate their "very efficient" machines, and consequently get into overloaded motor troubles. These extremes are gradually disappearing, and a more normal condition is taking its place. In a comparatively short time the greatly over-motored and under-motored machine will be a thing of the past, at least in so far as the general type of machine is concerned.

Motor Drive Ratings.

A number of manufacturers have already recognized three ratings of motor drive on certain of their machines; namely, heavy, medium, and light. Much of the existing trouble in motor applications to special machines, or to machines rigged for special operations, could easily be avoided if only preliminary tests were made with a temporary motor before making the permanent installation. A not uncommon source of trouble with motor-driven tools, and one that could easily be avoided, is that of attempting to increase the productiveness of the tool considerably by speeding up the machine, increasing the cuts, or attaching automatic feeding devices, etc. Although any one of these changes will increase the productiveness of the tool, the motor must not be overlooked for, if the tool were originally under-motored and the capacity of the motor is not increased when the change is made, trouble is very apt to result. Increasing the productiveness of the tool calls for an increase in power, although there are some cases where this is not true.

Motor Drive Advantages.

Although the advantages of the motor drive have been dwelt upon at length numerous times, a brief statement of the advantages derived from electrical installations will perhaps be worth repeating:

1.—Maximum output of the direct connected tool, due to greater power and overload capacity, absence of slipping belts, closer speed regulation which allows a maximum cutting speed for metals of varying degrees of hardness, rapid speed changes, quick starts, stops, reversals, independent operation of auxiliaries and ease of manipulation through convenient control stations. Too much stress cannot be laid on maximum output of tools.

2.—Power distribution not only for

*Power and Mining Engineering Department, General Electric Co.

tools, stationary or portable, but for lights, cranes, elevators, furnaces, welders, transportation, etc. This means that power and light can be had quickly and cheaply in any part of the buildings or yard, permanently or temporarily without regard to structural conditions.

3.—Elasticity in the arrangement of tools. Tools can be arranged to the greatest advantage for sequence of operation in routing work, and also for good lighting as well as for compactness when necessary.

4.—Ease of adding new tools and of moving and rearranging tools. Ease of adding new tools means a great deal in growing plants. Rearrangement becomes necessary after reasonable growth or because improvements in methods of manufacture call for a better routine of work.

5.—Head room for cranes, hoists, etc. For example, note the expensive manner in which work is often handled because belts or shafting interfere with the installation of cranes or hoists.

6.—Facility for running only such tools as are required for overtime work.

7.—To a large extent the elimination of belts and belt troubles.

8.—Unobstructed light and sanitation. Numerous belts obstruct light, whether natural or artificial. Under the modern structural conditions, avoidance of the well understood difficulties of line shaft installation in concrete buildings.

9.—Safety to operators. The individual motor drive offers absolute protection to the operator from accidential starting up of the machine by merely opening a switch. Machines so protected cannot be started unexpectedly by the starting up of line shaft, the creeping of belts from loose to tight pulley, the sticking of clutches, etc., or by the accidential tripping of clutches by the operator. This additional safety is of particular advantage on machines requiring certain setting up operations, as on punch presses, etc., also by the fact that machines can be quickly stopped from any one of a number of motor control stations.

10.—Competition to-day necessarily means the monotonous duplicate system of manufacturing wherein the individual makes only one part of the finished product. It is now recognized as not only desirable but as economical that some form of interest be restored to help break this monotonous routine of duplicate manufacturing. This can and is being accomplished in a manner by making the surrounding attractive. Electric drive not only increases production, but reduces to a minimum many of the unattractive features of the shop, such as overhead revolving pulleys, masses of moving belts, noisy transmission, stirring up of oil and dust, and bad lighting conditions. Electric drive also reduces many heavy manual operations to a minimum by the use of auxiliaries. It pays to capitalize cheerful surroundings.

Increased Cutting Speed Feature.

The general use of high speed steel has made it not only possible, but necessary for economical production, that the cutting speed be increased in order to meet competition. Increasing the cutting speed naturally means more power; and while much has been said from time to time regarding the increased production and saving in power due to applying the power direct to the tool, yet the writer has very serious doubts if anything like the real importance of this direct application of power is realized in many cases, even by those who are advocating it. For instance, the saving of power is looked upon generally as a matter of how much of the transmission friction load can be saved, and, though this saving may amount to 50 per cent., it is in many cases only a part of the real saving, as has been proved by numerous tests made by the writer.

The slipping, due to a belt not being able to pull its cut, means waste power and loss of production. If the cut be heavy enough, the maximum slip will be reached when the machine is stalled, the power input remaining approximately the same. The load is now entirely one of friction due to slip in the belt. A familiar illustration of this fact is that of an operator decreasing the depth of his cut on account of the slow down, because the belt will not carry the load. The solution of this would seem to be to increase the size of the belts. This will suffice in some cases, but there are numerous instances where either there is not room to increase the width of the belt or where step cones are used the number of steps will have to be decreased; such means as multiple countershafts or additional gearing being included to complete the speed range. Furthermore, it is difficult to shift large belts, and this method generally results in much loss of productive time.

As previously mentioned, up until a few years ago in the majority of shops where motors were used they were usually belted to the line shaft or countershaft of the tool. Adjustable speed motors were not so commonly used then as now, nor were they made in the great variety of sizes and speeds now obtainable. To-day, especially in the case of new tools with their requirements of high power and close speed regulation, it becomes not only more convenient, but in many cases almost a necessity, to apply the motor directly to the tool.

In driving tools with individual motors it will be noted that the motor not only supplies the power and speeds best adapted to the tool, but that in the case of variable speed tools the speed range of the adjustable speed motor alone in many cases will cover the entire speed range of the tool. The motor and its controlling apparatus should whenever possible be connected directly to the tool, thus making a compact unit. This has also the additional advantage of allowing the entire machine to be moved by simply disconnecting the leads and connecting them in the new position. In the case of portable tools this, of course, is an absolute necessity.

Kind and Power of Motor.

Many tests have been, and are being made, to determine the kind, and the horse power of the motor that should be used for different types and sizes of tools; but to the present time the motor is generally considered only as a means of driving the tool and not as one of the main elements of the tool construction. Recent motor improvements will produce many new designs in tools with corresponding higher efficiencies.

While there are numerous motor applications to machine tools which are a decided credit to the machine designers and for which due credit should be given, there are still many motor applications where it is only too plainly to be seen that the motor is an after-thought and thus much of the advantage of the application is lost. In order to derive the greatest advantage from motor drive, the motor should as far as possible be direct-connected to the machine. There are to-day many cases where motors are driving machines through unnecessary auxiliary apparatus. This additional apparatus not only takes up valuable floor space and wastes power, but fails to give the maximum output available when the motor could be connected directly to better advantage and in some cases at actually less cost.

From the foregoing it will be seen that the advantages derived from an up-to-date direct method of applying the motor not only increases the productiveness of the tool, but also decreases the actual power required, by the extent of the friction load loss, and also decreases the first cost of the motor on account of the less horse power required. The writer knows of cases where improved drives have cut the power required to half and even less. A cheap first cost is sometimes an expensive investment.

The advantages of individual motor drive for large tools and for certain of the smaller tools have been conceded for years, but there are many tools where either the cost of the motor or the cost of applying the motor to the tool on account of the construction of the machine is prohibitive. This cost could be modified in making the motor a part of the tool rather than a mere addition to it.

The Coming Foundrymen's Convention and Exhibition

Despite the general business depression in existence for a considerable period previous to the outbreak of an all-European war, with all its horrors, and the certain further dislocation of industrial enterprise, there is ample evidence that in attendance, quality, quantity and influence of subjects to be discussed and manufactures exhibited, this combination function will surpass all of its predecessors.

THE advance programme for the Annual Convention of the American Foundrymen's Association at Chicago, September 7-11, has now been prepared, and will be generally as follows:—

Monday, September 7.—Registration at the LaSalle Hotel.

Tuesday, September 8, 10 a.m.—Joint meeting with the American Institute of Metals and Associated Foundry Foremen at the LaSalle Hotel. Formal addresses to be followed by a number of papers on "Safety Work in Foundry Operations."

Tuesday, 2 p.m.—Individual session of the American Foundrymen's Association at the LaSalle Hotel. Papers will be presented on "Foundry Construction and Equipment."

Wednesday, September 9, 10 a.m.—Joint meeting with the American Institute of Metals at the Saddle and Sirloin Club, adjacent to the International Amphitheatre, where the Foundry and Machine Exhibition Co. will conduct its big exhibition of foundry equipment and supplies. This session has been termed a "Cost Congress." Papers will be read and addresses delivered on the necessity of obtaining accurate costs in foundry operations. How to make bids for work will be discussed, and a report on this all-important subject will be submitted. The cost committee of the American Foundrymen's Association will present its annual report, suggesting a revision of the Standard Foundry Cost System and a number of papers will be read on "Efficiency in Foundry Operations."

Wednesday, Noon.—Ladies' luncheon at the Stockyards Inn.

Wednesday, 2 p.m.—Entire session devoted exclusively to the discussion of "Malleable Foundry Practice."

Wednesday Afternoon. — Stockyards inspection.

Wednesday Evening.—Visit to the White City.

Thursday, September 10, 10 a.m.—This session will be devoted to "Steel Foundry Practice," the programme being prepared by R. A. Bull, senior vice-president of the American Foundrymen's Association.

Thursday, 2 p.m.—This session will be devoted exclusively to the presentation of papers and the discussion of "Grey Iron Foundry Practice."

Thursday Evening.—Banquet at the LaSalle Hotel, for members only. Speeches will be limited to one or two addresses by speakers of national fame. Banquet for ladies at the LaSalle Hotel.

Convention Papers.

We are advised that both the American Foundrymen's Association and the American Institute of Metals have prepared technical programmes of unusual length, and which will contain many features of interest to all foundrymen. Practically forty papers and reports will be presented and discussed by the members of the American Foundrymen's Association at their various sessions. A partial list of papers and reports follows:—

Papers on Safety Work.

"Safety in Foundry Operations," address by M. W. Alexander, General Electric Co., West Lynn, Mass.

"Safety First," by W. F. Riedenbach, Genesee Metal Co., Rochester, N.Y.

"Progress in the Safety First Movement," by Arthur T. Morey, Commonwealth Steel Co., St. Louis.

"Safety in Connection with Grinding Wheel Operations," by R. G. Williams, Norton Co., Worcester, Mass.

"Safety and Sanitation," by A. W. Gregg, Bucyrus Co., Milwaukee.

"Safety First—Driving Back the Saloon," by Thomas D. West, Cleveland.

Foundry Equipment and Appliances.

"Electric Motors and Controllers for Foundry Operations," by S. H. Libby, New York.

"The Second Storey Foundry," by G. K. Hooper, Hooper-Falkenau Engineering Co., Detroit.

"Economies of Motor Drive," by H. F. Stratton, Electric Controller & Mfg. Co., Cleveland.

"Abrasives in the Foundry," by Mr. Dietz, Norton Co., Worcester, Mass.

"Refractory Material," by — Kelly, Harbison-Walker Refractories Co., Pittsburgh.

"Molding Sand Tests," by Dr. Richard Moldenke, Watchung, N.J.

Cost Congress.

"Foundry Cost Keeping," address by F. J. Stevenson, cost expert National Association of Stove Manufacturers, Hoosick Falls, N.Y.

"Efficiency in Foundry Operations, the Essential Factor in Reducing Production Costs," address by A. K. Hathaway, Tabor Mfg. Co., Philadelphia.

"Efficiency in Foundry Work," by F. A. Parkhurst, Aluminum Castings Co., Detroit.

"Revision of the A. F. A. Standard Foundry Cost System," by Harrington Emerson, 30 Church Street, New York City.

"Prevailing Practice in Estimating the Selling Price of Castings," by A. O. Backert.

Malleable Iron.

"Manufacture of Malleable Cast Iron," by Harrold Hemenway, H. W. Cooper Saddlery Hardware Mfg. Co., Moline, Ill.

"Test of Malleable Cast Iron," by Enrique Touceda, Albany, N.Y.

"Effect of Silicon and Carbon in Malleable Iron Practice," by A. L. Pollard, Johnston Harvester Co., Batavia, N.Y.

"Malleable Iron Practice," by J. P. Pero, Missouri Malleable Iron Co., East St. Louis.

"Researches in the Annealing Process for Malleable Castings," by Oliver W. Storey, University of Wisconsin, Madison, Wis.

Steel Session.

"The Electric Furnace in the Steel Foundry," by W. L. Morrison, Welland, Ont.

Discussion of Mr. Morrison's paper, by G. J. Stock, Darlington, Eng.

"Making Steel Direct from Ore in the Electric Furnace," by Prof. T. A. Louden, Toronto, Ont.

"Side Blow Converter Practice," by John Gregson, Sivyer Steel Castings Co., Milwaukee.

"Manufacture of Acid Steel for Castings," by A. F. Blackwood, Detroit.

"Notes on the Microstructure of Steel," by Prof. Wm. Campbell, New York City.

"Some Defects in Steel Castings and Remedies for Them," by John Howe Hall, New York.

"Report of the Committee on Steel Foundry Standards," by Dudley Shoemaker, chairman American Steel Foundries, Indiana Harbor, Ind.

Grey Iron Session.

"Cast Iron With Unusual Structure," by K. W. Zimmerschied, General Motors Co., Detroit.

"Elimination of Waste in Bench Molding," by J. C. Pendleton and R. E. Kennedy, University of Illinois, Urbana, Ill.

"Report of the Conservation Congress," by Paul Kreuzpointer, Altoona, Pa.

"Report of the Committee on Industrial Education," by Paul Kreuzpointer, Altoona, Pa.

"Iron and Its Properties," by Peter F. Blackwood, Michigan Steel Castings Co., Detroit.

Green Sand Cores," by James Mulvey, Rensselaer Valve Co., Troy, N.Y.

"Dangers of Specialization," by Thomas D. West, Cleveland.

"Semi-Steel," by R. H. Probert, James Leffel & Co., Springfield, O.

"Tests of Cast Iron," by W. P. Putnam, Detroit Testing Laboratory, Detroit.

"Memorandum on the Preparation of Standard Specifications for Cast Iron for International Export Use," by Dr. Richard Moldenke.

"Industrial Pioneering, or the Establishment of a Foundry in a New Territory," by L. L. Anthes, Anthes Foundry Co., Detroit.

AMERICAN INSTITUTE OF METALS.

AN advance programme covering the 1914 Convention of the American Institute of Metals at Chicago, September 7-11, has been issued by the executive as follows:—

Monday.—Registration.

Monday Evening. — Foremen's banquet, LaSalle Hotel.

Tuesday, 10 a.m.—Joint meeting with the A.F.A. Addresses of welcome.

Tuesday, 2 p.m.—Reports and A. I. M. papers. Both meetings on Tuesday to be held at the LaSalle Hotel.

Tuesday Evening.—Programme open.

Wednesday, 10 a.m.—Joint meeting with A. F. A. Saddle and Sirloin Club. Cost congress. Papers and discussion.

Wednesday, Noon.—Ladies' luncheon at the Stockyards Inn.

Wednesday Afternoon. — Stockyards inspection.

Wednesday Evening.—Open.

Thursday, 10 a.m.—Saddle and Sirloin Club. Papers and discussion.

Thursday, Noon.—Ladies' luncheon, Marshall Field & Co.

Thursday, 2 p.m.—Papers and discussion. Election of officers.

Thursday Evening.—Banquet at the LaSalle Hotel (for members only).

Friday, 10 a.m.—Last session.

FOUNDRY AND MACHINE CO. EXHIBITION.

THE exhibition of foundry equipment and supplies, under the auspices of the Foundry and Machine Co., will be held in the International Amphitheatre, Chicago, from September 5 to September 11, and the following manufacturers have already reserved space for the display of their products:—

Ajax Metal Co., Philadelphia.
Arcade Mfg. Co., Freeport, Ill.
Armstrong-Blum Mfg. Co., Chicago.
Ayer & Lord Tie Co., Chicago.
Berkshire Mfg. Co., Cleveland.
Besley, Charles H., & Co., Chicago.
Blystone Mfg. Co., Cambridge Springs, Pa.
Brown Specialty Machinery Co., Chicago.
Buch's, A., Sons Co., Elizabethtown, Pa.
Buckeye Products Co., Cincinnati.
Carborundum Co., Niagara Falls, N.Y.
Cataract Refining Co., Buffalo.
Central Iron Works, Quincy, Ill.
Chicago Pneumatic Tool Co., Chicago.
Clark, Chas. J., Chicago.
Clark, Jas., jun., Electric Co., Louisville, Ky.
Cleveland Pneumatic Tool Co., Cleveland.
Clipper Belt Lacer Co., Grand Rapids, Mich.
Coburn Trolley Track Mfg. Co., Holyoke, Mass.
Curtis Pneumatic Machine Co., St. Louis.
Dixon, Jos., Crucible Co., Jersey City, N.J.
Edgemont Machine Co., Dayton.
Essley, E. L., Machine Co., Chicago.
Electric Controller & Mfg. Co., Cleveland.
Federal Foundry Supply Co. Cleveland.
Felt & Tarrant Mf. Co., Chicago.
Flexible Steel Lacing Co., Chicago.
Foundry, The, Cleveland.
Garden City Sand Co., Chicago.
Gardner Machine Co., Beloit, Wis.
General Electric Co., Schenectady, N.Y.
Gisholt Machine Co., Madison, N.Y.
Goldschmidt Thermit Co., New York.
Gould & Eberhardt, Newark, N.J.
Great Western Mfg. Co., Leavenworth, Kas.
Great Western Melting & Refining Co., Chicago.
Hayward Co., New York City.
Henion & Hubbell, Chicago.
Hill-Brunner Foundry Supply Co., Cincinnati.
Hill & Griffith Co., Cincinnati.
Hunter Saw & Machine Co., Pittsburgh.
Independent Pneumatic Tool Co., Chicago.
Industrial Press, New York.
International Molding Machine Co., Chicago.
Iron Trade Review, The, Cleveland, Ohio.
Janesville Wisconsin Molding Sand Co., Janesville, Wis.
Kawin, Chas. C., Co., Chicago.
King, Julius, Optical Co., New York City.
Lupton's, David, Sons Co., Philadelphia.
McCormick, J. S., Co.. Pittsburgh.
McLain's System, Milwaukee.
MacLeod Machine Co., Cincinnati.
Midland Machine Co., Detroit.
Monarch Engineering & Mfg. Co., Baltimore.
Norma Co. of America, New York.
Norton Co., Worcester, Mass.
Obermayer, S. O., Co., Chicago.
Osborn Mfg. Co., Cleveland.
Oxweld Acetylene Co., Chicago.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia.
Peerless Parting Co., Ottawa, Ill.
Picklands, Brown & Co., Chicago.
Pridmore, Henry E., Chicago.
S. K. F. Ball Bearing Co., New York.
Sand Mixing Machine Co., New York.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Sly, W. W., Mfg. Co., Cleveland.
Smith, R. P., & Sons Co., Chicago.
Sterling Wheelbarrow Co., West Allis, Wis.
Stevens, Frederic B., Detroit.
Sullivan Machinery Co., Chicago.
Superior Oxygen Co., Pittsburgh.
U. S. Graphite Co., Saginaw, Mich.
Vulcan Engineering Sales Co., Chicago.
Wallace, J. D., Chicago.
Warner & Swasey Co.. Cleveland.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.
Wilmarth & Morman Co., Grand Rapids, Mich.
Wood's, T. B., Sons Co., Chambersburg, Pa.
Wyoming Shovel Works, Wyoming, Pa.

DARK GREEN GOLD FINISH.

A DARK green gold can be made in the following manner:—

Cyande of potash	3 oz.
Pure silver to be made into chloride	¼ oz.
Pure gold to be made into chloride	¾ oz.
Water	1 gal.

Use hot with a gold anode composed of three parts gold and one part silver. This solution will give you a green deposit. In order to get a dark green, make up a solution of:

Water	1 gal.
Caustic potash	1 oz.
White arsenic	½ oz.

Boil together, then add a few drops of this solution to the above green gold solution until you get the desired color.

Metal Statistics.—Coincident with the announcement of the members of the New York Metal Exchange that that institution would discontinue operations until further notice, the Copper Producers' Association on August 4 announced that the usual monthly statement of copper production and stock on hand would be omitted because of the mixed conditions of the copper market.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

TURRET LATHE AND VERTICAL BORING MILL PRACTICE.—III.*

By Albert A. Dowd.

PARTS I. and II. of this series of articles dealt with the first and second settings and sequence of operations relative to the machining of the

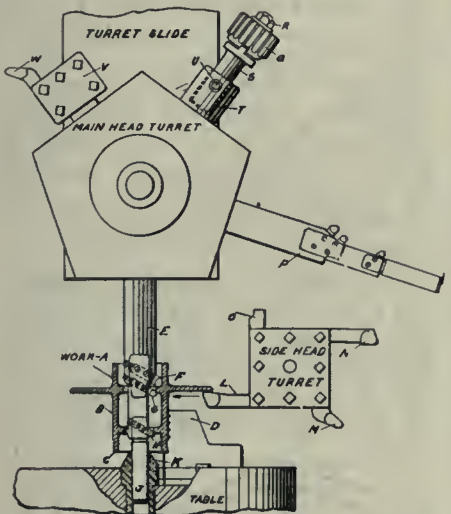


FIG. 5. FIRST OPERATION — FIRST SETTING.

rear hubs of an automobile on the vertical turret lathe. The present and succeeding article discusses the procedure adopted in machining a front hub.

Machining a Front Hub on the Vertical Turret Lathe.

We shall now take up the machining of a front hub in which the bearing seats at the two ends must be in perfect alignment with each other. The work A shown in Fig. 5 is of malleable iron and is held by the outside of the hub B in the special laws D. These jaws are provided with a shoulder against which the end of the hub C locates, thereby obtaining uniform vertical position. A hardened and ground tool steel bushing is fitted to the center hole of the table and acts as a guide for the piloted ends of the boring bars.

Attention is called to the fact that the upper end of the bushing is of conical shape, so that any chips or dirt falling on it will have a tendency to slide off on to the table. The boring bar E is of .040 carbon steel and is piloted at its lower end J in the bushing K. This pilot is carbonized, case-hardened and ground to a running fit. Three high-speed tools F, G, and H are angularly placed in the bar and are provided with backing-up screws so that fine adjustments may be readily made for diameters.

The finishing bar P is identical in construction with the roughing bar, and the tools are set for the finishing cut, making due allowance for the reaming cut in the bearing seat. The reamer Q is of high-speed steel and is finished with a taper hole which fits the conical stem on the arbor S, a suitable driver being provided as shown in the illustration. The nut B holds the reamer firmly on the arbor. The steel holder T is securely clamped in the turret hole and the pin U acts as a driver for the reamer arbor. Clearance is provided in the hole so that the reamer may float and follow the generative hole produced by the boring bars. A standard tool holder V contains a finish facing tool W of high-speed steel. The tool L in the side head is used for rough undercutting the flange, while that at N is the finishing tool for the same surface. A rough turning tool at M and a corner rounding tool at O complete the side head turret tooling.

Sequence of Operations—First Setting.

First operation:—The tools shown in cutting position on the work in Fig. 5 are used for the first operation, which is that of boring the bearing seat and the two inner clearance holes with the main head. During the operation of these tools the undercutting tool L in the side head rough faces the under side of the flange. The purpose of boring the two inner clearance holes is to make sure that the required clearance is obtained at these points, and in the case of the lower and smaller of the holes, the bored surface is used in the second setting of the work.

Second operation:—Fig. 6 shows the remainder of the operations in the first setting of the work. The second operation consists of finish boring the interior surfaces previously rough bored in the first operation, the boring bar P being used for this purpose. While this operation is taking place, the side head is used to face the end of the hub and trim up the outside of the flange, the tool M being brought into play for the work.

Third operation:—Immediately after the second operation of boring has been accomplished, the rapid power traverse on the machine is started to withdraw

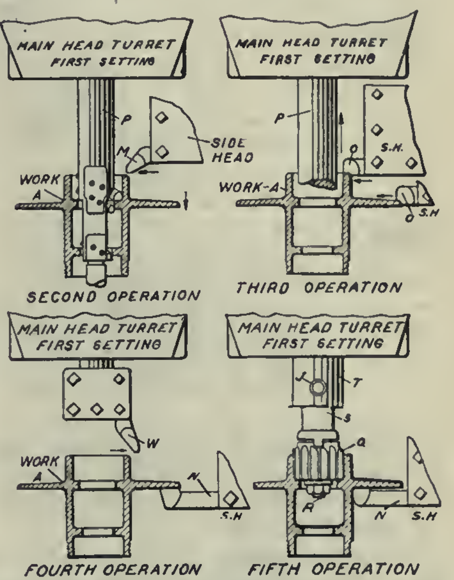


FIG. 6. REMAINING OPERATIONS — FIRST SETTING.

the bar from the hole, and the tool O in the side head is brought up against the flange and end of hub and used to break the corners. Very little time is lost by this method of procedure.

Fourth operation:—The finish facing tool W is now used in the main head turret to face the end of the hub, and the finish undercutting tool N in the side head takes a light finishing cut with a coarse feed on the under side of the flange.

Fifth operation:—Before the side head has finished its work, the floating reamer Q in the main head is indexed into position, the speed of the machine slowed down and the hole reamed to size. This completes the first setting of the work.

*Parts I. and II. of this series appeared in our July 30 and August 6 issues.

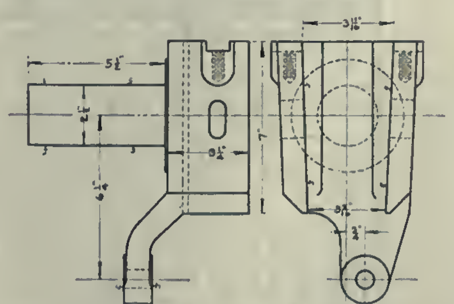


FIG. 1. STEAM TRACTOR REVERSE SHAFT.

AN INDEXING MILLING FEATURE.

By A. S. Loy.

THE casting shown in Fig. 1 was used as the reverse shaft on a well-known make of steam tractor. This piece has two internal faces milled at a taper with respect to each other, being 3 11-16 inches apart at the one end and 3 3-16 inches at the other. Each of these faces is provided with a steel taper key so that the insides come parallel for a sliding wooden block. Studs are placed in the tapped holes shown, and the tapered keys provide a ready means of adjustment.

The first operation on the piece was chucking and turning the $2\frac{1}{2}$ inch leg. The tapered sides were then shaped in as correctly as possible, and the keys which had previously been milled on the one side were then fastened in place and a milling cutter of the proper width run through them. This did not make for interchangeability and a great number of complaints resulted.

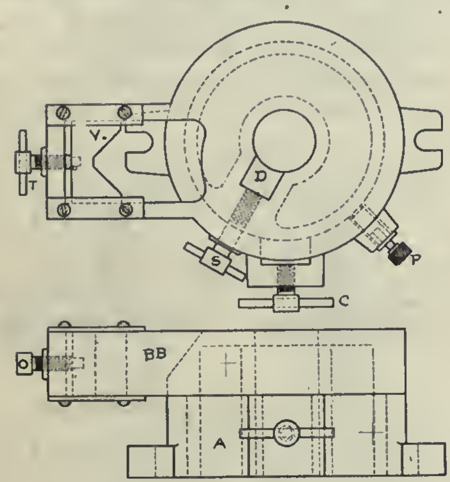


FIG. 2. INDEXING MILLING FIXTURE.

The fixture shown in Fig. 2 was then designed for milling the sides and producing duplicate parts. The base A was provided with keys to fit the miller table slots and was bored out to receive the table B which was clamped in the base by the screw C. The index pin P located the table at the proper angle. The reverse shaft was dropped into the hole in the center of the table, and the V-block run up by means of the screw T against the round boss at the one end. The shaft was clamped in the table by the screw S, which pushed up the piece D, bearing along the full length of the leg. A milling cutter was set at the proper distance from the center of the fixture so that, by indexing the fixture nearly halfway around, both faces could be milled with the one setting.

PISTON RING DATA.

By D. O. Barrett.

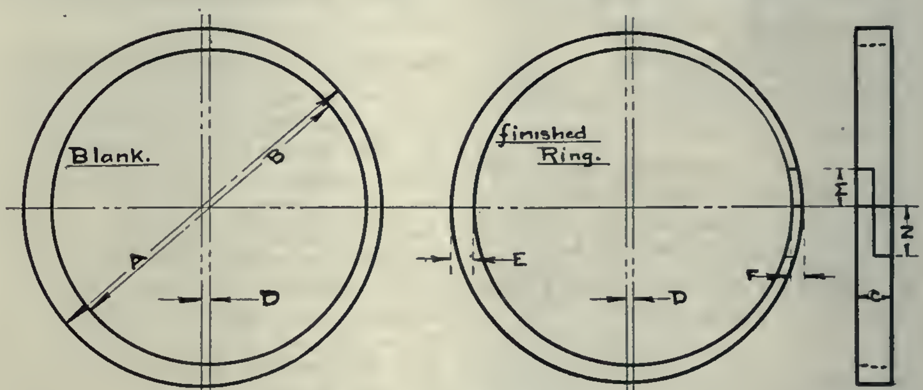
PROBABLY there is no part of a gasoline engine upon the design of which there is such a lack of accurate knowledge as the piston ring. Most piston rings are the result of hit-and-miss design, or are merely copies of some competitor. Of course, a properly proportioned piston ring for any particular engine can only be determined after long experimenting and trials under actual conditions. There are, however, a few points which, if understood, would make the calculation of piston ring sizes somewhat easier for the average man.

Piston rings may be turned either concentric or eccentric, each style of ring having its advocates, but, in general, nearly all manufacturers return their rings to the piston diameter after first having split them. The amount left for the returning is usually about 1/32 of an inch. For stationary horizontal engine work, the lap joint requiring two cuts is almost universally adopted. The amount to be cut out of a ring to give the proper amount of tension when in the cylinder is another matter of experiment. For the sake of example, let us say that the amount to be taken out of a lap joint ring is $\frac{5}{8}$ inch, and the bore of the cylinder is 6 inches.

The circumference of the cylinder bore will measure 6×3.1416, or 18.850 ins., and the circumference of the ring before splitting will be 18.850+0.625, or 19.475 ins., which corresponds to the diameter of 19.475÷3.1416, or 6,199 ins. Let us assume that 1/32 inch has been left for returning; then the diameter of the ring blank before splitting should be 6.199+0.031, or 6.230 ins. The diameter of the returning fixture for holding the rings while clamping, would of course, be about 6 1/32 inches. However, since in splitting the rings the sides of the cut are parallel, the edges only of the split will meet when the ring is closed together, necessitating a small amount of filing to bring both edges radial. The ring blanks will, therefore, have to be slightly larger than 6.230, or allowing 0.02 for filing, the diameter will be $6\frac{1}{4}$ inches. In actual practice the diameter of the returning fixture is obtained by trial, fitting a ring by filing the edges to the proper fit before inserting. No fitting will then be necessary after the rings are returned for the bore of the cylinder.

The accompanying table gives the piston ring practice of one of the large companies building gasoline engines. One side of the ring was cut with a $\frac{5}{8}$ milling cutter and the other side with a $\frac{7}{8}$ cutter. This left a $\frac{1}{4}$ inch opening on one side when the ring was closed together for a pin in the slot to prevent the movement of the ring around the piston. The blank diameters were made $\frac{1}{4}$ inch larger than the bore diameters, leaving slightly more than 1/32 inch for returning.

The ordinary practice of dimensioning a finished ring is to be deprecated. The dimensions for turning and boring the blanks should be given on a drawing of the blank, shown separate from the drawing of the finished ring itself.



PISTON RINGS.

Bore of Cylinder.	Ext. Diam Blank. A.	Int. Diam Blank. B.	Width of Ring. C.	Eccentricity. D.	Thickness. E.	Thickness. F.	Returned Diameter.	Cutter for M.	Cutter for N.
4	$4\frac{1}{4}$	$3\frac{27}{32}$	3/8	3/64	$\frac{3}{16}$	$\frac{3}{32}$	4	$\frac{13}{32}$	$\frac{5}{8}$
5	$5\frac{1}{4}$	$4\frac{27}{32}$	$\frac{3}{8}$	$\frac{1}{16}$	$\frac{15}{64}$	$\frac{7}{32}$	5	$\frac{5}{8}$	$\frac{7}{8}$
$5\frac{1}{2}$	$5\frac{3}{4}$	$5\frac{5}{16}$	$\frac{3}{8}$	$\frac{1}{16}$	$\frac{1}{4}$	$\frac{1}{8}$	$5\frac{1}{2}$	$\frac{5}{8}$	$\frac{7}{8}$
6	$6\frac{1}{4}$	$5\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{16}$	$\frac{9}{32}$	$\frac{5}{32}$	6	$\frac{5}{8}$	$\frac{7}{8}$
$6\frac{3}{4}$	7	$6\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{16}$	$\frac{9}{32}$	$\frac{5}{32}$	$6\frac{3}{4}$	$\frac{5}{8}$	$\frac{7}{8}$
7	$7\frac{1}{4}$	$6\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{16}$	$\frac{9}{32}$	$\frac{5}{32}$	7	$\frac{5}{8}$	$\frac{7}{8}$
$7\frac{1}{2}$	$7\frac{3}{4}$	$7\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{16}$	$\frac{9}{32}$	$\frac{5}{32}$	$7\frac{1}{2}$	$\frac{5}{8}$	$\frac{7}{8}$
$8\frac{1}{4}$	$8\frac{1}{2}$	8	$\frac{5}{8}$	$\frac{1}{16}$	$\frac{9}{32}$	$\frac{5}{32}$	$8\frac{1}{4}$	$\frac{5}{8}$	$\frac{7}{8}$
$8\frac{3}{4}$	9	$8\frac{1}{2}$	$\frac{5}{8}$	$\frac{1}{16}$	$\frac{9}{32}$	$\frac{5}{32}$	$8\frac{3}{4}$	$\frac{5}{8}$	$\frac{7}{8}$
$9\frac{1}{2}$	$9\frac{3}{4}$	$9\frac{1}{8}$	$\frac{5}{8}$	$\frac{1}{16}$	$\frac{11}{32}$	$\frac{7}{32}$	$9\frac{1}{2}$	$\frac{5}{8}$	$\frac{7}{8}$
$10\frac{1}{2}$	$10\frac{3}{4}$	$10\frac{1}{8}$	$\frac{5}{8}$	$\frac{3}{32}$	$\frac{3}{8}$	$\frac{3}{16}$	$10\frac{1}{2}$	$\frac{5}{8}$	$\frac{7}{8}$

PISTON RING PRACTICE OF A LARGE FIRM OF GASOLINE ENGINE BUILDERS.

It must be remembered that these are two separate pieces, varying in size, since the finished ring is smaller in diameter due to the returning than the blank.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

THE COLLEGE GRADUATE.—III.*

By D. S. Mann.

A GOODLY number of graduates, upon leaving school, depend upon their instructors or department heads to locate positions for them and in most cases these men are always glad to recommend them. However, would it not be infinitely better for a man, after graduation, to break loose from the ties which have bound and restricted his thoughts and activities for four years and to actually hunt for a job himself. Would not the job carry with it a greater sense of responsibility under these conditions? The man who depends upon another to locate and choose a position for him is in the same class with the man who lets some one else prepare his lessons for him. He has missed an opportunity to show the world that he can stand on his own feet. The writer recently saw an adage to the effect that a man who has made a success in business was only justly entitled to credit if his business had been a competitive one. The commercial world is practically summed up in the one word, competition, and the fact must not be lost sight of that business enterprises are operated in order to pay the stockholders a profit on their money invested and not merely to provide a lot of convenient openings for men who are looking for high-salaried positions with cane-seated chairs and eight-hour days.

The writer has always contended and has conducted himself along these lines: that a man gets or will get, if he has any ambition, just exactly what he is looking for and (most important of all), what he is prepared for. All one has to do to prove to his own satisfaction that positions of trust and responsibility are open is to look through the want columns of our engineering journals. The majority of these call for trained men and our colleges do not make any pretence of turning out specialists. A man who takes the average college course certainly deserves a lot of credit for the time and energy which he has expended but he must not let his energies flag in the least, in fact, the hardest part is before him, for he must now get out and, furthermore, produce in competition with men who are trained along these particular lines. He has now to devote himself to whatever line of work he has undertaken and proceed to make himself a specialist and he must concentrate all his efforts and know no limiting hours.

*Parts I. and II. appeared in our issues of July 30 and August 6, respectively.

The letter of John Fritz to Dr. Goss which was published after his death should certainly be an inspiration to college men who have had the preliminary training which he, however, was not fortunate enough to have. It is certainly high time that our colleges woke up their students and put some life into them outside of that engendered by their studies and, perhaps, athletics. To do this it would probably be necessary to plant some tacks in the cushions of some of our college professors' easy chairs. How is it that we expect to turn out $10,000 a year men under the tutelage of $2,000 instructors? If these positions are available, why are there not more instructors leaving the schools and accepting these for which they should be most admirably fitted?

Writing to Technical Journals.

The writer supplies considerable material to several technical journals and is in receipt of letter after letter asking for the names of parties who can write on various subjects. Numerous college men, both freshly graduated and with several years' experience, have been approached, but they have all expressed the opinion that they were unqualified for this work. This would hardly seem possible when all college courses contain a period devoted to English literature. How many practical men are there whose methods of expression are exceedingly raw, yet these self-made men bring forth ideas that prove to be wonderful time-savers and money-makers and, after all, is it not ideas which really count? Does the college man who thus readily acknowledges his incompetency as compared to the average man without his education reflect any credit either on the institution which matriculated him or upon himself?

Only one professor during the writer's college career, and he has already been mentioned, ever brought to mind that any such opportunity existed. While it is perhaps tedious work for some, and whether the remuneration is ample or not is a somewhat debatable question, yet the experience gained is exceedingly valuable and more than repays any extra effort exerted. A man's vision is broadened, his method of expression improved, and he is brought into contact with other men in such a way that only good can result. During the course in English would it not be a good plan to assign a subject to the class for a theme and, picking out the most valuable of these, to send them to some magazine for publication. Such a method as this would stir up interest in a course in Englsh which at present is almost an impossibility in an institution devoted to engineering studies.

It would also seem a wise provision in our colleges to insist upon, or better perhaps, add as an integral part of the four-year course, two or three months actual shop or drafting room experience during the summer vacations. A man would come back in the fall with a better idea of just the sort of preparation necessary, and would see the benefit of some portions of the course and perhaps the folly of some others. The writer is willing to express his belief that those schools which have the most practical work incorporated into their courses, both in the shop as well as the laboratory, turn out the best men, at least men who are able to go out and hold their own. A man coming directly from school is suddenly thrown into an entirely new atmosphere and he quite naturally sees things in a different light from those who have been actually engaged in the work for some time; but that is no reason why he should immediately suggest a lot of impossible reforms which do not do his good judgment any credit. Perhaps many of these have already been tried or for some particular reason are not feasible in the line of work.

With some sort of a preliminary practical training, much of this would be brought to his mind, and he would not feel hurt the first time some of these visionary methods are proposed to those in authority and turned down. Any firm is willing and glad to receive suggestions from their employees which will enable them to decrease the cost of manufacture of their product, or will enable them to increase their efficiency in any way.

The writer may, perhaps, have some radical views on the subject, but is guided entirely by his experience and observations and of those with whom he has come in contact. As industrial conditions change and become more and more competitive, so should our methods of education change, and men should be prepared for the conditions as they find them. It should hardly be necessary for a man, after putting in four or five years at college, to put in three or four more in order to become conversant with any one line of work. Our colleges must wake up to the fact that much is expected of them, and that their development is being keenly watched by those less fortunate, and any disappointing results throw a light upon this kind of an education.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

With the further development of this course in arithmetic, it will be found by those who have followed the introductory lessons and profited by them that the various practical applications resulting from the succeeding lessons will be easily observed and their time and labor-saving features so appreciated as to be adopted at every available opportunity.

FEEDS.

No doubt the adjustment of cutting tools for machining jobs in different machine tools in the shop is in large degree a matter of guesswork on the part of the operator, and where this guesswork on the mechanics part is derived from much experience, the adjustment of the tools or tables becomes very accurate; but when young and inexperienced men are adjusting the lateral or vertical feed of a tool or table, the proper adjustment will in most cases be only a matter of chance. To help overcome this failing to some extent, and instill the practice of using figures in work where their application obviates to a large degree the guesswork of the shop, a few practical examples are here given.

In chart 31 is shown a skeleton sketch of the cross feed of a lathe. A piece of work W requires 3-16 in. of metal removed in two cuts, the finishing cut to reduce the diameter 1-32 of an inch.

The roughing cut must remove 3-16 in. —1-32 in.=5-32 in. of metal, or the cutting tool must advance into the work 5-32 in.÷2=5-64 of an inch.

The cross feed has 6 threads per inch, and the graduated disc has 50 divisions.

The general way (and possibly the best one) would be to follow up the cut with a pair of calipers set to the required diameter, but as this series of lessons is for the purpose of showing the usefulness of calculations in the general run of shop problems, an approximate method of determining the proper adjustment of the tool may prove of some benefit to those who have been formerly taking a chance.

Most lathes or other machine tools of modern make usually have a graduated disc placed on parts of the machine where micrometer adjustment is desirable. In the cut, chart 31, (a) represents the graduated disc, (S) the cross feed screw, (t) the cutting tool and (W) the work. To find the lateral feed (F) we divide the number of divisions moved on disc (a) by the total number of divisions (d) on disc (a), and multiply by the pitch of the cross feed screw (S), or by formula.

$$F=\frac{M}{d}\times p,$$ or to find the movement of (a), use formula $M=F\times d\times n$.

To solve the above question, the required result is the number of divisions to move the disc (a) to remove 5-32 of an inch in diameter.

$M=F\times d\times n=5\text{-}64\times 50\times 6=$

$$\frac{5}{64}\times\frac{50\times 6}{1}=\frac{375}{16}=23\ 7\text{-}16 \text{ divisions.}$$

For finishing cut of 1-64 in. deep.

$$M=\frac{1}{64}\times 50\times 6=\frac{75}{16}=4.68,$$ or a little over $4\frac{1}{2}$ divisions. These solutions are only as a guide to approximate adjustment; accurate sizes must always be determined by the calipers or micrometers.

It is required to remove 3-32 inch of metal from a block of steel, the feed screw in the shaper head having a pitch of 1-6 inch or 6 threads per inch, and the graduated disc being divided into 80 divisions. What movement of the feed screw is required?

By formula chart 31

$$M=F\times d\times n=\frac{3}{32}\times\frac{80\times 6}{1}=45 \text{ divisions.}$$

In the foregoing example, if the feed screw had been revolved one turn and 15 divisions, what would have been the depression of the tool?

By formula chart 31

$$F=\frac{M}{d}\times p=\frac{95}{80}\times\frac{1}{6}=\frac{19}{96},$$ or expressed in the nearest 64th.

$$\frac{19}{96}\times\frac{64}{1}=\frac{38}{3}=12\ 2\text{-}3 \text{ or } 13\text{-}64 \text{ inch.}$$

In chart 32 is shown an arrangement, often seen on machine tools whereby the movement of the handwheel is transmitted to the feed screw through a pair of bevel gears. These gears may be of equal size or a pinion and a gear, thus compounding the movement of one shaft with the other. A general formula for adjustment of cut is given in chart 32.

$$M=\frac{N\times G\times D}{P}\times E,$$

$$\text{or } E=\frac{M}{\dfrac{N\times G\times D}{P}}, \text{ where}$$

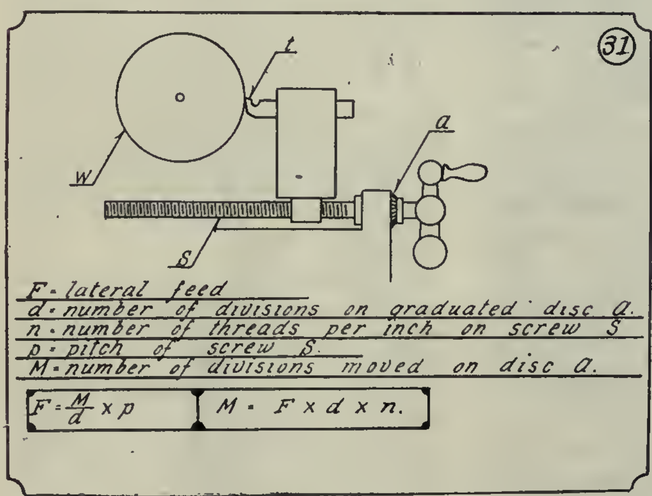
M=number of divisions moved on disc (a).

N=threads per inch on screw (S).

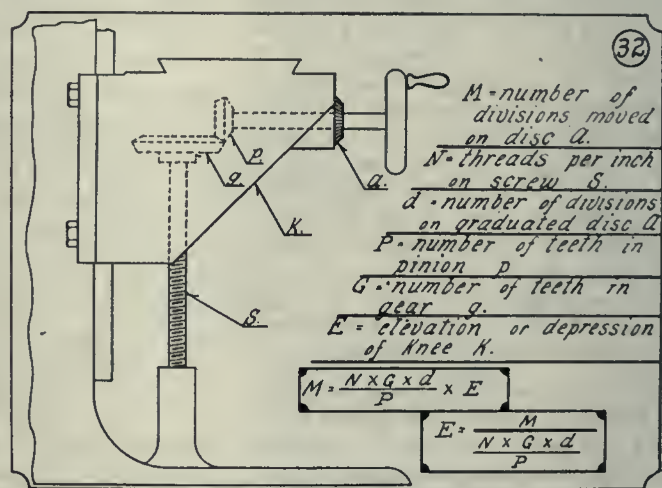
d=number of divisions on graduated disc (a).

P=number of teeth in pinion (p).

G=number of teeth in gear (g).



ARITHMETIC CHART 31.



ARITHMETIC CHART 32.

E=elevation or depression of knee (k).

The elevating screw on a milling machine has a pitch of 1-5 inch or 5 threads per inch, the graduated disc (a) has 100 divisions, ratio of the bevel gears is 2 to 1, and the pinion is on the horizontal shaft. What movement will the knee (k) have if the handwheel is revolved one turn and 40 divisions?

By formula

$$E = \frac{M}{\frac{N \times G \times d}{P}} = \frac{140}{\frac{5 \times 2 \times 100}{1}} = \frac{140}{5 \times 2 \times 100} =$$

7.50 in. or expressed as a decimal=.149 in.

In the above example, the ratio of the gears was used instead of the number of teeth, but the result would be the same, as 2:1 or 30:15 or 48:24, etc., would answer the same purpose when figuring, as definite sizes are not essential.

If, in the above problem the adjustment vertically was required to be .375 in., what would be the movement of the disc (a)?

By formula

$$M = \frac{N \times G \times d}{P} \times E = \frac{5 \times 2 \times 100}{1} \times .375 =$$

375 divisions or $\frac{375}{100}$ = 3 turns and 75 divisions.

If the adjustment required were 7-64 inch.

$$M = \frac{N \times G \times d}{P} \times E = \frac{5 \times 2 \times 100}{1} \times \frac{7}{64} =$$

109⅜ divisions, or one turn and 9⅜ divisions.

In a certain small die slotter the bevel gears are completely hidden, the screw (S), chart 32 has 6 threads per inch and the graduated disc (a) has 50 divisions. If each division represents an elevation or depression of the knee (k) equal to .001 of an inch, what is the ratio of the two gears (p) and (g)?

By formula

$$M = \frac{N \times G \times d}{P} \times E \text{ or}$$

$$\frac{G}{P} = \frac{M}{N \times d \times E} = \frac{1000}{6 \times 50 \times 1} = \frac{10}{3}, \text{ or } \frac{40}{12} \text{ or } \frac{50}{15}$$

Collingwood, Ont.—The management of the Imperial Wire Company state that they hope to start the entire plant almost immediately. For some time the keg mill has been in operation and this will be continued.

Questions and Answers

FOUNDRYMEN having difficulties of any kind in connection with their work are invited to forward them to this department for solution. The causes of lack of success in the foundry are of such variety that one man cannot possibly succeed in mastering them all. The greatest possible care will be taken to give only reliable and tried out advice on all questions submitted.

Light Casting Trouble.

Question. — We are having much trouble in getting sound castings in certain lines of work. Our coke is low in sulphur, and, as our castings are very light we are using iron with the silicon running up to 3 per cent. We have also used chills, but do not get satisfactory results.—A. O. B.

Answer.—Iron containing 3 per cent. of silicon is only suitable for very light castings, such as light hardware, and will give trouble in those of any size. Have your moulds well vented and use skim gates. Get some ⅜ or ½ inch rod aluminum and melt a piece about 1 inch long in 75 lbs. of metal. This aluminum is pure and will unite with the gas to form dross and thus eliminate it.

Large Cylinder Mixture.

Question.—Will you kindly give an analysis for a first-class heavy cylinder mixture?—T. R. W.

Answer.—A most suitable mixture for this purpose would contain: Silicon, 1.20 to 1.40 per cent.; sulphur, 0.09 per cent.; phosphorus, 0.35 to 0.50 per cent., and manganese, 0.50 to 0.80 per cent. The transverse strength of a test bar 1 inch square by 12 in. long should not be less than 2,600 lbs., and the tensile strength per square inch should be at least 24,000 lbs. per square inch.

Shrink Holes in Aluminum

Question.—We are making aluminum castings and would like to know how to overcome shrink holes which give us considerable trouble.—D. S.

Answer.—There are several causes for shrink holes in aluminum. There may not be enough feeders or they may not be large enough. The moulds are often rammed too hard or the casting may not be gated in the proper places. The constitution of the metal itself is often the greatest cause of the trouble. If some copper be used in the alloy and the zinc content be decreased as much as possible, the shrink holes will be less numerous. If ingot aluminum is being used, the trouble is not likely to be in the metal, and can be overcome by proper feeding and the use of chills on the heavy points.

Flux for Brass.

Question.—Please furnish us with what you would consider a reliable flux for brass.—T. G. Co.

Answer.—Common salt is the cheapest and best flux for brass. Put it in the crucible at the beginning of the heat in the proportion of about a small handful to 100 pounds of metal.

Light Malleable Mixture.

Question.—Will you give the chemical composition of first-class malleable iron for light hardware castings?

Answer.—A good mixture for this purpose will contain: Silicon, from 0.80 to 1.25 per cent.; sulphur, not over 0.05 per cent.; manganese, not over 0.25 per cent., and phosphorus not over 0.20 per cent. The carbon must not run below 2.75 per cent. and the silicon should be kept as near the lower limit as possible.

Plumbers' Ferrules.

Question.—We would like to know of a good cheap mixture for making brass ferrules for plumbers.

Answer.—A very much used composition for this purpose is made up of copper, 53 lbs.; zinc, 41 lbs. 10 ozs.; lead, 5 lbs., and aluminum, 6 ozs. This is a good fluid mixture, and you will have no difficulty in running any size ferrule.

Question.—Will you kindly tell me what treatment should be given acid burns of the eyes?—J. B.

Answer.—If clean warm water be obtainable, it should be applied immediately and liberally. Follow with application of sweetmilk, allowing the liquid to flow freely over the eyeball. After the milk and water washing, warm a few drops of cocaine hydrochloride and apply to the eye, and then apply a little castor oil; next saturate a small piece of absorbent cotton with warm water and bind over the eye with a light bandage. This cotton should be renewed frequently. The cocaine hydrochloride may be warmed by putting a few drops in a teaspoonful of hot water. If the burn be a bad one, and the eye becomes inflamed, use an ointment at bedtime consisting of vaseline and 2 per cent. cocaine hydrochloride. Burns of the eye resulting from potash or hot cyanide copper solution should be immediately washed with clean cold water and then bathed with a strong solution of boracic acid. This treatment will relieve the soreness and avoid inflammation, which would otherwise cause the eye to become very troublesome.

PROGRESS IN NEW EQUIPMENT

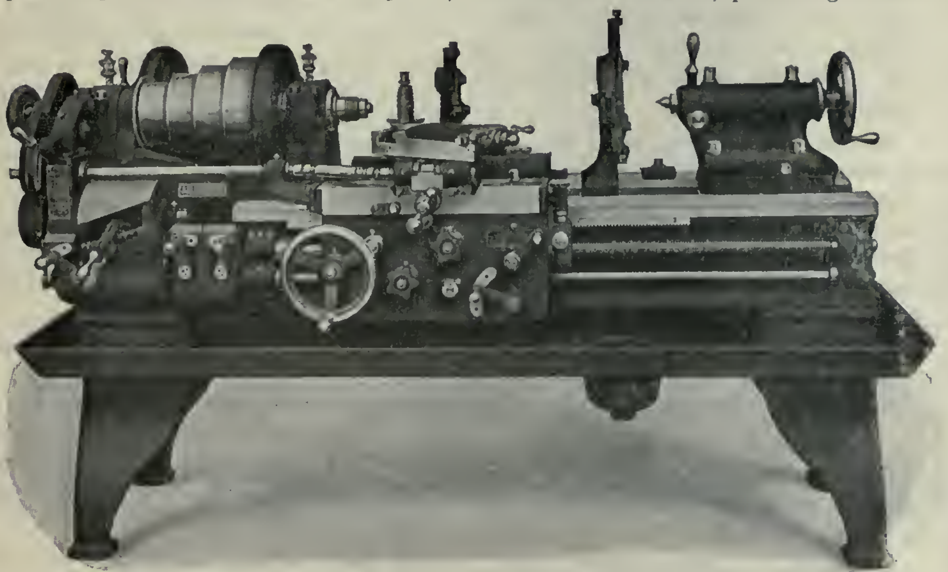
A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

"AMERICAN" TOOL ROOM LATHE.

THE 14 in. x 6 ft. lathe, with complete tool room equipment, described and illustrated herewith, is a product of the American Tool Works Co., Cincinnati, Ohio, and was supplied through the manufacturers' agents (Rudel-Belnap Machinery Co., Toronto and Montreal) for tool room work in the Toronto plant of the S. F. Bowser Co.

This lathe has a patented type of bed providing what is known as a drop vee; that is, the inner or tailstock vee is dropped below the level of the outside vee. The construction provides greater swing over the bed than the rated swing of the lathe, viz., 15¼ inches. Probably, however, the greatest advantage of the patented bed construction is that it permits the use of a very deep carriage bridge, thus greatly strengthening the machine at that point, and thereby eliminating the possibility of chatter. It should also be noted that the ways of the bed are chilled, offering a very hard, close grained surface to the carriage bearings, which, being less subject to wear, confines whatever wear that does take place to the carriage bearings, where it will not effect the alignment of the machine. The chilled ways also prevent the bed from wearing hollow; consequently, it will hardly be found necessary to resort to replaning to regain the original alignment.

It is further to be noted that the quick change gear mechanism fitted is particularly adapted to tool room work, for not only does it provide a wide range of threads and feeds, but it is so designed that special threads can be cut when desired by simply making a slight change in the gearing of the back quadrant, very similar to the change required on a loose change gear lathe to cut different threads. This feature provides practically an unlimited range for the lathe, consequently the machine need never be found wanting in any emergency. All gears in this mechanism are steel, the cone and tumbler gears being cut with 20° B. & S. cutters, producing a tooth of wide section at the base and pointed at the top. Both lead screw and feed are furnished, all threading operations being confined to the lead screw and all feeding operations to the feed rod. This tends to insure greater accuracy and longer life to these members than when only a splined lead screw is provided, which is called upon to do both the feeding and threading.



14 IN. X 6 FT. AMERICAN TOOL ROOM LATHE.

The apron is of substantial design, being of the box type with a back plate, giving all studs a double support, and thus eliminating all overhang. All gears are cut from bar steel with the exception of the large friction gear, which is a steel casting, and every bearing is bushed with a renewable phosphor bronze bushing and is provided with efficient means of lubricating. Oil reservoirs are cast in the back plate of the apron, into which the oil is led by means of gravity through pipes from the front. Oil ducts lead the oil from the reservoirs to the various bearings, and over each duct a strip of felt is placed, which filters the oil and insures a good, clean lubrication at all times, and also regulates the flow of the oil and prevents waste.

Probably the most important and desirable feature for tool room work, however, is the extreme accuracy claimed. This machine is positively guaranteed to work within .001 of an inch in 24 inches. The workmanship of this lathe is also fully guaranteed to be of the very best that intelligent effort, combined with long experience, skilled workmen and a complete jig and tool system can produce, likewise a positive guarantee is given of every piece of metal entering into construction.

A 12-IN. PRECISION GRINDER.

IN the accompanying cut a 12-in. precision grinder recently put on the market by the C. G. Garrigus Machine Co., of Bristol, Conn., is shown. The feature in this grinder wherein it differs from most grinders, lies in the fact that it operates on the rotary principle instead of the reciprocating. This, of course, increases the speed with which work can be done over that of the reciprocating types. The limit of the machine is a casting that comes within a circle of 12 in. diameter, and is not thicker than 8 in. It is claimed by the manufacturers that the machine will grind to within .0004 in. of accuracy.

A 12-IN. PRECISION GRINDER.

The head is supported on a vertical oscillating column 41 in. long. This column is attached to the feed shaft which receives its motion from a pawl and ratchet. One tooth movement of the ratchet wheel lowers the head .000125 in. A magnetic chuck is mounted on a spindle, which is operated by a cone clutch pulley and connected by gearing to the cam which operates the wheel column. The amount of oscillation is regulated by the adjustment of this cam roll. Throughout the machine, the bearings are amply large for all requirements, and in the wheel column the construction is such that slight wear in the bearings does not appreciably effect the accuracy of the machine.

The lever controlling the movement of the head and the rotation of the clutch is situated at the side of the machine.

A NEW STARTING UNLOADER.

TO maintain a uniform pressure in the receiver and pipe lines, and to prevent the engine or motor driving the air compressor from stalling through overload,

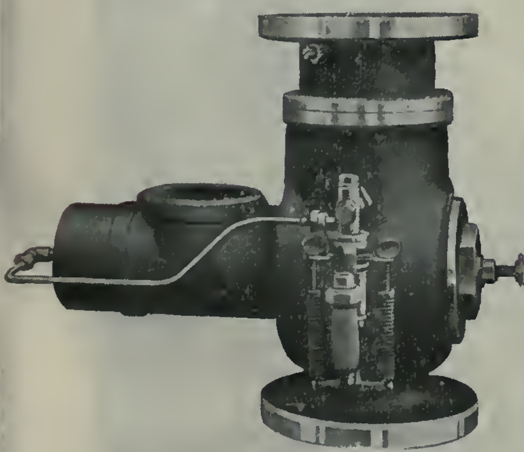


FIG. 1. STARTING UNLOADER.

it is essential that the compressor, whether steam, gas or motor-driven, be provided with some device that will unload it, when the desired receiver pressure is attained, and start the air into the receiver again when the pressure has fallen but a small amount below maximum or any predetermined point.

An interesting starting unloader for motor-driven compressors, in which the motor current is cut out or in to stop or start the compressor when a maximum or minimum load is reached, has recently been added to the field of air controlling devices by George M. Richards, formerly of Erie, Pa. In this latest apparatus the unloading action is obtained by the velocity of the air pressure passing through the chamber and the variation of the receiver pressure. The compressor is completely unloaded when speed is reduced about 25 per cent., and by this action any recoil on the last revolution experienced when stopping against a load is obviated.

When the motor starts the air is by-passed to the atmosphere, until the desired speed is obtained, at which point

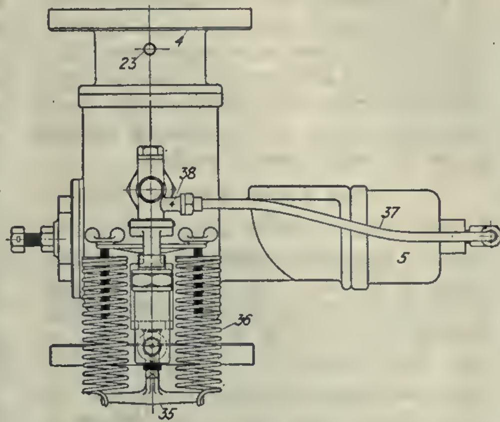


FIG. 2. STARTING UNLOADER.

the by-pass valve closes and the air passes to the receiver until the predetermined pressure at which current is cut out is reached. Then the by-pass is opened by the receiver pressure, via the trigger, against the unloading piston. The intake air has then, with the compressor unloaded, a practically free passage through the cylinder, with resultant cooling effect until the machine stops. The different loading and unloading operations are dependent upon the speed of the machine, and, therefore, entirely automatic. When the current is cut out and the compressor slows down, the by-pass valve opens automatically and unloads before the compressor stops. When the current is cut in, compression does not occur until the motor has obtained the desired speed. The principal advantage claimed for this new unloader is the fact that a compressor equipped with it will require very much less power to start it. Such a compressor can, therefore, be driven by a motor of much less

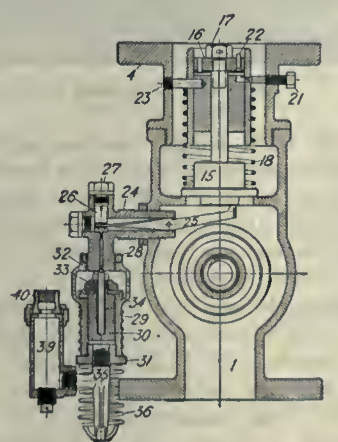


FIG. 4. STARTING UNLOADER.

power than ordinarily used. The operating parts of this new unloading device are few and simple, and consist of a by-pass valve (3), a check valve (15), unloading piston (6), and trigger (35). The detailed operation in connection with Figs. 2, 3 and 4 is as follows:—

Operation Features.

The air from the discharge port of the compressor enters at the bottom of the unloader and passes through the open valve (3), Fig. 3, to the atmosphere until the by-pass valve (3) is closed by the velocity overcoming the tension of spring (10). It then lifts check valve (15) and passes to the receiver connected to the top of the unloader. Check valve (15) is controlled by dash pots (16) and (19) to prevent its seating at every stroke; the time of seating being regulated by vent screw (21), Fig. 4. The small valve (22) is a vacuum breaker to allow the check valve to lift freely, while (23) is a fixed pin for holding the dash pot bushing in place.

The receiver pressure to operate the trigger mechanism enters trigger cylinder (29) through port (40) and filter (39), Fig. 4, and constantly acts on piston (30) to close bleeder valve (32), and closes valve (32) when pressure is within 3 lbs. of the maximum. As soon as the motor current is cut out and the speed is reduced about 25 per cent., the

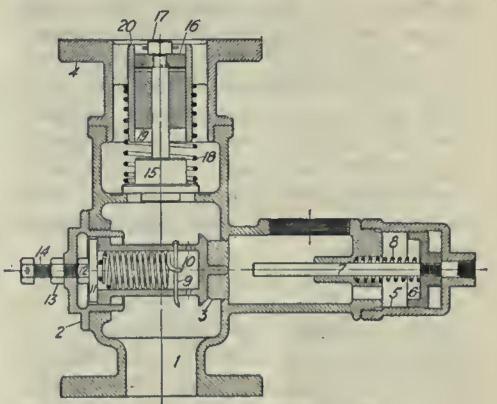


FIG. 3. STARTING UNLOADER.

check valve (15) seats and presses down lever (25) and lifts pilot valve (26), admitting pressure from chamber (1) through tube (37), Fig. 2, behind piston (6). Fig. 3 in cylinder (5), and by-pass valve (3) is forced open by piston rod (7), Fig. 3.

When the receiver pressure has dropped about 3 lbs., or any predetermined amount, tension springs (36), Fig. 2, pull down the trigger piston (30), Fig. 4, and bleeder valve (32). After starting again and the velocity has closed by-pass valve (3), the accumulating pressure in the valve chamber (1) blows out of the pilot valve (26) and bleeder valve (32) until check valve (15) lifts and lever (25) releases pilot valve (26) and allows it to close. The tension on springs (36) is usually so adjusted that the pressure under piston (30) closes bleeder valve (32) when within 3 lbs. of maximum and opens the valve when the pressure has dropped about 3 lbs. In order to prevent any possible leakage past pilot valve (26) from acting on piston (6) and forcing by-pass valve (3) open a minute hole is drilled at (38), Fig. 2, to permit this air to escape.

Just before unloading occurs the bleeder valve (32), Fig. 4, closes and allows the full pressure to act on piston (6). While loading it is kept open to prevent the pressure from acting on the piston. The baffle washer (34) is to prevent cylinder oil which may blow out of the bleeder valve from coming in contact with piston (30).

The unloader is generally placed on the discharge port of the compressor cylinder, but may be placed anywhere in the discharge line near the cylinder, and efficient operation will not be hindered. The adjustment of the unloader to the required condition of the compressor is particularly simple. When the compressor is near the desired speed, lock nut (13) is backed away and thrust screw (14) is turned in, thus moving by-pass valve (3) towards its seat till it closes automatically by the velocity of the escaping air, then the lock nut is set up. When the receiver pressure is within about 3 lbs. of the maximum or cutting out point, then springs (36) on the trigger are so adjusted that the pressure under piston (30) closes bleeder valve (32), and, conversely, opens the valve when the pressure has dropped the same amount. After these two single spring adjustments have been made, the compressor is ready for its regular work under the required condition of speed and pressure.

The unloader in no way controls the starting and stopping of the motor. It merely unloads the compressor and keeps it unloaded until it is again started and up to required speed. The control of the motor current is accomplished by some one of the standard controlling switches and circuit breakers.

The Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa., will in the future manufacture and sell all of the Richards air-controlling devices.

MACHINE-FIRING IN RAILWAY SYSTEM POWER STATION.

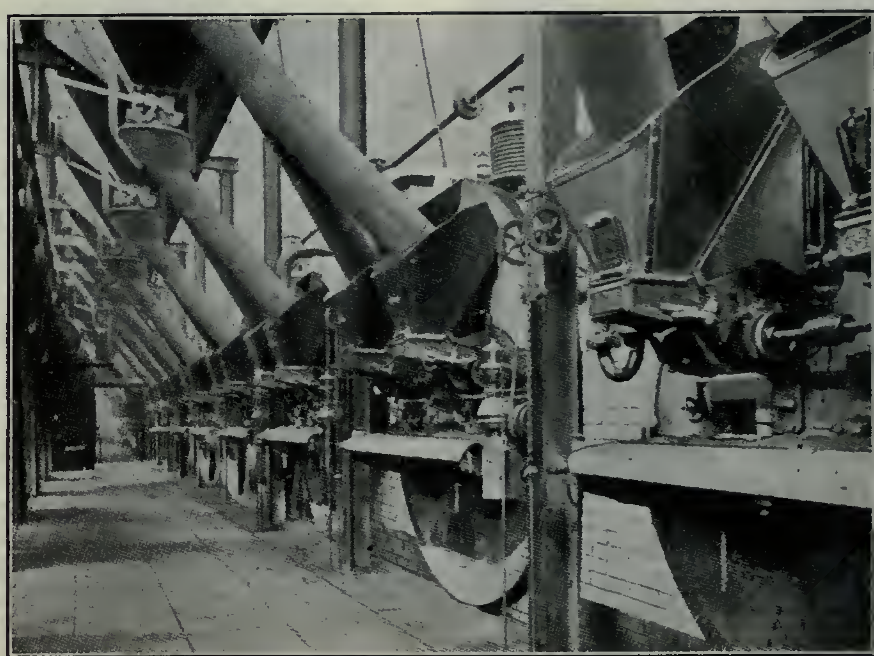
FORMBY power station is situated about half-way between Liverpool and Southport, England, close to the River Alt, thus ensuring a cheap and abundant supply of water for condensing purposes. Current is generated for the electric railway owned by the Lancashire & Yorkshire Railway Co. and links up Liverpool and Southport. The passenger traffic carried over this line in the course of a day is large, joining up as it does the important seaport shipping center with the residential seaside town of Southport. Trains follow each other in rapid succession from early morning until midnight in both directions and it will be understood that a delay on this section of the line would have serious results. It is thus very important that the principal factor in the power station, i.e., the steam-raising plant, should be maintained in a high state of efficiency and also be composed of units which after careful study have been found to be the most reliable under all conditions of working.

The Power Factor.

The power factor is necessarily an extremely variable quantity. At certain times of the day the trains are heavily laden and at other portions traffic is comparatively light. It is thus incumbent upon the officials to be certain that the steam-raising plant is highly flexible and that heavy peak loads may be easily taken when offered without imparing the efficiency of the line.

Coal is brought from collieries about twenty miles away, and is delivered by gravity from hopper wagons on to a bucket conveyor by which it is carried to overhead bunkers. From the bunkers, which hold about 130 tons, the coal is fed to the boilers by Bemis machine-stokers. The bucket conveyor, it may be mentioned, is also used for the disposal of the ashes. It should here be said that the boiler-room is 280 ft. long and 56 ft. wide and contains sixteen Lancashire type boilers. Each boiler is 32 ft. 6 in. long, 8 ft. 6 in. diameter, and has a grate area of 420 sq. ft., and 1,200 square feet of heating surface, with a normal evaporation of 12,000 lbs. per hour. The boilers are arranged in two batteries, north and south. The products of combustion on leaving each boiler pass through a superheater of 35 tubes, of 158 sq. ft. heating surface, and then go to the main flue, 10 ft. x 6 ft., which runs parallel to and against the wall between the engine-room and the boiler-room. The draught is induced by two fans 9 ft. 6 in. in diameter, one placed at each end of the main flue. Each fan has eight radial blades, being driven at a normal speed of 160 revolutions per minute by a compound vertical enclosed engine of 100 i.h.p. The products of combustion on their way to each fan pass through economizers, one being placed at each end of the flue. Each economizer consists of 720 tubes, 9 ft. long by 3 11-16 ins. internal diameter, embracing 7,200 square feet total heating surface.

Steam is generated at a pressure of 160 lbs. per square inch, and passed from each boiler through a superheater formed of a nest of U tubes, giving 150 deg. F. superheat into the main steam range. Each battery is a complete unit in itself, having, as already intimated, an efficient set of economizers so as to utilize the heat in the waste gases. A separate fan and chimney distinguishes each battery. At the same time, the arrangement of the dampers renders it easily possible to run the whole of the boilers through either set of economizers to either chimney. The chimneys are of steel, about 50 feet high, and the draught is created by a fan, direct-coupled to a high speed engine. It is possible when the fan is working at full speed to produce a suction equal to 2 ins. water gauge at the outlet of the economizers.



BENNIS STOKERS IN A RAILROAD SYSTEM POWER STATION.

Previous to the installation of mechanical stokers, the boilers were hand-fired and burning a good class Burgy coal, but the constantly increasing demands for steam became a serious problem. After careful inquiry and due consideration, the railway company decided to install mechanical stokers, and Edward Bennis & Co., Ltd., who are represented in Canada by G. H. Tod, Toronto and Winnipeg, were given instructions to fit eight of these boilers, that is, the whole of the south battery, with their latest type sprinkler stokers and self-cleaning compressed air furnaces.

The order was placed subject to severe and minute guarantees. Any or all of these boilers were to be capable of evaporating 14,000 lbs. of water per hour as from and at 212 deg. F. for twenty-four hours continuously if required, and for peak purposes 16,000 lbs. of water per boiler per hour for short duration. Under special conditions as to feed temperature, pressure, superheat, etc., and when burning ordinary Lancashire slack, the boilers, whilst evaporating the quantities of water stated above were not to exceed a coal consumption of 1,200 lbs. for each 10,000 lbs. of water evaporated. The steam and power required for the driving of the stokers, fan, engine, steam jets, was to be deducted before the total evaporation was recognized. Without the fan at work and with very little draught available, each boiler was to evaporate 10,000 lbs. of water per hour.

The tests were carried out in the presence of the company's officials, and the results were highly satisfactory and more than fulfilled the guarantee given. The water was measured in tanks, each holding 10,000 lbs. of water, carefully weighed and calibrated, previous to the test. The coal was weighed in trucks on the company's weighbridge which was guaranteed correct to 7 lbs.

The tests showed that the over-all efficiency was 81 per cent on the whole eight boilers and on a maximum evaporation test the evaporation per boiler per hour, from and at 212 deg. F. reached 23,000 lbs. The economical guarantees were satisfactorily fulfilled and the plant was then taken over by the company. It should be stated that the fuel was changed by adopting the stokers to a much cheaper grade, and also that the boiler capacity had been increased. After five months' operation, instructions were given to fit up the remaining battery of eight boilers with similar stokers.

During the period that elapsed between the fitting of the two batteries, several improvements in the throwing mechanism of the stokers were introduced by the patentees, and, as a consequence, the last eight boilers were fitted with the balanced double shovel arm gear. The plant was erected and tested, to the satisfaction of the officials of the company and taken over, and the improvements in the throwing mechanism having given satisfaction, the latter has been since applied to the first eight stokers installed.

The boiler-house may now be considered as a scientific part of the whole generating plant. CO_2 recorders are installed, careful details kept of all particulars necessary to perfect combustion and efficiency, and test results have always been maintained, which fact is a credit alike to the stoker manufacturers and to those in charge of the plant operation.

BRONZE MIXTURES.

We are indebted to the Brass World and Platers Guide for the following bronze mixtures in common use:

Aluminum Bronze.

Copper	90 parts
Aluminum	10 parts

Acid Bronze.

Copper	52 parts
Zinc	46 parts
Tin	2 parts

High Tension Aluminum Bronze.

Aluminum	2 parts
Copper	63 parts
Zinc	33 parts

High Tension Aluminum Bronze with Silicon.

Aluminum	2 parts
Copper	63 parts
Zinc	33 parts
Silicon	2 parts

Bronze to be Gilded.

Copper	58.3 parts
Tin	16.7 parts
Zinc	25.3 parts

Bronze Articles Exposed to Shocks and Great Friction.

Copper	83. parts
Tin	15. parts
Zinc	1.5 parts
Lead	0.5 parts

Bronze Resisting Action of the Air.

Copper	576 parts
Brass	48 parts
Tin	59 parts

Durano Bronze.

Copper	64 parts
Zinc	31 parts
Tin	1 part
Aluminum	2 parts
Cold Blast Iron	2 parts

French Bronze.

Copper	58 parts
Zinc	38 parts
Ferro-Manganese	3 parts
Ferro-Aluminum	1 part

Gold Bronze 1.

Copper	97 parts
Aluminum	3 parts

Gold Bronze 2.

Copper	90 parts
Zinc	3 parts
Tin	7 parts

Malleable Bronze.

Copper	56 parts
Zinc	42 parts
Manganese Copper	2 parts

Manganese Bronze.

Copper	64 parts
Tin	8 parts
Yellow Metal	8 parts
Manganese Dioxide	7 parts

Manganese Bronze for Bearing Set.

Copper	80 parts
Tin	10 parts
Manganese Copper	10 parts

Old Peruvian Bronze.

Copper	90. parts
Tin	4.5 parts
Lead	0.2 parts
Iron	0.3 parts

Phosphor Bronze.

"Standard" Copper	90 parts
Phosphor Tin	10 parts

Phosphor Bronze for Feed Screws.

Copper	16 parts
Banca Tin	1 part
Phosphor Tin	1 part

Phosphor Bronze for Bearings.

Copper	80 parts
Banca Tin	8 parts
Lead	8 parts
Phosphor Copper	4 parts

Platinum Bronze for Table Ware.

Nickel	100. parts
Platinum	0.5 parts
Tin	15. parts

White Platinum Bronze.

Yellow Brass	65 parts
Nickel	30 parts
Platinum	5 parts

Preston's Bronze.

Copper	55 parts
Zinc	40 parts
Tin	1 part
Nickel	1 part
Cold Blast Iron	3 parts

Red Bronze for Machine Parts.

Copper	74 parts
Zinc	5 parts
Tin	8 parts
Lead	3 parts
Manganese Copper	10 parts

Richard's Bronze.

Copper	55 parts
Zinc	42 parts
Aluminum	2 parts
Cold Blast Iron	1 part

Silicon Bronze for Telegraph Wires.—1.

Copper	99.94 parts
Tin	0.03 parts
Silicon	0.02 parts

Silicon Bronze for Telegraph Wires.—2.

Copper	97.12 parts
Tin	1.14 parts
Zinc	1.62 parts
Silicon	0.05 parts

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Vol. XII. AUGUST 13, 1914 No. 7

PRINCIPAL CONTENTS.

COMBATTING THE MENACE TO WORLD-WIDE FREEDOM.

CANADA IS AT WAR. Although hard of realization because of our distance from the territory in which the nations of Europe are so involved, 'tis nevertheless true. As a nation within an Empire to whom honor, freedom and right made duty clear, we are out to help wipe out the menace and crush the octopus of militarism which for years has kept Europe sitting on a powder barrel, so to speak; generally retarded the progress of civilization over all the world, and kept in chains and slavery a people who in spite of the latter have shown themselves to be worthy of a wider and higher field of effort.

We are at war now instead of later, because the time seemed opportune to his self-deified majesty, the Kaiser, and to those moral degenerates who pampered his inborn whim of a world dictatorship. We are not at war with the people of Germany, but on their behalf, for away deep down in their heart of hearts, could they now express it, there would be found hearty appreciation of the activities against the yoke of autocracy.

Whether the war be long or short, its termination will only materialize when freedom from the curse of militarism has been achieved, and the men and women of Germany have opportunity to turn their universally admitted talents to higher and nobler purposes. We are enthusiastic in Canada, because at one with the whole Empire in the determination to exterminate this military fanaticism once and for all, but we must needs be sober and be prepared to make the every sacrifice demanded.

In the mad rush amounting almost to panic that has been in evidence within our borders during the early days of this red letter month, we have had the spectacle of Rule Brittania being shouted at one moment, and in the next the attempt to corner everything in sight in the provision line, forgetting meanwhile that those who will make it possible for Britain and her allies to come out on top, will have in many cases to give of their life blood, and in others have to suffer and endure privation and hardship. Again, this food panic on the part of those who have the means is nothing short of criminal, playing, as it does, into the hands of human vultures who will not hesitate to screw prices up regardless of the sufferings of those who at normal times find it hard enough to make ends meet.

If we need not fight, it is because others are doing it for us, therefore let us at least acquit ourselves like men by sacrifice to keep our commerce and industries as close to normal as possible. It will be worth while, for of the ultimate outcome of the struggle there need be no fear because right is might. When the smoke of battle has passed, this old planet of ours will realize a prosperity hitherto undreamt of, much less attained, for the war spectre which aforetime stalked abroad stifling civilization and crushing humanity will have vanished in thin air. Needless to say, we in Canada will participate largely in that prosperity.

FOUNDRYMENS' CONVENTION AND EXHIBITION OPPORTUNITY.

THE opportunity to inspect and see in practical operation another year's achievement in foundry and accessory equipment is almost available and, together with the data relative to the ways and means of their accomplishment which will form the substance of the various papers to be read and discussed before and by the delegates in convention assembled, will make Chicago the Mecca of every foundryman for whom circumstances conspire favorably.

As in previous years, Canadian foundrymen, administrative and operative, will be much in evidence, but much as has been the representation in the past, we are of opinion that many more could not only be present, but for educative reasons should be so.

There is every indication that the coming convention and exhibition will, like its predecessors, be an easy record-breaker, and Canadian foundrymen of every class and kind should so lay their plans that theirs may be a record attendance, being assured that the educational reward will not fall short of bestowal on them.

INDUSTRIAL NOTABILITIES--No. 47

JAMES HENRY SHERRARD, president Alaska Feather & Down Co., manufacturers of beds and bedding, 400 Ambroise St., Montreal; vice-president, the Ideal Bedding Co., Toronto; vice-president, Alaska Bedding Co., Winnipeg; vice-president, The Alaska Western Bedding Co., Calgary; vice-president, Alaska B. C. Bedding Co., Vancouver, was born at Shediac, N.B., Sept 21, 1866, the son of Thomas F. and Mary Elizabeth (Durham) Sherrard.

He was educated at Shediac Grammar School, and started his business career with O. M. Melanson & Co., general merchants, Shediac, in 1883. He came to Montreal in 1891, and established the present business in the same year.

JAMES HENRY SHERARD.

Mr. Sherrard was chairman Montreal Branch Canadian Manufacturers' Association in 1911; is vice-president Canadian Manufacturers' Association for 1914; was alderman, Westmount, 1909; was chairman, Parks Committee; is vice-president, Victorian Order of Nurses, and a member Board of Management, Montreal General Hospital.

He married Lucy Warren Atwater, daughter of Henry W. Atwater, Montreal, June 24, 1898, and has one son.

His clubs are St. James and Canada, Montreal; Garrison, Quebec; National, Toronto, and Manitoba, Winnipeg; while his recreations are golf and fishing. He is a Conservative in politics and a Presbyterian in religion, and his home is 1 Forden Ave., Westmount, Que.—Photo courtesy the International Press.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		16 00
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 50	17 85
Victoria, No. 2X.......	18 25	17 60
Victoria, No. 2 Plain ..	18 00	17 35

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh............	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh..........	1.15
Beams and angles, Pittsburgh....	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes..	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings. 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10. in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Gal.	Lapweld Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 25	$15 65
Electrolytic copper	15 00	15 40
Casting copper	14 50	15 25
Spelter	6 00	6 00
Tin	70 00	70 00
Lead	5 25	5 25
Antimony	25 00	25 00
Aluminum	20 00	25 00

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15
Lard Oil, per gal.	0.60

CHAIN.

¼ inch	$5.65
5/16 inch	4.70
⅜ inch	4.00
7/16 inch	3.65
½ inch	3.45
9/16 inch	3 45
⅝ inch	3.35
¾ inch	3.25
⅞ inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough. Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1½-in	$37.50	$30.00	$17.50
33/64 to ¾-in.	41.25	33.00	19.25
7/16 to ½-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	95c lb.
Leather in sides	85c

BELTING RUBBER.

Standard	60%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

¾ inch	$ 4.95
1 inch	8.05
1¼ inch	12.65
1⅜ inch	15.30
1½ inch	16.50
1⅝ inch	19.40
1¾ inch	22.50
1⅞ inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Aug. 10, 1914.—The war in Europe has had the effect of putting an effective check on the very hopeful outlook of a few weeks ago. Since the declaration of hostilities there has been no real business transacted, but this, of course, is what would naturally be expected, because the situation is entirely unique, being one that knows no precedent. In a flash the whole of Europe has been precipitated into this struggle. Foreign exchange and all commerce has been suspended. The prevailing opinion here seems to be one of entire confidence in the ability of Britain and France to confine the hostilities within the boundaries of Germany, or at worst not far beyond these. The financial situation might be a great deal worse. Money is, of course, tight. However, no nervousness is evidenced, and up to the present no great difficulty in obtaining funds for business purposes has been felt.

The Steel Market.

During the past week very little steel has been purchased. Those firms who prefer to use European products usually carry fairly heavy stocks in hand, because of the fact that the delivery across the Atlantic takes several weeks under normal conditions. Thus, with little or no business their stocks remain complete. All orders are being filled, and no great change of price is to be noted. It is felt that it will only be a matter of a short time before trans-Atlantic shipping is resumed. No large orders are being sought. Some firms still have their salesmen on the road. Although the tendency is to conserve stocks of European steel, no orders are refused. All quotations are, of course, for immediate acceptance, and, therefore, are merely nominal. An important factor in assisting to steady the market is the fact that American rolling mills can supply the Canadian trade in the unlikely event of trans-Atlantic shipping being suspended very long.

Pig Iron.

The market in European pig iron remains quite steady. No delivery can be guaranteed. Several vessels which sailed before the declaration of war have since safely arrived, and no shortage is being felt meantime. The fluctuation in price is small. There is also here a tendency to conserve stocks; still no orders are being refused. Large orders are, however, scarce, because manufacturers are awaiting definite developments before purchasing.

Machine Tools.

Here, of course, the crisis is being felt more keenly than in any other line. No sales for the past week have been reported. Those firms representing European manufacturers, of course, cannot sell, because no delivery can be guaranteed. However, those houses dealing in machine tool supplies are enjoying quite a brisk business, and are able to keep their organization pretty well intact, although the turnover is quite small.

Metal Markets.

There has been no change in prices of metals except tin and aluminum. Tin has jumped up to 65 cents a pound, while antimony has gone up to 15 cents a pound.

Toronto, Ont., Aug. 11, 1914.—A week of suspense and uncertainty has passed, and the country is becoming rather more accustomed to a situation which is without a parallel in modern history. Having no precedents to follow as a guide in dealing with the situation, it will take some time for the business affairs of the country to become adjusted to the abnormal conditions. It is difficult, if not impossible, to foretell what effect the European war will have on Canada, but there is no doubt that it will disorganize trade for some time, the extent depending more or less upon the length of the struggle. Upon the ability of the British Navy to keep open the trade routes, of which we have no doubt, depends to a large extent the effect of the war upon trade, both export and import.

As far as can be seen at present it appears to be highly probable that the export trade will be increased, which will offset to some extent the depression in internal trade, which seems bound to result from the disturbance in financial circles, consequent upon the war. The export trade, however, only effects a few commodities, principally foodstuffs, and will not benefit our manufacturers to any appreciable extent.

It is possible that the entire surplus of this year's crops, not required for home consumption, will be shipped to the Old Country at a price which will result in a substantial return to the farmers, and offset the deficiency in yield which appears to be probable, judging from recent reports from the West.

Steel Market.

At this writing, the iron and steel markets are in rather a chaotic condition owing to the uncertainty as to what effect the war will have on the trade of the country, and also on account of the financial disturbance following on the outbreak of hostilities. There is every possibility of a drastic curtailment in building operations and municipal works, although we believe the latter will be carried on as far as is possible under the circumstances. We understand that the Dominion Government will continue progress with public works as far as the financial situation will allow.

Tin plate and galvanized sheets have advanced in price, but the market is so irregular that it is practically impossible to obtain quotations except against definite specifications and for prompt acceptance. The European sources of supply have been temporarily cut off, leaving only firms in the United States to supply the market. The prices of steel products have advanced, which, together with the increased difficulty of making satisfactory financial arrangements, will no doubt hinder the development of both private and public works. Makers of agricultural implements who do a large European business, will suffer severely, and will no doubt be obliged to curtail their operations.

In some lines no contracts for future delivery are being booked, quotations being made only for immediate acceptance. Prices are sure to fluctuate, and little business is being done. The British Government has prohibited the export of all metals, including ferro-manganese, which will vitally effect steel manufacturers, and what export trade we have in steel products will be stopped for the time being until the trade routes are reopened.

The United States Steel Corporation has withdrawn all prices on its products, and quotations have been advanced $2 per ton. The reason we believe is partly on account of the favorable rate decision by the Interstate Commerce Commission, and also because foreign competition on certain products has been eliminated. This advance will, of course, affect Canada, but how long it will remain in force or be still further increased remains to be seen. It is highly probable that the United States mills will eventually benefit from the war through their export trade.

Pig Iron.

Pig iron is perhaps the least affected of any. Owing to the conditions which have prevailed for some time in the market, comparatively little pig iron has been imported from the Old Country; the cutting off of the supply from that source will, therefore, not have much effect. The price of pig in the United States remains stationary, consequently prices have not changed except in the case of "Victoria" iron, which is slightly weaker. There is little business being done, and the market is very quiet.

WAR MARKETS.

NOTE.—Owing to the unsettled condition of the markets generally, and consequent upon rapid fluctuation in prices, it is impossible to give firm prices in our selected market quotations for many products, as prices on a number of lines are liable to change daily or oftener. The quotations will, however, serve as a guide while at the same time indicating the general trend of the market.

Machine Tools.

Little can be said regarding the machine tool market, except that there is practically no business being done, and prospects for an improvement are hardly possible until the European crisis is on a fair way to a settlement. A certain amount of business in single tools will no doubt be done right along, but orders of any size are not likely to be placed. The business which was expected from the railroads will be delaped indefinitely.

Metals

The metal markets as regards the amount of business being done are distinctly quiet; one firm, however, report satisfactory business. The war has cut off the supply of tin, which has jumped to 70 cents. The tin situation is assuming serious proportions, and a famine is probable. The British Government has prohibited the export of spelter and antimony, the supply of the former having also been cut off from Germany, consequently a further advance may be expected. Antimony advanced to 25 cents and spelter to 6 cents a pound to-day. Copper is steady, but an advance may be expected; prices are quite nominal. Both London and New York Metal Exchanges are closed indefinitely.

Ottawa, Ont., Aug. 10, 1914.—With the first scare over the war news passed, business is settling down to a little more like normal. That Canada was on the verge of a financial panic a week ago when the war scare was at its height is undoubted. In a number of Ottawa banks there were incipient signs of a run. Sir Edmund Walker and other banking leaders at once came to Ottawa, and a conference was held with Hon. W. T. White. As a result of the prompt action taken by the Government, the danger of a panic was stopped. Financial men at the capital believe that now even if things started to go against the allies there would be no serious disturbance in Canada.

How will the war affect Canada is the question that is now being asked in official financial circles? It is the belief that as soon as Great Britain secures absolute control of the sea and commerce to the United Kingdom can pass without danger of menace, trade will immediately pick up, and that there will be a big improvement in business conditions. That Western Canadian farmers and agriculturists will receive higher prices is undoubted. The millions of Europe cannot be taken from the farms of that continent without having a serious effect on the grain markets of the world. Higher wheat prices will help out the West, which, to speak frankly, has only about a sixty per cent. crop, and high prices will tend to compensate a little at least. While many manufacturing lines will be seriously hurt by the war, and will have to run on half-time, yet industries which produce commodities needed in warfare will be given an impetus. Leather manufacturers, cotton manufacturers, etc., will without doubt see an improvement in conditions.

Many Government officials in the Trade and Commerce Department believe that the result of the present war should give an impetus to Canadian export trade in manufactures. They point out that Germany now is an enormous exporter to South Africa, South America and Australia. They think that as soon as the trade lanes are free, Canada should be able to secure more than its share of the present German trade in these countries.

The announcement that the Canadian

Government had offered the Imperial authorities a million bags of flour and that the offer has been accepted has more than a sentimental side to it. It has an important business side. Owing to the difficulties in the exchange market, due to the financial moratorium in England. it has been impossible to send any foodstuffs to the Old Country. The port of Montreal is crowded with grain and other foodstuffs, which the shippers are willing to take chances on moving if they could only make the necessary financial arrangements. The Canadian Government, along with the English authorities, are making arrangements for the shipping of this grain, flour, etc. This will tend to relieve the situation, while it will generally assist the business situation in Canada.

It is the general belief that the industries which will temporarily be hurt most will be those relating to iron, steel and machinery. Railroad construction is bound to drop off, if not to stop altogether. The C. N. R. only got part of its bonds sold before war broke out, while the Grand Trunk Pacific bonds have not been put on the market, and cannot be now. Both roads will certainly have to curtail work.

Winnipeg, Man., Aug. 8, 1914.—The Grand Trunk Pacific Railway, who recently asked prices on a long list of machine tools for their McBride shops, have since notified dealers that the order for these will probably not be placed for some time. This action is said to be the result of the war in Europe. Most firms are cutting down their demands, and improvement is not anticipated until things are more settled.

The Saskatchewan Bridge & Iron Works of Moose Jaw have secured a contract for several bridges, the steel for which is coming forward to be fabricated at Moose Jaw. Their new plant at Medicine Hat is making progress towards completion, and when the work is finished, machinery will be installed gradually.

The Canadian Fairbanks-Morse Co., commenting on the business being done, state that woodworking tools have been up to the average this year, although inquiries are dropping off now. Metal-working tools they have found much duller this year than last. Jobbers are taking no chances on carrying stock under present conditions; yet, while admitting that machine tools are moving slowly, they state that a fair business is being done in supplies.

Wells & Gray, Ltd., Toronto, have been awarded a contract for the erection of a factory at Windsor, Ont., for the Remington Arms Co.

FORBIDDEN CANADIAN EXPORTS.

A proclamation was issued by the Government at Ottawa, on August 7, prohibiting the exportation from Canada of the following articles:—"Aluminum, aluminum alloys, armor plating, armor quality castings and similar protective materials, asbestos, cables, telegraph and telephone, camp equipment, articles of cannon and other ordnances and parts thereof, carbolic acid, carriages and mountings for cannon and other ordnance and for machine guns and parts there of, coal, steam and large compasses and parts thereof, including fittings, such as binacles cresol, engine and boiler packings, explosives of all kinds, fuel, manufactured implements and apparatus designed exclusively for the manufacture of munitions of war, for the manufacture or repair of arms, or of war material for use on land and sea; india rubber sheet, vulcanized, manganese, mercury, mica, mineral jellies, mines and parts thereof, molybdenum nitrocresol, nitrates of ammonium, nitrates of potassium, nitrates of sodium, nitratulol, nitric acid, picric acid and its components, rangefinders and parts thereof, rope and steel wire, and hawsers, saltpetre, sounding machines and gear, steam vessels, lighters and barges of all descriptions, sulphur, sulphuric acid, swords, bayonets and other arms not being firearms and parts thereof, tin, tinplates, torpedo tubes, torpedoes and parts thereof, tungsten, vanadium, four-wheeled wagons, capable of carrying one ton and over, two-wheeled carts capable of carrying 15 cwt. and over, harness and saddlery of all kinds, brass wire for long spans 450 lbs., per mile, horse and pony shoes, materials for telegraphs, wireless telegraphs and telephones, field glasses and telephones, field glasses and telescopes, railway materials, both fixed and rolling stock, men's marching and shooting boots, heliographs, portable forges, farriers', carpenters', wheelers' and saddlers' tools and transport service sets, glycerine, alcohol as covering rectified spirits uniform clothing and military equipment, accoutrements, walnut wood of scantling which can be made into rifle butts and forends."

WEST INDIAN TRADE.

THE results of the preference given to Canadian goods by the West Indies under the recent treaty made therewith were reviewed in a report to the Trade and Commerce Department recently by Commissioner Tripp, of Trinidad. In a number of cases, the preference has been without result, among them the following:—Cement, glass. glassware and plated ware, boots and shoes, brooms and brushes, butter, meal, hardware, lard, iron and steel manufactures, milk, paper, etc. It is to be concluded that there was an object in placing cement in the tariff bill, as the exports of that commodity from Canada have greatly diminished during the last few years. It is presumed that the local demand exceeds the supply, says the report.

There are several commodities, however, which, it is considered, should be open to Canada to supply in the near future, such as china and earthenware, coal and coke, electrical apparatus, jewelery, and refined sugar. Then there are a number of commodities which have already shown the beneficial results of the trade agreement and which have been received in increased quantity from Canada since the treaty came into effect. These include traveling bags, cordage and twine, cars, carriages, etc., flour (this being a striking increase), farinaceous preparations, meats in brine, paints and manufactures of wood.

May Acquire Nail Co.—It is stated in circles close to the Dominion Steel Corporation that considerable progress has been made in negotiations leading up to the acquisition of the Maritime Nail Co. by the Dominion Steel Corporation. Under present plans, should the deal go through, it is the intention to merge the Maritime Nail business with that of the nail department of the Steel Corporation, and take over the staff of the Maritime Nail Co. to operate the nail department of the Steel Corporation.

C. G. E. Patriotic Offer—The Canadian General Electric Co., Toronto, gave tangible expression in the accompanying telegram to Premier Borden of their desire to be of service to the Empire and the Dominion in the present crisis, and, needless to say, acceptance was gratefully acknowledged:

"Toronto, August 6th, 1914.

"The Right Honorable
Sir Robert L. Borden,
Prime Minister, Ottawa, Ont.

"The Board of Directors of the Canadian General Electric Co., after full consideration, and having regard to the present serious war situation, have resolved to submit to your Government an offer to raise, equip, and pay the salaries of a company of twenty-five skilled electrical and mechanical operatives who would be available for service in any part of the Dominion, and be under the control of the Minister of Militia as part of the Canadian forces. Probably their services could best be uitlized in the erection, repair and maintenance of wireless telegraph stations, cable stations, bridges, transport vehicles, artillery, etc.

"(Sgd.) Frederic Nicholls,
"President."

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Redcliff, Alta.—The Imperial Brass Mfg. Co., of Chicago, Ill., will build a factory here.

Jonquieres, Que.—A New York syndicate is contemplating erecting pulp and paper mills here and a power plant at Alma. B. A. Scott, of Quebec City, is interested in the project.

Sault Ste. Marie, Ont.—The new open hearth furnace at the Algoma Steel Corporation steel plant is now making steel and the first heat was tapped with satisfactory results on August 3.

Humboldt, Sask.—The town council has awarded to Theodore Kipp & Co., of Winnipeg, the contract for the supply and installation of pumping machinery and accessories for pump house at $12,350.

Princeton, B.C.—The British Columbia Copper Co., will make extensions to their plant at Copper Mountain. Machinery for the treatment of ore will be installed, and a large pump will be required.

Galt, Ont.—The officers of the Galt Machine Screw Co., Ltd., are R. W. Roelofson, president; F. D. Palmer, vice-president, and C. K. Jansen, secretary-treasurer, all of this town: The company is capitalized at $40,000.

Galt, Ont.—Ratepayers last Monday voted on two by-laws—one for a loan of $12,000 to the Galt Machine Screw Co., and the other for $20,000, to be expended on roads and machinery. The vote was small, but both passed by more than 250 majority.

Halifax, N.S.—President Harris, of the Nova Scotia Steel & Coal Co., has announced that as a result of the unprecedented financial situation created by the war it has been decided to close down a portion of the plant at Wabana Mines, and the blast and open hearth furnaces at Sydney mines have been temporarily stopped.

Ford, Ont.—It is reported that a $300,000 addition to the Ford Motor Co.'s plant will be erected at once. The new section will replace the only remaining old buildings. The new building will be six storeys high and 200 feet square. It will be of reinforced concrete, of the same design as the main building of the plant.

Hedley, B.C.—The Granby Consolidated Mining, Smelting & Power Co. now has three blast furnaces running at its copper smelting works at Anyox, the third furnace having been blown in lately. The capacity of the plant is stated to be about 2,000 tons of ore a day, but tonnage figures have not been made public as yet, so it is not generally known what quantity of ore is actually smelted daily. Besides its Hidden Creek mines, near Anyox, the company is operating two mines in south-east Alaska; and the ore from these is also to be shipped to the works at Anyox for reduction.

AUSTRALIAN RAILWAY WORKSHOP TENDERS.

Tender forms for the under-mentioned supplies required for the Victorian Government Railway shop at Ballarat and Bendigo have been received by the Canadian Government Department of Trade and Commerce, Ottawa. Tenders close at Melbourne on September 23, and the last mail available to Canadian manufacturers is that leaving San Francisco on September 1.

27085—44 tons copper rod.
27086—109 tons copper plates.
27087—19 tons best iron angles.
27088—347 tons steel boiler plates
27089—4,244 cwts. brass locomotive tubes.
27090—476 cwts. copper locomotive tubes.

Electrical

Florence, Ont.—The proposed route of the hydro-electric road from Strathroy to Dresden will pass through this town.

Nottawa, Ont.—The question of extending hydro-electric lines here is being considered.

The Dominion Machinery Co. have received an order from the Cordova Mines, Ltd., for two 75 and one 10 h.p. Westinghouse motors, transformers and other electrical equipment.

Brantford, Ont.—Work on the Hydro-electric branch line between Brant sub-station and Port Dover is to be completed immediately, and in a short time Hydro power will be available for Burford, Scotland and elsewhere. Engineers have been over the ground and laid out the route, and construction of the line will be gone ahead with as rapidly as possible.

Municipal

Berlin, Ont.—It is announced that there will be no civic abattoir established here.

Belleville, Ont.—The by-law endorsing an agreement with the Trenton Electric and Water Co. has been passed by the ratepayers.

Cranbrook, B.C. — Work on the new city water works will start next week. The contractors are Leder, Hotson & Goode, of Lethbridge, Alta.

Moose Jaw, Sask.—The Southern Saskatchewan Oil & Gas Co., which has its head office in the Walter Scott building, have appealed for the franchise to supply natural gas to the city.

Saskatoon, Sask. — The ratepayers have defeated the by-law conferring a 20-year contract to supply and distribute gas in this city. Voting was 608 for, 600 against. As a two-thirds majority is required, the by-law is beaten.

Haileybury, Ont. — Continuing their agitation for cheaper light the town council on August 3, discussed the by-laws of the Hydro-Electric Commission. The Northern Ontario Light & Power Company's franchise expires early next year.

Ottawa, Ont.—Hazen & Whipple, of New York, are the engineers in charge of the preparation of plans for the Ottawa River water supply. It is stated that these will be ready for submitting to the Provincial Board of Health for approval by the middle of August. The plans are for the construction of a filtration plant.

St. Thomas, Ont.—Reeve Smith, representing the township of Yarmouth, and a special committee of the board of works, held a meeting recently, relative to the proposed Hughes street viaduct. The estimated cost of the improvement is placed at $7,582. Filling in will cost, $2,000; culvert, $1,600; excavation, $1,978; pipe, $1,904.

INDUSTRIAL EXPANSION NUMBER

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Facts and Figures Relative to Industrial Opportunity

Staff Article

The accompanying article seeks to focus within easily appreciable compass the wide-spread natural resources, developed and otherwise, and the desirableness of a multitude of locational opportunities from the viewpoint of raw and finished market product transportation by land and water, which the Dominion of Canada offers manufacturers, enabling thereby prompt and wise decisions to be made concerning the establishment or extension of particular enterprises.

CONSIDERABLE progress has been made during the last twelve months in the industrial development of Canada, although the expansion in trade has been retarded by a severe depression, now somewhat aggravated. The position of most industries is sound and the check only of a temporary character, to be followed in due course by a period of good trade which will surpass any which the country has yet experienced.

An encouraging feature is the boundless faith which manufacturers in this and other countries have in the future of Canada. This is especially true of manufacturers in the United States, who are coming over in greater numbers every year and building branch establishments to take care of their increasing business with us. More manufacturers from Great Britain are establishing branches here now than formerly, having realized the opportunities which this country offers. The difficulty of obtaining reliable information regarding suitable locations is becoming less every year, as many organizations are at work with the object of furnishing information to help prospective industries.

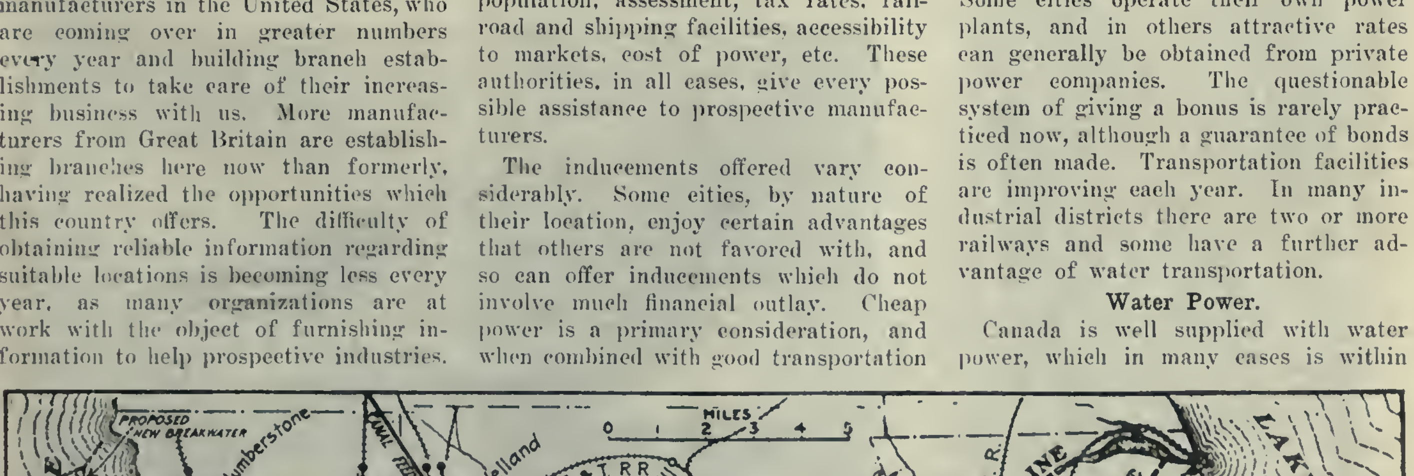
Manufacturers desiring to locate in Canada are confronted with problems varying according to the features of their particular industry, and the authorities in our industrial centers are becoming more alive to this situation, with the result that in the majority of cases they have taken definite steps to meet any necessary requirements. In all cases there is a Board of Trade, while some cities employ an Industrial Commissioner, often at considerable expense, whose duty consists of preparing and distributing literature containing facts and figures regarding the city and other general information, covering population, assessment, tax rates, railroad and shipping facilities, accessibility to markets, cost of power, etc. These authorities, in all cases, give every possible assistance to prospective manufacturers.

The inducements offered vary considerably. Some cities, by nature of their location, enjoy certain advantages that others are not favored with, and so can offer inducements which do not involve much financial outlay. Cheap power is a primary consideration, and when combined with good transportation facilities at low rates, makes a very attractive proposition. Some industries, again, require that raw materials shall be within easy reach, while to others this is not such an important consideration. It will, therefore, be seen that each city has its own problems to solve when offering inducements to prospective manufacturers. Each case has to be treated on its merits, according to what the city has to offer, and also the size and nature of the industry.

As a general rule, a fixed low assessment for a term of years and a partial remission of taxes can be obtained, while in some cases free sites are available. Some cities operate their own power plants, and in others attractive rates can generally be obtained from private power companies. The questionable system of giving a bonus is rarely practiced now, although a guarantee of bonds is often made. Transportation facilities are improving each year. In many industrial districts there are two or more railways and some have a further advantage of water transportation.

Water Power.

Canada is well supplied with water power, which in many cases is within



THE NEW WELLAND SHIP CANAL, SHOWING ITS RELATION TO THE PRESENT AND OLD CANALS.

reach of manufacturing districts. This is a valuable asset, and one that will be of the greatest assistance in developing the natural resources of the Dominion. In Nova Scotia about 16,000 h.p. is being developed; in New Brunswick, 10,000 h.p.; in the province of Quebec, 300,000 h.p.; Ontario, 560,000 h.p.; Manitoba, 60,000 h.p.; Alberta, 8,000 h.p.; and in British Columbia approximately 110,000 h.p. It has been estimated that over 17 millions h.p. is available in Canada.

By far the most important water power is that of Niagara Falls, Ont., where 405,000 h.p. is being developed on the Canadian side out of a possible 425,000 h.p., this being the maximum allowed under treaty with the United States. The largest power company on the Canadian side is the Ontario Power Co., who supply a large part of their current to the Ontario Hydro-Electric Commission for distribution. The Commission is a Provincial Government proposition, and the transmission lines serve a large part of Ontario. The lines are being extended each year until practically the entire province will eventually be connected up with hydro-service. The Commission are developing other water powers in the province, making thereby a complete system. It will thus be seen that the industrial expansion of Ontario is assured each year, showing it to be attracting more industries.

In the province of Quebec, the possibilities of hydro-electric development are great, but in many cases the water powers are as yet undeveloped. The principal water powers being developed are at Shawinigan Falls, Lachine, S. Timothee, Chambly, and Cedars Rapids. The city of Montreal obtains power from all of these sources for operating the public utilities.

The next most important province with regard to water powers is British Columbia, but development has not reached an advanced stage. The city of Vancouver has 200,000 h.p. available, but is only using about half that amount at present. Only a small percentage of the water powers in this province have as yet been gauged.

SHAWINIGAN FALLS, NEAR THREE RIVERS, QUE.

In Manitoba, it is estimated that 400,000 h.p. is available. At present, however, only about 60,000 h.p. is being developed, principally at Lac du Bonnet, which supplies the city of Winnipeg with power.

In the other provinces, the development does not call for any special mention, although in the majority of cases the large powers are waiting development as the demand calls for it.

Coal.

A considerable amount of the coal used in Canada is imported from the United States, the reason being on account of the location of the coal fields. There are practically only four districts where coal can be obtained, these being at Sydney, N. S., in Alberta, in the southern part of British Columbia, and on Vancouver Island. The output from the Sidney district is the largest, amounting to about seven million tons of bituminous coal in 1913. The output from the mines in Alberta was about four million tons, including bituminous, anthracite and lignite. In British Columbia about three million tons of bituminous coal was produced, including the output from the mines on Vancouver Island. In Saskatchewan an effort is being made to develop the lignite coal areas. It will be seen from the above why so much coal has to be imported from the United States.

Natural Gas.

In some directions natural gas is being used for industrial and domestic purposes. In Alberta, New Brunswick, and Ontario, natural gas is being used extensively, and further developments are anticipated. Petroleum is often met with in gas fields, but the development of this product has not attained the same measure of success as natural gas. Oil is, however, being found in fair quantities in some districts, and better results are expected.

The Market Feature.

We have referred briefly to the power feature obtaining in Canada, and will now deal with the question from a geographical standpoint. A country extending over 3,000 miles from coast to coast naturally offers a great variety of conditions to be considered by the prospective manufacturer. The position becomes complicated when considering the question of accessibility to markets for the product. The greatest industrial developments in the United States have

GALT COAL MINE, LETHBRIDGE, ALTA.

been in the Northern States, east of Chicago, and a similar condition may be said to exist in Canada. The result has been that up to the present time the greatest development has been east of Fort William. One reason for this is the greater population, and therefore better markets, and another the proximity to that section of the United States where the larger number of industries are located. Although the Eastern Provinces still continue to attract the greater proportion of new factories, a decided change in the situation is taking place, and the Western Provinces are making great progress in the development of new industries.

Each year sees new plants starting up in Winnipeg, Medicine Hat, Calgary, Edmonton, and other prominent cities, these all becoming manufacturing centers and distributing points for extensive territories.

Ontario has made greater industrial progress than any other province on account of its location and proximity to the United States. Many manufacturers from over the line prefer to have their branch establishments as near the home plant as possible, and for this reason have located at such points as Windsor, Walkerville, Welland, Thorold, St. Catherines, Hamilton, Toronto, Montreal, etc.

In the West, Winnipeg, Calgary, Vancouver and other cities have the same advantages on account of their proximity to Chicago and other manufacturing centers in the Western States. The reason as stated is, of course, distinct from other advantages offered by the various cities, and also so far as the development of Canada by British capital is concerned. Other considerations have naturally entered into the situation, one of these being the cheap power which is obtainable in greater or less degree in practically all manufacturing cities. Transportation facilities are unusually good with two or more railway systems, and in some cases supplemented by water transportation.

In the Maritime Provinces, industrial development has not been as marked as in some of the other provinces, although Sydney, C.B., and Halifax, N.S., and St. John, N.B., are important cities, especially the former, where is located the Dominion Steel Corporation plant. In the province of Quebec, lumbering and pulp and paper mills are very important industries, while Montreal, Sherbrooke, and Three Rivers are the principal manufacturing centers.

GREAT WEST LUMBER CO. PLANT AND LOG POND, RED DEER, ALTA.

The industrial development is well distributed throughout the province of Ontario, except for the northern section, which is mostly confined to the mining industry only. The principal manufacturing centers are Toronto, Hamilton, and the Windsor district; the Niagara peninsula, including Welland, Thorold and St. Catherines; London, Berlin, Galt, Guelph, etc. In Manitoba, Winnipeg is the principal manufacturing and distributing center, while in Alberta, Edmonton, Calgary, and Medicine Hat are developing into important industrial cities.

Comparatively little development has so far been made in Saskatchewan along manufacturing lines, except in the cities of Saskatoon, Regina, and Moose Jaw, where a number of industries are established and good progress is now being made. In British Columbia, including Vancouver Island, Victoria and Vancouver are important cities commercially and are making great progress as manufacturing centers. Lumbering, mining, and fishing are important industries, and a number of factories, mills, and canneries are being established to take care of the increasing demand for the various products.

British Columbia.

The principal cities in British Columbia are Victoria, the capital, on Vancouver Island, and Vancouver on the mainland. Both cities owe their importance to their natural location and fine deep-water harbors. Steamers trade

SHIPPING LUMBER FROM HALIFAX, N.S.

from these ports to the Far East and Australia, and great developments are expected with the opening of the Panama Canal. The Dominion Government is spending large sums of money in improving the harbors at both ports, while a large drydock will be located at Esquimault. The population of Victoria in 1913 was 50,000 and the assessment $116,000,000.

Vancouver at the same period had a population of 122,000, with an assessment of $227,000,000, although these figures do not include the adjoining municipalities of North and South Vancouver, which have populations of 12,000 and 40,000 respectively.

Prince Rupert, the Pacific terminus of the G.T.P., was incorporated about four years ago, and has a population of about 7,000. The first train arrived in Prince Rupert on April 9, 1914, making a red-letter day in the annals of that city. A fine harbor is being developed, and already a 20,000 floating dry-dock is being constructed, which when completed will be stationed there. The industrial possibilities of Prince Rupert are great, as there are a number of water powers awaiting development, after which cheap power will be available. Fishing, lumbering, and canning industries will eventually be established, while the development of the mining industry will be an important factor in the upbuilding of the city. Several towns, such as New Westminster, Kamloops, Fernie, and Nelson are centers of districts where fishing, lumbering, mining, and fruit farming are being developed.

INDUSTRIAL AND MANUFACTURING BUILDING, PRINCE RUPERT, B.C.

$3,000,000 PLANT UNDER CONSTRUCTION FOR THE GRAND TRUNK PACIFIC DRYDOCK AND SHIP REPAIR CO., PRINCE RUPERT, B.C.

Alberta.

The province of Alberta is better known as a cattle ranching and farming country; coal, however, is being mined in considerable quantities, and, in addition to being a source of wealth, will help considerably in the development of manufacturing. Calgary, Medicine Hat, and Edmonton are the most important industrial centers, while smaller towns such as Lethbridge, Red Deer, and Redcliff are attracting quite a number of factories. Natural gas, which is found in large quantities, principally in Bow Island and the Medicine Hat district, is an important factor in the growth of the above cities, cheap gas being available to manufacturers. On the Bow River, near Calgary, 10,000 h.p. has been de-

CALGARY, ALTA., FROM THE NORTH HILL.

ALBERTA CLAY PRODUCTS CO. PLANT, MEDICINE HAT, ALTA.

veloped, providing a further supply of cheap power in addition to natural gas. In the northern parts of Alberta there are large water powers awaiting development, approximately 800,000 h.p. having been gauged up to date. As already stated, a considerable amount of coal is mined in this province, the coal fields covering an extensive territory to the north and west of Calgary, the city being the chief market. Edmonton, the capital, has a population of 70,000, Calgary 80,000, and Medicine Hat 14,000.

Saskatchewan.

The province of Saskatchewan is essentially a grain growing country, but considerable development is in progress in certain cities, notably Saskatoon, Regina, and Moose Jaw, while Battleford, Yorkton, Prince Albert and Swift Current are also becoming important distributing and industrial centers. There are few water powers of any importance in this province, La Colle Falls, near Prince Albert, being the only one of any size that is being developed. There is no coal, with the exception of lignite, but exhaustive tests are being made in an endeavor to find the best method of burning it, in the form of briquettes or otherwise. Saskatoon has a population of 30,000, with assessment of $54,000,000. The population of Regina is 50,000, with assessment of $73,000,000. Moose Jaw has a population of 30,000, with an assessment of $52,000,000.

Manitoba.

Manitoba and Saskatchewan are the wheat-growing provinces of the Dominion, and both derive the greater part of their wealth from this source. Manufacturing has made little headway, except in Winnipeg, which is fast becoming the Chicago of Canada. The population of Winnipeg is about 225,000, and the assessment approximately $260,000,000, a remarkable growth considering that it is only forty years since the incorporation of what was then a small town. Winnipeg is an important distributing centre, and has in addition an ample supply of cheap power. Approximately 60,000 h.p. is being developed at Lac Du Bonnet, while large powers on Winnipeg River are awaiting development. There has been practically no coal discovered in Manitoba, and consequently a considerable amount has to be imported from the United States.

Ontario.

Industrial development in Ontario has been greater than in any other province, and the reasons are many. Ontario is one of the older provinces, and has the largest population. Its very close proximity to the United States is one reason why many manufacturers from that country have established factories within its borders. Transportation facilities are good, power is cheap, coal is not far away, and a good supply of labor is available. Toronto and Hamilton are the most important manufacturing centres, while there are a number of smaller cities which are showing considerable development. Among the latter might be mentioned Ottawa, Berlin, Brantford, Chatham, Fort William, Galt, Guelph, Ingersoll, London, Peterborough, St. Catharines, St. Thomas, Sarnia, Welland, Sault Ste. Marie, Stratford, Thorold, Walkerville, Windsor, Whitby, etc.

The population of Toronto is about 445,000, and the assessment this year is approximately $516,500,000. The bank clearings in 1913 were about $2,000,000,000, and building permits for the same year totaled $27,000,000. Hamilton has a population of 100,000, its building permits for 1913 amounted to $5,000,000, and its assessment $76,000,000. The population of Ottawa is 89,000, and that of London, 50,000.

There is hardly a known industry which is not represented in Ontario, while in the northern section of the province some of the largest silver mines in

DOMINION GLASS CO. PLANT, REDCLIFF, ALTA.

OGILVIE FLOUR MILLS, MEDICINE HAT, ALTA.

SASKATCHEWAN BRIDGE AND IRONWORKS, MOOSE JAW, SASK.

the world are being developed. Cheap power is available in all the above mentioned centres, principally through the agency of the Hydro-Electric Commission, whose transmission lines will ultimately serve the entire province. In the Niagara Peninsula, the Cataract Power Co. and the Hamilton Power and Transmission Co. also have lines extending throughout the district. In Western Ontario, natural gas is being used extensively for both industrial and domestic purposes, Tilbury being one of the more important places where gas is found. No coal of any commercial value is mined in this province, consequently practically all the coal used is imported from the United States. Although gas is found in large quantities, comparatively little oil has been found of any commercial value. As already stated, the largest water power development is at Niagara Falls; there are, however, numerous minor water powers either being developed or awaiting development as the necessity arises. Other natural resources include lumber, iron, nickel, silver, and various miscellaneous metals, while farming and fruit-growing are important industries.

STREET SCENE, REGINA, SASK.

Quebec.

Quebec is one of the oldest provinces, and in point of population comes second to Ontario. The industrial development of Quebec is widely scattered on account of the lumbering industry, which is perhaps the most important in the province. It is estimated that the forest area is about 130.000,000 acres. A considerable variety of mineral deposits are being developed, asbestos being the most important, with a production of about 112,000 tons last year. No coal is mined in the province, the greater part used coming from Sidney, N.S., while the remainder, chiefly anthracite, is imported from the United States. Immense water powers exist in this province, aggregating over 1½ million h.p. already gauged. Only a comparatively small amount has as yet been developed, the principal developments being Shawinigan Falls, Lachine, Chambly, and Cedars Rapids, the latter being the largest, although not yet in operation.

The principal city is Montreal, the largest city and foremost port in the Dominion. Montreal is also a long way in front of any other city in the province as a manufacturing centre, being very favorably situated for attracting industries. Montreal is at the head of ocean navigation, has cheap power from several hydro-electric plants in the vicinity, both rail and water transportation facilities, and ideal labor conditions. The population of Montreal proper is 568,000, and of Greater Montreal 652,000. The assessment is approximately $791.000.000. The building permits for 1913 were valued at $27,000,000 . Sherbrooke, Hull, Shawinigan Falls, and its neighbor Three Rivers, are important manufacturing centres where cheap hydro-electric power is available. A number of smaller towns, although they have comparatively small populations, support some industries. Quebec City, although of considerable importance as a seaport, has not as many industries as might be expected, considering its location and cheap power at hand. Quebec City has a population of about 85,000, Sherbrooke 20,000. and Hull 21,000.

New Brunswick.

The Province of New Brunswick, together with Nova Scotia and Prince Edward Island, form what are called the Maritime Provinces. In New Brunswick the principal industries are lumbering and fishing, including canneries. The forest areas are large, the Provincial Government owning over 10.000 square miles. The total value of the fisheries in 1912 was nearly $5,000.000. A number of mineral areas are being developed, but not very extensively. Coal is being mined at Grand Lake, and iron ore near Bathurst. Shale deposits, from which oil is obtained, are being worked in Albert and King's Counties, while natural gas is being obtained in commercial quantities near Moncton. There are a number of water powers from which about 10,000 h.p. is obtained.

Fredericton, the capital, with a population of 9,000, has a number of important industries. St. John, however, is the principal industrial centre, and in

ONTARIO PAPER CO. PLANT, THOROLD, ONT.

addition is an important seaport, being the winter terminal of a number of the trans-Atlantic liners. In recent years, St. John has made considerable progress as a manufacturing centre, and is also

CITY HALL AND PRINCIPAL STREETS, THREE RIVERS, QUE.

an important distributing centre for the Maritime Provinces. Extensive harbor improvements are now in progress, and the Dominion Government is spending a large amount of money in this development. The population is about 45,000. Moncton has a population of 15,000, and is perhaps best known as being the headquarters of the Intercolonial Railway.

Nova Scotia.

Nova Scotia, with which we will include the Island of Cape Breton, has an extensive seaboard, and consequently fishing is an important industry, being the largest in the Dominion. It is estimated that over six million dollars are invested in the fishing industry, which provides employment for over 40,000 people. Lumbering is also an important industry, about 200,000,000 feet being exported yearly. The estimated forest area is 780 square miles. The minerals being developed are coal and iron, the Cape Breton and Glace Bay districts being the most important.

The Dominion Coal Co., alone at Glace Bay, have, it is estimated, sufficient coal in their holdings to provide for an output of $3\frac{1}{2}$ million tons per year for 1,000 years. The output for each year is nearly 7,000,000 tons of bituminous coal. Iron ore is found in several districts, but on account of the Newfoundland deposit being nearer to Cape Breton, the large steel companies at Sidney import iron from there, consequently the iron mines in the province have not been developed to the extent that they would otherwise have been. There are a number of water powers in Nova Scotia, but although comparatively small, are exceedingly valuable on account of their advantageous position.

Halifax, the capital city, has a population of 55,000, and an assessment of about $31,000,000. There are a number of important industries in Halifax, including a large sugar refinery. Halifax has a fine harbor, and improvements are in progress, costing several millions of dollars. Halifax is a winter port of call for most of the trans-Atlantic liners. Sidney has a population of 22,000, and is famous as being the headquarters of the Dominion Steel Corporation, the largest of its kind in the Dominion. At Glace Bay, twenty-one miles distant, is the centre of the Dominion Coal Co.'s properties. New Glasgow is the headquarters of the Nova Scotia Steel and Coal Co. and the Eastern Car Co.

Newfoundland

Newfoundland, the oldest British colony, has not been developed very extensively. Lumbering, fishing, iron mining, pulp and paper manufacture are the principal industries. There are a number of water powers, a small proportion only being under development. The capital city, St. John's, has a population of about 34,000, and is both the largest city and the most important distributing centre. Wabana Island contains larger deposits of iron ore than any other district in the Dominion.

Soot Fall Data—Careful measurements were made during the past year by means of which it was determined that the soot fall in Pittsburgh ranges from 595 to 1,950 tons per square mile per year. London, England, has been considered one of the "gloomiest" cities in the world, yet the soot fall there is only 426 tons per square mile per year.

PICKLED FISH EXPORT, HALIFAX, N.S.

The Progressive Maritime Province of New Brunswick

By J. B. Dever

A fund of not only interesting but highly useful information concerning this Eastern section of our Dominion is available from a careful study of the following article, and as the details have been secured first-hand by the writer from observation and residence in the territory, prospective settlers, manufacturing or otherwise, cannot fail to profit.

THE Maritime Provinces of Canada offer splendid opportunity for industrial expansion and development. The success attained by many large manufacturing houses in past years presents substantial evidence of the fact, and each succeeding twelve months adds its share of generous support to the statement. Last year, when from all parts of Canada, the United States and large European centres came pitiable bewailing regarding the financial situation and the business outlook, there was a clearly apparent air of contentment in the East because, though progress was checked to a slight extent, there was no actual stay in advancement, much less a set-back. This was true of all cities and towns through the Atlantic Provinces, but particularly so as regards St. John, N.B.

Industrial Activities.

St. John has a Board of Trade. Furthermore, it is an active organization, and possessing a very energetic and capable secretary and industrial commissioner in the person of R. E. Armstrong. Is he appreciated? Well, it is hardly proper to ask the question in this form, but it might be said in all truthfulness that his efforts are appreciated. His endeavors to further the industrial development of the city have been quite successful, and the board has supported him ably.

St. John offers much to attract outside industries to locate, and the city is ever ready to grant all consistent concessions to a deserving manufacturer. There is no definite form of concession. No bonus is given by the city, but an inducement is offered in the way of special favors as to exemption from taxation for a certain period, reduction in taxation for a fixed term, provision of a site by the city and other privileges, the only consideration demanded being the employment of a certain number of workmen and the definite establishment of the industry within limited time mutually agreed upon.

This policy has proven quite satisfactory. It is not only applied to outside concerns, but industries starting from within the city have been favored under it. In ten years, up to 1911, the capital invested in manufacturing industries in St. John increased 80 per cent.: but since that time the tremendous development of its transportation facilities has attracted many new factories, and there are at present works of enormous magnitude under way. There has to a certain extent been a slight movement, hardly amounting to a migration, of industrial plants from the city to the suburbs; for instance, in the case of the T. S. Simms Brush & Broom Co., who have built a new structure of reinforced concrete in Fairville, just outside the city limits. The Maritime Assembling & Service Co. have a large plant within a short distance of the city at Coldbrook, where also the Ford Motor Co. have their works. In these cases it is not correct to speak of the establishments as being migratory, but more properly as part of a movement for the founding of large manufacturing enterprises just on the outskirts of a city.

The Housing Problem.

With the discussion of this phase of industry, the establishment of factories in the suburbs, comes the consideration of the housing problem. This is now being grappled with in St. John. Before long it is hoped to have neatly arranged rows of workmen's cottages on land owned by the city or private concerns on the outskirts and connected with the heart of the town by street railway service. The rails from the city streets are now being extended outward, and are approaching Coldbrook, where it is planned to have a **Garden City**, and where the suburban industrial movement so far as St. John is concerned will likely be selected. A few miles further out the Canada Cement Co. have acquired a huge limestone and clay deposit, and will construct a large modern plant, showing again the movement towards the suburbs in the sphere of industry. The Wilson Box Co. have enlarged their plant and added more modern machinery. They also are located in a suburb, as is the case with another new industry, the Moore Woodenware Factory. In each case efforts are being made to have the workmen employed properly housed in the immediate vicinity, and extensive plans to this end are now well advanced with a view to holding skilled labor in the suburban districts in question.

Transportation Facilities Constructed and Projected.

The importance of adequate railway and water facilities to the development of industries is one of the most important factors in the consideration of a location. Without these little can be done. One of the first questions an intending manufacturer will ask, after ascertaining the value and extent of the raw products to be developed, is as to the shipping facilities. Large sums of money have been expended about St. John to develop and equip the port. Millions more are now being put out to make it still more fitted to the rapidly growing trade, and thoroughly deserving of the title of "Canada's Winterport." In dredging and dock construction to provide accommodation on the eastern side of the harbor for the Grand Trunk and Canadian Northern Railways, each of which it has been announced will make St. John its winter terminus, fully $30,000,000 are being expended. The huge breakwater being built by the Norton-Griffiths Co. is rapidly nearing completion, and a start will soon be made on the stretch of two miles of docks where twenty-three modern, large-sized steamers can find accommodation. Seventy acres of land have been purchased adjacent to the docks by the Grand Trunk Railway for terminal facilities, elevators, shops and other appurtenances. On this side of the harbor also is to be constructed by the Norton-Griffiths Co. a gigantic dry dock and ship repair plant. In a few years will be found here a new harbor rivaling some of the best on the Atlantic coast, and superior to many.

Winter Port of St. John.

On the western side of the harbor is to be found the winter terminal of the Canadian Pacific Railway. The third big elevator at this port has this year been completed by this corporation, and they have announced that at least $1,000,000 yearly will be spent by them in keeping their facilities adequate to cope with the traffic demands. The city and the Dominion Government are co-operating with the C.P.R. in this matter, and contracts totaling more than $10,000,000 have been provided for by the Government in dock construction, dredging, and in the extension of the present breakwater to a much greater distance. New wharves and berths are now being built by the Maritime Dredging & Construction Co. In the main harbor also, the Intercolonial Railway is developing its facilities, and soon must provide greater equipment for the increasing trade. It should be noted that all this harbor work being done provides for the docking of the greatest steamships afloat. In addition to the other roads mentioned, the St. John Valley Railway will make its terminal at this port, and when completed will have opened up a vast area of valuable and as yet almost unknown lands with their unlimited supply of natural products to the manufacturer.

Throughout the Province of New Brunswick as a whole new railway lines are penetrating and bringing to the seats of manufacture the best to be had from the inner regions in raw material and natural resources to be moulded into marketable commodities by the wheels of industry.

Industrial Expansion and Possibilities.

During the last few years, St. John's industrial houses have passed through a period of expansion and growth which has been most encouraging. New plants have been established, and old ones have been made more modern and enlarged, and there is a strong feeling that in the near future there will be established in St. John a steel shipbuilding plant. The Norton-Griffiths Co. have acquired 100 acres west of the dock to be built for the purpose and, close by, other interests have taken upon themselves the acquisition of land as a site for a smelting works and steel plant. The work on the plant of the Atlantic Sugar Refineries will soon be completed. It is now nearing the final stages, and refining will begin some time this fall.

At a cost of $1,000,000, T. McAvity & Sons, Ltd., will extend their already large plant to a new site in the Marsh Road, where a most up-to-date brass and finishing foundry will be erected. Six times within the last eight years the Maritime Nail Works have extended their plant, employing 300 hands, and still further expansion is planned. Other industries are especially active, particularly those more recently established, including the Canada Brush Factory, Simms Brush & Broom Co., Oil Motor Co., Ltd., Ganong Confectionery Co., and the Royal Vacuum Cleaner Factory. Of course, the older plants have been kept busy as well.

As to the possibilities of industrial expansion about St. John, with so much raw material available and the transportation facilities up to the standard, the opportunities for manufacture are almost unlimited. There is believed to be room in St. John for a brick manufacturing plant, a furniture making factory, a structural steel concern, a paper factory, and other manufacturing branches. As to the first named, tests have been made, and it is learned that there is an abundance of workable clay near at hand. There are only two such plants here now. Negotiations in one or other of these lines have been carried on relative to having such plants locate in St. John, and a decision is pending in regard to some of them.

The Power Question.

For some years, various schemes have been discussed for harnessing the great water powers along the St. John River and turning it into service. There is practically a monopoly of electric power held now by the St. John Railway Co., but different schemes are being given consideration whereby other power plants may supply also. These schemes have by no means been abandoned, though one or more may appear dormant at present. One of the most fondly cherished hopes of St. John manufacturers is the possibility of having natural gas from the wells near Moncton piped to the city. These wells have proved of rare value to manufacturing plants in and near Moncton, and their importance for domestic supply is also fully realized. Late borings have improved the situation considerably. There is a good supply of bituminous coal in Queen's County, not many miles from St. John, which can be had cheaply for steam purposes at about $2.25 a ton.

General Trend Towards Advancement.

Throughout New Brunswick generally there is every indication of progress. Each town and city throughout the province is experiencing a period of activity, and building permits have been issued to a greater amount than for many years. Moncton is attracting especial attention through its proximity to the oil and gas wells, and its possibilities as an industrial and railway centre. There are many big commercial enterprises under way in Campbellton, where in one month recently fifteen permits for building were issued. Newcastle, Woodstock, Fredericton, Sackville and St. Stephen are all joining in the forward movement, and in the last named place there is a prospect of the establishment of a harbor of national importance to be brought about by improving the natural environment. A large new shoe factory has recently been built there also.

At St. Andrews, progress is being made on the new hotel to be erected to replace the Algonquin, burned some weeks ago. It will cost about $250,000. Speaking of hotels, it may be said that plans are under way for the erection of two large hostelries in St. John—the Hotel Carleton and the Hotel Imperial six and eight-storey structures. From Fairville to St. John the new spandril arch bridge of steel being erected by the Provincial Government is being rapidly stretched across the Reversing Falls, and, when this has been completed, the C.P.R. intend building another steel cantilever bridge alongside.

All of the foregoing facts tend to show the prosperity of the East. There the people have confidence in the future and look for further progress. Manufacturers are shipping their goods to the Pacific Coast in one direction and the West Indies in another, and the name of New Brunswick's industrial houses is more and more becoming better known and recognized for its worth. There is reason to believe that the next few years will see even a more marked development, and that the era of industrial expansion, of which mention has been made, will continue to at least keep pace with other sections of the Dominion.

The Work and Worth of Municipal Boards of Trade

By A. G. W.

It seems only natural to infer from its very constitution that a Board of Trade where established would be a prime factor not only in the effort to secure industries but also in placing them. As an institution considerable development has quite recently taken place, with the result that even in comparatively small towns such a body is organized.

THE industrial progress of Canada as exemplified in our various manufacturing centres is largely due to the formation of Boards of Trade in the majority of our cities and towns. It is reasonable to suppose that a body of citizens working together for one cause can accomplish more than any individual effort, however well directed, and a Board of Trade can accomplish still more in this direction than even the local civic council. It is organized for a particular purpose—to foster trade and confine its energies to that particular end. Furthermore, the members of Boards of Trade are usually representative citizens anxious to see their city grow and its councils are selected from the more prominent members.

Organization of a Board of Trade.

Boards of Trade or chambers of commerce may be formed as corporations independent of the Government under the provisions of an Act passed in 1886. Either may be formed by thirty persons connected with representative industries or professions, and who are resident in the district. The various vocations include merchants, traders, brokers, mechanics, manufacturers, bank managers or insurance agents. A certificate of formation under hands and seals of the original or charter members must, however, be filed with the Secretary of State. It will thus be seen that a Board of Trade, although not a Government appointed body, occupies a position of much importance, and its rulings and decisions carry considerable weight in the community.

The officers are president, vice-president and a council of not less than eight members who appoint a secretary. General quarterly meetings must be held each year but usually meetings are held more frequently than this, according to the amount of business to be transacted or when called for special purposes. Persons other than the above mentioned can only become members upon recommendation of the council. The corporation have power to elect twelve persons who shall form a board of arbitration and any three members shall have power to arbitrate on cases submitted to them. The Canadian boards of trade are not official organizations to the full extent that obtains in Great Britain, but they probably are more effective in one way—that of encouraging new industries. This has become in recent years, perhaps the chief reason for their formation in many cases.

Duties of a Board of Trade.

While it is true that they are in a position to influence legislation and often exercise that privilege, yet in the majority of cases their chief work lays in the direction of furthering the commercial interests of the municipality on business lines rather than legislative. The only exception to this, in what may be called principle rather than rule, are the boards of trade in some of the larger cities such as Montreal and Toronto. In both these instances the boards do not make any particular effort to encourage new industries but rather confine their energies to general work in connection with manufacturing and commercial undertakings, assisting those interested in every possible way, either by promoting legislation or generally endeavoring to further their development.

Occasionally their work assumes national importance, such as the stand taken by the Montreal Board of Trade over the Long Sault power development controversy which readers of Canadian Machinery will remember and appreciate. This case briefly, was an attempt by a powerful United States corporation to develop a large water power at the Long Sault Rapids on the St. Lawrence River, for the benefit of manufacturers across the border at the expense of Canada. The influence of the Montreal Board of Trade with other organizations opposed to this scheme, went a long way towards defeating it. This incident serves to show how a strong organization, such as this board is, can be of the greatest service to the country generally, as well as to the municipality in which it is located.

As already stated, the boards of trade are organized with a view to improving the industrial conditions in the municipalities where they are formed. The best proof of the success of these organizations can be seen in the fact, that nearly every town and city in the Dominion has a Board of Trade. They are becoming practically indispensible and are doing much valuable work. In a new country like Canada where syndicates, companies and private individuals are continually looking around for suitable locations for factories, it is absolutely essential that, if a town desires new industries, it should be in a position to negotiate with the prospective manufacturer and have the necessary organization to deal with the situation. It must have a representative body with full powers to negotiate and lay before the prospective manufacturer all the inducements which they are prepared to offer and, in addition, have complete data as to sites, freight rates, cost of power, etc. Unless this information be given promptly there is little hope of landing any new industries. This service a board of trade is able to render if conducted on proper lines.

Industrial Commissioner Feature.

An important official is the secretary or in some cases the industrial commissioner. He should be the scout of the organization and also the chief of the **Intelligence Department.** An active secretary or commissioner will go a long way towards making success of a campaign to attract new industries. We have a case in mind where a large concern had practically decided to locate, but the industrial commissioner of an adjoining city heard of this and immediately went to interview the principals of the company, and stayed with them until he had induced them to locate in his community. The city that lost this industry had no organization to deal with a case of this kind, and the incident serves to show how essential it is that a municipality should have an active organization to take care of such conditions.

In most cases the secretary is in the receipt of a salary, the amount usually depending upon the duties attached to the position. An industrial commissioner as a rule devotes his whole time to the work and is paid accordingly, often with an attractive salary. It can hardly be expected that a small city would be able to pay for the services of a commissioner, but the larger cities find it a profitable investment. The point is that if an active campaign is to be instituted, there must be a qualified official to conduct it and he naturally must be paid accordingly. The location of the city and inducements which can be offered are of course a vital consideration in deciding as to advisability of incurring such expenses.

Civic Publicity.

In the more progressive towns, the board of trade conducts a systematic advertising campaign, involving the printing and distribution of literature, setting forth the various inducements which the town can offer, and such other particulars as are likely to interest prospective manufacturers. The advisability of such a campaign naturally depends upon what the town has to offer, but generally speaking, success has attended the majority of such campaigns. The literature is distributed to parts where it is likely to be most effective, a considerable amount usually finding its way to the United States, from which country a large number of manufacturers are coming each year to establish Canadian branches. Both eastern and western cities will continue to attract new industries as long as they can deliver the goods.

This publicity committee, or industrial commission feature of the board of trade, is one that has developed within the last few years and is a new departure in civic work. It has now come to be a recognized factor in the growth and expansion of municipalities throughout the country, from coast to coast. Practically every town, except the very small ones, has a board of trade and a large proportion of these organizations have a publicity or industrial committee. A board of trade would be neglecting one of its most important duties if it failed to appreciate the value of civic publicity, the foundation of which must be a committee of energetic members backed up by the board and a suitable appropriation for the work.

There is no question but that the board of trade idea is a good one, and one that has been responsible to a great extent for the development of many of our manufacturing centres. The idea is good both in theory and practice, for the members comprise men who are most likely to have the best interests of their town at heart, and their position in the community entitles their views on industrial questions to be respected. It is to be hoped that these organizations will continue to still more further the interests of their respective communities as they have in the past, and assist as far as possible all industries, established and prospective by every legitimate means in their power.

Specific Industrial Opportunities for Manufacturers

By a Staff Reporter

No individual, however generally superior in the eyes of his fellows, has a monopoly of gifts or is a perfection in personality, and we esteem it well that it is so. In like manner no one location in our Dominion has a monopoly in the matter of attracting industries. With the almost endless variety of the latter there is fortunately an equivalent personal condition existent; manufacturers have therefore a wide choice and can shrewdly estimate the value to themselves of the different facilities offered.

INDUSTRIAL DEVELOPMENT AT TORONTO, ONT.

THE phenomenal growth of Toronto, as a manufacturing center, up to the present time, has been of a haphazard nature and absolutely without aid from the civic or other public bodies who in other cities spend so much time and effort to secure new industries. The opening of the year 1914, however, witnessed the commencement of a work which marks a new era in Toronto's industrial history, and with which the people of the whole North American continent are by this time thoroughly familiar; to wit. the gigantic plans of the Toronto Harbor Commissioners for the development of the city's harbor and waterfront. The section of this development regarded by the commissioners as its most important work is the reclamation of the Ashbridge's Bay district for the purpose of providing an ideal location for industries of every description. From now on industries seeking a location in Canada will be taken in hand by the Harbor Commissioners of Toronto. and will be shown factory sites in an industrial district within a mile of the heart of a big city and served by railway sidings connecting with all three Canadian Transcontinental Railroads in addition to service at public docks by lines of freight vessels carrying cargoes from Montreal in the East to the head of navigation at Fort William in the West.

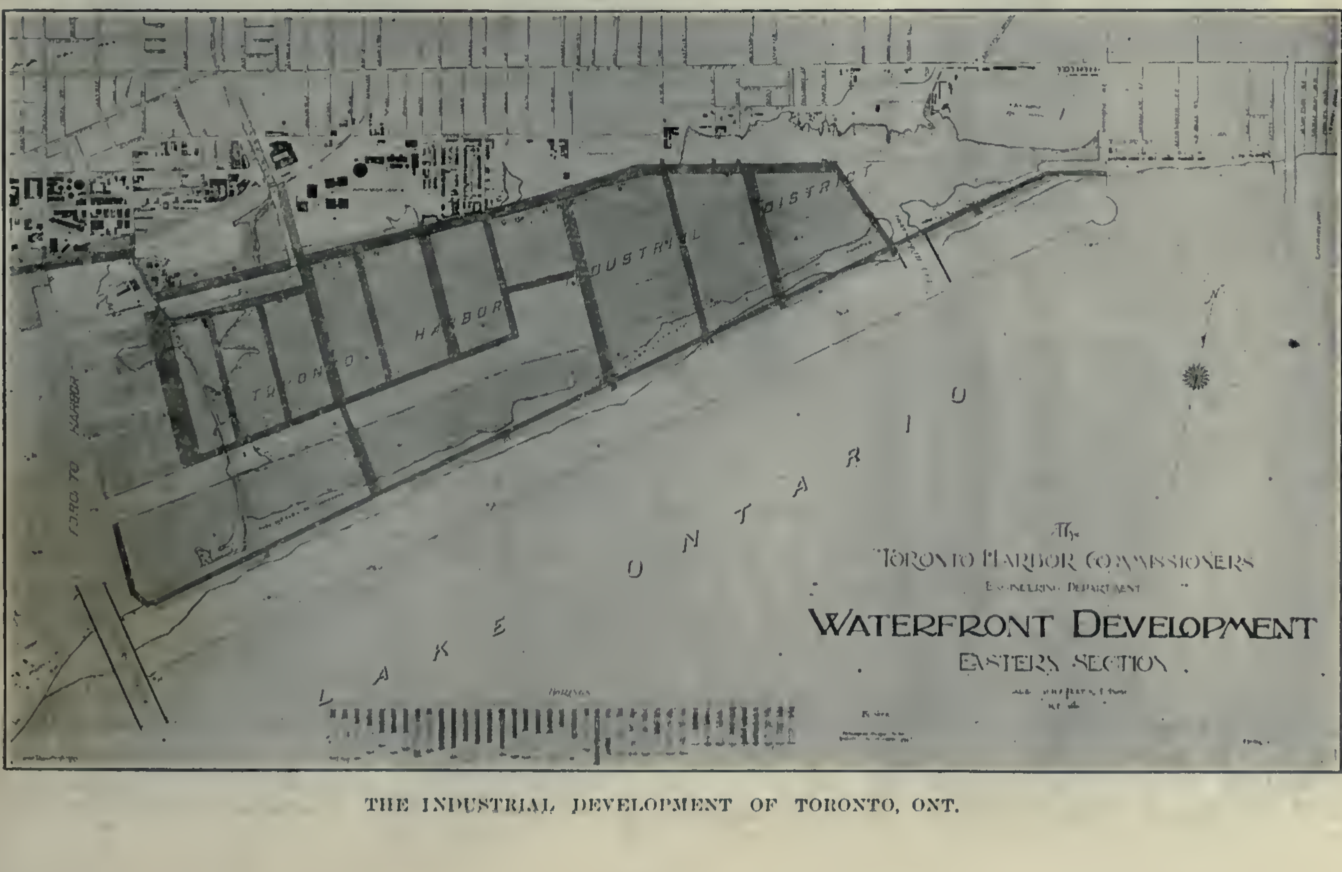
Transportation Facilities.

The Harbor Commissioners have provided for an expenditure of $15,000,000 to place this industrial district in condition for use and when their work is completed they will have created 646 acres of land available for industries on which it is estimated 1,000 new factories can be located. These factory sites have been laid out on the lines of most modern developments, railroad siding reservations totaling thirty miles in length having been set aside by the commissioners for the purpose of serving the district and each individual lot. These sidings will be at the service of factories locating on the property of the commissioners and will be free of expense to them. Thirty miles of streets varying in width from a minimum of 75 feet to a maximum of 175 feet will be provided for pedestrian, vehicular and street railway use and five miles of docks will be constructed to serve the shipping needs of the district.

In planning for railroad service in the Toronto harbor industrial district under which name Ashbridge's Bay will be known in future, the commissioners have made a traffic agreement with the three railroads under which there will be no interswitching charges, the result being that factories locating on the lands of the commissioners will receive or ship goods over any one of the three lines without being subject to the vexatious charge of from $5 to $8 per car which is inflicted on factories located on only one line of railway. This feature will be appreciated by manufacturers who have the service of only one railway at the present time.

Reclamation Work.

The reclamation work as outlined above is already well under way, substantial progress having been made during the present summer on contracts which amount in total to over eleven mil-



THE INDUSTRIAL DEVELOPMENT OF TORONTO, ONT.

lion dollars. Over 100 acres of land has already been reclaimed, one large modern dock served by 24 feet of water has just been completed and work is rapidly progressing on the first section of a ship channel 400 feet wide by 7,800 feet long, which will provide access for large vessels right into the heart of the district. The dredging and pile-driving plants of three companies in addition to the fine modern plant owned by the commissioners themselves have been busy at work since June carrying out the plans prepared by the commissioners and approved by the city council and Dominion Government and, by the end of the present season, the citizens of Toronto will see very substantial progress on an undertaking for which they have waited many years. With the completion of this reclaiming work, Toronto will be placed in a position to compete for factories with other Canadian cities and will be able to offer intending locators, modern factory and shipping facilities in addition to the advantages which are naturally hers.

TORONTO'S NEW UNION STATION AS IT WILL APPEAR WHEN COMPLETED.

THREE RIVERS, QUE.

ABOUT the beginning of 1914, the Board of Trade of Three Rivers thought it advisable in the interest of their city to try and induce English, American and Canadian industries to locate there. They felt that the Dominion of Canada as well as the United States and foreign countries were not aware of the advantages they had to offer, and with a view to bringing these before the world, they inaugurated a new department, known as the department of Publicity and Industry. They engaged as commissioner, W. J. Shea, who has had considerable experience in this field, to look after the work. Already the wisdom of the move is being felt in the city proper, as on all sides, enthusiasm among the citizens is noticed, and civic pride is taking the place of mere personal issues. The department is at present negotiating with several prominent capitalists who contemplate locating in Three Rivers.

In addition to its advantages as a manufacturing centre, they have been attracted by the inducements which the city offers in the way of free sites, tax exemptions and a freedom from labor troubles, more or less prevalent in the larger centres. Cheap and adequate help is always available and has done much in bringing the name of Three Rivers before the outside world.

There are at present several very important industries located there, the most important being the Wayagamack Pulp & Paper Co., who specialize in **Kraft** paper, and employ over 600 hands with an annual pay roll of over $500,000. This company represents an investment of $3,000,000. The next in importance is the Wabasso Cotton Co., which began operations a few years ago with capitalization of $1,250,000. They have lately doubled the size of their plant and are employing now over 1,000 hands.

The lumber industry has always been the backbone of Three Rivers and the surrounding country, the lumber supply coming from the forests extending more than 300 miles up the St. Maurice river. It is estimated that over 500,000,000 feet of timber come down the St. Maurice annually, which is converted into lumber, pulpwood and paper. The population is over 19,000 inhabitants, which represents an increase of almost 100 per cent. in the last fifteen years.

Outside manufacturers are gradually becoming aware of the fact that a city such as Three Rivers, built on the very shore of the St. Lawrence, the highway to the Atlantic seaboard with a harbor of two miles in length and with a depth of 52 feet, make it possible to accommodate the largest vessels afloat, is bound to command recognition sooner or later. The cheap power feature which Three Rivers is now offering, due to the arrangement with the Shawinigan Water & Power Co., situated a few miles from there, is one of the most important factors in its development as an industrial centre.

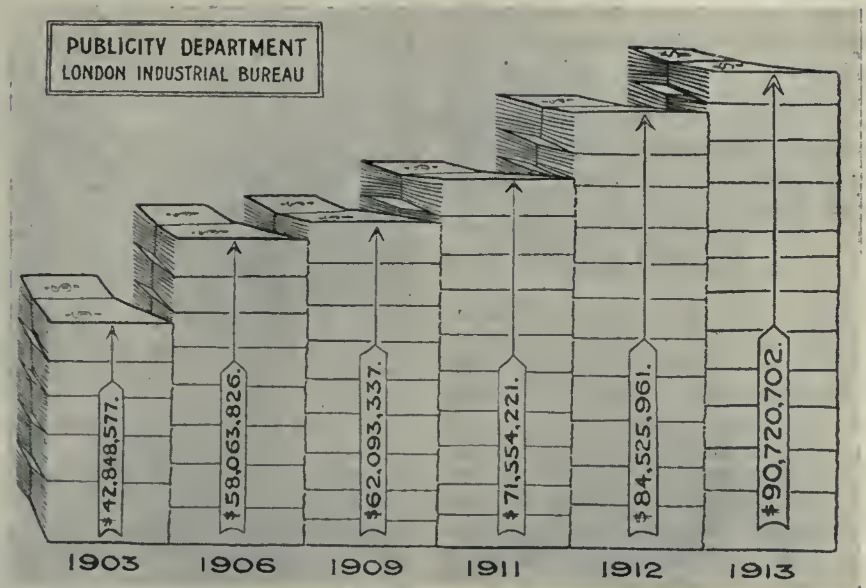
The community are uniting their efforts to make of this city a bigger, greater and better Three Rivers and have adopted the slogan **Watch Three Rivers Grow.** They feel that their city is destined to become the Buffalo of Canada, for the reason that the great power available at Niagara had much to do with Buffalo's making, and they naturally conclude that Shawinigan power, which is second only to Niagara, is bound in time to make the importance of Three Rivers felt throughout the world.

GUELPH, ONT.

FORTY-EIGHT miles west of Toronto lies the City of Guelph on the main line of the Grand Trunk Railway, and on the Toronto, Hamilton and Goderich branches of the Canadian Pacific Railway. The Toronto Surburban Electric Railway owned and operated by the C. N. R. also runs into Guelph, thus making very favorable transportation facilities and correspondingly cheap rates.

Guelph owns and operates all the public utilities including the Guelph Radial Ry., the waterworks, gas works and the Guelph Junction Railway, with a matter of 15½ miles of track leased to the C. P. R. It has an unlimited supply of hydro-electric power which is distributed at low rates, while gas can be obtained at 80 cents per 1,000 cub. feet for manufacturing purposes. Other inducements offered to new industries are free sites and loans at a low rate of interest.

Guelph is the centre of a fine farming country, and the home of the Ontario Provincial Winter Fair, which is held annually and attracts thousands of visitors. The Ontario Agricultural College and Experimental Farm are also located at Guelph, and form a valuable adjunct to the farming industry of the Province. Among the more recent industries to be established are those of the International Malleable Co., and the Guelph Stove Works.



COMPARATIVE BANK CLEARINGS, LONDON, ONT.

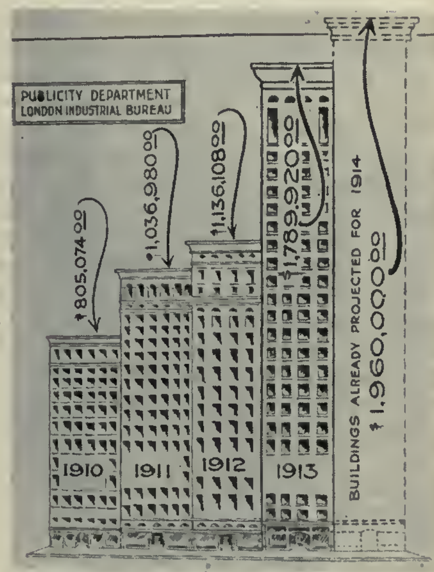
LONDON, ONT.

DURING the past three years—years not particularly favorable to development — London has made greater advancement than is recorded in its remarkably steady growth since incorporation as a city over eighty years ago. The figures of building permits, bank clearings, population and other statistics of civic progress, show greater percentages of annual increase in 1911, 1912 and 1913, than any previous year.

There is a tide in the affairs of cities, as well as of men, which if taken at its flood leads to increased prosperity and prestige, and Londoners, wise in their generation, early this year showed their faith in the city's future by authorizing expenditures which will mark an epoch in the city's history. This is the rehabilitation, electrification and municipal operation of the city-owned road to London's harbor, on Lake Erie, Port Stanley. At a cost of $700,000, this 23-mile line—a valuable heritage secured by the city fathers over sixty years ago—with right of way from the water front to factory, uncontrolled by the railways, will give London shippers the advantage of a competitive water route, owned and controlled by the city.

The London and Port Stanley Railway.

This unique municipal enterprise will be managed by a civic railway commission, which has already been appointed, and has done some good work already in getting the ties and steel on the ground since authority for the work was granted by Act of Parliament only a few weeks ago. The electrified line—now leased to the Pere Marquette and operated by steam has accessibility to the heart of the city with interswitching to all railways. London has four trunk and seven branch lines, and forms the

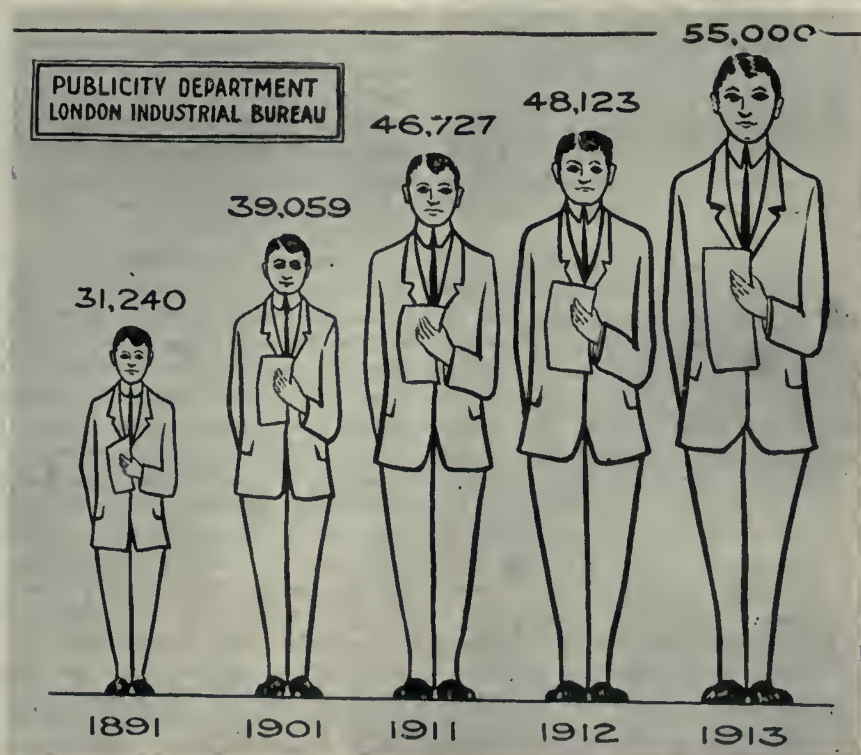


COMPARATIVE BUILDING PERMITS, LONDON, ONT.

key to the hydro-radial situation of the Western Ontario Peninsula, being the natural center of the network of radial lines for which surveys are now being made. Some of these are to Aylmer, Stratford, Sarnia and other points, passing through the rich agricultural districts en route.

Miscellaneous Statistics.

The figures of London's growth, population and building permits and



COMPARATIVE GROWTH OF POPULATION, LONDON, ONT.

bank clearing increases are shown in the diagrams accompanying this article. Manufacturing output as shown by the Government census 1910, has increased. from between $8,000,000 and $9,000,000 to $18,600,000, or 100 per cent. in the ten years, 1900 to 1910. This figure, however, does not indicate the industrial increase which is taking place at the present time. Some idea of this is to be got, however, by comparison between the Government census figures, 1910, and figures first compiled by the London Industrial Bureau. These show that in the matter of employees engaged in the various spheres of industry, there has been a remarkable increase since 1910. Here are some increases: — Boot and shoe manufacture, 189; bread, biscuits and confectionery, 716; cement, brick, tile, etc., 22; flour and grist mill products, 58; iron, steel, foundry and machine shop products, 109; furniture and upholstered goods, 89; hats, caps and furs, 63; jewelry and repairs, 35; liquors, malt, 35; lumber products, 325; printing, publishing and bookbinding, 125; tobacco, cigars, etc., 435. Under the classification of **all other industries** in the Government list are various lines for which the number of employees is not given separately. To these have been added 31 enterprises employing between 500 and 600 people. London's factories numbering over 250, now employ between 12,000 and 13,000 people.

Manufacturing Advantages.

To manufacturers, London holds out general inducements unequalled anywhere in Canada. There are four trunk lines of railway and seven branch lines centering in and radiating from it, and with a city-owned harbor at Port Stanley and a city-controlled railway to that harbor, with interswitching on all railways, London has a competitive water route to every place, that other cities not on the line of ocean steamships, possess.

There is no place in Canada, it is claimed, where convenient factory sites can be obtained so cheaply according to the density of settlement as in London. There is plenty of ideal acreage right in the city with railway trackage and interswitching privileges, at from $500 an acre upwards. There is even some free acreage on the outskirts of the city. In any case it costs only hundreds to locate here where it costs thousands in many other cities. There are other reasons. London affords cheap power, cheap water, cheap fuel, abundant and high quality labor and low fixed assessment—single tax to manufacturers.

It seems to be a natural industrial center, where labor may be procured, where raw material may be assembled, and where cheap fuel is abundantly available. An economic manufacturing and distributing center for articles used throughout the whole Dominion. It has a call on the wealthy Eastern market and the rapidly growing Western market with, in addition, a home market of upwards of a million people, being in the very heart of prosperous, bustling Western Ontario.

Though London is 23 miles from Lake Erie she can boast of harbor advantages over cities with their own waterfronts. Owning the Port Stanley harbor, controlling the London & Port Stanley Railway, and with interswitching privileges to the siding of all railways, fuel and raw material can be brought to all London factories with one handling. London has easy access to Buffalo, Conneaut, Cleveland and other United States ports, and all Canadian ports. Coal comes in and is placed on the sidings right at the plants at $2.60 to $2.80 per ton.

As a special inducement to manufacturers the city has adopted an unusually liberal policy of granting a fixed assessment of 15 mills for fifteen years on lands values only, with exemption from taxation on buildings and plants. This covers a factory area of approximately 1,800 acres recently added to the city to the east and south, including Ealing, Pottersburg, Knollwood Park and Chelsea Green.

General.

At present power in London is five per cent. lower than Toronto, and electricity is 15 per cent. lower. A further reduction of 25 per cent. is promised for next year. The city gives especially low water rates to manufacturers, and the water supply of London is so pure that the Grand Trunk Railway dining car department use it without filtration. The average of freight rates to all parts of the Dominion is lower from London than any other eastern city of comparative size.

Natural gas is not yet into London, but it is piped to the city limits, and the Southern Ontario Gas Co. is preparing to submit a proposition to the ratepayers to supply natural gas to manufacturers at an economical figure. The local gas company at present supplies manufactured gas for industrial purposes.

London is famed for its labor supply, skilled and unskilled, male and female, and serious labor troubles are practically unknown. Prices of land are not yet high enough to prevent the head of a family owning his own home, and it is estimated that 80 per cent. of the heads of families own their own houses, which speaks well for living conditions in the city. It is the center of a rich agriculturial section and produce is brought directly from farm to consumer at the city market three times a week.

Workingmen's houses cost from $1,800 to $2,000, and rent at from $12 to $16 a month.

BERLIN, ONT.

BERLIN or **Busy Berlin** as it is often called, is a city that has made considerable progress as a manufacturing center. The industries are varied, the principal being furniture, rubber, leather, shoes, shirts, etc. On account of the diversified industries employment is afforded for both males and females, making thereby labor conditions particularly favorable. In addition, the city is well supplied with parks making it desirable from a residential point of view. The population is over 18,000, and assessment about $9,000,000.

Berlin believes in municipal ownership, and owns all the public utilities including the waterworks system, gas and electric lighting plants and street railway. It was one of the first cities to secure power from the Hydro-Electric Commission, and consequently attractive rates can be obtained by manufacturers. In addition the city offers reasonable inducements to new industries in the form of free sites, fixed low assessments, low water rates, etc.

Transportation facilities are good with corresponding favorable freight rates, the city being on the main G.T.R. line Toronto to Sarnia. It also connects with the C.P.R., while the C.N.R. will shortly be running there. An efficient electric railway service embraces the surrounding district which is excellent farm land; products of the field are, therefore obtainable at reasonable prices in the city.

WINDSOR, ONT.

THE City of Windsor, situated at the extreme western point of Ontario has enjoyed remarkable success as an industrial centre, and with the adjoining towns of Walkerville and Ford, forms one of the most important and progressive industrial districts in the Dominion. The proximity of Windsor to the United States, and especially to the city of Detroit, Mich., is one of the principal reasons for the rapid development which has been experienced in recent years. Its situation from the standpoint of the United States manufacturer who desires to extend his market by locating a branch factory in Canada, is especially attractive. In many cases the manufacturer likes to be as near his home factory as possible in order to give close attention to the management of both plants. The geographical location of Windsor makes it an excellent distributing point, being within easy access of both the eastern and western markets, which combine with good transportation facilities and competitive rates. Cheap power, another important consideration, is available in the form of electricity and natural gas.

The City of Windsor has taken definite steps to attract and accommodate industries. An Industrial Committee with an enterprising commissioner have been the means of inducing many manufacturers to locate in the city. Since January 1st, 1913, over thirty concerns have established plants here, nearly all being now in operation. Two factory districts have been allotted, No. 1, comprising 40 acres, has already been sold out, while several sites have been disposed of in the No. 2 factory district. The sites are sold to manufacturers at cost price, and concessions are granted in the form of exemption of taxes, free water and light for a term of ten years. The following figures will indicate the progress made during the past three years. Building permits, $392,000 to $1,137,000; assessment, $10,921,950 to $21,262,450; population 17,534 to 22,080.

THOROLD, ONT.

THE Town of Thorold in the Niagara Peninsula, is exceptionally well situated for attracting industries, and has grown considerably in recent years. In 1912 the population was 2,800; now it is 5,000. During these two years the greatest development may be said to have taken place. The chief inducements to manufacturers are cheap power and low transportation rates, the town being located in the Welland Canal, and having connection with four steam railways, and also an electric railway. There are a number of suitable sites, and a low fixed assessment is granted by the town.

Although Thorold has had quite a number of old industries which have been operating for some years, it is only within the last two that the greatest progress has been made, and this is largely through the instrumentality of James Battle, the town's commissioner, backed up by progressive citizens. Pulp and paper making is the principal industry, although there are other important ones will will be seen later. The Interlake Tissue Mill Co., the Foley-Reiger Pulp & Paper Co., the Thorold Pulp Co., St. Lawrence Paper Co., and the Coniagas Reduction Co., are the chief of the older established plants. Since 1912 the Ontario Paper Co., has started operations, followed by Pilkington Bros., Ltd., from St. Helens, Lancashire, England, the largest glass manufacturers in the world. The Beaver Board Co. new factory is nearly completed, and will soon be in operation. The latest industry to locate in Thorold is the Exolon Co., who will manufacture an artificial abrasive.

The Ontario Paper Co.

The Ontario Paper Co., which is located on the Welland Canal, has erected a plant which cost $1,000,000 and uses 10,000 electrical h.p. obtained from the Ontario Power Co. at Niagara Falls, only a few miles distant. There are two large paper machines in the plant, having a capacity of 100 tons of news print per 24 hours, all of which is shipped to the Chicago Tribune by the Rutland line of steamers when navigation is open. A large proportion of the pulp wood is obtained from Anticosti Island in the St. Lawrence River. The pulpwood is rossed and shipped in lengths of 2 ft.; about 30,000 cords will be brought to the mill this season. Some pulpwood is also obtained from Northern Ontario. The plant is owned by the proprietors of the Chicago Tribune.

Pilkington Bros., Ltd.

Pilkington Bros., Ltd., of St. Helens, Lancashire, England, purchased 200 acres of land adjoining the town of Thorold. The initial section of the plant is in operation and turning out factory wired glass of the highest quality. It is the intention of the company to build a large plant for making plate glass. The company brought over 100 expert operatives from the St. Helens factory, these being in addition, of course, to the other hands employed. The company are building a model village for their employees, adjacent to the factory which is located on high land and extremely healthy.

The Exolon Company.

The Exolon Co., of East Cambridge, Mass., have started operations on the construction of what will be a large factory for making an artificial abrasive. The "first sod" was turned by James Battle this spring, being the fourth ceremony of this description at which Mr. Battle has officiated within the last two years; not a bad record. The plant will be built in five units, costing approximately $100,000 each. One unit is going forward now, and it is proposed to build two units in 1915, and the other two in 1916. When complete, it is estimated that about 10,000 electrical h.p. will be used. The company has purchased a site covering six acres on the Niagara, St. Catharines and Toronto Railway, and the first unit will be in operation by November 1st of this year. The contract for the steel work has been let to the Hamilton Bridge Co., and the general contractors are Christman & Co., of Hamilton, Ont.

The Beaver Board Co.

The Beaver Board Co., of Buffalo, N. Y., is one of the latest concerns to locate in Thorold. The company has purchased a site covering 23 acres adjoining the town of Thorold, and have erected a large factory for making the product known as "Beaver Board." The factory, which cost $500,000, is nearly completed, and will shortly be in operation, employing about 150 hands in the first instance.

ST. CATHERINES, ONT.

ONE of the principal cities of what is usually termed the Niagara Peninsula, is St. Catherines, which has a population of 16,000, representing an increase of nearly 4,000 since the last census in 1911. There was a settlement at St. Catherines as long as 1797, and exciting times were seen in 1812-14, while in 1824 the first sod of the first Welland Canal was turned and incidentally was the beginning of the material growth of the "Garden City."

St. Catherines is the centre of one of the principal fruit growing districts of Canada, but at the same time has, latterly, developed into an important manufacturing center. Cheap power is perhaps the chief reason for this, as nearby at Decew Falls, is a hydro-electric plant operated by the Cataract Power Co., and capable of producing 100,000 h.p. In order to attract industries the city offers fixed low assessments, water privileges and land grants, the inducements being in proportion to the size and importance of the industry. There is no lack of house accommodation.

A number of well-known firms have established plants here, among the most important being the Canadian Crocker Wheeler Co., Jenckes Machine Co., Whitman & Barnes Mfg. Co., Canadian Yale & Towne, Ltd., Steel & Radiation Ltd., Reo Motor Car Works, etc. The latest industries to locate are Welch Grape Juice Co., from Westfield, N.Y., and Lord & Burnham, from Irvington, N.Y. The former concern will make a temperance beverage while the latter will make greenhouses and supplies of all kinds. The Welch Grape Juice Co., will build a concrete and brick factory 102 x 102 feet, four stories high and costing in the neighborhood of $150,000.

St. Catherines has gained some prominence in recent years by being the headquarters of the engineering staff of the Welland Ship Canal. This is a national work of great importance and will benefit the city considerably.

(Continued on page 170.)

Hon. David McPherson, M.L.A., died at Halifax, N.S., on August 13, aged 82. Mr. McPherson, who was a shipbuilder and well known in the Maritime Provinces, was born at Jordan River, Shelburne County, N.S., and was elected to the Legislature in 1897.

Securing and Holding Labor in Manufacturing Suburbs

By J. P. S.

With the increase in land values and the double-barrelled taxation accompaniment now so pronounced in our larger towns and cities, the disposition is towards the emigration to and establishment in suburban districts of both large and small industries. To secure in the first instance, and retain labor which has been more or less cradled in and among the glitter of a city's life and attractions is generally the master problem.

THERE has, of late years, been a decided movement on the part of manufacturers to seek locations in the suburbs rather than in the congested districts of our cities. The natural tendency of Canadian cities to grow causes real estate and property values to increase, and thus assessments for taxation, though reasonable enough at the beginning, are almost sure to become more or less inordinate sooner or later. This is not the only objection to the city plant. The higher cost of living and the multitudinous, frivolous opportunities of spending money tend to increase the wages demanded by the working man as well as to decrease his efficiency as an employee.

A large percentage of the desirable class of help has been more or less burnt with the iron of metropolitan attractions, so that a plan to make the suburban workshop a place of contentment for them by supplying the created want is bound to prove a failure. The man of this type is usually in the search of novelty, and hence something unusual or different from what he has become accustomed will often be equally effective in holding him. The more desirable mechanics demand, not so much the levity as the more substantial of urban comforts. To them the furnished apartments, the restaurants and the rapid car services have become as the necessities of life, and are among the most difficult for the manufacturer unaided to supplant with the means at his command. A great deal can be accomplished in this connection by a little co-operation on the part of the municipal authorities, many of whom are willing to go some considerable length for the mutual good of local industries and themselves.

The Size of the Pay Envelope.

One of the greatest drawbacks of most suburban organizations is the fact that they expect to pay considerably less for help than the metropolitan plant for the same class of labor. No employer can successfully lower the rate of wages unless he be in possession of other features to take the place of the difference. The writer is well aware of one of the largest Canadian manufacturers whose men receive at least one-fourth less than the employees of many other firms, but such are the ameliorating conditions that the list of employees contains a fair sprinkling of those who have been with the firm for from thirty to fifty years, and many of these have temporarily left the service and come back.

There is a class of men who adapt themselves easily to the suburban factory conditions and surroundings. These are the men who are trained and brought up, so to speak, in the plant and make it their lifework. Their disposition creates no serious problem, and, as far as the management is concerned, an adoption of the system as far as is practicable will greatly simplify the help question. This is the natural outcome of suburban conditions where the worker is not so subjected to the excitements and amusements of city associations whic htend towards uneasiness and discontent.

The home bred man, who is a sticker and a hustler, is an acquisition in every sense of the word, and the error largely committed in Canada is that of going too far in this direction. What we need more than any other country is "new blood." The acquiring and holding of this new blood presents such problems that it is often neglected even in the urban centres.

Effect of Labor Scarcity.

The great scarcity of labor during 1912-13 brought forth no very wonderful systems of procuring or retaining help other than increasing wages. Some manufacturers gave this increase directly, while others donated it in the form of a provisional bonus that could be withdrawn as soon as the condition of labor stringency was relieved. Such methods can have no permanent good effect, and, even if carried out in the best spirit, cannot but embitter the feelings of the workmen against the so-called heartlessness of corporations. A system which exhibits no personal consideration for the workman who firmly believes himself to be supporting it, cannot retain the most valuable help, no matter where the industry is located.

The problem of holding help in the suburban plant is becoming less difficult of solution each year. The same mediums of education are more and more being made equally available to the manager and the mechanic. Practical education is without doubt one of the strongest antagonists of the excesses and allurements of city life, and if technical and other educative books and papers could be made easily procurable in the homes connected with the suburban factory, another large section of desirable help would also become easily procurable to the organization.

The technical press is not alone in this work. The home journals, childs' welfare leagues and other mediums rapidly growing in influence, are surely beginning to make their influence felt, with the result that the thinking man who has the prosperity of his family at heart will make his home if possible 'mid healthful suburban surroundings. These influences are to be encouraged. Up till recently the congestion of work in the manufacturing centres has been such that if the workman desired that his family enjoy the country advantages to the smallest extent, he must leave his employment and take his people to live on a farm. This, the opposite extreme is, in many cases, equally undesirable. The suburban shop would greatly assist such men as these, and men who are possessed of such desires are certainly desirable help.

Is there any tangible reason why suburban plants cannot devote as much time and effort to making their plants attractive as those of the metropolis are doing every day? It is a very significant fact that one of the greatest sufferers during the labor market stringency already mentioned was a plant that is approached by roads that stalled automobiles several times during last winter. Many of the employees walked back and forth over these same roads every day. Is it likely that these men will be most self-respecting and most desirable employees? A great many men associate suburbanism with cow stables and hog pens, and the sight of this factory would not be inclined to reform their way of thinking.

City Comforts in the Suburbs.

With the help of the present-day mechanical and sanitary appliances, there is no reason why city comforts and utilities cannot be enjoyed by the suburban mechanic. It is not reasonable to suppose that the employee who gives the greatest part of his mental and physical energy to the advancement of his employer's interests will have enough left each day to perform the chores of the average farmer. In many cases, suburban locations can be chosen so as to give the workman most of the home advantages of the city and a plot of ground large enough to swing a hammock in, besides with the minimum of expense. It must be borne in mind that the better mechanic demands a certain grade of living and surroundings, and if these are not provided the man, once procured will only stay long enough to acquire the necessary "stake" to move out.

In the city these necessities are provided for by a part of the taxes which the manufacturer must pay the municipality, and for this reason the average manager has failed to take them into consideration when moving to the suburbs. The employer of the outskirts must assume to a certain extent at least the responsibility for which the civic government is well paid by his city contemporary. The extent to which this is required, of course, depends upon the class of work carried on. The demands of a cement mill, for instance, would be insignificant when compared with those of a machine tool works. In any case, it will be found that if judgment be exercised, living conditions can be made better for the workman in the suburbs than in the city, and the "living expenses" of the factory can, at the same time, be made much less.

The Personal Element.

The most attractive feature of any position from the workman's point of view, provided the wages are at all reasonable, is the consideration shown him by the officials of the firm. This does not mean the latitude of misdemeanor permitted or the loosening of proper discipline in any way, but the removing as far as possible of the systems and rules that make him feel very much like the machine he operates. It will be necessary for the officials of the suburban plant to exercise more of the personal element and less of the commercial spirit in getting the best efforts of the best men. They must make up, largely by influence and example, for that which is furnished in the city by the policeman, the civil engineer and others.

The greatest tendency to be guarded against is stagnation, which is already all too evident in some of the institutions of our small towns. The guardian of the company's interests against this condition is first of all the manager, and the responsibility for its prevention rests upon his subordinates in order of their importance. This is largely offset in the city plant by the continual influx of strange mechanics with fresh methods and new ideas. In the suburban plant this must be combatted by the influx of proper literature, competitive methods and the spirit of an energetic management.

Development of the Power Building Feature

By Lycurgus Carson

While large manufacturing concerns are, of course, most in demand by our municipalities, it has not been forgotten that smaller industries are also worth while. To encourage these latter, with in most cases limited capital, or which is at least insufficient to purchase land, build and equip a plant, the laudable expedient of providing a power building where several small concerns may locate is being quite generally adopted.

OF the many plans adopted by municipal governments for the purpose of nurturing young industries and attracting others already developed, the power building idea is worthy of considerable favorable comment. This institution is essentially a building constructed to accommodate a number of small industries. It is built at public expense, and so arranged that partitions can readily be placed anywhere desired to accommodate works of different sizes and requirements. All provision is made for the attaching of line shafting and the setting up of machinery as well as arrangements for heating, light and power.

The building is let out to small industries in sections to suit, and at reasonable rentals. The plan, as has been worked out by municipal authorities, is not a direct revenue producer, the rentals being so gauged as to pay expenses and sinking funds only. A plant of this kind was projected in Montreal by a private corporation, but is not yet in operation, and its value as a private enterprise has not yet been demonstrated. The scheme is said to have originated in the Middle States, where it has been customary for small firms to club together for the purpose of erecting a central building and installing a power plant. The mutual benefits of such co-operation were evident, particularly as the power units in those days consisted mainly of cumbersome and expensive steam engines. Although the advent of the efficient electric motor has much reduced the power advantage, the benefits accruing from the common building are becoming still more pronounced, particularly in the larger cities, where land values make individual enterprise almost prohibitive.

The lack of capital prevents many small enterprises that may, in time, become great, from getting a start. Numbers of young industries have found that the greatest capital cost is the cost of land, building, and power plant. The efforts of embryo factories may be most readily seen in the younger Western provinces, where the struggle with the cheapest building construction, wasteful second hand power units and unattractive surroundings calls loudly to the practical altruistic sense of the observer.

In Montreal, Toronto and some other large Eastern cities, the idea is unconsciously carried out under very adverse conditions. A large number of old and tottering buildings, whose usefulness as offices and warehouses has long ceased, are now rented to small industries, such as clothing factories, instrument makers, engraving companies, etc. In most of these the condition of the building confines to very narrow limits, the amount of power and weight of machinery that can be installed. Even under such circumstances, the system has proved successful, and structures that would otherwise have to be demolished are, in this way, made to pay dividends.

Reform of the Manufacturing District.

The ramshackle effect created by the economical systems of building adopted by small industries, to say nothing of poor heating, lighting and sanitary conditions, would be largely done away with by a municipal power building. The higher status of labor conditions will eventually lead to a better class of work-people that cannot help but be an indirect asset to the city. Industries which depend more or less upon market conditions for their existence, are rarely in a position to build and equip creditable plants of their own and, unless some such provision is made for them, their presence will always be more or less detrimental to the health and appearance of their chosen location.

There are a large number of institutions, such as mechanical experts and specialty manufacturers, whose product is necessary and valuable, and who employ a high class of mechanical help, and who must rent premises of some kind. Such enterprises invariably find it not only necessary to procure a location, but to make the best of a floor space that was never intended for manufacturing purposes. This feature is usually accepted by the land lord with some satisfaction, as the expense of moving is some assurance that he will retain his tenants without serious difficulty.

In locations where cheap electric power is not procurable, the economy of coal or gas consumption should strongly appeal to all patriotic citizens. Small engine units are wasteful, both in fuel and attendance. The greatest difficulties encountered with the smoke nuisance are in the small plants where the best appliances for its prevention cannot be installed. The fewer and larger the power plants, the more easily this evil can be combatted. Again, many factories require steam for heating and others use it for power only. When it is understood that the same steam can be used for both purposes with little greater cost than for one alone, the folly of installing a plant for a single service is evident. In the power building, the variety of requirements of different lines of business makes possible the most efficient use of fuel. Aside from these large savings, the aggregate of the small ones, such as boiler inspection fees, insurance, etc., will be found to go a long way towards paying the expense of operation of the plant.

Practical Working Examples.

The apartment house has become exceedingly popular among certain classes of people, and is regarded in prosperous localities as a gilt edged investment. The modern apartment house is much more attractive and sanitary than the private homes of the class of people that inhabit them. Although the comparative cost of construction is much greater, the co-operative establishment can, under favorable conditions, give more for the money than the private house. If this can be accomplished in co-operative expense, how much more successful should be mutual support in the production of income.

The municipal power building project, though young, has been tried out and is in operation in several Canadian cities, including Calgary, Lethbridge and Walkerville. Many objections have been raised to its adoption, and have been satisfactorily surmounted. The fault most commonly advanced is that the peculiarities of many enterprises are such that they cannot be housed in a single building. This can be easily overcome by grouping the different concerns in several buildings, with a central power, light and heating plant. The plan followed by the larger manufacturing companies in segregating their foundries, smith shops, machine and woodworking departments, is a practical solution of this question.

The obtaining of the best shipping facilities, both by water and rail is impossible for small concerns without united effort. The large corporations can build docks and sidings equipped with the most efficient handling machinery at their own expense, and such is the volume of their business that these investments may be directly profitable. These advantages can readily be made available to the younger industries in the power building groups. In many places the railway frontage requirements have made it necessary for the small factories to follow the tracks far outside the limits of the cities to which they belong. The sidings, in most of these plants, are not enough used to prevent rapid natural deterioration, and constitute a substantial addition to the overhead expense. The teaming cost of plants without sidings is often equal to the railway freight on their products.

Any means of bringing the industrial part of a town more or less under municipal control is certain to greatly facilitate the governing of these institutions for their own and the general good. The city government must necessarily assume a large number of responsibilities that are difficult to place among a number of segregated institutions. The obligations of sanitation, waste, proper business methods, etc., are much more likely to be fairly met by the municipality than by a small industry which is struggling for existence.

The nurturing of young enterprises is an important branch of the public duty. The elaborate outlay required to carry on a manufacturing business has done much to bring about the trust and the monopoly with their many evil accompaniments. The best cost, wage and other conditions most affecting the public, are brought about and retained by the efficient competitive systems which are best encouraged by the municipal power building. The protection of the smaller and weaker plants from the dominance of the larger masses of capital is best accomplished by providing them with a means of co-operation that will enable them to put up a fair fight for existence.

INDUSTRIAL DEVELOPMENT OF NEWFOUNDLAND.

IN the past fifty years the cod-fishery flotilla of Newfoundland has doubled in number and quadrupled in tonnage. She has maintained and succeeded in the seal-fishery when Dundee and Halifax have abandoned it, and she is now prosecuting it with splendid steamships and reaping a bounteous harvest every spring. She enterprised the modern method of whale-hunting before Canada attempted it, while her herring fishery became so important as to compel England and America to resort to The Hague tribunal for an arbitrament upon issues arising out of it. Her bait industry became so pivotal that her enactment to regulate it, reduced the islets of St. Pierre-Miquelon to beggary, and re-established herself in the European markets from which bounty-fed competition had almost driven her.

A Generation of Progress.

Within thirty years Newfoundland has built 1,000 miles of excellent railway, provided a fleet of twelve coastwise steamers tapping every section of the island of Labrador, and superior to anything of their kind in Eastern Canada, set up 2,500 miles of telegraph lines, erected eighty lighthouses, and doubled the outlay on the various public services by which the mass of the people benefit directly. Her exports have grown from $5,000,000 to $15,000,000, her imports being in the same proportion and her revenue from $1,000,000 to $4,000,000.

The material prosperity, too, of the people has been enhanced in a still greater degree. She has overcome the consequences of a fire that devastated St. John's in 1892, causing a loss of $20,000,000, with only $5,000,000 of insurances, a bank crash that nearly beggared her two years later, and the vicissitudes of the fishing industry in recent years, with a loss of millions of dollars of local capital. Yet the latest statistics show that the savings secured in her banks and debentures total $15,000,000, while the investment in fishing and other enterprises is enormously in excess of this.

Rich in Minerals.

Fish is no longer the mainstay of Newfoundland. The smelters of the Dominion Steel Works at Sydney are fed with ore from Belle Isle, near St. John's. From there 1,500,000 tons were taken last year, and President Plummer, at the recent meeting of the Steel Company, stated that ore could be sold at a profit of $1 a ton, while experts estimate the deposits to contain 3,635,543,360 tons. Other minerals are also abundant and her forests are immense. It is expected that soon the island will be the home of many manufacturing enterprises, each town with its 5,000 to 10,000 persons.

Branch railroads are even now being enterprised to tap sections as yet unsupplied with this progressive auxiliary, the dredging of shallow harbors is being undertaken that the prosecution of the fisheries may be made more convenient, and added stimulus is being imparted to education, the handmaiden of all real advancement.

Marconi received in Newfoundland his first pulsations across the ocean, and the island will yet be the great clearing house for the wireless traffic of the world. The airship man is also casting a speculative eye on Newfoundland, and when he prepares himself for his first overseas flight he will ascend from her island coast.

Toronto, Ont.—It is announced that the Massey-Harris Co. will close their plant on August 22, for an indefinite period on account of the unsettled conditions caused by the European war, and the cutting off of the German, French and Russian markets for their product.

Specific Industrial Opportunities for Manufacturers

Continued from page 165

BRITISH COLUMBIA OPPORTUNITIES.

THE natural advantages of the Fraser River estuary from a commercial point of view cannot help but impress one who makes a personal investigation. Those who would examine it from a critical viewpoint must seek to judge it upon such considerations as proximity to markets, its labor conditions, availability of supplies, etc., and not upon the features with which Nature has endowed it.

One section, miles in extent, embraces a number of islands and a portion of the mainland as level as the sea, and but a few feet above its level at high tide. This land is, although marshy in places, lends itself easily to building purposes as is attested by the number of good roads and other structures which have existed for a long time. The several branches of the river form numerous fresh water basins where ships discharging cargo automatically rid themselves of barnacles and other objectionable marine growths. The Fraser River carries a large volume of water to the ocean, and, although it originally contained impediments to navigation, these, engineers contend, can and are being removed with comparatively little trouble and expense.

To the north and south the land rises in gentle slopes naturally forming residential districts which, for superb natural scenery, are rarely surpassed. This northern part already forms the southern suburb of the city of Vancouver, the importance of whose shipping is well known. The most reasonable line of the city's rapid growth is in this direction, so that the district will be fairly populous in a comparatively short time.

Climatic conditions are mild and such as allow the carrying on of operations in factories very nearly the year round without the expense of artificial heat. The usual objections to mountain seashore climates, namely dampness, is no doubt present, but it is maintained that one becomes much more easily acclimatized to this than to the more rigorous climates of the central and eastern provinces.

The mineral and timber resources of British Columbia are vast and accessible, involving a large percentage of those required in the average manufacturing processes. In fact, available manufacturing sites are few in comparison to the quantity of certain kinds of raw material procurable. The markets have, for some time been more or less confined by the mountain barriers to the Province, but with the introduction of two more transcontinental railways and the continual improvement of grades, the rapidly increasing population of the northwest, is becoming more and more dependent upon the products of the mountain province. The possibilities of the Pacific Ocean in this respect are obvious. It is plainly the duty of the provincial direction of affairs to see that transportation, labor and other advantages are on a par with the great natural industrial endowments of this favored province.

PETERBOROUGH, ONT.

THE progress the city of Peterborough has made is evidence of its suitability for manufacturing. The population is over 22,500, and the increase in population between 1901 and 1911, as shown by the Dominion Census, was 63 per cent. The census also showed that the percentage of increase in the products of the factories in Peterborough from 1890 to 1910 was greater than in any city in Ontario. The value of these products per head of population in 1910 was $579.14, which was only slightly exceeded by three other cities in the Dominion.

Peterborough has the advantage of being centrally located between the two commercial centres, Montreal and Toronto, and has direct railway connection with them by the Canadian Pacific and Grand Trunk lines direct to the Georgian Bay. It thus is on the main arteries of traffic to the Northwest by both the rail and water and the all-rail routes. The Grand Trunk branches out in four different directions from the city, and besides having the direct Montreal-Toronto line of the Canadian Pacific, the new Georgian Bay and Seaboard line of that railway runs from here, placing Peterborough closer than Toronto to the Northwest. As an indication of the service and traffic, twenty-five passenger trains go out of Peterborough daily.

This city is also on the Trent Waterway, a series of locks and short canals connecting navigable rivers and lakes, which is being built by the Dominion Government, and will give water communication with Lake Ontario and the Georgian Bay. The section which opens it to Lake Ontario is all under contract and nearly completed. The River Otonabee, which runs through the city, and connecting waters, furnish abundant water power, and electric current is delivered to the factories at very low rates. Peterborough is surrounded by an excellent agricultural and dairy district, and the cheese market held here fortnightly during the season is one of the best in the Dominion. Manufacturing sites, with shipping facilities and civic conveniences, are available, while labor of all kinds is readily obtainable. The workmen are largely home owners and interested in the city. While Peterborough has the conveniences and attractions of a city, expenses are lower than in the larger centres, and the cost of labor is less. One of the attractions here to mechanics and other workingmen is the beautiful river and the attractive lakes close to the city.

Among the industries which have located and been built up here, are the Canadian General Electric Co., employing 1800 hands, the mills of the Quaker Oats Co., of Chicago, the English Brinton Carpet Co., and many others. The DeLaval Separator Co., of New York and Poughkeepsie, one of the best known and strongest companies in its line, Henry Hope and Sons, of Birmingham, England, and the Vermont Marble Co., of Proctor, Vt., each selected Peterborough for the location of their Canadian factories.

MOOSE JAW, SASK.

MOOSE JAW began to take on the appearance of a thriving town in 1901, the population then being 1,500. This has increased more and more rapidly each year, until now (1914) the population reaches 30,000.

As a grain and milling centre, Moose Jaw hold an unique position, being in the very heart of the greatest wheat belt of North America. During 1912 there was a total acreage under crop in Saskatchewan of 9,184,814 acres and from this 237,278,446 bushels were harvested. In 1913 the total acreage under crop in the province was 9,673,125, from which 243,513,384 bushels were harvested.

Surrounded by such a vast and fertile grain-growing country, Moose Jaw is the natural four-milling centre of Central Western Canada. One plant, the Robin Hood Flour Mills, is turning out 2,300 barrels of flour per day and 500 barrels oatmeal. Besides this, the mill contains a porridge oats plant, cornflake plant, grain drying plant, and their own cooperage for making the barrels in which the flour is shipped. 135 men are employed by this company. The capital invested in this plant is $800,000. The Moose Jaw Flour Mills is now erecting a flour mill, which will cost $350,000, and which will have a capacity of 1,500 barrels flour daily. It is expected that this plant will be in full operation next week.

Gordon, Ironside & Fares, meat-packing plant, located in the city, is one of the most up-to-date packing plants in Canada. There are 190 men employed and the daily killing capacity is 3,000 sheep, 3,000 hogs and 350 cattle. The initial investment in the plant and sales equipment amounts to over $1,500,000. The International Linseed Co. is erecting a flax mill, and has taken out a building permit to the amount of $750,000. Their plant is being erected on the ground immediately adjoining the Government elevators. This mill, when completed, will have a daily capacity of 8,000 bushels of flax. Electric power is supplied to these industries by the city at from 1¼ to 1½ cents per k.w. hour.

The Saskatchewan Bridge & Iron Works are located in Moose Jaw, and carrying on the business of erecting bridges and general iron working. The plant and equipment represents an investment of $500,000. The C. P. R. have their divisional point for Saskatchewan established here, and their investment at this point represents over $5,000,000. They employ 2,500 men in and around Moose Jaw, and the pay roll amounts to over $250,000 per month. There are here sixty-seven miles of trackage, the yards being the third largest individually-owned trackage yards in the world. Besides the C.P.R., the C.N.R. and G.T.P. have lines running into and out of Moose Jaw. The Street Railway Co. is now operating on fourteen miles of trackage, giving a service to all central parts of the city.

The educational facilities of the city are second to none in the Prairie Provinces. There are seven schools, collegiate institute and the Moose Jaw College, where the youth of the city receive their education, up to the preparatory course for the university.

Unlike many other cities of Western Canada, Moose Jaw's real estate, it is claimed, has never been boomed, the values steadily increasing without leaps and bounds, and the "wild cat" subdivision man has never played an important part in the city. With its strategic position as a shipping centre, the bounless acres of fertile wheat lands surrounding the city, and the unlimited resources of the Province of Saskatchewan, the future of Moose Jaw as a great industrial centre seem assured.

MAIN STREET, LOOKING NORTH, MOOSE JAW, SASK.

CALGARY, ALTA.

RATING fifth among the commercial cities of Canada, Calgary offers to those who are seeking locations for factories the advantages derived from its geographical position, its cheap and varied sources of power, and its well supplied labor market. As an assembling point for raw materials it has the benefit of three transcontinental railways. As a distributing centre, with ten main and branch lines radiating throughout the 125,000 square miles of trade territory, the city possesses splendid opportunities for serving a rapidly developing market demanding the various manufactured goods used in city and town, in field, forest, or mine.

Much of the railway mileage entering Calgary traverses a country which is and will be pre-eminently devoted to grain growing. When the Panama Canal is in full operation and the double-tracking of the Canadian Pacific Railway is completed from it to Vancouver, a goodly portion of the grain crop of Saskatchewan will here join that of Alberta en route to the markets of the Orient or to Europe via the Panama Canal. The Dominion Government, in preparation for this, has now called tenders for the construction in Calgary of an interior terminal elevator, having a 3,500,000 bushel capacity as its first unit. Transportation facilities, low-priced grain and cheap power are the prime factors in the successful manufacture of grain products, and Calgary seems to possess these.

Within two years Calgary has become the premier cattle market west of the Great Lakes. Cattle, hogs and sheep to the value of $14,000,000 passed through the city stockyards in 1913, while hides to the number of nearly 200,000 were sent to Eastern tanneries. It has been discovered recently that there is hemlock bark in abundance within easy shipping distance of the city, the bark of the Western or Washington hemlock yielding 184 lbs. more tanning per cord than the bark of the Eastern tree, and next to milling and meat packing there is an excellent opportunity for one or more tanneries. Industries subsidiary to those utilizing raw materials at their primary sources will naturally be prepared to take advantage of proximity and establish themselves close by.

Calgary has, therefore, special inducements to offer both large and small manufacturers. Power is derived from the hydro-electric system of the municipality and sold to manufacturers at $26 per horse-power per annum. Natural gas is supplied at 15 cents per 1,000 cubic feet to manufacturers, and good steam coal may be purchased for $3 per ton.

Oilfields.

Adjacent to Calgary are the Southern Alberta oilfields, where a hundred companies will soon be drilling for oil, with the prospect of repeating the strike of the Dingman well a few weeks ago, when almost pure gasoline was tapped and rose 2,000 feet in the well. Expert geologists express the opinion that this will prove to be one of the most wonderful fields yet developed. Canadian, British and American capital in millions is already invested for development work, and the outcome promises a commercial and industrial forward movement, compared to which the past few years, phenomenal though they were, will be but an incident. In three years Calgary's population increased 130 per cent.; bank clearings, 83 per cent.; assessment, 245 per cent.; Customs receipts, 246 per cent.; Post Office receipts, 188 per cent.; and there were erected new buildings to the value of $41,921,985. To large manufacturers the city offers factory sites, power, light and water at cost.

A modern industrial building will soon be placed at the disposal of manufacturers starting in a modest way and requiring leased floor space. This building, being erected from municipal funds at a cost of $250,000, is the first of its kind to be built and operated as a municipal enterprise.

REDCLIFF, ALTA.

THE town of Redcliff is situated about 180 miles south-east of Calgary, on the South Saskatchewan River, and on the C.P.R. Redcliff, although of recent growth, being incorporated in 1912, has already a population of 3,000, with an assessment of approximately $7,000,000. The town has developed into an important manufacturing centre, considering its comparatively small population, principally on account of the abundant supply of natural gas, which can be obtained at a cost of 15 cents a thousand feet. Suitable clay for making bricks and allied products is also obtained in the district, which has led to the formation of several companies engaged in this industry.

The foremost industry is the Redcliff Brick & Coal Co., which was established in 1912, and was followed closely by the Redcliff Pressed Brick Co. and the Redcliff Clay Products Co. Another important industry is the Alberta Ornamental Iron Works, capitalized at $200,000, and manufacturing principally bronze and ornamental iron work. The Redcliff Rolling Mill & Bolt Co. is one of the most recent industries. The company has laid down a well-equipped plant, with a capacity, when working full time, of 40 tons a day. The prospects for an industry of this description are good when the district develops to a greater degree.

One of the latest industries to be established is the Redcliff Motors Co., who make commercial cars for delivery purposes. The Alberta Shoe Mfg. Co. have built a large factory for making shoes. The factory is equipped with modern machinery, but has only quite recently started operations. A knitting factory is under construction.

LETHBRIDGE, ALTA.

LETHBRIDGE is the central commercial and supply point of Southern Alberta. The city is served by eight arms of the Canadian Pacific Railway, and the construction programme of this railway for 1914-1915 gives Lethbridge a largely increased commercial importance. The new line of about 450 miles between Lethbridge and Weyburn, Sask., now under construction, will considerably shorten the mileage between Winnipeg, Port Arthur, St. Paul, and all other Eastern gateways, and Lethbridge, while the completion of the Canadian Pacific Railway line through the Crow's Nest Pass to Vancouver in 1915 will make the route from Winnipeg to Vancouver through Lethbridge and the Crow's Nest pass shorter than the route through Calgary and the Kicking Horse Pass. The new transcontinental line thus formed through Lethbridge will be notable, not only for shorter mileage, but for lower grades. The C.P.R. has added some eight miles of track to its Lethbridge yards during the past year. Lethbridge is spoken of by the traveling public as being the most beautiful of all the prairie cities. It is clean and sanitary. Its well-kept parks and boulevards merit the admiration of all.

The municipality of Lethbridge owns and operates all of the public utilities including a coal mine. The cost of production for mine-run coal for 1913 was $1.19 per ton, while electric power is furnished by the city on a cost basis ranging from $13 per h.p. per annum up. The municipality also owns and operates a ready-made factory, conveniently located and with every modern improvement in which floor space is leased to small industries at low rental. Lethbridge is the first city in Western Canada to adopt the commission form of government; three commissioners with defined responsibilities administering all the municipal affairs. The production of Lethbridge coal mines for 1913 amounted to an average of 4,000 tons per day. The city affords ample opportunities for the investor in manufacturing and jobbing of many and various lines.

THE PAS, MANITOBA.

THE PAS is the southern terminus of the Hudson Bay Railway and at present time, work on the terminus is proceeding. This consists of station, roundhouse, shops and forty tracks to accommodate 4,000 cars. As the construction of the Hudson Bay Railway is going ahead, The Pas, with its population, meantime of 2,000, and situated at the junction of the Opasquia and North Saskatchewan Rivers, will be the distributing point of the Anglo-Canadian commerce and is likely to become a great commercial and industrial centre.

Timber, minerals, fish and furs is plentiful. The Finger Lumber Co.'s plant represents an investment of $1,000,000 and employs 500 men. The mineral wealth is unknown to a large extent, as the country has not been prospected, but copper has been found in rich values in Wintering Lake district and a valuable find of gold has been made at Beaver Lake. The only inlet to these rich fields is via The Pas, where the prospectors can outfit with everything necessary. Fishing is in its infancy, but the unlimited supply will shortly develop into a valuable industry. Sturgeon, salmon, whitefish, pickerel and goldeyes are plentiful. Fur-bearing animals abound, and fur-trading is a leading industry. Beaver, martin, fischer, muskrat, lynx, bear, otter, mink, ermine, foxes (white, silver, black, blue and mixed varieties), are among the fur-bearing animals caught.

There are openings for a canoe and launch factory, a sash and door factory, an abattoir, and brick and tile yards, a rich clay bed, suitable for brick, sewer tile and pottery having been located close to The Pas.

MEDICINE HAT, ALTA.

IT is probably a fact that the average manufacturer who located in Eastern Canada, Great Britain or the United States does not realize the substantial progress that industrial enterprise has made in some parts of the Canadian West. He may have heard now and again something about it, or more likely some of his travelers in scurrying after business, have found that, in some respects, at least, some Western Canadian cities are beginning to supply the local and district needs in the manufacturing line. Usually, he is in a state of blissful ignorance of what has been and is being done industrially west of the Great Lakes.

Among the cities and towns of Western Canada which have made steady propress in manufacturing during the last two or three years, possibly none stand out more prominently than does Medicine Hat—the city located about midway between Winnipeg and Vancouver on the main line of the C.P.R.; the place that is unique in many other respects, and is to-day one of the exceedingly few points where progress is being made industrially and municipally during this readjustment year of 1914. When it is realized that to-day there are half a dozen factory-owners actively busy on their construction programmes in Medicine Hat; that said industries can secure natural gas at the nominal price of one cent per thousand cubic feet for industrial purposes; that there are sites of suitable size on railway trackage at cost—which is nominal; that the water supply is wholesome; that electrical energy is priced as low as one cent per k.w.h. in quantity by the up-to-date municipal power plant—together with a few other advantages—he may well sit up and take notice. Here is a combination which the average resident of Medicine Hat, and the manufacturers already located here, claim cannot be beaten anywhere in Canada, East or West.

Industries in Medicine Hat.

To-day upwards of twenty factories are in operation in Medicine Hat, steadily manufacturing goods and shipping them all over the prairie provinces to points less favorably located and blessed — and thus helping those places to get manufactured articles cheaper than if shipped from Eastern Canada. In addition to the score or more of factories now operating in Medicine Hat, several others are now under construction, besides those that have signed contracts to erect factories. Every industry in Medicine Hat uses natural gas and there is a coal mine with 77,000,000 tons just outside the city limits.

Clay Working.

Naturally clay working takes a prominent place in the industries of Medicine Hat, with some establishments of outstanding importance. For instance, the Alberta Clay Products Co., with an investment of some $700,000, manufactures 87 different shapes of building block, hollow tile, drain tile, pressed brick, etc., and has furnished thousands of carloads of its product to the different cities of Manitoba, Alberta and Saskatchewan, and is still doing so. Recently, however, the company has taken up more actively than previously the making of salt-glazed, vitrified sewer pipe, of a quality that has evoked praise from the municipal engineers of the cities of the Western prairies. The Medicine Hat Brick Co., which has an investment of about $200,000, is to-day turning out an average of 100,000 wire-cut, stiff-mud brick each ten hours. It is one of the large concerns of the district.

Flour Milling Centre.

Another prominent feature of industrial Medicine Hat is its selection by Canada's greatest flour milling concerns for the location of their Western plants. It was chosen, of course, for the logical location and the economical power costs, together with proximity to the Pacific Coast, where a good trade is being built up with the Orient and Australia, with that via the Panama Canal looming up in the foreground in such a way that it promises to be no small factor.

Three large milling companies are located here. The Ogilvie Flour Mills Co. have had their million-dollar plant in operation in Medicine Hat for about a year, with a capacity of 2,000 barrels daily, the mill being large enough to turn out 4,000 barrels each twenty-four hours. A 500-barrel oatmeal mill is on the programme for next year. This company has elevator capacity to care for 1,300,000 bushels of grain, including the 500,000-bushel grain tanks here and the twenty-seven country elevators in the surrounding districts.

On June 1, the Lake of the Woods Milling Co. acquired for $300,000 the plant, good will, business and elevators of the Medicine Hat Milling Co., which had a capacity of 1,000 barrels daily, and was established here ten years ago as a small grist mill with 100 barrels daily capacity. Immediately the Lake of the Woods management began alterations and improvements to cost about $100,000 for the purpose of increasing the capacity to 2,000 barrels daily, the elevators being trebled in size, and the warehouse also being enlarged.

Within the last month the Maple Leaf Milling Co. started construction on a 3,000-barrel flour mill, the elevators to be of a size to hold 500,000 bushels of wheat or other grain. The structure will be similar to that of the Ogilvie concern here, and a large number of men are now being given employment on the work of construction. At first the capacity will be for 1,500 barrels daily, the additional machinery for double that amount to be added later. It is announced that the mill would be completed in time to handle at least a portion of the 1914 grain crop.

In addition to the above, Messrs. Fraser and Ness, of Ottawa, have a contract with the city for the building of another large flour mill, though probably not as large as the others.

Other Factories.

Medicine Hat is a place of diversified industries as well as substantial ones. It is not dependent on one or two lines. Some 50 or 60 different articles are made in the various factories, and the variety continues to increase each year. Briefly, here are some of them:

The Alberta Rolling Mills Co. manufacture almost every kind and variety of blacksmiths and other merchantable iron, including twisted reinforced rods for heavy concrete work, and the Medicine Hat Nut & Bolt Works started a short time ago, is also turning out an excellent product. One of the busiest places in the industrial district is the factory of the International Supply Co., who are makers of gas and oil-well drilling machinery and supplies. They also contract for boring wells. Two other iron working establishments that have made good and are doing an excellent business are those of the Alberta Foundry & Machine Co. and the Medicine Hat Pump & Brass Mfg. Co., there being a steady demand for the goods they manufacture.

The Canada Cement Co. is building a mill to cost about $2,500,000, which will handle 4,000 barrels of cement every 24 hours. They have already spent upwards of a million there. The Medicine Hat Radiator Co. has construction well forward on its factory to cost some $75,000. The J. H. Tabor Candy Co. is building a two-storey brick factory. The Dominion Sanitary Fountain Co. is proceeding with the construction of its building, while the Murdoch McLeod clothing factory is expected to start work at an early date. The industries now under construction will cost well up to three million dollars.

WHITBY. ONT.

WHITBY is the junction point of the main line of the Grand Trunk, with its double track between Montreal and Chicago, and the northern division of that railway running to Lindsay, Orillia, Peterborough, the Muskoka and Kawatha Lakes country. The building of the C.P.R. new lake front line, now just coming into operation, gives Whitby the full benefit of connection with that great railway system, at present the only completed transcontinental in Canada. It will provide a direct service with the National Capital, Ottawa, and to Montreal. The Canadian Northern Railway will, when completed, become the third transcontinental of Canada, reaching Whitby by means of the Toronto Eastern, a subsidiary of the Mackenzie-Mann system.

Inducements Offered

Cheap electric power, the purest of filtered water from Lake Ontario, and hundreds of acres of low-priced land along the trackage of railways in their several courses through the town, afford admirable industrial sites, which for the present are offered free to manufacturers locating in Whitby. There are also highly favorable conditions as to tax exemption, etc., that invite the favorable attention of manufacturers in the United States and elsewhere looking for branch factory locations in Canada.

OWEN SOUND, ONT.

OWEN SOUND is the principal port on the Georgian Bay, and is the headquarters of the Dominion Transportation Co., the Georgian Bay fleet of the Northern Navigation Co., and of the Chicago, Duluth & Georgian Bay Transit Co. It was a lake terminus of the C.P.R. fleet until that company moved to Port McNichol.

Owen Sound was incorporated in 1857, and has grown steadily, the population now being rather more than 13,000, with an assessment of over $6,250,000. As a residential place, it is particularly desirable, especially in summer, when the natural beauty of the city and surrounding district is seen at its best. From a geographical standpoint Owen Sound is well favored, it being an eminently suitable location for factories, on account of the facilities offered for shipping goods to both Eastern and Western markets at competitive rates, having two railroads, the C.P.R. and G.T.R., in addition to the water routes.

A further inducement will be available in about twelve months time in the form of hydro-electric power. At Eugenia Falls, 36 miles distant, the Provincial Hydro-Electric Commission has decided to develop a water power capable of producing 5,000 h.p., which will be a valuable asset to the town, enabling manufacturers to obtain cheap powers for operating their plants. Owen Sound has already a steel foundry, malleable iron and grey iron foundries, basic industries, which invariably help in attracting others.

HAMILTON, ONT.

SINCE 1910, over 40 factories with an invested capital of over 15 million dollars have located in Hamilton. For the four years previous to 1910 the growth in population was 10,678, while for the four years since 1910, it has been 30,587. Building permits for the four years previous to 1910 were $7,760,047, while for the four years since 1910 they total $18,461,135.

Among the largest industrial acquisitions may be mentioned: The Oliver Chilled Plow Works, of South Bend, Ind.; the National Fireproofing Co., of Pittsburgh; Standard Underground Cable Co., Pittsburgh; Boston Insulated Wire Co., Boston; Grasselli Chemical Co., Cleveland; National Steel Car Co., Passaic, N.J.; Willys-Overland Co., Toledo, Ohio; Dominion Steel Foundries Co.; Canadian Porcelain Co., Rochester; Mercury Mills, Victor Saw Works, Springfield, Mass.

The city refuses to have anything to do with bonus-seekers and believes that a plain statement of facts will appeal more to a concern worth while than the offer of a free site.

A few years ago, practically little attention was paid to all the important matters requiring careful consideration in the proper location of a factory. The matter of successful factory location is one which commands the attention of experts, and those cities which have much to offer in the matter of advantages for manufacturing are the ones which are coming to the front as industrial centres.

Opinion varies as to what is the direct cause for the tremendous expansion in Hamilton. Apart from human energy and local enterprise and without attempting an arrangement in order of importance the six great agencies which are constantly advancing Hamilton as a manufacturing centre are: Geographical location; competition in transportation facilities by steam, electric railroads and water; unlimited competitive electric power; raw materials; labor and living conditions. To attempt to go into this phase of the question fully would take more space than is at our disposal, but these are the fundamental essentials which must always be met in the successful locating of a factory.

Practically all of the important manufacturing and financial cities of Canada and the United States, including the financial and political capitals of both countries come within the radius of a nights' journey from Hamilton.

SHERBROOKE, QUE.

SHERBROOKE is situated at the confluence of the Magog and St. Francis Rivers, on the main line of the C.P.R., between Montreal and St. John, N.B., and on the G.T.R., Montreal to Quebec and Portland, Me., line. The town was incorporated in 1840, and was raised to the status of a city in 1875; the population is 19,500, and assessment about $10,000,000.

The principal feature from an industrial standpoint is the cheap power available. The city owns and controls 10,000 h.p., which it sells to manufacturers at ¾ cent per k.w., or about $15 per h.p. per annum. Power is obtained from two hydro-electric plants, each having a capacity of 5,500 h.p., while extensions are under consideration. There are also two undeveloped water powers—one on the Magog River and the other on the St. Francis River, which would give a further 6,000 h.p. The city owns the gas plant, gas being sold at $1.25 per 1,000 cubic feet.

Sherbrooke is an important manufacturing centre, among the older established concerns being the Canadian Rand Co., Sherbrooke Iron Works, Jenckes Machine Co., and Canadian Fairbanks-Morse Scale Factory. In more recent years manufacturers in the United States have come to realize the facilities offered by Sherbrooke, with the result that a number have established branch factories there. Among the latest to locate are the Canadian Connecticut Cotton Mills, Ltd., making cotton duck; the Panther Rubber Co., from Stroughton, Mass., and the Whiting Davis Co., from Plainville, Mass.; the latter company make wire mesh for bags and purses.

There are a number of valuable mineral deposits in the district, the most important being the asbestos mines at Black Lake and Thetford, which are world famous. Copper mines and a smelter are located at Capelton, while at Brompton and East Angus are large pulp mills doing an extensive business. The exports from this district, principally to the United States, are asbestos, lumber, platinum, chrome and wood pulp.

DOMINION STEEL CORPORATION AND THE WAR

REPLYING to an inquiry as to how the European war would affect the Dominion Iron & Steel Co. plant, J. H. Plummer, the president, said:—

"We have a considerable tonnage of rail orders on our books, but they are chiefly for shipments by water. The disturbed condition which affects the sending of material by sea and the further disturbance of financial arrangements of our customers caused by the war would seem to make it inexpedient to continue rolling on these orders.

"We already have several cargoes awaiting shipment, and more or less held up by those conditions. We think it probable, therefore, that we shall have to shut down much of the plant, or rather to suspend a major part of our operations for a time until we see more clearly what conditions we have to meet.

"In time of war the general iron and steel industries are usually very active, and that effect is likely at this time to be more marked in neutral markets because the great centres of industry in Europe are all directly involved. It is difficult to say how this would affect us in Canada, but if there is an active market in the United States we shall follow them to a greater or less degree.

"At the moment we are preparing to damp down two of the blast furnaces now in blast, and the open hearth furnaces. The finishing mills can and will be operated so far as orders are obtainable. We have on hand a supply of billets sufficient to keep these in full operation for some months. The demand for coal is unlikely to fall off, and unless our transportation arrangements should be seriously interfered with, this portion of our business will continue without change."

CITY OF TORONTO TURBINE PUMP CONTRACT.

MR. FREDERIC NICHOLLS, president of the Canadian General Electric Co., Toronto, has written Mayor Hocken as follows:—

"Dear Mr. Mayor,—I have just learned that the Board of Control of the City of Toronto, have placed their order for steam turbine pumps, amounting to nearly one hundred thousand dollars, with the Turbine Equipment Co., to be made by the De Laval Co., of Trenton, N.J.

"We on Monday last shut down our pipe foundry because of cancellations of orders by various municipalities throughout the country who are unable to sell their bonds and finance their requirements, and while we have been making very strenuous efforts to keep as many men employed at our Davenport works as possible during this period when there will be so many unemployed in this city, it is incredible to my mind that the city should have placed this order for nearly one hundred thousand dollars with a United States concern when the prices were practically the same.

"The city will have to provide for thousands of unemployed during the coming winter and there is absolutely no reason why it should be sending this amount of money abroad for the employment of United States workmen when we were able and willing at the same price to do the work in Toronto.

"Yours very truly,

"FREDERICK NICHOLLS.

"President."

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A weekly newspaper devoted to the machinery and manufacturing interests, with special reference to machine tool improvement and development, machine shop methods, devices and systems relative to efficiency and economy of production.

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Vol. XII. AUGUST 20, 1914 No. 8

PRINCIPAL CONTENTS.

WAR PANIC DISORGANIZING BUSINESS.

THE principal developments to be noted since a general European war became an accomplished fact, are those in which business interests predominate. A real live panic has got hold of the Canadian people, and as a result there is a tendency in industrial circles for the managements to cut loose, **burn their bridges**, sit tight and conserve their present resources. On another page of this issue much sane advice by the noted economist Sir George Paish, is compressed into small space. One thing that strikes us as regards the situation created by the war, and which may be read into Sir George's statement is that the public weal should at all hazards be conserved.

Industries have without doubt been directly affected as a result of the outbreak, but amid all the panicky pessimism, there is no real outlook to warrant a stoppage of the productive power and income of our country. It is a time more than ever before which puts our **Captains of Industry** in the limelight and on their mettle, and just as we unhesitatingly look forward to the triumph of our Empire in its titanic struggle for right and freedom, we likewise predict that our manufacturers will not fail by their actions and attitude during this crisis to merit the universal commendation of the Canadian people.

WAR BRINGS INCREASED REVENUE.

ALTHOUGH literally speaking, **the time to make hay is while the sun shines**, figuratively, it may be made at any time. We need not lay ourselves specially out for the purpose either, although perhaps as individuals such a proceeding would probably be necessary. Our patriotism, if worthy of the name would, however, be a sufficient deterrent in these stirring times.

While Canadian manufacturers and industrial concerns generally have been more or less adversely affected by this world-involving European War, it is worthy of note that our great public utility corporations are being affected beneficially, a condition of things likely to exist until long after peace is declared and until trade and commerce get back again to normal. The highly satisfactory part of this experience is that no special effort has been made to secure the increased business, therefore no imputation of sharp practice, meanness or lack of patriotism is applicable.

By reason of the war the revenues of certain corporations in Toronto have increased considerably. The Bell Telephone Co. state that calls have increased about thirty-three per cent., the greater number of these extra calls being to the newspaper offices. Towns outside Toronto have also sent in additional long-distance calls, the increase being reckoned at about ten per cent. The lines of the telegraph companies have also been exceptionally busy, their revenue showing an increase of twenty per cent.

The business of the cable companies has increased about ten per cent., although the number of cables was not as large as before. The fact that addresses and signatures had to be given in full has augmented the revenue. Another corporation that has scored heavily is the street railway. The war bulletins and special editions of the newspapers have brought thousands of people down town, who in the ordinary course of events would have stayed at home. It has been estimated that the additional profits of the street-car company amount to some $5,000 per day.

What is true of Toronto is without doubt the experience of the public corporations and municipally owned utilities in the principal cities and towns of the Dominion. As a consequence we think it right that the attention of the various executive bodies who are planning Empire aid in able-bodied men and material, who are taking steps to succor the wounded and dying, and last, but not least, who are planning to keep **the wolf from the door** of homes from whence the bread-winner has gone at his country's call, should be drawn to this phase of the situation so that a share in the profit arising from our Empire's fight for liberty, be forthcoming to further and bring that fight to an early and successful conclusion, and with the minimum of suffering and inconvenience.

This is no time for **hoggishness**, individual or otherwise. Practical demonstration was given a few days ago, here in Toronto, of what individualism can achieve, and the Canadian Pacific Railway Co. management as has been their wont are again to the front with full handed patriotism, an example of corporation generosity. Canada and the Empire expects **every** public utility corporation to do its duty.

INDUSTRIAL NOTABILITIES--No. 48

PHILIP LESLIE MILLER, naval architect and general manager Canadian Vickers, Ltd., shipbuilders, ship repairers, engineers and boilermakers, Vickers Bldg. and Naval Construction Works, 3072 Notre Dame St. Longue Pointe, Montreal, was born in Dundee, Scotland, May 27, 1876, the son of Alice (Waterston) and James William Miller, M.D. He was educated in the High School of his native town, following which he served a five years' apprenticeship with Gourlay Bros. & Co., shipbuilders, also of Dundee. He next spent one year at St. Andrew University.

In open competition Mr. Miller gained a free studentship and Admiralty scholarship, entitling him to a three years' course in Naval Construction at the Royal Naval College, Greenwich, which he completed and qualified at the final examination in 1901.

PHILIP LESLIE MILLER

He was appointed by the British Admiralty to the Royal Corps of Naval Constructors, serving as such for twelve years in the construction department of the Admiralty and of the Royal Dockyards at Portsmouth, Hong Kong and Malta.

He supervised construction of warships on the Clyde on behalf of the British Admiralty from 1908-1911, and was lent by the British Government to the Turkish Government in the latter year to supervise construction of Dreadnought battleships being built in England for the latter. Mr. Miller resigned from this position and from the Royal Corps of Naval Constructors in 1913 to take his present positoin at Montreal.

He married Flora Margaret Baxter, daughter of Arthur Baxter, Blairgowrie, Scotland, Nov. 5, 1906.

His clubs are the Engineers, Outremont and Kanawaki Golf, Montreal, while his recreations are golf and music. He is also a member of the Institution of Naval Architects of Great Britain.

In religion, Mr. Miller is a protestant, and his residence is 164 Crescent Street, Montreal.—Photo, courtesy of International Press.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 65	
Lake Superior, charcoal, Chicago	16 00	
Ferro Nickel pig iron (Soo)	25 00	

	Montreal.	Toronto.
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 50	17 85
Victoria, No. 2X.......	18 25	17 60
Victoria, No. 2 Plain ..	18 00	17 35

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b, Montreal.	2.00
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh ...	1.20
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes..	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price per ft.	Extra Strong. Sizes Ins.	Extra Strong. Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload ..	$15 25	$15 25
Electrolytic copper	15 00	15 00
Casting copper.	14 50	14 50
Spelter	5 50	5 50
Tin	60 00	55 00
Lead	5 00	5 00
Antimony	25 00	25 00
Aluminum	20 00	23 00

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15
Lard Oil, per gal.	0.60

CHAIN.

¼ inch	$5.65
5/16 inch	4.70
⅜ inch	4.00
7/16 inch	3.65
½ inch	3.45
9/16 inch	3 45
⅝ inch	3.35
¾ inch	3.25
⅞ inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2 90	3 15
Canada plates, all bright	4 00	4 10
Apollo brand, 10¾ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1½-in	$37.50	$30.00	$17.50
33/64 to ¾-in.	41.25	33.00	19.25
7/16 to ½-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	95c lb.
Leather in sides	85c

BELTING RUBBER.

Standard	60%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

¾ inch	$ 4.95
1 inch	8.05
1¼ inch	12.65
1⅜ inch	15.30
1½ inch	16.50
1⅝ inch	19.40
1¾ inch	22.50
1⅞ inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Aug. 17, 1914.—Another week of suspense has passed and business still remains at a standstill. This, of course, is not other than can be expected because of the fact that military operations are being executed upon such a gigantic scale, therefore decisive developments cannot be hoped for in a short time. All markets are very erratic, and the various firms form quite as varied a number of opinions as to how the war will effect Canada; as a consequence, prices of material quoted cover a wide range, and a like condition exists in all lines of trade. The metal business is completely disorganized.

The general idea, however, is that the German forces will receive a decisive check as soon as a battle on land occurs. This will restore confidence among manufacturers and in financial circles, the outcome being increased business.

Pig Iron.

The pig iron market is no exception to the others, it, too, being in a most unsettled condition. One can form no definite idea of how the European market is, because no quotations are being received. Considerable quantities of pig iron from England are in the country and from this stock the demand is being supplied. England and Scotland import a large amount of ore and this supply is meantime being cut off.

The Steel Market.

The steel market is in much the same condition as that of the pig iron. All rolled sections of steel are commanding a higher price than they were a month ago. No large orders for steel have been received during the week.

Machine Tools.

There have been only a few minor sales reported during the week. This branch of business feels the depressions first and is about the last to recover. The delivery of European tools is still uncertain, but as there are no sales this phase of the situation does not have much effect.

Metals.

The sales here have been low during the week. Tin seems to have reached its high level and has since sagged a little. Copper remains steady. In other metals but slight variation is noted. However, all prices are more or less nominal as the London and New York Exchanges are still closed.

Toronto, Ont., Aug. 18, 1914.—The war in Europe is the principal topic being discussed and it is naturally having an effect on the spirits of the community. Business conditions cannot be said to be any more settled and a considerable amount of anxiety still exists as to how Canada will be affected. Opinions naturally differ on this point seeing that the situation is one that has never been experienced before, there being no precedents to follow. It has been officially anounced that the Atlantic trade routes are open for commerce, which will help to allay fears expressed when the trouble started; this will also relieve the situation as it affects our export trade.

Canadian business will be further reassured by the action of the Dominion Government in making arrangements with the Bank of England for the collection of gold at Ottawa until such time as international exchange is again on a working basis. This arrangement will release for export a large amount of material, principally foodstuffs, which had been held up on account of the prohibitive exchange rates which made it almost impossible to finance shipments. Trade with Germany is cut off, which will mean a reduction in our export trade in metals, manufactures of iron and steel and agricultural implements, amounting roughly to one million dollars. The decrease in Customs receipts on products from that country will be considerable.

It is futile to hazard a guess as to the duration of the war, but in any case it is essential that everybody should be calm and confident in the face of difficulties and as far as possible act in their business relations as if great events were not impending. Let not our confidence be seriously disturbed; otherwise conditions will become worse. The financial situation cannot help but affect trade adversely, but there is no real reason why factories should be closed down and employees laid off, except in exceptional cases. The population remains practically the same and the requirements of the people will not decrease to any appreciable extent. The natural resources of the country do not depreciate and the productive powers of the country should be maintained as far as possible.

We notice that municipal works are being stopped in some places and in others continued. In the former case the works are mostly of considerable magnitude and therefore difficult to finance. Some industries, notably pulp and paper, will benefit while; with others the reverse will be the case. Taking an average, it is possible that the country will not be very seriously affected.

Steel Market.

The situation in the iron and steel markets is practically the same as last week. Comparatively little business is being done, everybody awaiting developments in the war zone. This condition may continue for some time until all fears are dissipated and a more confident spirit permeates the community. The increase in the cost of raw materials and the uncertainty of the sources of supply of some products are causing manufacturers to withdraw all prices and only book orders at prices mutually agreed upon or at prices ruling on date of shipment. This is a natural outcome of conditions which we hope will approach nearer to the normal as soon as the excitement has subsided. The base price on bars, plates and shapes has advanced to $1.20 Pittsburgh. There appears to be a belief in the United States that the war will, at no distant date, cause an increased demand for steel products for export, but when this is likely to happen it is difficult to venture an opinion. Nearly all the countries involved in the war are large exporters of steel products so it is reasonable to suppose that this trade will be transferred for a time to the United States and possibly a share to Canada. The situation is a difficult one to gauge with any degree of certainty, but will be greatly relieved when Great Britain and her allies have got the upper hand and control the area of hostilities.

Pig Iron.

The pig iron market is very quiet but prices are firm. Little business is being done, consumers waiting until the situation is clearer. The pig iron production in Canada is not of very large proportions but the few furnaces that are in operation may possibly benefit by the war as regards their export trade.

Machine Tools.

There is no change in the situation, the machine tool business is very quiet with little prospect of a near future revival. Dealers view the situation with a certain amount of apprehension.

Machinery Supplies.

Little business is being done in machine shop supplies, small orders being the rule to fill immediate requirements. There is a tendency to curtail machine shop operations, which will directly affect the demand for supplies.

Tool Steel.

The demand for tool steel has fallen off in sympathy with other lines, and few orders are being placed meantime. A considerable amount of tool steel is imported from England, while a certain amount comes from Germany and United States. The supply from the two former countries has been cut off, leaving the United States to supply any deficiency. We understand, however, that some dealers have considerable stocks, principally carbon steel, on hand and can supply the market without much difficulty for the time being.

Mechanical Rubber Goods.

The prices on mechanical rubber goods have not been advanced as yet, being made principally from reclaimed rubber. Those lines made from crude rubber are subject to different conditions and have advanced in price, This, however, will not materially affect goods used in machine shops.

Metals.

Considering the abnormal conditions, the metal markets are comparatively steady. Antimony at 25 cents is the only metal to remain at the high figure quoted last week, all other metals have weakened. There is apparently no relief in the tin situation, but the price has dropped to 55c. Spelter is slightly weaker at 5½c, lead 5c, and aluminum 23c per lb. Copper is quiet and price weaker. The demand for most metals is light, as might be expected with present conditions.

WAR MARKETS.

NOTE.—Owing to the continued unsettled condition of the markets generally, and consequent upon rapid fluctuation in prices, it is impossible to give firm prices in our selected market quotations for many products, as prices on a number of lines are liable to change daily or oftener. The quotations will, however, serve as a guide while at the same time indicating the general trend of the market.

Ottawa, Ont., August 17, 1914.—The emergency session of Parliament opened this week. It will be a brief, business session. The situation is too serious for party politics, and the country is in no mood for patriotic speeches. Canada wants action, not words. The Government has its legislation already in shape, so that there should be little delay. There will not be many bills, but they will be important, and will give the Government sweeping and drastic power to deal with any situation which may arise. There will be general legislation giving the Government more authority to deal with the question of militia and naval defences. Approval will have to be secured of some action already taken by the Government.

From the standpoint of the business world, the most important legislation will be that giving the Government power to declare a moratorium in case of an emergency and also authority to deal drastically with the problem of food supply. The bills introduced by the Government will be based on English legislation.

Winnipeg, Aug. 15, 1914. — Speaking generally, the tendency in the West is for those who have been contemplating purchasing machine tools, to delay until conditions in Europe right themselves. Several who had placed orders, cancelled them temporarily. Hand to mouth buying seems to be the general rule, and all orders received are for actual requirements.

Last week saw the arrival of Alfred Martin, representing the John Bertram & Sons Co., Dundas, Ont., for machine tools, and Pratt & Whitney Co., of Canada, for small tools. He has opened an office on the first floor of the Bank of Hamilton Building. The Canadian Fairbanks-Morse Co. recently secured an order fro mthe town of Kamsack, for a pumping and electric lighting outfit, consisting of gas producer, gas engine, dynamos, and pumps.

Metals.

Tin is practically priceless here. A few lots are being sold out of Montreal at 70 cents. Antimony is almost impossible to procure, the market price now being 20c. Copper is one of the few metals which are plentiful. The jump in the price of tin has caused solder to go up 10c., being now quoted at 35c. by local jobbers.

Face the Situation with Courage and Confidence

¶ In view of the events taking place in Europe, which will constitute an epoch of perhaps unprecedented importance in history, we appeal strongly to all Canadian business men and all who hold securities or investments of any kind, to meet the present situation with calmness and confidence. Our first duty, at any cost, is to aid in Great Britain's sustenance and defence, and our next duty, not less important, is to keep the business of the Dominion moving as normally as possible.

¶ "In the unprecedented and critical situation that exists," says Sir George Paish, in the London Statist, "we would make a special appeal to the patriotism as well as to the interest of the investing public.

¶ "At such a time it is of the greatest importance that everyone should endeavor to act as if great events were not impending. Were confidence seriously disturbed business would come practically to an end, and our ability to face the difficulties that may be in front of us would be seriously impaired. Therefore, it is of vital importance that, as far as possible, the events that are now taking place should not interfere with the daily life and the daily work of the nation. Orders should be given, factories should be run, and everything should be arranged to maintain, as far as possible, the productive power and the income of the country.

¶ "Yet for this to be accomplished the situation must be faced with courage and confidence on the part of everyone. Investors must continue to invest, bankers must continue to lend, the Stock Exchange must continue to deal, and everyone, according to his ability, must endeavor to work hard in order that individual incomes, and therefore the income of the whole nation, may be maintained at the highest possible level.

¶ "A little over a century ago, when the nation was at war with Napoleon, its income was a very small one, being less than one-eighth of what it is at present, and in a comparatively short space of time the British people succeeded in raising about £1,000,000,000 of money for war purposes, and so great was their confidence and courage that at the end of the great war, which severely taxed their resources, they were stronger and wealthier than they had been at the beginning."

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Brampton, Ont.—The Clinton Motor Car Co. will build a factory here.

Guelph, Ont. — The Canadian Ingot Iron & Culvert Co., will make extensions to their factory.

Essex, Ont.—T. A. Hill is equipping a plant for making and repairing motor cycles and cars.

Salmon Arm, B.C.—J. K. Gardner and W. Thorpe propose establishing a machine shop and garage here. Machine tools will be required.

Toronto, Ont.—Fire did $5,000 damage to buildings and contents of the Standard Foundry Co., at the foot of Jarvis street, on August 11.

Medicine Hat, Alta.—Work is about to start on the construction of the Dominion Harvester Company's plant at Dauntless. Mr. F. S. Ratliff is secretary of the company.

Saskatoon, Sask.—The John Deere Plow Co. has applied to the city commissioners for a water main to their warehouse building on Twenty-fifth street. The company wants the additional water supply to feed a sprinkler system which it intends to install in the building.

Halifax, N. S.—President Harris of the Nova Scotia Steel Co., has announced that as a result of the unprecedented financial situation created by the war it has been decided to close down a portion of the plant at Wabana Mines, and the blast and open hearth furnaces at Sydney Mines have been temporarily stopped.

Toronto, Ont.—Next week work will be started in earnest on the new Union Station. Six carloads of machinery and heavy timbers arrived from Calgary and are now on the ground and will be used in the construction work. The consignment consists of donkey engines, cement mixers and derricks. The Peter Lyall & Sons Construction Co. are the contractors.

Saskatoon, Sask.—A strong committee has been appointed by the Saskatoon Gas & Oil Co. to take charge of the reorganization of the company. The committee was appointed at a meeting held recently. It is composed of the following prominent business men: J. F. Cairns, chairman; D. D. Currie, G. H. Clare, R. F. Preston, S. W. Johns, J. P. Murphy, E. F. Crawford, H. Tupling, Geo. Tupper, Wm. Oliver, C. J. Hanratty and C. G. Locke.

Windsor, Ont.—Cast stone blocks are being manufactured here by the Canadian Zagelmeyer Co., Ltd. This company also owns the patent rights to manufacture the machinery used in making cast stone blocks and they have the entire Dominion of Canada as their territory. Although they have been in operation only a week or so they have already equipped plants in Montreal, Winnipeg and Edmonton. Adam Kolb is the president of the company, Frank Zagelmeyer vice-president, L. H. Walker local manager, and J. F. Kinzinger secretary.

AUSTRALIAN RAILWAY WORKSHOP TENDERS.

Still further additional tender forms, specifications and drawings for equipment required by the Victorian Government Railway Workshops continue to be received from Commissioner D. H. Ross, Melbourne, and are open to the inspection of Canadian machinery manufacturers on application to the Department of Trade and Commerce, Ottawa. Particulars of these requirements, together with the dates on which the tenders close at Melbourne, are briefly outlined thus:—

27189—September 30, 1914—100 steel booms to specifications.

26912— November 4, 1914—60 sets balls and races for turntables

The mail leaving Vancouver (tenders should be endorsed by that route) on September 2, will reach Melbourne on September 28, and the mail leaving Vancouver on September 30 is scheduled to arrive at Melbourne on October 26th.

Porcupine, Ont.—The task of centralizing operations on the group of properties controlled by the Canadian Mining & Financing Co., will commence at once. The twenty-stamp addition to the Hollinger mill has been completed, and will be running almost certainly next month, and then with as little delay as possible the foundations will be laid for the twenty stamps which are to be reserved for the ore from the Acme gold mine, the private property of the syndicate. Alterations will gradually be made to the Cyanide end of the plant all over the mill until it has been converted into a continuous decatation process.

Electrical

Ayr, Ont.—The site on Northumberland street, recommended by an engineer of the Hydro Commission, is now declared unsuitable, though the municipality has purchased the lot. Nothing definite has yet been done about a new one.

Windsor, Ont.—The plant of the Walkerville Light & Power Co. has been disposed of to the Hydro-Electric Commission at a price stated as $85,000. The plant will be taken over at once and operated at higher prices to consumers till Niagara power is ready. It is expected the hydro wires will be ready to deliver current at Walkerville inside of one week. The power plant will then be dismantled and disposed of.

Drumbo, Ont.—Work is being rushed on the hydro transmission line to this town. A substation will be erected here, the location is selected and the work will begin at once. The supplies for the line are all here to be distributed to Plattsville and Princeton, and work will be pushed as fast as possible, and light will be given early in September.

Municipal

Stratford, Ont.—The council has authorized the purchase of a pulmotor.

Hamilton, Ont—Burlington village will extend its waterworks system.

Sandwich, Ont.—The city will make considerable extensions to the water main system.

Stratford, Ont.—The garbage committee has been instructed to proceed with the purchase of wagons for the local system.

Lethbridge, Alta.—The city will complete the high pressure water system which includes a new intake and new mains representing a total outlay of $54,755.

Comber, Ont. — Little interest was manifested in the vote last Monday to expend $4,500 for securing power from

Plant and Equipment Features the A. B. Ormsby Co., Toronto

Staff Article

To even the casual observer it must be amply evident that sheet metal products in almost endless variety are features of industrial enterprise sufficiently important to place them in the very front rank of twentieth century developments. An insight into what is being achieved, both utilitarian and highly ornamental, may be acquired by a careful perusal of the accompanying article.

THIS firm having become associated with the Metal Shingle & Siding Co., of Canada, found that their former premises were too small to take care of the increased volume of business. Their new plant is located in Toronto at the corner of King and Dufferin streets, and is thoroughly up-to-date in every detail. The main building is two storeys high, of brick and with concrete floors throughout. Occupation was had early in November, 1913. A few improvements are being added this season and when these are finished the new factory will be a model of completeness.

Sheet metal has become more and more widely known of recent years and its use, more extensive. Metal is being used in all classes of building as a preventitive of fire. Thus to-day its various uses are almost unlimited. One can easily see then that the product of such a plant as the A. B. Ormsby Co., is of an exceedingly varied nature.

Lines of Product.

The most important lines are as follows:—Various kinds of sheet steel for siding and roofing, and large sheets of corrugated steel. The smaller sheets, steel siding plates are stamped in various designs, more or less ornamental. A large part of the factory is given up to the hollow steel department. Here are made various articles, chief among which may be noted wall panelling, partitions, hollow doors, and interior trim. These products are all beautifully enamelled to represent oak, mahogany and other finishes. In another department steel sash and steel window casements are made. Various grades are produced, from those of plain painted steel for factories and warehouses to the highly decorative variety used in the best class of buildings.

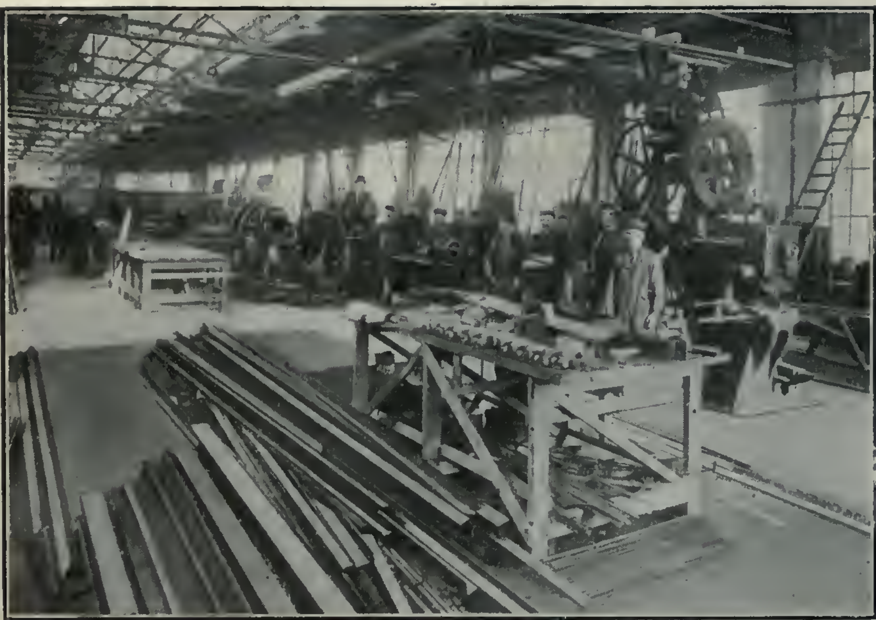
GENERAL OFFICES, KING AND DUFFERIN STREETS, TORONTO.

The Kalamein Department.

The kalamein department is also extensive. This process is used largely for doors, window sash, and mouldings. The method of manufacture is to build doors and sash of good dry wood, laminated to prevent warping or distortion, and to cover them with sheet brass or copper, and any one of a dozen or more colors can be obtained by the proper chemical treatment of the metal. These colors and finishes, thus made, are permanent. A large market has also been created for galvanized iron kalamein work, because it is fireproof and much cheaper

SHEET METAL SHOP, A. B. ORMSBY CO. PLANT, TORONTO.

than hollow steel products. Various woods are used according to the class of work. In the highest grade, mahogany is used, while in the cheapest lines a good grade of white pine answers the purpose. All the wood used is kiln dried to ensure its being thoroughly seasoned and perfectly dry. Still another product of this department is that of revolving doors, and also more or less veneer work. In a general way this comprises the list of products of the factory.



MACHINE SHOP.

The Power Feature.

Nearly three hundred horse-power is used about the plant. This is supplied through various units by Canadian Westinghouse Co., motors. There are in all sixteen motors varying in size from 75 horse-power down to $2\frac{1}{2}$ horse-power. The arrangement makes a very economical installation because the motors only run when the machines they operate, are being used. One motor usually drives a length of line shaft to which various machines are belted, but some of the larger machines have individual drives.

There is also a power house in connection with the plant; it is not under the roof of the main building, however. Here will be found a battery of three return tubular boilers, supplied by the John Inglis Co., Toronto. Two of these boilers are 78 inches in diameter by 20 feet long, and one 72 in. diameter by 16 feet long, being rated at 150 h. p., and 100 h.p. respectively. They are built for a working pressure of 125 lbs. This pressure is required by the enamel ovens which are situated in the factory proper. Atmospheric pressure steam is used for heating the buildings themselves, and from atmospheric to 5 lbs. pressure is used in the dry kilns.

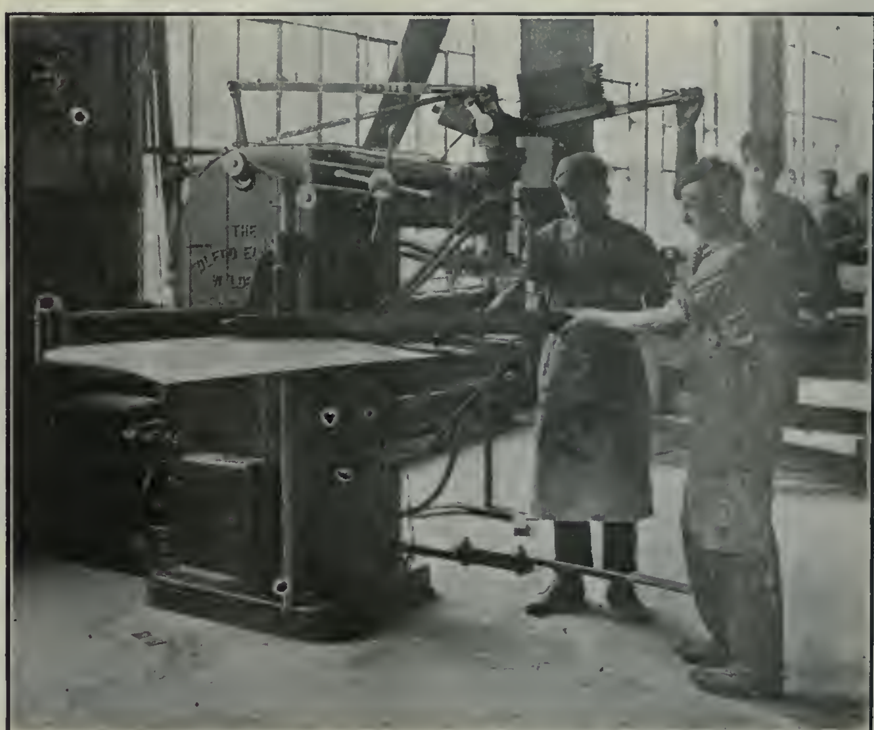
The boilers are so arranged with high and low pressure headers that each or all boilers may be used on high pressure or low pressure as may be required, the steam being by-passed through reducing and controlling valves. It is also possible to take from one boiler 125 lbs. pressure steam for the enameling ovens, atmospheric steam for the heating and low pressure steam for the dry kilns. This also is possible from each or all boilers.

Factory Heating.

The general heating in the factory is that of the vacuum system, all the heating in the different departments being acomplished through radiators placed along the outside walls. There is, however, one exception to this, in the case of the large shop, there being 2 38-in high column radiators and coils of $1\frac{1}{2}$ in pipe in the monitors. On every unit there is placed a Webster water seal motor valve for controlling the amount of steam which is passed through the radiator or coil. The return lines from the different buildings are carried to a vacuum pump through Webster condenser heads and lift fittings to the 10-12-12 in. **Bawden** vacuum pumps. The vacuum pumps discharge the water of condensation into the receiving tanks, from whence it drains by gravity to the boiler feed pumps, which are 10-16-12 in. The boiler feed pumps operate through an automatic control.

The general heating scheme is arranged as follows: A 12-in. low pressure header is carried to an 18-in. wrought iron low pressure steam distributing header, from which steam is carried to every building in a separate line. Each building and every separte steam line is controlled with its own valve on the header. Thus the engineer in charge has complete control of the entire radiating system from the boiler room.

The boilers are operated under induced draught, the stack being only forty feet high. A 120-in **Canadian Sirocco** standard steel plate fan of extra heavy steel, has been placed on top of the boilers, and is direct connected to a 7-in. x 7-in **American Buffalo Forge** vertical engine.



SPOT WELDING MACHINE IN HOLLOW STEEL SHOP.

It is possible through this medium to carry any draft required up to as high as 1½ in. water gauge. This also allows the use of a cheap grade of fuel. At present there is being burned a half and half mixture of hard and soft coal screenings, with practically a total elimination of smoke.

In the enameling ovens where a pressure of 125 lbs. is required there is placed in each oven two coils of 1 in. extra heavy pipe, each coil having a header of 3-in. extra heavy wrought iron pipe, tapped out for the 1-in. pipes which are screwed into it. The returns are carried back through **Mason** side lug high pressure steam traps to the receiving tank in the boiler room. These coils make it possible to raise the temperature in the ovens to 300 degrees Fah. very quickly.

STEEL SASH SHOP.

The plant has been so designed that three additional storeys may be added at any time, and the present equipment will be amply sufficient to take care of same.

Machinery Equipment.

In the carpenter shop and kalamein department are to be found a large number of wood working tools. These have been supplied largely by the Canada Machinery Corporation, Galt, Ont., and consist of edgers, groovers, hand saws, rip saws, planers, etc. A 30 h. p. motor driving a Canadian Sirocco suction fan carries the saw-dust and shavings from each machine to the power house where they can be blown into the boiler fireboxes and burned, or into a vault from which they can be stoked into the boilers by hand when desired.

In the machine shop, a 75 h.p. motor is connected up to a Pokorny & Wittekind air compressor. The firm making this machine is located at Frankfort-on-the-Maine, Germany. Their product varies widely from the prevailing American design. This machine has one cylinder of two bores, and by an ingenious differential piston it does duty as a two-stage compressor. An inter-cooler is mounted on the top of the cylinder which is horizontal. The valve in the compressor is mechanically operated and is known as the Koester piston valve gear.

An extremely ingenious device is fitted to the compressor to prevent it from putting excessive pressure on the receiver. When the pressure has reached one hundred pounds per square inch, the device closes the air intake valve and the compressor runs idle until the pressure becomes sufficiently reduced; it then takes up its load again. The capacity of the compressor is 320 cu. ft. of free air per minute, its stroke is 15¾ in., the bore of the large end of the cylinder is 18⅛ in., and the compressor is run at 145 r.p.m. The air intake is in the roof. This intake leads from the compressor and consists of an 8-in pipe with a T fitted on the end, in each end of which a short nipple is screwed. To each nipple an elbow is fitted with open end down. Two large galvanized iron funnels are fitted over the ends of the elbows and screened.

Air is used in the sand blast system which is a Hoevel unit. Both the compressor and the sand blasting unit were supplied by R. M. Fotheringham, Toronto, who has the Canadian agencies for both firms. Air is also used in the hoist in the paint shop, and in the pneumatic tools in the machine shop. These latter are all Cleveland pneumatics. In the power house the air is also used for blowing out boiler tubes and for removing ashes. The use of the air is of course more or less irregular and this varying load causes the automatic cut out to work frequently. As this compressor was somewhat unique in design and seems to have given excellent satisfaction, its description at some length was thought advisable here.

Machine Shop.

In the machine shop is installed a very complete range of machine tools consisting of lathes, shapers, planers, drill presses, punches, shears, and several automatic machines which execute certain operations to parts of the standard steel sash. Among the interesting machines are two triple combination plate shears,

HOLLOW STEEL SHOP.

punches, and bar and angle cutters, purchased from the Wiener Machinery Co., of New York. These machines have solid steel frames permitting compactness which makes them most suitable and economical for crowded shops. Without change of tools they are capable of splitting plates of unlimited length, cutting flat bars, shearing off rounds and squares, cutting and mitering both right and left hand angles and tees at any degree, and punching plates and structural material either of web or flange form. With interchangeable tools, beams, channels, Z bars, etc., can be cut. The punching tools can also be interchanged for coping and mitering tools.

The following firms are among those which supplied the shop equipment:—

Canadian Westinghouse Co., Hamilton, Ont.

Canadian General Electric Co., Toronto, Ont.

Loy & Nawrath, Newark, N.J.

Hendey Machine Co., Torrington, Conn.

Walcott & Wood Machine Tool Co., Jackson, Mich., whose Canadian agents are the General Supply Co., of Canada.

W. F. & J. Barnes Co., Rockford, Ill.

Toledo Electric Welder Co., Cincinnati, O.

Fitchburg Machine Works, Fitchburg, Mass.

The John Bertram & Sons, Co., Dundas, Ont.

The Brown Boggs Co., Hamilton, Ont.

The V. & O. Press Co., New York City.

The Farrell Foundry & Machine Co., Waterbury, Conn.

Geo. A. Ohl & Co., Newark, N.J.

Superior Machine Tool Co., Kokima, Ind.

The Tubular Rivet & Stud Co., Boston, Mass.

E. W. Bliss & Co., Brooklyn, N.Y.

H. W. Petrie, Ltd., Toronto, Ont.

The W. P. Davis Machine Co., Rochester, N.Y.

The Stahlwerk Oeking Co., Duesseldorf, whose American agents are the Wiener Machinery Co., New York.

The Barnes Drill Co., Rockford, Ill., whose Canadian agents are the Canadian Fairbanks-Morse Co., Toronto.

The R. McDougal Co., Galt, Ont.

The Canada Machinery Corporation, Galt, Ont.

The Canadian Fairbanks-Morse Co., Toronto, Ont.

The John Steptoe Shaper Co., Cincinnati, Ohio.

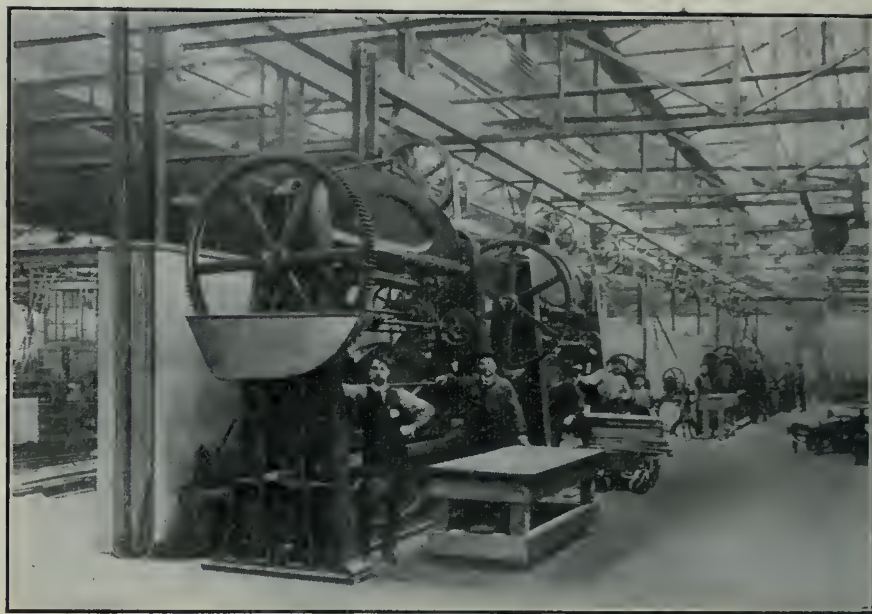
Stock Room

In the receiving department a stock of about one thousand tons of steel is usually kept. There is of course a large variety of sections in the stock, but as the sections are all small, the total represents a rather large quantity. A great deal of this material comes from the Carnegie Steel Co., but the Hamilton branch of the Steel Company of Canada, have installed rolls that will turn out some of the required sections. As a result they are now enjoying a portion of the business.

Process of Manufacture.

The rolled steel sections are stored in receiving sheds conveniently located near the company's railway spur. This raw material enters the shop and is cut to length. Then it passes from machine to machine through the successive operations which make it a finished part. The various sections each pass through their respective series of cutting, punching, shearing, etc., and are passed on to the assembling department. Here the pieces are riveted and welded and a finished sash turned out.

The various ideas and tastes of architects are constantly bringing new orders of a distinctly original character, and to make dies and to machine the tools required to manufacture these special articles keeps a staff of machinists busy. Their work is of a very general character and often requires considerable ingenuity to accomplish it.



SHEARING AND FORMING DEPARTMENT.

Sand Blasting and Pickling.

There are two small departments of no little importance located at the entrance to the storage and packing department. These are the sand blasting room, and the pickling room. In the sand blasting room the hollow steel work is cleaned and finished preparatory to being enamelled and grained. This is done by means of a spray or blast of sand working under high pressure. The

HOLLOW STEEL SHOP SHOWING THE ROLLING MILLS.

blast plays on the comparatively rough steel product and the result is a smooth polished surface which is pleasing to the eye.

The sand blasting room is a brick building well lighted from the roof and sides, and is equipped by the Hoevel Sand Blast Machine Co., of New York. The equipment consists of a sand blast pressure tank, an automatic sand conveyor, and a bucket elevator with a dust arrester. The sand after leaving the pressure tank strikes the castings and falls through a grate into a trough containing a screw conveyor. The latter delivers it to one end of the trough where it is raised by the bucket elevator and discharged through a device that separates the dust from the blasting sand which goes back to the sand blast pressure tank. The power necessary to operate this circulatory system exclusive of the pressure-tank is about 1 to 1½ horse-power; an unusually small power consumption for this purpose. The dust created in the blasting-room is exhausted by a fan and passes through a sand arrester which intercepts all particles of sand while the lighter dust escapes to the atmosphere. For installations where the amount of dust is considerable, or objectionable the Hoevel Sand Blast Machine Co. provide an air filter for the exhaust which effectually prevents any dust passing into the atmosphere.

In the pickling room the copper and brass kalamein work is cleaned in acids and the various finishes obtained by submerging the pieces in different solutions. Near the power house, but in a separate building is the paint shop where the steel frames and sashes are dipped. The dry kilns are also located near this building, while a little further along the garage is located, over which is the dining hall.

Overhead Runway.

The whole of the plant is served by means of an overhead runway, supplied and erected by the Herbert Morris Crane & Hoist Co., Ltd., Toronto. Sections of the runway are carried out over the railroad sidings in the form of swing jib cranes, so that a load can be picked right off the car and taken into the warehouse at one handling. **Morris** chain blocks and trolleys run over the whole system, and will carry cases, bales, bars and other supplies up to a ton in weight.

An interesting feature of the runway is to be noted in connection with the finishing of the steel sash product. After the latter is completely manufactured it is taken into the paint shop to receive a protective covering. The sash is suspended by means of special two-wheel trolleys, on which it is taken to a rising and lowering section of the track, located immediately over the paint dipping tank. This section is controlled by a **Morris** pneumatic spur-gear hoist, which is fitted with automatic stops to prevent overwinding. A slight depression in the track beam retains the trolley in a central position during the dipping process. Afterwards the trolley with its load is run over the draining board, where surplus paint drips off. All the switches in this overhead runway are of the **Morris** fixed type without moving parts.

ASSEMBLING HOLLOW STEEL DOORS.

Employees' Welfare.

Throughout the various departments of the plant the comfort of the employees has not been forgotten. Clean sanitary wash rooms are provided as also are lockers which were made in the shop. The sides of the buildings throughout have been constructed as far as possible of glass to give the best natural light. The monitors also are largely of glass. The machines are all located so as to make the very best use of the excellent light.

The factory is also equipped with powerful incandescent electric lights in frosted globes and fitted with powerful reflectors. A large number of smaller incandescent lights are distributed about the various departments. The windows in the monitors and side walls all open, so that a very efficient ventilating system is thus aided during the summer months. Throughout the whole plant and in the yard there is a monorail system for the rapid and convenient handling of heavy materials.

The offices are located in the northwest corner of the main building. They occupy both storeys and are both pleasant and comfortable. The drafting room is on the second floor and is exceptionally well lighted. The whole factory is modern and up-to-date in every respect, being of course fireproof.

An automatic sprinkler system is installed and provision has been made for further extension of this system. An underground tank is to be added as also a steam driven pump. Bennett & Wright, Toronto, installed the sprinkler equipment, as also the heating and ventilating systems. The plant enjoys an exceptionally low rate of insurance and when this further addition to their sprinkler system is completed their rate will be as low as can be obtained.

There is in Toronto and elsewhere a great deal of building in progress and this plant is receiving a fair share of the business connected therewith. The future outlook is also good as there are a number of proposed buildings upon which construction will no doubt soon be in progress. When running to full capacity about at least 500 men are employed.

Speeding-up a Machine Shop by means of an electric drive has been proved possible at a shop maintained by the city of Chicago for repair work on pumping and other apparatus for the water department. Formerly the shop was driven by a slide-valve steam engine through intricate line shafting. No-load tests made showed that 53 per cent. of the power generated was required to drive the line shafting and idle pulleys. A motor-generator set was substituted for the steam engine, with the result that the line-shaft losses have been reduced from 53 to 10.8 per cent. Furthermore, it has been possible to increase the speed of the line shafting a third, and the men in the shops have unconsciously speeded-up correspondingly.

Boiler Makers' Convention — The American Boiler Manufacturers' Association will hold its 26th Annual Convention in New York City, Sept 1 to 4, inclusive, with headquarters at the Waldorf-Astoria hotel. All boiler, tank and stack manufacturers and fabricators of steel plate, also manufacturers and representatives of materials and supplies used by boiler manufacturers are invited to attend the convention.

Electrical Equipment for Motor Driven Machine Tools--II.

By C. Fair *

The importance of motor drive for the machine shop is every day becoming more evident and more thoroughly appreciated, and it is worthy of note that in practically all new industrial plants where power is required, electrically-driven machinery has been installed. Little trouble is now experienced with either motors or control for the ordinary type of machine tool, due largely to a better understanding of the situation between machine builder and user.

BETTER drives are possible now than formerly, due to the motor speed range obtainable, to the decrease in size of motor per horse power, to motor characteristics which specially adapt them to the work which they are to do, to more perfect balance of the rotating parts at high speed; and, to a certain degree, to improvements in gears which allow higher speeds without excessive vibration and noise, and to the many recent improvements in control.

Present Requirements Exacting.

Much more exacting requirements of both motor and control are now demanded. Motors driving machines reversing ten times per minute and operating twenty-four hours per day are now not unusual. Duty cycles that were impossible to meet only a short time ago are now not only practicable but common. With the great variety of motors and controllers now on the market, and the large quantity sold sometimes without the motor manufacturer even knowing for what service they will be used, it would be surprising if trouble did not occasionally occur.

Much of the success of a motor-driven machine depends on its control. Magnetic control, which is coming into more general use somewhat complicates the control situation. While the possibilities of magnetic control are infinitely greater than the older types of control, likewise the chances for misapplication are greater. However, as the characteristics of the different types of control become better known these complications will disappear.

The increase of the number of individual motor-driven tools is due fundamentally to the facts, as has been shown, that the tool can do more work, do it better, and do it cheaper.

Motor Drive Application

Increasing discrimination is being exercised in applying motor drives. When the work of actually equipping a factory with motor drive is undertaken, it is necessary to study the conditions of operations, which vary greatly with the product manufactured. The arrangement of a factory may be entirely different if many motors are used instead of a few groups. Simply the difference in the position of a number of the tools may greatly facilitate the handling of material.

In general, the most satisfactory electrical equipment for machine shops, using a large number of motors, would be one having available both a-c. and d-c. distribution; a-c. for all constant speed machines and d-c. for adjustable speed machines. In the smaller shops, with rare exceptions, the choice of motors would depend upon the current available, which in the majority of cases would be alternating current. The very size and product of the small factory makes a proper layout a comparatively simple matter, while in larger factories skill and ingenuity, are essential to obtain the most advantageous equipment. The standard motor of to-day will answer for the majority of the machine tools, although special motors are in some cases necessary. When equipping tools with individual drives, the controlling apparatus as well as the motor should be attached directly to the tool whenever possible. In the case of portable tools this, of course, is a necessity.

A graphic recording wattmeter in circuit with a tool is of value in efficient management as it not only tells the actual power consumed by the machine, showing whether or not the tool is properly motored, but it also shows whether the tool is operating at its maximum rate, by registering the time of unproductive cycles or the length of time the tool is idle. By analysis, the cause of the lost time may be discovered and a change of operating conditions can be made with a corresponding increase in production.

Choice of Motors.

Table I. will, in a general way, aid in the choice of motors. The great variety and the size of tools of the same name make it necessary in a general list, such as this, to double-check a number of tools. It must be kept in mind, however, that various circumstances, such as size and roughness of work, and flywheel capacity, etc., may call for radical departures in the choice of motors, this list being compiled to meet average conditions.

TABLE I

Motors for Machine Tools.

Tool.	D.C. Shunt	D.C. Comp.	D.C. Series	A.C. *	A.C. †	A.C. ‡
Bolt cutter	√			*		
Bolt and rivet header		20%		*	†	
		40%				
Bulldozers		20%			†	
		40%				
Boring machines	√			*		
Boring mills	√			*		
Raising and lowering cross rails on boring mills and planers		20%	√		†	
Boring bars	√			*		
Bending machines		20%				
		40%				
Bending rolls		20%	√			
		50%				‡
		20%		*	†	
Corrugating rolls		50%				
Centering machines	√			*		
Chucking machines	√			*		
Boring, milling and drilling machines	√			*		
Drill, radial	√			*		
Drill press	√			*		
Grinder—tool, etc.	√			*		
Grinder—castings	√	20%		*		
Gear cutters	√	20%		*		
		20%			†	
Hammers—drop		40%				
Keyseater—milling—broach	√			*		
Keyseater — reciprocating		20%		*		
Lathes	√			*		
Lathe carriages		50%	√		†	
Milling machines	√			*		
Heavy slab milling	√	20%		*		
Pipe cutters	√			*		
		20%		*	†	
Punch presses		40%				
Planers		§20%		*	†	
Planers—rotary	√	10%		*		
Saw—small circular	√			*		
Saw—cold bar and I beam		20%		*		
Saw—hot		20%		*		
Screw machine	√			*		
Shapers	√	10%		*		
		20%		*	†	
Shears		40%				
Slotters	√	20%		*		
		20%		*	†	
Swaging		40%				
Tappers	√			*		
Tumbling barrels or mills		20%		*		

*Squirrel cage rotor.

†Squirrel cage rotor—high starting torque.

‡Slip ring induction motor with external rotor resistance.

§Does not apply to reversing motors.

*Power and Mining Engineering Department, General Electric Co.

Shunt motors, for instance, are used in the following cases:—When work is of a fairly steady nature, when considerable range of adjustment of speed is required as on lathes and boring mills, and on group and lineshaft drives, etc.

Compound-wound motors are used where there are sudden calls for excessive power of short duration, as on planers (not reversing motor drives), punch presses, beinding rolls, etc.

Series motors should be used where speed regulation is not essential, and where excessive starting torque is required, as, for instance, in moving carriages of large lathes in raising and lowering the cross rails of planers and boring mills, and for operating cranes, etc., but not where the motor can be run without load as through a clutch, or belt that might leave its pulley, as the motor would run away if the operator failed to shut off the power.

When in doubt as to the choice of compound or series motors of small horse power, the choice might be determined by the simplicity of control in favor of the series motor.

The alternating-current motor of the squirrel cage rotor type corresponds to the constant-speed, shunt, direct-current motor; but with a high-resistance rotor it approaches more closely the characteristics of a compound, direct-current motor. It is understood that the variable-speed machines checked in Table I. under the alternating-current squirrel cage rotor column have the necessary mechanical speed changes.

The slip-ring induction motor with external rotor resistance would be used for variable speed, but this must not be construed to mean that it corresponds to a direct-current, adjustable-speed motor, as it has the characteristics of a direct-current shunt motor with armature control. The self-contained, rotor resistance type could be used for lineshaft drives, and for groups when of sufficient size.

Multi-speed, alternating-current motors are those giving a number of definite speeds, usually 600 and 1,200, or 600, 900, 1,200 and 1,800 r.p.m., and are made for both constant power and constant torque. These motors would be used where alternating current only was available, and where the speed ranges of the motor, together with one or two change gears, would give the required speeds. These motors should, however, be used with discretion, especially on sizes above six-horse power.

The adjustable speed, a-c., commutator or brush-shifting type of motor with shunt characteristics would, on account of high cost, be used mostly where an adjustable speed motor was highly desirable and where a-c. only was available and where there were not enough machines calling for adjustable speed drive to warrant putting in a motor-generator set.

Adhering to Standard Motors.

An important feature in the selection of motors, and one that is often overlooked, is the adherence to the use of standard motors, and by standard motors is meant standard armature shafts as well. The importance of maintaining standard armature shafts will be recognized when it is pointed out that by such an arrangement spare armatures are reduced to a minimum. In emergencies it is often possible, where spares are not carried in stock, to replace the armature or even a whole motor by one from an idle tool, or from a tool of relatively less importance at the time. Also, of course, stock motors can be supplied promptly by the manufacturer and shipments materially improved if special shaft extensions are not called for. That special features in a motor are sometimes desirable, is true; it may so happen that the advantages from some special feature in the motor may more than offset the disadvantages referred to, but in cases where these features are thought necessary they should be carefully considered before final decision.

In the early days of motor drive before the present great variety of sizes and speeds of standard motors were obtainable, many special features were thought necessary in the motor to make it adaptable to the tool; special frames, shafts and speeds were required, and little thought was given to the interchangeability of parts. In fact, tools which only a few years ago it was thought necessary to drive with special motors are to-day driven by standard motors, and as a result are easily and quickly repaired. It is therefore easy to recognize in these early equipments the responsibility for part of the existing idea that special features in the motor are still necessary for tool equipments. Many of these special features required for the early drives are now recognized as unnecessary, and to-day the tool builder in the majority of cases builds his tools ready for attaching standard motors.

The old prejudice existing against the electric motor, which was mostly a mistrust due to a lack of familiarity with its operation, is rapidly dying out, and to-day motors are found driving machines in shops of every description.

Choice of Control.

Equally important with the choice of motors is that of control. In selecting the control its adaptability, its accessibility to the operator, the method of attaching it to the tool and in some cases its relative position to other tools should be considered. As an illustration of this last point, an open-type starting rheostat, if used, or unprotected magnetic control, should not be mounted on a machine in such a manner as to be exposed to danger of short-circuit by flying chips. It is now, however, only a matter of time before all live parts of both motor and control will be enclosed. In the majority of cases, a shunt motor of ½ h.p. and less would be started by a switch. Exceptions to this would be motors on tools that must be gotten under way slowly. With adjustable-speed motors care should be taken to first throw the switch on full field. Series motors up to 8 h.p. or even larger can be started by a switch without resistance. Exception to this would be cranes and tools requiring a certain amount of armature speed regulation. Larger motors for tools where starting service is infrequent or not severe, and for lineshafts, and for group drives, would be satisfactorily operated with a dial-type controller, which is cheaper than the drum controller, provided, however, that the controller is placed in a protected position.

When making installation, accessibility to the controller in case of accident should be kept in mind, even though but of little importance so far as starting up is concerned. The starting apparatus should be placed where the motor or some of the moving parts can be seen by the operator. On individually motor-driven tools, where the motor is started and stopped many times a day, or where the starting conditions are of a severe nature, or where tools are edged along, drum type controllers or magnetic control with extra heavy starting resistance should be used. For adjustable-speed motors using the drum type control, the field control should be connected through fingers making contact on segments of the controller drum and not by sliding contacts on a dial as with the latter trouble will develop sooner or later. With magnetic control, provision should be made in the control either to start the motor on full field or to provide necessary points for starting on weakened field in order to protect the motor. Motors of moderate size and larger, operating under severe duty cycles, are best controlled by magnetic switches. This class of starting apparatus will stand almost any amount of abuse and, by the addition of a simple current limit relay device, becomes practically a fool-proof protection for the motor. There are cases where it might be advantageous to use magnetic control even with smaller motors.

Squirrel cage rotor type motors, two-phase and three-phase, up to 5 or 8 h.p., generally speaking, can be thrown directly on the line, depending largely upon the power conditions. Above 5 or 8 h.p. this type should be operated by a compensator or sliding resistance in the rotor, while for the slip-ring type a controller with external resistance should be used.

Convenient Arrangement of Control.

Upon the convenient arrangement of the control depends, to a considerable degree, the output of the tool; and the importance of the arrangement from the standpoint of the operator should not be ignored, since the output of a tool will be materially increased when an operator can start and stop the tool and obtain at all times maximum cutting speeds by simply turning a handle. The controller must be placed in a safe position and should be accessible for repairs, which very often mean that some arrangement is necessary to bring the operating handle within easy access of the operator. A familiar illustration of the convenience of control is the arrangement so commonly seen on lathes, whereby the operating handle travels with the tool carriage and allows the operator at all times a complete control of his tool. Strange as it may seem, this most important feature, the convenience of control which bears directly on production, is ignored in many tool equipments.

Power to Drive Tools.

Exhaustive tests have been and are being made to determine the amount of power required to drive tools. Hasty conclusions should not be drawn from incomplete data since they are apt to be misleading; for instance, where tests are made with motors which are considerably underloaded or overloaded, where efficiencies are not taken into consideration, where the material used and duration of test are not stated, or where there has been failure to state whether the test was a practical one or merely a breakdown test. The conclusions drawn from breakdown tests are often deceptive and should not be used for determining the power required to drive tools, for it does not follow that a tool which stands up longer than another under breakdown conditions will do the same under practical conditions. To develop a general formula that would be of practical value in determining the horse power required to drive tools would be difficult, as the power required varies with the metal worked, the cutting speed, the kind of tools used, the efficiency of the machine, and many other conditions.

The construction of the tool is seldom taken into consideration when estimating horse power, thus some of the worm-driven tools are notoriously inefficient. Other machines are so constructed that the greatest part of the power delivered to the tool is consumed in friction losses and not in useful work; again, the tool may be constructed upon approved lines but may not be stiff enough to stand the strains to which it is subjected thereby causing a considerable loss of power, all of which, as well as the difference in power due simply to the shape of a cutting tool, have been repeatedly proved by tests.

Again the duty required of a tool in one shop may be more severe than that in another, from which it will be seen that it cannot be accurately stated that a definite size of motor is required for a given tool. In the majority of cases, however, the horse power for small tools is very well fixed. With the larger tools the variation in horse power required for such tools, of course, is more pronounced and demand more consideration on account of the size of the motors involved.

Little trouble is experienced in obtaining new tools already arranged for attaching motors, since many of the tool manufacturers are alive to the superiority of the motor drive and have for years built tools especially adapted for motor drives. Unfortunately, others have seen fit to merely arrange a make-shift for attaching the motor, while still others leave the purchaser to attach the motor as best he can, and consequently the best results are not always obtained.

When the driving of old tools by individual motors is under consideration, the speed range, the number of similar tools to be equipped, and the condition of the tool should be taken into account. It sometimes happens that when a tool in itself would not call for an individual drive, certain circumstances might make such a drive advisable. As an illustration, when the majority of tools in a shop have become individually driven, there might still remain a number of scattered tools, which, unless they were driven by individual motors, would necessitate the running of long lines of shafting; or, in the event of moving into new quarters, a cement building perhaps, it is decided not to use line shafting.

Since production is the ultimate aim of progressive shop management, and since the electric motor is generally conceded to be the greatest factor in increasing production, it is only a matter of time before the motor will be universally used in machine shops.—G. E. Review.

TOOL-HARDENING ELECTRIC FURNACES.

A MODERN steel hardening furnace, in order to meet the requirements of the engineer of to-day should fulfil the following conditions, says Page's Weekly.

(1)—Rapidly reach and easily maintain constant the particular temperature required for any given class of steel.

(2)—Permit the practical recording of the exact temperature of the heated steel at any moment by means of a really efficient pyrometer attached to and forming part of the furnace itself.

(3)—Heat the steel or tool uniformly throughout and without overheating or burning any of its edges or projections.

(4)—Be capable of a gradual application of its heat so as to prevent sudden stresses and strains in the steel, which would probably cause the latter to warp and crack.

(5)—Not permit of the accidental contact of any foreign matter with the steel that is being heated, otherwise the carbon percentage of the steel may be altered or adversely affected.

(6)—Be placed in the immediate neighborhood of the cooling plant, so as to reduce to a minimum heat losses in the metal during its transmission from the furnace to the cooling liquid.

(7)—Only permit of the least possible amount of oxidation whilst in operation.

(8)—Not be dangerous to health; nor be liable to cause a fire or other damage to its surroundings.

(9)—Lastly, it should be simple and reasonably economical to operate, and must be efficient in the truest and broadest sense of the term.

The furnace consists essentially of an iron case, inside of which is a lining of firebrick, together with some suitable heat-insulating substance, and built into this lining is the crucible itself containing the metallic salt bath; then, fixed into and at each side of the crucible are the electrodes which transmit the electric current through the metallic salts, thus directly applying its great and uniform heating powers to all parts of the bath.

For regulating the heat, the furnace equipment includes a switch regulator, which varies the voltage. This regulating apparatus consists of an ordinary static electric transformer with the secondary winding connected to the electrodes in the bath, whilst the primary winding of the transformer, which is connected to the source of supply, is subdivided into a number of sections connected to the regulating switch contacts.

Peat Fuel.—Encouraging reports of the development of the peat fuel industry have been received from Alfred, Ont., where the Canadian Peat Co. is operating. This is the plant formerly operated by the Mines Branch of the Dominion Government. For several years a limited quantity of this fuel has been shipped into Ottawa, and has given the utmost satisfaction to all who have used it as a fuel for either kitchen ranges or open fireplaces. The company is now operating night and day and expect to have several thousand tons for delivery in Ottawa this season

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

TURRET LATHE AND VERTICAL BORING MILL PRACTICE.—IV.*

By Albert A. Dowd.

IN our August 13, issue, the first setting of the work in the sequence of operations covering the machining of a front hub for an automobile on the vertical turret lathe was dealt with. In the present instance the second setting and remaining operations to complete the work are detailed.

Second Setting of the Work.

Fig. 7 shows the method of holding and the necessary tooling for the second setting of the work. A cast iron fixture C is bolted to the face of the table by the three tee-bolts D, the tool steel plug E centering the fixture on the table. A driving pin B enters one of the flange holes (which are jig drilled between the first and second turret lathe operations). The upper end of the stud E is split in four places at K, is spring tempered, and ground at G to a diameter slightly smaller than the hole which it enters in the work. The lower portion F fits the bearing seat which has previously been machined. A hardened and ground tool steel operating plug is ground cylindrical at H and K and is threaded on the the lower end at L to a loosely fitting

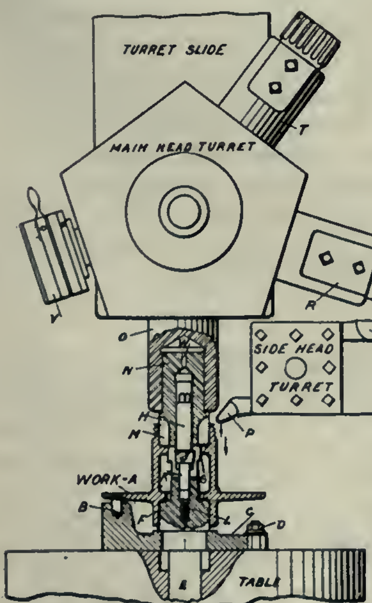


FIG. 7. FIRST OPERATION—SECOND SETTING.

thread. The fit at K is accurate so as to insure concentricity of the upper piloted end H, with the remainder of the fixture. The tapered portion is ground to fit the inside of the split end, and therefore serves to expand it as desired.

All internal cutting tools are furnished with a hardened and ground hole which acts as a guide for the stem H. In this setting of the work no boring tools are used, their place being taken by the four lip drills M and S. These drills are

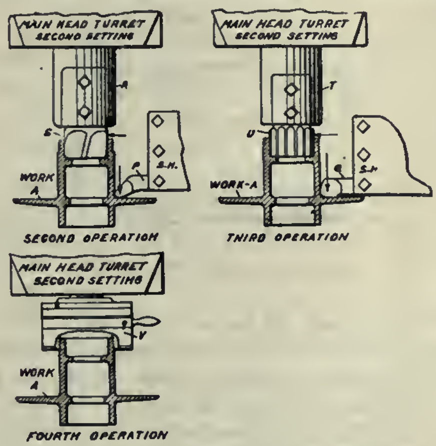


FIG. 8. REMAINING OPERATIONS—SECOND SETTING.

made of high speed steel and fit the holders O and R respectively. Air holes similar to that shown at W are provided in order to prevent air compression. A reamer U is held in the holder T and also pilots on the stem H. An opening die V is used to cut the thread on the outside of the hub. The tools P and Q in the side head turret are of high speed steel and are used for roughing and finishing.

Sequence of Operation—Second Setting.

First operation:—The tools shown in proximity to the work in Fig. 7 are used for the first operation, which is that of rough drilling out the bearing seat with the four-lip drill M in the main head turret, while the tool P in the side head faces the end of the hub, turns the thread diameter, and starts the turning of the outside of the hub. The four-lip drill should be turned in the holder so that the facing tool can pass in between the flutes.

Second operation:—The second operation is shown in Fig. 8 and consists of finishing out the bearing seat with another four-lip drill S similar to the one used in the first operation, but slightly larger in diameter, and being so proportioned as to leave about .012 for the reamer to take out While this tool is working the side head, tool P continues the turning on the outside of the hub until completed.

Third operation:—The reamer U shown in the third operation finishes out the bearing seat, while the finish turning and facing tool Q in the side head faces the end of the hub, turns the thread diameter and finishes the outside of the hub. A coarse feed is used for these operations, a sufficient "drag" being ground on the tool to smooth up the surface nicely.

Fourth operation:—The thread on the outside of the hub is cut by an opening die V, the operation of which is similar to that previously mentioned. This operation obviously completes the piece.

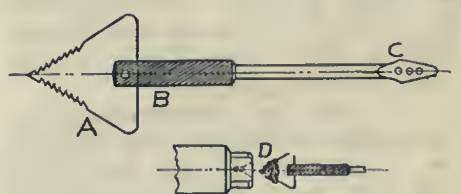
*Parts I. to III. of this series appeared in our July 30, August 6 and 13 issues.

COMBINED CENTRE HOLE CLEANER AND OILING PIN.

By James E. Cooley.

THERE is no regular means provided for cleaning out the centre holes in shafts, arbors, etc. A common method for doing this is to take a piece of waste, press it in the centre hole with the thumb, and twist it around several times. Another way is to fasten the waste on the point of a file shank or other similar tool and use this for a cleaner.

In the accompanying illustration is shown a combined centre hole cleaner and oiling pin. The cleaner A is a triangular piece of sheet metal, 1-16 in. thick, having a number of notches filed on the point, as shown. This is pinned through a slot on the end of the oiling pin B. On the point of the cleaner is tightly wound a piece of waste, as



COMBINED CENTRE HOLE CLEANER AND OILING PIN.

shown at D; this as seen is inserted in the centre hole, and when twisted around thoroughly cleans out the hole. The notches prevent the waste from slipping off the point.

The oiling pin is used for dropping oil in the centre holes before the work is placed on centres, and is kept in the oil well that is cast on the tail-stock of most lathes. The end is flattened and pointed similar to the one shown in the sketch. An idea shown in the oiling pin here is that of the holes at C, which are for the purpose of holding oil on the point. Usually it is necessary to dip the pin in the well two or three times before sufficient oil is taken up to fill the centre holes. The holes, however, retain a sufficient amount at one dip. The end of the oiling pin is knurled for convenience in turning the cleaner around.

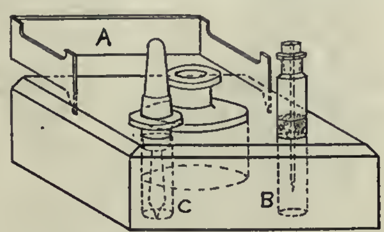
UTILIZING THE INK-BOTTLE HOLDER.

By James E. Cooley.

NEARLY every draftsman finds it necessary to use a holder for his drawing ink bottle, as the latter is easily tipped over. The holder is made from a square block of wood, having a hole bored out in the centre to hold the ink bottle, as seen in the sketch. As these holders take up considerable space on drawing tables, it is found that they can be utilized for other purposes than for just holding the drawing ink bottle.

The first of these to be noted is a pen and pencil-holder A made from a strip of sheet metal, bent in the shape as shown in the sketch and fastened in the block.

At B is a hole that contains a small bottle of oil, the oil being used for lubri-



UTILIZING THE INK BOTTLE HOLDER.

cating the adjusting screws and nuts on drawing instruments. Usually an oil can is kept in the drawing-room for this purpose, but as it is generally too greasy to handle, it is seen that the oil bottle is a needed improvement, and is neater besides. In the cork is fastened a toothpick for dipping out the oil.

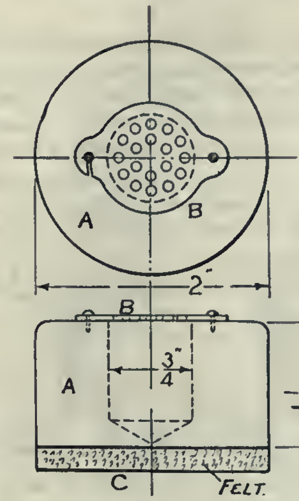
At C there is a hole containing the bottle stopper. When inking in figures on a drawing the pen has to be dipped frequently in the bottle and the stopper is lifted out and put back each time, or it is left off, where it rolls around and smears the spot on which it is placed, the end or quill being covered with ink. If placed in the hole as suggested it cannot soil anything, and is out of the way.

TRACING CLOTH PAD.

By J. E. C.

THE glazed side of tracing cloth always requires to be rubbed down with pounce or chalk before it will take ink. This is usually accomplished by first sprinkling the powder from a can on the tracing cloth, and then rubbing this over the surface with a piece of waste.

In the accompanying sketch is shown a tracing cloth pad, which contains both the powder and the means for rubbing it over the tracing cloth. The pad is made



TRACING CLOTH PAD.

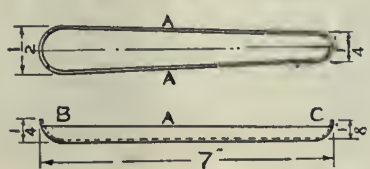
from a piece of round wood, as A, having a hole drilled in the centre to hold the powder. Over the hole is placed a movable tin cover, B, having a number of holes in it from which to sprinkle the powder. On the lower side of A is glued a round piece of felt, which is used for rubbing down the cloth.

SPOON FOR DRILL-CHIPS.

James E. Cooley.

A DRILLED hole that does not pass clear through a piece of work always contains chips in the bottom of the hole after the drill is drawn out, and it is necessary to empty them out. This is easily done by turning the work over. But on work that is fastened down or on heavy castings other means must be provided for removing chips from holes.

A very quick method for doing this is by means of the spoon shown in the accompanying sketch.



SPOON FOR DRILL CHIPS.

It is made from a strip of sheet-steel about 1-16 in. thick. The two sides A, are first bent up, and then the ends B and C are rounded as shown. The spoon can be used for several sizes of holes, as it is tapered down for this purpose. The larger end B is used for cleaning holes above ½ in. diameter, and the smaller end C for holes of lesser diameter.

MODERN METHODS OF WORK

GEORGE BURMAN FOSTER, writing recently in the "American Artisan," on the advantages and disadvantages of modern methods of work, said: The machine has brought about a mighty revolution; labor becomes more and more mechanical; the individual himself works almost like a machine; such work makes a man one-sided; it dulls and deadens him. Everything creative is relegated to the machine, and the machine has gulped down personality; mechanism has triumphed. The modern method of work can very easily effect a depreciation of man as laborer.

Owing to the modern mode of labor, the articles necessary for our use and comfort can be produced in much shorter time. Combined with capitalism, the machine exploits the forces of nature in an undreamed-of manner; hence the possibility of shortening the hours of work. Hence too, the possibility of the laborer having more time for his family, for further development—in spiritual and technical ways, for finding nobler joys than his labor affords him. Machine work is in a position to give him means of culture for little money.

The modern mode of labor can restrict the disadvantages of mechanical labor also, so great is the quantity of production under present conditions of labor that want and misery can be fought much more effectively than formerly, and the conditions of our common human life have been actually improved under the influence of machine work. It shows as never before the value of "team work" and of combination. We belong to one another and are dependent upon one another. The division of labor has led to the union of labor. Each for all and all for each! Industries throw men together, but life in and through labor unions can, and probably is, a powerful school for the formation of character.

The Electric Furnace.—A new form of furnace, due to Ivan Rennerfelt, of Sweden, is provided with three electrodes. Two of these are mounted horizontally in the same plane above the charge. The third is vertical, and ends in the space between the horizontal electrodes. With three-wire two-phase or direct current, a compound arc is formed in the shape of a V and is projected down on to the metal. The electrodes themselves do not come in contact with the metal or the slag. The electrodes are contained in a cylindrical furnace which can be tilted, and the inner walls act as a reflector. Some of these can take about half a ton of iron at one charge.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

PROBLEMS RELATING TO GEARS.

THE introduction of special machinery has largely done away with the necessity of gear calculations. This pertains mostly to the laying out of tooth forms. Problems in connection with diameters, pitches, etc., still often come to the average mechanic. The object of the particular shapes adopted for the teeth is to produce a smooth, continuous, true rolling motion between the wheels, and there are in use two general methods of producing these forms—namely, form milling and generating. The first requires a rotary cutter of the correct shape to plow out the space between two adjacent teeth, while in the latter a reciprocating tool is shaped and fed in such a way as to take the place of a rack tooth in mesh with the gear being cut. The result is a space that will accommodate the rack tooth throughout its whole passage through the gear.

In order to understand gear calculations, certain terms must be understood. Pitch diameter or diameter alone is the diameter of the gear if it were considered as a cylinder without teeth simply rolling against its mate without friction. The thickness of the tooth is its thickness measured along the pitch circle. The addendum is that portion of the tooth which extends outside of, and the root is that portion which is inside of the pitch circle. The surface of the tooth below the pitch circle is called the flank, and that above is called the face. Circular pitch is the distance from the centre of one tooth to the centre of the next measured along the pitch circle. Diametral pitch is the number of teeth of a gear for every inch of pitch diameter—that is, the total number of teeth divided by the pitch diameter in inches.

Question.—A pinion having 12 teeth meshes with a gear having 90 teeth. What is the ratio of pinion to gear?

Answer.—Ratio $= \frac{90}{12} = 7.5$, or, in other words, the pinion will make 7½ times as many revolutions as the gear.

* * *

Question.—A gear of 120 teeth drives one of 60 teeth, which is keyed to the same shaft as an 80-tooth gear. This, in turn, drives another of 48 teeth. What is the ratio of the gearing If the 120-toothed gear made 30 revolutions per minute, what would be the speed of the one with 48 teeth?

Answer.—Ratio of gearing

$$= \frac{120}{60} \times \frac{80}{48} = \frac{10}{3} = 3\ 1/3.$$

$$\text{Speed of driven gear} = 30 \times \frac{10}{3} = 100 \text{ r.p.m.}$$

* * *

Question.—A driving shaft is fitted with a 36-tooth pinion. It is required to drive another shaft at one-sixth the speed, with available gears increasing by 4 from 24 to 72 teeth.

Answer.—Ratio = 6. To drive a shaft directly from the 36-tooth pinion would require a gear of 36×6=216 teeth, which is not available. Divide the ratio into 2, say 3 and 2. The first could be obtained by a combination of the 24 with gear of 24×3=72 teeth, while the second could be got by a number of combinations, say 32 and 64. The 24-toothed pinion would drive the 72-toothed gear, and the 32-toothed pinion fastened to the same shaft as the 72 would drive the 64-toothed gear. The ratio then is

$$\frac{72}{24} \times \frac{64}{32} = 6$$

* * *

Question.—What would be the circular pitch of a gear whose diametral pitch is 4?

Answer.—The diametral pitch multiplied by the circular pitch is always equal to 3.1416; therefore, circular pitch is $\frac{3.1416}{4} = .7854$ in.

* * *

Question.—A 6-pitch gear has 240 teeth. What is its pitch diameter?

Answer.—As the gear has 6 teeth for every inch of diameter, then diameter

$$= \frac{240}{6} = 40 \text{ inches.}$$

* * *

Question.—A 2-pitch gear is to be made with 36 teeth. What should be the diameter of the blank?

Answer.—Rule—Add 2 to the number of teeth and divide by the pitch, hence

$$\text{Outside diameter} = \frac{36+2}{2} = 19 \text{ inches.}$$

* * *

Question.—What is the circular pitch of a wheel having 240 teeth and a diameter of 60 inches?

Answer.—Circular pitch $= \frac{3.1416}{\text{Diametral pitch}}$

$$\text{Diametral pitch} = \frac{\text{Number of teeth}}{\text{diameter}} = \frac{240}{60} = 4$$

$$\text{Circular pitch then} = \frac{3.1416}{4} = .7854$$

* * *

Question.—What is the distance between centres of two gears of 1 inch circular pitch and having 64 and 24 teeth respectively?

Answer.—Addendum = flank or working depth of tooth. Total depth of tooth = addendum plus flank plus clearance. Rule for distance between centres is: Multply working depth by one-half the total number of teeth in both gears.

Working depth $= \frac{1}{\text{diametral pitch}}$, and diametral pitch $= \frac{3.1416}{\text{Circular pitch}}$. Working depth, therefore, is $\frac{\text{Circular pitch}}{3.1416}$

$$= \frac{1}{3.1416} = .3183$$

Distance between centres is then

$$\frac{64+24}{2} \times .3183$$

$$= 44 \times .3183 = 14.005 \text{ inches.}$$

* * *

Question.—If the distance between centres of two gears is 24 inches and their speed ratio is 4 to 1, what would b the diameters of the two gears?

Answer.—Rule, for small gear diameter

$$= \frac{2 \times \text{distance between centres} + 1}{1 + \text{ratio}},$$

or diameter of small gear

$$= \frac{2 \times 24 \times 1}{1+4} = \frac{48}{5} = 9.6 \text{ inches.}$$

For large gear, diameter

$$= \frac{2 \times \text{centre distance} \times \text{ratio}}{1+\text{ratio}}$$

$$= \frac{2 \times 24 \times 4}{1+4} = \frac{192}{5} = 38.4 \text{ inches.}$$

NEW PROCESS DEVELOPMENTS

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

QUALITIES OF CASE-HARDENING MATERIALS.

SOME particulars are to hand as to various qualities of case-hardening materials necessary for different kinds of work. It is claimed by W. H. Palfreyman & Co., of Liverpool, that hydro-carbonated bone-black is best suited to general classes of work; at the same time, where the uniformity of work is of no material value, a common bone-meal of the cheapest quality can be used.

When fancy mottled designs are required, which can be produced only by certain chemicals, hydro-carbonated bone-black cannot be used, but wherever the toughest, finest and deepest case is desired, or ordinary coloring only required, there is no material that will compare in either economy or quality with hydro-carbonated bone-black. The above firm have endeavored to generate all the desirable properties and avoid all those undesirable. In its manufacture, pure white bone, selected for its hardness is first taken, and all pith and grease removed. It is then ground to a uniform size or mesh, and placed in closed retorts, charred by a uniform slow heat, the temperature being uniform for every batch. As the bone comes from the hot retorts, all moisture is excluded, and it is immediately charged with rich carbon, extracted from a pure hydro-carbon oil. The pores are by this method filled with an oleaginous substance, which excludes all possibility of absorption of moisture, and guarantees more pure carbon to the pound or square inch than is possible to obtain in any other material.

By this process we are informed, three times the case-hardening power possessed by the ordinary forms of bone-black is guaranteed. This material can also be used for annealing.

COAL SMOKE ABATEMENT IN IRONWORKS

EARLY this year the British Local Government Board appointed a Departmental Committee to consider the question of coal smoke abatement, and on July 30, Professor J. W. Cobb, Livesey Professor in the Department of Coal, Gas and Fuel Industries (with Metallurgy) in the University of Leeds, gave evidence with regard to what has been done in this connection by the Farnley Iron Co., where he was for twenty years prior to going to Leeds. All the reheating of iron and steel for welding, hammering, or annealing is now carried out by the Farnley Iron Co., by means of gas-fired furnaces, with a considerable economy of material.

Gas Fired Puddling Furnaces.

The main advantage claimed for gas, of course, is its greater ease of regulation, coupled, at the same time, with the absence of smoke. Professor Cobb explained to the committee the difficulties of using gas in puddling furnaces. Puddling required the maintenance of a definitely reducing atmosphere for considerable periods of time unless excessive waste was to result, and this accounted for the evolution of considerable quantities of smoke from the furnaces. Experiments with gaseous fuel had not met with any large measure of success. The great difficulty was an economic one, since the use of gas was only possible with a regenerative furnace, in which a considerable proportion of the heat of combustion was restored to the gas and air which were to be burned in the furnace. Such a regenerative arrangement was always expensive to install, and such an expense in connection with a furnace which was only dealing with charges of from 350 to 550 lbs., was a very serious matter. This rendered the use of gas economically difficult. Furthermore, the conditions of work so far as the puddler was concerned were rendered worse by the neighborhood of large quantities of brickwork such as exist in regenerators. Even if a smokeless puddling furnace could be invented, it would be so much worse for the puddler that it would not be fair to adopt it.

Continuing, he said that even a gas-fired puddling furnace might make smoke. This was a very complicated question to explain, but what was known as smoke from gas fuel in ordinary work would also apply in large scale work. The formation of particles such as were obtained from coal could also be obtained from gas, but the advantages of the latter were that since it was possible to control the ratio of gas and air, it was easy to minimize the smoke formation to a very considerable extent, and there was not the same fluctuation as in a direct coal fire.

It was mentioned that the Farnley Iron Co. had not used gas for boiler firing yet. The average boiler, he said, was a very economical piece of apparatus, and there was not the same possibility of improvement in efficiency by the use of gas as there was in the other processes to which he had referred. On the whole, however, he was of opinion that there was need for further legislation to prevent the emission of smoke in industrial processes.

Technically Trained Inspectors.

A point of some interest which may be mentioned in connection with the evidence given by other steam boiler users is a general consensus of opinion that the present type of smoke inspector should be improved upon by the appointment of technical men, who would co-operate with the manufacturers with a view to making suggestions as to improvements in equipment. The feeling among many large steam users is that the local authorities treat them as hostile parties, and that they are more interested in the collection of fines than in the improvement of the atmosphere, and, consequently, in the public health.

AMERICAN PRACTICE IN ANNEALING STEEL CASTINGS.

THE following recommendations as to the annealing steel castings were recently issued by the American Society for testing materials:—

(1)—The castings should preferably be sufficiently cleaned of adhering sand before annealing to ensure thorough and uniform heating.

(2)—The castings should be heated slowly and uniformly to temperatures varying with the carbon content of the steel, approximately as follows:—

Carbon, per cent.	Deg. Cent.
Up to 0.16	925
0.16 to 0.34	875
0.35 to 0.54	850
0.55 to 0.79	830

Nothing in these recommendations shall operate against the temperatures aimed at being 50° and, in special cases, 100° C. higher than those given in the table, when necessary to attain the desired result.

(3)—The castings should be kept at the maximum temperature a sufficient length of time to ensure the refining of the grain. In general, the heavier the sections of the castings, the longer must be the time of exposure to the maximum temperature.

(4)—(a)—The castings should be cooled slowly and uniformly in the furnace, when it is desired that the steel shall possess the maximum softness.

(b)—The castings may be cooled at an accelerated rate, when it is desired that the steel possess rather higher tensile strength and elastic limit than can be procured by very slow cooling. This cooling must be so conducted as to leave the steel reasonably free from cooling stresses.

The manner of carrying out this accelerated cooling should be such as will attain the desired result. For instance, the castings may be withdrawn from the furnace and buried in a bed of material that is a poor conductor of heat, or the annealing furnace may be so thrown open that it will cool more rapidly than if left closed. Should the castings be of such uneven section that they cool at unequal rates at various points when the furnace is opened, especially if the carbon of the steel is high, the furnace should be closed after the castings have become black, and their further cooling so retarded that the stresses set up by the unequal rates of cooling are relieved.

STEEL IN IRON CASTINGS.

THE use of steel with iron in making castings must depend on the cost of the steel in the first instance, says W. J. May, in the Practical Engineer, London, Eng., because if this is much more than that of good hematite iron, very little is gained in return for increased cost where general work is concerned. For particular purposes exact cost does not always matter. Still, suitable steel for cupola work is limited in supply. A heavy demand would soon run up prices to a point that would make the use of semi-steel, or whatever the mixture be called, so much more costly than the best hematite castings that only f- -special purposes would the cost be justified. As an example of this increase in price, for some years I used scrap files and tool steel rather largely in a special manufacture and for the first two years from $20 to $22.50 per ton delivered at works was the price. Later, supplies dwindled and prices rose until at the end of the fifth year from $42.50 to $45 per ton had to be paid, and it was a trouble to get supplies even at these prices.

At the present time steel scrap suited for cupola work can be got at about $10 to $12.50 in the merchant's yard, which would make the price delivered run from $12.50 to $17.50 per ton, and as the price of hematite is about $16.50 plus carriage, this shows some slight advantage for the steel, as an iron costing about $13 per ton could be used with it, the total cost of the castings not being more than that of good hematite castings, while giving a greater strength probably. One point that tells in favor of the use of steel with iron in casting is that the metal is closer and cuts in the machine with a finer and better surface, while it can be brought to a fine polish where needed. The metal need not be unduly hard, and it will cut freely when properly melted. Like hematite, there will be a liability to hard skin surface on the castings with certain forms of moulding, and for this reason pickling should be adopted wherever possible.

Objection to Steel in Cupola

Generally, the objection made to the use of steel in the cupola is that it requires a greater heat than grey iron to make it fluid, and that the blast pressure has to be so high that the metal is whitened and rendered hard; but this is rather a mistake. To melt steel no greater air pressure is required than for iron. A small increase in the coke may be necessary, while, to obtain quicker and more intense combustion with greater heat, an increased volume of air may be needed, but certainly where the pressure is sufficient for iron it is sufficient for steel melting. Not only foundrymen but others connected with mechanical trades overlook the fact that carbon must have a certain amount of oxygen supplied to reduce it to carbonic acid, and given this supply of oxygen at a pressure enabling it to reach all parts of the fuel, there is no advantage in increasing the pressure. At the same time, if the air volume be increased, the fuel will burn more quickly and the total heat be corespondingly increased, while on account of the quicker working when confined within reasonable limits, more refractory material can be melted. Usually where the air propeller and carrying pipes are large enough and there is no choking of the blast by enlarging the tuyeres a large increase of heat is secured combined with quicker melting, the pressure remaining the same, while the content of the metal is not materially changed.

Both the tensile and transverse strength of the iron is increased by the addition of steel, and according to the kind of iron user, scrap steel may be added up to about 40 per cent. of the total charge, although usually a smaller percentage would be sufficient. It is not desirable to use steel with common mixed cast iron scrap, however. Generally, the castings come out well and very sound, few wasters being produced. There is often rather more contraction than with iron alone, and this has to be allowed for. Otherwise the use of steel with grey iron for castings is an advantage when properly arranged.

FERRO-MANGANESE STEEL ALLOYS.

DEALING with the question of electrically melted-ferro-manganese, a recent issue of Metallurgical and Chemical Engineering states that although the use of molten instead of solid ferro-manganese in steel manufacture results in a very considerable saving of alloy, and by making the deoxidation more efficient gives a better steel, the trouble and cost of melting it and keeping it molten has generally been considered as greater than the advantages obtained; but now electric furnaces are coming into wide use for the purpose, and are giving highly satisfactory results.

In America the first firm to take up this practice has been the Illinois Steel Company, who have installed a 4-ton Hercult furnace to keep on hand a supply of molten ferro-manganese, from which 150 lbs. are taken every seven minutes. They have found that besides the saving in alloy there is a clear advantage in quality.

The results from a 3-ton 350 k.w. ferro-manganese melting furnace, of the three-phase, 50 frequency, three-ring Roechling - Rodenhauser type, from which some 30 to 50 tappings, ranging each from 198 lbs. to 264 lbs., are made every 24 hours, depending upon the demands of the steel plant, are of interest. For the first five weeks the average energy consumption, excluding the energy required for burning in the lining, was 721 k.w. hours per ton for an output of 220 tons of ferro-manganese. To maintain the furnace hot, during long intervals 200 k.w. to 250 k.w. are required.

As a result of using molten ferro-manganese, an average saving of 30 to 40 per cent. by weight of ferro-manganese required is recorded. With cold ferro-manganese from 15 lb. to 18 lb. are used per ton of steel, and during a year some 2,100 tons of cold ferro-manganese are required. With molten ferro-manganese this amount is reduced to less than 1,400 tons, representing a saving of more than 700 tons, which at £11 per ton represents a saving of £7,700 per year. For burning in the lining and heating up a 3-ton furnace about 3,500 k.w. hours are required, and a life of about 84 days of 24 hours may be expected from the lining. These results, however, only apply to induction furnaces.

Hardening Dies and Punches.—When hardening dies and punches, in which there are screw and dowel pin holes, it is common practice to plug the holes with asbestos, of the wick or granulated form. Where this is done, trouble is often experienced in cleaning out the holes, as the asbestos sometimes becomes baked on. To avoid this trouble, the asbestos should be mixed with graphite and oil, as holes plugged with this mixture can be readily cleaned and will be found entirely free from scale and the like.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

VERTICAL DUPLEX PISTON PUMP

THE cut herewith illustrates a vertical duplex piston pump, manufactured by the Smart-Turner Machine Co., Hamilton, Ont. These pumps, being vertical, take up less space in the engine room and do away with the tendency—which is present in horizontal pumps—to wear on the bottom side of the steam and water cylinders. This has a direct effect upon the life of the plunger.

It will be seen that the suction and discharge valves are so placed that they are readily accessible, and that it is not necessary to open up the whole of the valve chamber to examine or repair any particular valve. These pumps are suitable for either stationary or marine service.

MACHINE TOOL EXHIBIT.

THE Canadian Fairbanks-Morse Co. have arranged a permanent exhibit of machine tools in their warehouse on Front Street, Toronto, which consists of, among others, the undernoted individual units. Our illustration shows a corner of the layout.

A Brown & Sharpe No. 2 plain milling machine, which embodies in its construction the latest improvements. There is to be noted the feature common to all Brown & Sharpe milling machines of an unsplined table screw, following out the best modern practice in engineering design, also the location of the train of back gears between the cone and the front spindle box, thereby obviating any tendency to chatter on heavy cuts. The single lever for clamping the over-hanging arm and the clamping of the knee from the front of the machine are also shown. There are also embodied the latest refinements of feeding mechanism with "foolproof" features.

A Stockbridge 18 in. two-piece crank, single pulley drive shaper. This, we understand, is the only shaper on the market fitted with a two-piece crank mechanism, which gives a uniform cutting stroke and a 3:1 quick return. The type of knee support is also claimed to be new and exclusive to this shaper; the box table having on the front rail a sliding support equal to its own width, making the knee practically solid. The machine is fitted throughout with taper gibs, while the bearing for the ram is fitted with planer type oil rolls. Speeds are selective and are operated through a friction clutch; there being eight changes of speed with a variation of 8 to 100 strokes per minute.

A Seneca Falls 14 in. x 6 ft. geared head toolroom lathe. This lathe is fitted with all-geared head, self-lubricating

VERTICAL DUPLEX PISTON PUMP.

through pump contained within the head, giving eight changes of speed with three levers and variation of 9 to 456 r.p.m.

CORNER OF CANADIAN FAIRBANKS-MORSE CO., TORONTO, MACHINE TOOL EXHIBIT.

A compact form of quick change feeding mechanism is fitted, this being controlled from the apron and fitted with automatic tripping device with micrometer adjustment. A special feature of this lathe is the micrometer stop on the cross-feed, which enables the tool to be set for either inside or outside cutting. This stop is of entirely new design and enables a reading to be made directly in thousandths in the regular way, or in two-tenths of a thousand per graduation of the thimble to the left. As this positive stop is contained within the body of the cross-slide hand wheel, there is consequently no straining of the crossfeed screw when striking the stop and, therefore, an accurate reading in every instance.

A Pratt & Whitney 16 in. x 8 ft. engine lathe, cone drive, and fitted with quick change gears, apron control, taper attachment, compound elevating rest and quick withdrawing attachment to the cross-slide, with full set of collets and chucks.

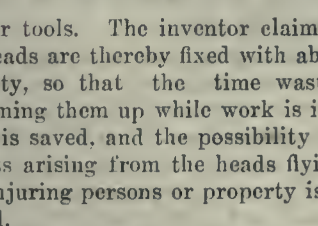
A Barnes 24 in. all-geared manufacturing drill fitted with back gears and oil pump and piping. This machine gives eight speeds varying from 25 to 248 r.p.m., all obtained through a series of gears and controlled by three levers. It is to be noted that there are no right angle drives in this machine, 45 deg. being the greatest included angle, enabling very coarse pitch gears to be used in the bevel drives. Eight changes of feed are provided in two series, ranging from .004 to .075 in. per revolution of spindle. Ball thrust is fitted to the spindle, with automatic knockout and quick return; all gears being efficiently guarded. The oil pump and tank are self-contained, being fitted with relief valve to avoid back pressure.

A Sibley 24 in. drill with cone drive, power feed and plain table, which is a sturdy belt-driven tool, but differing in every way to the one previously described.

A Henry & Wright 8 in. over-hang high speed sensitive drill. This tool is fitted with ball bearings throughout and arranged with four speeds, all controlled from the front of the machine, altogether a high class tool and embodying all the modifications and improvements found necessary by the builders in their extended experience in high speed drills. This machine will efficiently drive drills from $\frac{3}{4}$ in. to $\frac{1}{8}$ in., the combination of sliding head and sliding table giving an exceptionally wide range.

EXPANDING WEDGE FOR HAMMER HEADS, ETC.

NOT the least of the many little annoyances the mechanic meets with in the course of his work is the loosening of hammer-heads from their handles owing to the shrinkage of the wood. This is of frequent occurrence in spite of the rather makeshift methods usually adopted to prevent it, and is often the cause of rather serious accidents. Attention is therefore called to a patented expanding wedge for the purpose of fixing the heads of hammers, axes, picks, and other



FIGS. 1, 2, 3, 4. EXPANDING WEDGE FOR HAMMER HEADS, ETC.

similar tools. The inventor claims that the heads are thereby fixed with absolute security, so that the time wasted in tightening them up while work is in progress is saved, and the possibility of accidents arising from the heads flying off and injuring persons or property is eliminated.

The accompanying illustration, which is more or less self-explanatory, shows the design of the wedge and the method of applying it to fix a hammer-head. The device will be seen to consist of a pair of tapered side-plates lettered A in Fig. 1, pinned together at their thin ends for convenience in fixing, and a central wedge, Fig. 2, the object of which is to expand the side plates. The inner and outer faces of the side plates, and the two faces of the wedge, are serrated, as shown, so that slipping of any part is prevented.

To apply the device, a saw cut a little deeper than the thickness of the head is first made in the end of the handle, as shown in Fig. 1. The head having been placed in position on the handle, the side plates are driven into the saw cut so that the projecting flanges are flush with the end of the handle and the head, as shown in Fig. 3. The central wedge is then driven in between the side plates into the position shown in Fig. 4. This operation bursts or shears the pin connection between the side plates, and forces them apart, so that the wood is expanded sufficiently to fill the hole in the head completely; the latter is therefore quite immovable. If, after a time, any further shrinkage of the wood should occur, it can be taken up very easily by driving the central wedge down another notch, and this operation can be repeated several times if necessary. In this way the wedge might be driven half-way through the head, though the amount of shrinkage thus taken up would be greater than is ever likely to occur in practice.

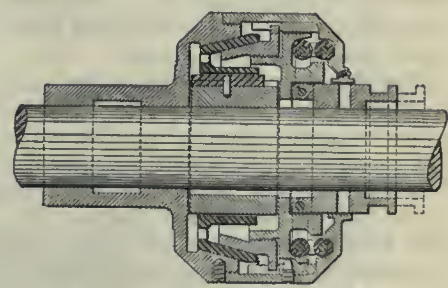
These wedges are made by the Patent Expanding Wedge Co., 114 Great Portland street, London, W., in fourteen different sizes, of which the smallest measures 15-32 in. by $\frac{7}{8}$ in., and is suitable for a head weighing $\frac{1}{2}$ lb.; the largest size measures $1\frac{3}{8}$ in. by $2\frac{1}{2}$ in., and can be used for heads up to 14 lbs. in weight. They are very inexpensive, and their use would often save the cost of fitting new handles.

MULTIPLE DISC CONE CLUTCH.

THE Ideal Multi-Cone Clutch built by the Akron Gear & Engineering Co., Akron, Ohio, is a decided departure from the usual type of friction clutches. The ideal multi-cone clutch has retained the simplicity of the two-cone clutch, greatly increased the pulling power in less space, allows smooth engagement due to momentary slippage, and will, it is claimed, release instantly. The small diameter and consequent light weight permit high speed and location on line shafts.

To avoid too sudden engagement of the cones, their face angles are greater than those of the ordinary two-cone clutch, and the clutching force and pulling power so lost is more than compensated for by the addition of a third cone, which really doubles the pulling power. The cones running constantly in oil have oil films between them, and these films permit a slippage before being broken down by the pressure of the cones coming into engagement. Proper face angles of the cones, and small unit pressure on same, as well as the oil bath, permit immediate disengagement when clutch is thrown out. The third cone doubles the total area of the friction surfaces, which reduces the unit pressure thereon, and gives them longer life. The clutch throws in with extremely small force and little movement of shifter sleeve, making it very suitable for foot control or places where long levers are prohibitive.

There are no projecting parts to catch workmen. The outside is smooth and



MULTIPLE DISC CONE CLUTCH.

all working parts are completely enclosed in a cylindrical oil-tight and dust-proof casing. No outside part of clutch revolves when clutch is out, if mounted as shown in illustration. The adjustment is made very quickly by turning shifter sleeve, and this may be done with shaft running, if mounted as shown. It is not necessary to shut down an entire line of machines to adjust one clutch.

The horizontal pressure exerted by the throw-in mechanism is distributed equally around the complete circumference, and cannot distort the cones from a true circle. When the clutch is out, the throw-in mechanism is still, and centrifugal force cannot throw it in. With clutch in, centrifugal force cannot throw it out, but instead will tend rather to keep it in. The clutch is easily put in place while self-contained, without altering the adjustment made in the maker's shop, and the casing can be easily removed and slid along the shaft, exposing all inner parts for inspection.

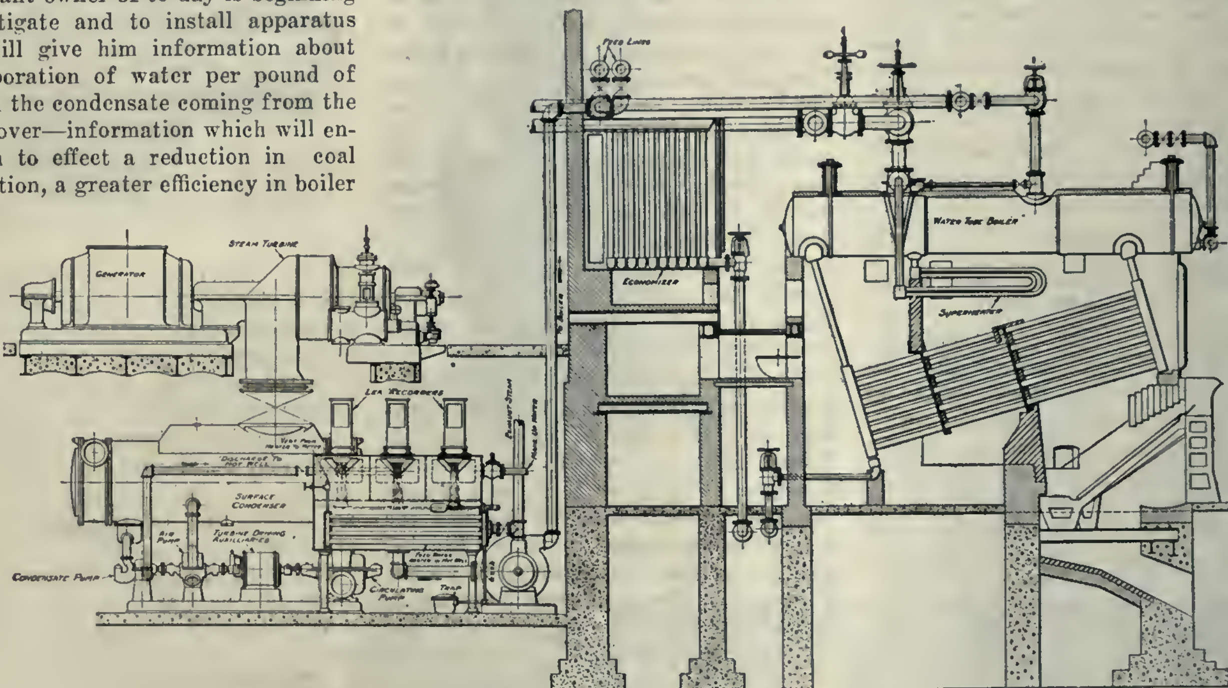
RECORDING LIQUID METER APPLICATION.

IT is universally conceded that the fuel bill represents by far the largest expense in the operation of a power plant, manufacturing or otherwise. Of the heat units available from the 200,000,000 tons of coal burned each year under power plant boilers in the United States, it is estimated that almost fifty per cent. is wasted from one cause or another. Since the marketable supply of coal is steadily increasing in price, power plant and factory owners are awakening to a more thorough consideration of the fuel bills, and to apparatus designed to give information leading toward their reduction.

Until quite recently power plant measurements have been confined chiefly to the last and most efficient step in the transformation of heat units into horsepower, few plants of any size being unequipped with volt-meters, ammeters, steam engine indicators, etc. This, it would seem, however, is working upon somewhat the same principle as locking the door after the horse is stolen, since the greatest losses in economy occur long before the arrival of steam at the prime mover, the transformation of mechanical power into electricity, or indicated horsepower into shaft horse-power.

The plant owner of to-day is beginning to investigate and to install apparatus which will give him information about the evaporation of water per pound of coal, and the condensate coming from the prime mover—information which will enable him to effect a reduction in coal consumption, a greater efficiency in boiler operation, a more economical production and use of steam. These determinations all involve water measurements, in most cases hot water, since engineers are universally agreed that economy and good management demand the feeding of water to the boiler at a temperature above 160 degrees.

Water heated by exhaust steam or by flue gases effects a very considerable saving in fuel, since heat imparted to the water in feed water heaters, or in fuel economizers, takes the place of an equivalent amount of heat that otherwise would have to be supplied from fuel on the grates. With a reliable and efficient means for keeping a continuous record of the consumption of boiler feed, condenser returns and make-up water, the owner or operator is enabled to determine many facts tending towards economy in that part of the plant where the greatest wastes generally occur. In this connection, the application of what is claimed to be an entirely successful recording liquid meter to a modern steam power plant equipped with fuel economizers and feeding water little below the boiling point, will be of interest to manufacturers, power plant owners and operators.



"LEA" RECORDING LIQUID METER APPLICATION.

The accompanying drawing shows a boiler room containing standard type water tube boilers equipped with superheaters; the products of combustion discharging through economizers on the way to the stack. The engine room shown is equipped with horizontal turbine-driven generators using a typical surface condenser with turbine-driven air pump, condensate and circulating pumps. It is also equipped with a centrifugal turbine-driven boiler feed pump, which discharges into the economizers, the pump taking its feed water from the combined **Lea** V-notch meter, heater and hot well.

The combination of boiler feed meter, heater and hot well shown on this drawing is of particular interest, because of the application of the **Lea** V-notch meter to the measurement of the various elements going to make up the total boiler feed water. The drawing shows three V-notch meters built in and forming part of the hot well of the plant. The meter on the left receives the condensate from the turbine shown on the drawing and measures accurately the steam consumption of the generating set. The meter in the middle receives the condensate from turbine and surface condenser No. 2, while the third meter on the right is used for the measurement and control of the necessary make-up water. These three elements go to make up the total boiler feed water.

On the extreme right of the tank is shown a balanced control valve connected with the make-up water line. This valve is operated by means of a float and lever from the water level in the hot well below the meters, so that if there is not sufficient condensate coming back from the surface condensers to feed the boilers the water level in the hot well drops and in turn opens the make-up water valve. The feed pump draws its supply directly from the bottom of the hot well.

As it is desirable to have the feed water enter the economizers at an approximate temperature of 150 to 160 degrees in order to prevent sweating of the economizer tubes, and as the condensate leaves the condensers, under the best of conditions, at between 80 and 90 degrees F., and as the make-up water enters the hot well at a considerably lower temperature (usually dependent upon the outside or atmospheric temperature), it becomes necessary to introduce a heating element to raise the temperature of the boiler feed to the proper entering temperature for the economizers.

This condition has been met in the plant by introducing in the hot well of the meter a tubular heater, which receives exhaust steam from the boiler feed pump, or some other auxiliary. It will be noticed that this combination of meters, hot well and heater economizes floor space and gives a method of control of the elements entering into the boiler feed, both as to quantity and temperature, that is of great value to steam power plants using fuel economizers.

From the foregoing it would seem that the method outlined above, should produce very satisfactory results in steam plants equipped as described.

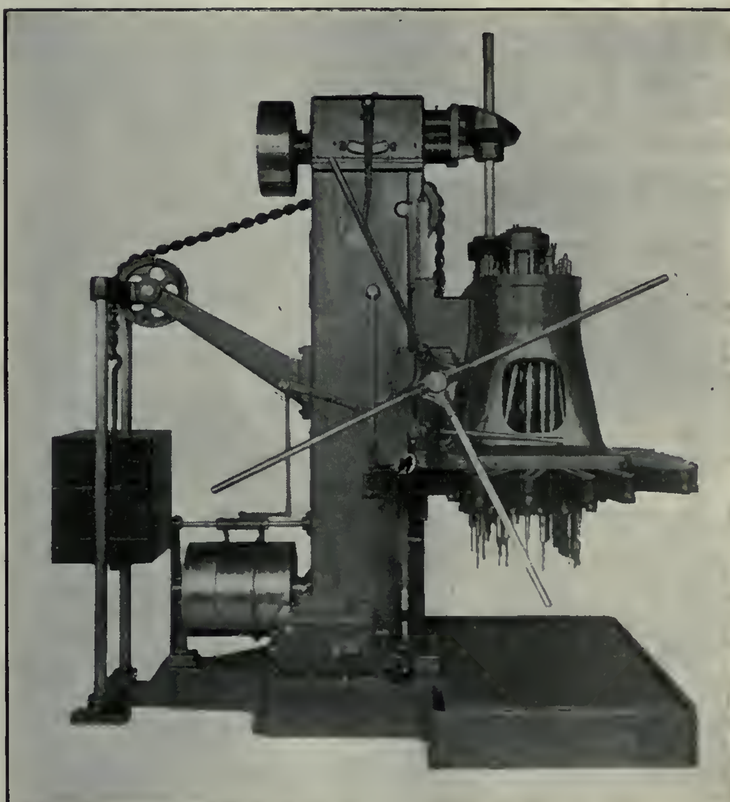
MULTIPLE SPINDLE DRILL.

THE National Automatic Tool Co., Richmond, Ind., has just added to its already complete line of multiple spindle drills the No. 30 machine, illustrated herewith. This is a large, heavy machine, built to meet the demand for a multiple drill capable of carrying a large number of adjustable spindles over a large drilling area. A machine of this type is particularly adapted to such drilling as automobile crank cases and any work of similar nature. The machine illustrated is capable of carrying from 3 to 44 adjustable spindles, or it may be equipped with cluster boxes carrying from 3 to 90 spindles. The size of heads furnished on this machine are 16 x 30 ins. and 16 x 44 ins. The machine shown carries the latter head, and was furnished to a motor manufacturer for drilling six cylinder crank cases in one operation. It is built along simple and sturdy lines, and has ample power to drive high-speed drills to their maximum efficiency, regardless of speed.

A single pulley drive is employed, so that the machine may be belted direct to the line shaft if so desired, or if individual motor drive is wanted it is also easy to apply this. The driving pulleys are of large diameter and wide face, and are mounted on Hyatt roller bearings. The speed box is located at the top of the column, and three changes of speeds are provided by the sliding gear transmission. The gears are of coarse pitch and wide face, and are hardened and ground. For each speed obtained from the speed box there are two independent changes of speeds in the head made by the means of the sliding gearing in the head. These changes are made while the machine is running. The bearings in the speed box are also provided with Hyatt high duty roller bearings, which insure a high transmission efficiency. The speed box and feed box gears are provided with the Cascade system of lubrication.

There are three independent drill feeds which permit the use of any feed with either of the three double drill speeds that are available in the head. All of the feed changes can be made while the machine is running. The feed box is located at the base of the column, the feed gears being cut from the solid, hardened and ground. They are of large diameter, and run at moderate speeds. The cover of the feed box is provided with a small tray, convenient for holding tools. The machine is mounted on a heavy base, which is provided with an oil channel for catching the overflow. This channel has a screen pocket, through which the cutting lubricant must flow to enter the tank from which it is pumped back to the tools. The pumps employed for oiling the machine and delivering cutting lubricant to the drills are independent of each other. When so desired, the base of the machine may be provided with T slots.

Any head furnished on this machine may be equipped with various combinations of adjustable spindles and cluster boxes for drills ranging in size from 1/8 in. to 1 in. in diameter. The head is provided with power feed and with a pilot arm to facilitate advancing and returning easily and rapidly. The power feed may be tripped either automatically or by hand, while the head is counterbalanced by means of three chains which support a counterweight within the column, and also additional sectional counterweighting in the rear of the machine to compensate for the variations in the number of arms used.



NATIONAL ACME NO. 30 MULTI-SPINDLE DRILL.

The column is heavy and rigid and of box section. The spindles are made of special steel hardened and ground, and are provided with ball thrust bearings at the lower end and lock nuts at the upper end to take up any end wear that may develop. The spindles are made to carry either straight shank or Morse taper shank drills as required. Individual flexible oil tubes deliver the cutting lubricant to each drill when the machine is working on steel or aluminum. The bronze bearings which carry the drill spindles are provided with a vertical adjustment to compensate for the variation in drill lengths. This adjustment is easily and quickly secured by simply loosening one nut, which is always accessible, regardless of how close the spindles may be clustered together. When vertical adjustment is needed, it is not necessary to move any arm from its set position. This spindle adjustment is a patented construction and holds the bearing rigidly to the end of the arm, while the arm may be moved to cover any layout within the range of the head. The universal joint used on all Natco drills is milled from the solid and carefully hardened. It is composed of only five pieces, and does not depend upon pins that may be broken or upon screws that may work loose. The universal joints are guaranteed for two years.

One of the most important features of this machine, which is used exclusively on Natco drills, is the independent drill speeds in head, which give two independent changes of speeds to each spindle for each of the three changes of speeds obtained in the gear box. This enables large and small holes to be drilled simultaneously at correct cutting speeds, it being a recognized fact that it is impractical to drive drills of different sizes at the same speed or feed per revolution.

The Herbert Morris Crane & Hoist Co., Toronto, have received an order from the Board of Education of the city of Toronto for four telescopic ash hoists which will be installed in four of the schools coming under the jurisdiction of the Board.

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Vol. XII. AUGUST 27, 1914 No. 9

PRINCIPAL CONTENTS.

THE WAR AND BUSINESS.

It is quite apparent that the European War as far as it has progressed has been fraught with disastrous results, not only to commerce and industry in the countries more immediately involved, but in every land where business enterprise has a foothold. That some degree check or upset should result was only natural because, in spite of fads and creeds, we are nationally, Imperially or internationally, as well as individually, interdependent. However, this may be, we need not lose sight of the stern fact that as individually we can be done without, so in the business or trade reciprocity sense we as a nation can both do and be done without.

The loss of trade brought about through the war, with our enemies, our allies or with neutrals, is no reason why Canadian industrial enterprise should suffer impairment or why our business interests should court despair and invite inactivity. Our industrial position and agricultural prospects were, it is true, not in the most stable shape for some considerable time previous to the war, yet no reasonable deduction can be drawn even from such circumstances as to warrant the stage fright attitude adopted these last few weeks. Too much attention by too many of our people —those who direct and those who serve included, has been given to the war campaign plan and progress.

We are in such hearty accord with the Motherland, with her allies and with the cause, that we believe it to be only effective if we devote ourselves, heart and soul to its expression and propagation. No greater misconception of duty is to be comprehended—the duty to our own kith and kin who are doing the grim work, and duty to ourselves as citizens of Canada. With commendable expedition a number of schemes have been launched which have the threefold purpose of providing men for the firing line fully equipped, of succouring the wounded, and of ensuring sustenance and comfort to the families whose bread-winners have gone. We want to be careful, however, that the base from which our supplies are drawn does not become isolated from these purposes through unwarrantable business inactivity and pessimism. We have now got well over the shock which the declaration of a wholesale European War created, and even so soon are able to forego the questionable luxury of unreliable and panic-fostering news—happily confined to a very small section of the Canadian press.

The temporary disorganization of our business, it being only such, as heads are getting level again, was traceable to no other cause than that of a few newspapers running amuck, but that such a condition of affairs should be allowed to prevail is evidence that the Press Association Executives are powerless to discipline. Until some such powers as are vested in the legal, medical and other bodies, become a constituent part of our Press Associations, just as surely will people's attention be diverted from their daily work and callings when scare head lines invite parting with a brown cent.

At this writing, the industrial outlook has brightened considerably since a week ago, our big corporations and those responsible for extensively equipped business enterprises having in the interval set their houses in order and made plans to not only maintain employment at the maximum possible, but to aggressively prosecute a campaign whose new business results will largely augment that employment. It has been realized that our workpeople will give expression to their loyalty and give of their substance to the various humane organizations more readily when opportunity to earn is their portion, while at the same time those who make employment provision, play an equal, if not greater part.

In a period such as we have been passing through, there is always a possibility that the small employer or dealer suffers unduly, and that generally unwittingly. By this we mean that our larger business concerns are apt to overlook him in settling with reasonable promptness, numerous, and it may be comparatively small accounts for goods supplied. It is too often assumed that the business man in a small way can be side-tracked temporarily in the interests of shareholders and employees. Such a proceeding is rarely, if ever, justifiable and, while the interests of our plant shareholders and employees are being safeguarded to the utmost, let us not forget the small employer and trader who also fills a not inconsiderable place in our business economy.

INDUSTRIAL NOTABILITIES--No. 49

WILLIAM PEARSON GUNDY, vice-president and general manager W. J. Gage & Co., publishers and manufacturing stationers, Toronto; vice-president and managing director Kinleith Paper Co., St. Catharines; vice-president Educational Book Co. of Toronto, Ltd.; president Toronto Board of Trade, 1914, was born at St. Catharines, Ont., Nov. 7, 1858, the son of Rev. S. B. and Susan (Pearson) Gundy; paternal ancestors were Irish, maternal, Canadian.

He was educated at the Model School, Toronto, and when fifteen years of age entered the Civil Service in the Queen's Printer Department of the Ontario Government where he remained several years.

Mr. Gundy began his business career in 1881 with W. J. Gage & Co., opening a branch house for that firm one year later in Winnipeg, and returning in 1884 to Toronto,

WILLIAM PEARSON GUNDY

afterwards assuming the management of the Gage business in 1890. He became managing director in 1893, and was made vice-president and general manager in 1912.

He was a delegate to Congress of Chambers of Commerce of the Empire, Montreal, 1903; was chairman Toronto delegation to Congress of Chambers of Commerce of the Empire, Guild Hall, London, 1912; is trustee National Sanitarium Association; trustee Toronto Free Hospital for Consumptives; trustee Toronto General Burying Grounds Trust; governor Toronto Conservatory of Music, and trustee Metropolitan Methodist Church, Toronto.

Mr. Gundy married May Richardson Simpson, daughter of Henry Simpson, Barrie, Ont., October 6, 1886.

His clubs are the York, National (president 1913-1914), Lambton Golf and Rosedale Golf, while his recreations are golf, hunting and fishing. His residence is 4 Hawthorn Gardens, Rosedale, Toronto, Ont.—Photo, courtesy International Press.

Specific Industrial Opportunities for Manufacturers

By a Staff Reporter

No individual, however generally superior in the eyes of his fellows, has a monopoly of gifts or is a perfection in personality, and we esteem it well that it is so. In like manner no one location in our Dominion has a monopoly in the matter of attracting industries. With the almost endless variety of the latter there is fortunately an equivalent personal condition existent; manufacturers have therefore a wide choice and can shrewdly estimate the value to themselves of the different facilities offered.

SARNIA, ONT.

"SARNIA lights the way" industrially and also as a port of considerable note. The town was incorporated in 1857, and this year received a city charter. The population is about 12,000, with assessment valued at approximately $6,500,000. The city is at the gateway to the Upper Lakes, being at the junction of the St. Clair River and Lake Huron, thus placing it on the highway between Lakes Erie and Huron, through which a large amount of shipping passes yearly. The well-known steamers of the Northern Navigation Co., now the Canada Steamship Lines, Ltd., ply from Sarnia, while a large number of freighters also make it a port of call.

Its location has to a very great extent been responsible for the industrial growth which has been so pronounced in recent years. Manufacturers in Sarnia have easy access to the Western markets and have a further advantage of a water route and low freight rates, while rail connection with East and West is made by means of the Grand Trunk Railway. That remarkable engineering work, the St. Clair Tunnel, is near Sarnia, and on the main line to Chicago, Ill. Ferries run regularly during the navigation season to Port Huron across the river, connecting with the Pere Marquette Railway.

The most important industry in Sarnia is that of the Imperial Oil Co., who have an immense plant at the southern end of the city, to which oil is piped from a point 90 miles distant, in the United States. The H. Mueller Mfg. Co., of Decatur, Ill., has established a modern plant here for making brass goods and plumbing supplies, the present plant being the nucleus of what will yet be a large industry. The Cleveland-Sarnia Saw Mills Co. has a large factory here, while a number of smaller concerns have also established industries in the city.

From a shipping standpoint, the Reid Wrecking Co., of Sarnia, has rendered invaluable service on the Great Lakes in salving wrecks. They are reputed to have the best wrecking outfit on the Upper Lakes and judging by the results obtained, especially since the severe storm last November, this reputation is justified.

Sarnia owns the water works and has just completed an extensive pumping and filtration plant. The city is a delightful place in which to live, especially in summer, when full benefit can be obtained from the extensive water front. An active Board of Trade under the presidency of Oscar Mueller is enthusing new life into the city and important developments will no doubt be seen during the next few years.

PRINCE RUPERT, B.C.

THE opening of through traffic on the line of the Grand Trunk Pacific Railway this Fall will undoubtedly be followed at Prince Rupert—the Pacific terminal —by the establishment of many new industries, in which the natural resources of the country will play a prominent part. Prince Rupert will undoubtedly secure the great fishing trade that is now being developed in the waters of the North Pacific. Fish curing and packing plants are being projected, and one of the most modern cold storage plants, representing an expenditure of over one million dollars, has been in successful operation for some time. Scattered along the coast line at stragetic points and on the Skeena and Naas River, are a score of salmon canning establishments, while at Naden Harbour, at the north end of the Queen Charlotte Islands, is located a whaling station. The products of these different industries of the sea will eventually be handled through Prince Rupert for distribution to the four corners of the globe.

Mining Industry.

The development of the mining industry is another important factor that will add to the upbuilding of the city and in the very near future the needs of reduction works must be provided. Within a radius of 200 miles are to be found some of the largest deposits of minerals on the continent and with the exception of the Granby camp, all ores at present have to be sent long distances for treatment. This additional expense for transportation mitigates against the development of many low grade mines whose ore contents cannot stand the cost. A smelting plant, treating both copper-gold and silver-lead ores, located at Prince Rupert, would command the output of the Portland Canal,. Queen Charlotte Islands, Alice Arm, Kitselas, Skeena Crossing, Hazelton and other camps, providing as it would both steamship and rail facilities. The lumbering industry is also in its infancy. There are large areas of merchantable timber both in the interior and along the coast. Sawmills, shingle mills, box factories, etc., will be centralized at Prince Rupert in the near future. Along the route of the G.T.P. are to be had deposits of sand, clay, limestone and marble, only awaiting the advent of capital for their utilization commercially.

Drydock and Shipbuilding Plant.

One of the largest industrial projects on the British Columbia coast is that of the erection of a 20,000 ton floating dry-dock and shipbuilding and repair yards. This enterprise involves the expenditure of $2,750,000, and is under the name of the Grand Trunk Dry Dock and Ship Repair Co., a subsidiary of the Grand Trunk Pacific Railway. The work is well advanced and, with the completion of the necessary steel frame buildings and the floating dock, will be ready for business next year. A feature of the plant is that practically all the machinery has been manufactured in Canada. When in operation, it will give employment to from 300 to 500 skilled mechanics.

Water Powers.

Immediately surrounding Prince Ruper are a number of water powers that when developed will furnish the city with all the electrical energy needed for industrial purposes. At present the city is constructing the first unit of its proposed hydro-electric plant at Woodworth Lake at an initial cost of $380,000. This will provide 2,000 h.p. Up the North Arm of Wark's Channel (Thulme River), is to be had 10,000 h.p., and at Union Bay, Wark's Channel, is a similar horse power. The Hocssall river is estimated at 27,885 h.p. and the Khtada river 17,500 h.p. These two powers are owned by the Prince Rupert Hydro-Electric Company. At Port Edward, locally called "Prince Rupert's Industrial Annex" this company has erected a concrete power house and have now ready for installation two Diesel oil engines to develop 1,500 h.p.

In brief, the requirements for an industrial city, viz., the nearness to the supply of raw materials, adequate means of transportation, reasonable cost of power, proximity of markets and labor are all to be had, or will be, in Prince Rupert and its vicinity. Prince Rupert wants fish curing and packing plants, cold storage plants, pulp, lumber and shingle mills, brick and cement manufacturers, smelter and refining works.

SASKATOON, SASK.

ALREADY there are several important manufacturing concerns located in Saskatoon, including the sole Western Canadian plant of the Quaker Oats Co. of Chicago, the largest concern of its kind in the world. A tent and mattress factory is also an important institution, producing an exceedingly high grade of mattress, which is largely sold throughout the West. In addition, Marshall, Sons & Co., of Gainsboro, England, one of the oldest British firms of tractor engineers, have an assembling plant located here in the vicinity of the Dominion Interior Elevator. The latter, which is expected to be ready for operation in November next, will have a storage capacity of about 5,000,000 bushels, and will cost in the neighborhood of $2,000,000. The Saskatoon Garment Co. is another rapidly developing concern, now employing quite a number of women and girls in the manufacture of overalls, working shirts, etc. There are several large wood working establishments, two highly equipped foundries and machine shops and numerous smaller manufacturers.

Regarding Saskatoon's strategic location from a manufacturing standpoint, it is only necessary, it is claimed, to place the finger on any reliable map of the West,—just where all the railways meet,—and to add that Sasakatoon's distributing territory extends to 48,600 square miles within which there are even now over over 200 thriving towns and villages on 2,225 miles of operating railways. Another point which ought not to be overlooked is that the operation of the new Hudson Bay route will bring this city—its natural prairie terminus—in very close touch with raw material in the form of steel, iron and coal from the East. The distance from Saskatoon to tidewater on the Hudson's Bay is 738 miles, while the distance from Saskatoon to Montreal is 1,894 miles. There is thus a saving of 1,156 miles of expensive railway haulage. This is advanced as a consideration that will convey its own significance.

WINNIPEG, MAN.

WINNIPEG, the capital city of Manitoba, has made wonderful progress since 40 years ago, when it was a Hudson Bay Co.'s trading post, and known as Fort Garry. A charter was granted in 1874, when the population was less than 2,000, whereas the present population is over 225,000, the assessment $260,000,000. Building permits for 1913 were valued at nearly $19,000,000, and bank clearings for the same year $1,635,000,000; truly a remarkable growth.

Winnipeg may well be called the Chicago of Canada, seeing that the grain business of the West centres there and its growth has been in a measure, similar to that of the "Windy City." Winnipeg is the most progressive city in the West. The citizens have taken full advantage of the opportunities presented and have shown commendable foresight in their efforts to keep pace with Western development. The city is laid out on modern lines and the public buildings are second to none in the Dominion.

Being the centre of a large wheat growing district, it is natural that Winnipeg should derive considerable importance because of this. In addition, large quantities of wheat and other grains from all over the country west of the "Peg" are dealt with on the Winnipeg Exchange. It is the distributing point for a large territory and headquarters of many wholesale houses, while a large number of Eastern concerns have branch establshiments in Winnipeg.

Winnipeg is an important manufacturing centre, and has a large number of factories embracing various industries. There are many features which combine to make this city a good place in which to locate a factory. First, cheap power is obtainable from the municipal hydro-electric plant on the Winnipeg River, where 60,000 h.p. is being developed. All the railways in the West converge in Winnipeg, giving the city excellent transportation facilities, a very important consideration for manufacturers. It is claimed that the C.P.R. yard, with over 150 miles of sidings, is the largest in the world controlled by a single corporation. The Union Station cost nearly $2,000,000.

Trade Gossip

War Grist.—The Nova Scotia Government a few days ago sent a message to His Royal Highness the Duke of Connaught stating that they would be glad to contribute one hundred thousand tons of Nova Scotia coal for such purposes as would best serve the interests of the Empire at the present time. The Governor-General replied, saying that he felt sure the patriotic and generous action of the government would be greatly appreciated. Sir Robert Borden wired in similar terms, and added that the offer had been communicated to His Majesty's Government. Landed at Halifax, this coal would be worth half a million dollars.

War Grist.—Some two weeks ago the Dominion Government sent tender forms to the various paint manufacturers for supplies for immediate delivery to be used in putting in the best of shape the Canadian cruisers Niobe and Rainbow. Brandram, Henderson Co., Montreal and Toronto, etc., received the order form and without waiting to think of specifications and prices immediately notified the Department that the firm would donate 40,000 pounds of white lead. To say that the splendid patriotism was appreciated by the Department would be putting it very mildly, as the price of white lead even before the war broke out was steadily advancing, and manufacturers were not booking a single order ahead.

The Russell Motor Car Co., Toronto has announced its intention to keep its full staff on its books, and is very optimistic regarding the stability of Canadian business. "We are endeavoring to keep every man employed, so that our workmen may not suffer to any considerable extent," says an official, "and we have no intention of laying off men or closing down the works. We feel that Canadians will be fair enough to support a Canadian industry which at a time like this gives support to Canadian workmen." In neither the automobile or bicycle department declares the Russell Co. has there been any falling off in the amount of orders, and they may have to hire additional men instead of discharging any.

To Oust German Trade. — The announcement of the Government regarding the capturing of Germany's export trade has been received with great enthusiasm by British traders, says a London, Eng., correspondent. With the view to replacing some of the larger markets in hardware and metals, a syndicate of British merchants have sent out by the S.S. Lake Manitoba a direct representative, P. G. Donald, who will act in the general interests of obtaining orders for some goods hitherto supplied by Germany for the whole of the English markets. "That Canada is alive to opportunities presenting themselves is obvious," says Mr. Donald, "from the prompt and courteous assistance given to us by the Canadian representatives on this side. It now merely remains for the Canadian Government and manufacturers to grasp the opportunities for the large trade to spring up between us."

R. W. McConnel, of the survey staff, has been appointed as acting deputy, and will likely be confirmed in that position.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh	$13 65	
Lake Superior, charcoal, Chicago	16 00	
Ferro Nickel pig iron (Soo)	25 00	
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 50	17 85
Victoria, No. 2X.......	18 25	17 60
Victoria, No. 2 Plain ..	18 00	17 35

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b, Montreal.	2.00
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh ...	1.20
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in..	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes..	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload ..	$15 00	$15 00
Electrolytic copper	14 75	14 75
Casting copper	14 25	14 50
Spelter	6 00	5 75
Tin	55 00	55 00
Lead	5 00	5 00
Antimony	25 00	25 00
Aluminum	20 00	25 00

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt, casks, per cwt.	6.40
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.67
Linseed oil, raw	0.70
Linseed Oil, boiled	0.73
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.16
Lard Oil, per gal.	0.60

CHAIN.

¼ inch	$5.65
5/16 inch	4.70
⅜ inch	4.00
7/16 inch	3.65
½ inch	3.45
9/16 inch	3 45
⅝ inch	3.35
¾ inch	3.25
⅞ inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets. black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2 90	3 15
Canada plates, all bright	4 00	4 10
Apollo brand, 10¾ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1½-in	$37.50	$30.00	$17.50
33/64 to ¾-in.	41.25	33.00	19.25
7/16 to ½-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	95c lb.
Leather in sides	85c

BELTING RUBBER.

Standard	60%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

¾ inch	$ 4.95
1 inch	8.05
1¼ inch	12.65
1⅜ inch	15.30
1½ inch	16.50
1⅝ inch	19.40
1¾ inch	22.50
1⅞ inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

THE WORLD'S MONEY.

A DECIDED improvement has been manifested during the past week in the general financial situation, both on this continent and in Europe. The calmness with which the situation has been accepted in London after the first deliberate action and somewhat drastic steps taken by the directors of the Bank of England, is striking evidence of the implicit confidence of the business community in the financial strength of the British Empire, and this confidence is daily growing stronger on the recognition of the fact that the ocean trade routes are being maintained. Added to this, the remarkable strengthening of the cash position of the Bank of England, as shown by the last weekly statement, will help to allay any apprehension that may still be felt.

Montreal, Que., Aug. 24, 1914.—During the past week we seem to have passed the crisis, and in the business world there is awakening a new confidence. However, it is as yet only an awakening; nevertheless, it is significant in itself, and we can feel sure that, in as far as the business situation is concerned, the worst has really passed. Men at the head of our large industrial institutions have been able to adjust their policies to the new conditions. The meeting of the Dominion Parliament at Ottawa has had a great deal to do with the restoring of confidence. Our people have confidence in their national leaders, and with other added factors Canada seems in a fair way to receive a wave of prosperity.

The crisis, coming as it did on the heels of a hard time period, only serves the more to impress upon us the value of using sane and careful methods in business. Thus our new progress will be sounder and our prosperity more real. Canada as well as the United States cannot help herself from participating in better times right away. All trade with the Continent of Europe is very effectually cut off, while British trade is rapidly assuming normal proportions. There is, however, a new set of conditions prevailing. The German and Belgian competition is removed. The steel industries of Great Britain will have to supply the whole home demand. The iron ore mines of Britain cannot, however, supply that need, therefore from Sweden, Spain and Algeria more ore must come. The prices of all kinds of iron and steel will go up temporarily, and trade will be brisk. In the case of hematite pig, an iron used largely in the steel industry, the price has soared from 60s. to 72s. 6d. This high level will not, however, be maintained. The shipping interests will soon have their services adjusted, and a supply of imported ore will be brought into England in ample quantities to supply all demands. In Canada, shipments of British steel are arriving, but on account of the price having risen, the demand is not great. American and Canadian mills seem to be able to supply the trade with an equally good article and at a slightly lower price.

Pig Iron.

The supply of pig iron from Britain has practically ceased. Of course, small quantities are from time to time arriving, but no great amount has been received. The American and Canadian product seems to be filling all demands, and the price is remarkably steady. No large orders have been received, and there has really not been enough trade to make any real difference to prices.

The Steel Market.

More or less British steel has been received here in the last ten days, but there will not be much more, as home consumption will more than care for it all. The American quotations are rather varied. Some firms boost one line and not another. Thus the market is in a somewhat unusual position. Structural steel has taken about the highest jump, while sheet steel and thin plates have advanced the least. However, following the general tendency of the moment, there is no doubt but that the market will rapidly adjust itself, with prevailing prices somewhat higher than before the declaration of war.

Machine Tools.

There are very few sales reported, and these are all of a minor nature. However, with the new awakening, machine tools will undoubtedly participate in any improvement.

Metals.

The metal market remains very steady. Tin continues to sag a little, having dropped five cents in the last week. Copper dropped a little also. The sales for the week were, however, not large, and no really definite idea of the markets can be gained until the New York and London Exchanges are reopened.

Toronto, Ont., Aug. 25, 1914.—The unsettled conditions caused by the war do not show much improvement, and a great deal of caution is being exercised pending more favorable news from the scene of hostilities. The full effect of the war upon trade has hardly yet been felt, and it is impossible to foretell to what extent Canada will suffer. There is no doubt that we are becoming more accustomed to the unparalleled state of affairs, and so will be able to gauge the situation better and act accordingly. A considerable proportion of the war-scare depression is psychological and will be alleviated when news comes of a decisive victory by the allies; until then we must be calm and resolute, each doing his best to help things along.

It is unfortunate that some business concerns show a tendency to get panic-stricken, hardly warranted by the conditions; others, however, have expressed their intention of keeping factories open, if only on short time, an action which cannot be too highly commended. A species of scare seems to have taken hold of many to the detriment of those who are trying to instil more courage into the community. The situation is no doubt serious for the time being, compared with what we have usually been accustomed to, but the feeling is gaining ground that Canada stands to benefit by the conditions that will be created by the stagnation of industries in the countries involved in the struggle.

It must not be forgotten that the farming industry, which is the backbone of this country, will benefit appreciably by the war, as the Old Country can take all the foodstuffs that can be spared. Further, some industries should benefit by the elimination of the German export trade, although in a few cases the inability to obtain certain articles from that country will be a handicap; this no doubt will be satisfactorily adjusted in time. These conditions open up possibilities for new industries and Canadian manufacturers should get together and see what can be done to take advantage of the unique situation.

Considerable progress has been made towards restoring normal conditions on the Atlantic. Shipping facilities have improved considerably and schedules have been arranged for vessels trading between Canada and Great Britain; consequently the congestion at our Eastern ports has been considerably relieved and large quantities of foods have been shipped. Freight and insurance rates are both above normal, which is having a tendency to reduce the volume of shipments.

Steel Markets.

The condition in the markets for steel and allied products has not changed; consumers are watching developments and are not making contracts for the time being. Both the Dominion Steel Corporation and Nova Scotia Steel Company have decided to practically close down their plants, partly on account of the difficulty created by the war in shipping and financing foreign orders, and also because of the depression of the home market. These conditions may be relieved sooner than at present seems probable.

A representative of a syndicate of Old Country merchants is already on his way to Canada to ascertain whether manufacturers here can supply such materials as wire nails, iron gas and water pipe, etc. Large quantities of these products have in the past been imported from Germany, which market is now of course cut off. This indicates the possibility of interesting developments in the steel trade which may also eventually benefit from production being tied up in Europe.

Prices on steel products rule about the same, although as far as home production is concerned, there is hardly enough business being done to test the market. Firm prices can only be obtained against definite specifications and for immediate acceptance. Manufacturers are continuing to withdraw prices, and a return to original lists can hardly be expected for some time. The ferro-manganese situation is becoming serious, as the steel mills have not very heavy supplies of this indispensable material on hand, and it is impossible at present to obtain any from Europe. We understand that there may be a resumption of shipments by English makers next month, but how long this will continue is not certain. Some mills in the United States are confronted by a similar situation; the United States Steel Corporation is the most notable exception.

Pig Iron.

The pig iron market is very quiet. Owing to the unsettled conditions, the majority of foundries are operating at much reduced capacity and further, are not inclined to buy unless absolutely necessary. Some consumers have practically suspended operations altogether.

Machine Tools.

Business in machine tools continues very quiet; in fact it, might easily be said that no business is being done. Consumers are no doubt holding off until the outlook improves.

Machinery Supplies.

With machine shops in many cases running at reduced capacity, few supplies are required, consequently business is quiet. Prices remain at the same level on all supplies except babbitt, which has advanced slightly. Prices on belting have not changed. Dealers handling English brands have stocks on hand and shipping facilities are getting better.

Tool Steel.

No fear may be entertained as regards obtaining tool steel. Most dealers have considerable stocks on hand and shipments have now been resumed from England. No change has been made in prices, but there is not much business being done.

Metals.

The metal markets are steady with prices practically the same as last week. Aluminum, however, has advanced 2 cents a pound. Tin is steady although the situation has not improved. The difficulty in obtaining this metal is largely on account of the difficulty in financing, and the British Government's restrictions on shippers. The tin market is sensitive and likely to continue to fluctuate in an erratic manner. The demand for most metals is dull, consumers covering for immediate requirements only. The antimony situation has not improved, although the price is steady.

The J. F. Brown Co., Ltd., has been authorized to manufacture copper and brass goods.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

DEVELOPING OUR EXPORT TRADE.

THE Canadian Trade and Commerce Department is making every effort to assist Canadian manufacturers in their intention to take advantage of the present European situation and capture the trade of Germany, Austria-Hungary and other countries which have ceased to manufacture as a result of the outbreak of war. In a bulletin issued to our manufacturers attention is called to the opportunities at their door.

"Evidence has lately come before the Department in the shape of remarks of several United States publications to show that the people of that country are realizing the opportunity that is presented for enlarging their export trade, now that active competition in the world's markets on the part of several European countries has been withdrawn as a result of the present war," says the bulletin.

"To a certain extent the arguments put forth by these publications are applicable also to Canada. While it is generally pointed out that an extended European conflict will prove of great benefit to Canada as a supplier of foodstuffs, the opportunity that is given to Canadian manufacturers to develop their export trade through the temporary withdrawal from the sphere of world trade of such countries as Germany and Austria-Hungary does not appear to be generally realized."

Trade Opportunities.

The bulletin then goes on to deal with various trade opportunities open to Canada. "First of all," it states, "as a result of the war Canada's direct trade with Germany and Austria-Hungary must necessarily suffer. In 1913 Canada imported from Germany goods worth $14,473,833, and she exported to Germany goods to the value of $3,402,394, a total trade of $17,876,227. With Austria-Hungary, Canada carried on a total trade to the value of $1,829,943, of which $1,674,349 consisted of imports and $154,594 of exports. It is thus seen that these countries, especially the former, had obtained a foothold on the Canadian market which will be lost during the progress of the present war. An opportunity is presented for other countries to increase their trade with Canada, or Canadian producers to make up a part of the deficiency thus created."

The British Market.

The foremost market of which Germany will be deprived as a result of the war is the United Kingdom, which has been buying goods from Germany at the rate of about $145,000,000 a year. German exports of agricultural machinery to Great Britain in 1913 were $131,189, as compared with $437,099 from Canada; of sewing machines, $500,000, as compared with Canada's $2,263. Under the head of machinery, Germany has exported to Great Britain to the value of over $5,000,000 a year; of electrical machinery, over $31,000,000 a year; of electrical goods and apparatus, $41,000,000 a year; hardware, $4,000,000; boots and shoes, $250,000; brooms and brushes $789,000, as compared with an import from Canada of only $7,917; of paper, $2,017,575, as compared with an import from Canada of $587,010.

Germany's trade with various British Dominions has also been large and here is an opportunity for Canadian manufacturers. Australia's purchases from Germany amount to over $32,000,000 a year, as compared with but $3,996,387 from Canada. South Africa imports $17,000,000 worth of German goods annually, as compared with less than $4,000,000 from Canada.

PAPER MARKET ACTIVE.

THE break in the shipping deadlock has afforded the Canadian paper companies opportunities to close profitable business for export in newsprint. Some big orders for shipment to England, South Africa and South America have been accepted by the Laurentide Company in the last few days. As an indication of the broadening tendency of the market J. H. A. Acer, treasurer of the company, states that inquiries had also been received from France and Italy.

The South American market is not a new one, but business in that direction has been small, Germany having supplied most of the trade. United States companies are now putting forth every effort to capture the market, but the opportunities for Canadian companies are there, and Laurentide at least is reaching out for some additional business.

Apart from the increased demand for export, the domestic demand has gone up at least 25 per cent. since the beginning of the month. Some trade authorities say the increase has been 40 per cent. The natural result has been rising prices and export business has been done on a basis of 2.50 f.o.b. Montreal, against 1.90 to 2 cents a pound before the war started.

Sulphite pulp continues strong, owing to the fact that the supply of 30,000 tons a month which used to go into the United States from Europe has been completely cut off. The quotation for sulphite is now $45 to $50 a ton, a rise of $10 to $15 a ton.

INCREASED OUTPUT OF ALBERTA COAL

THE very rapid development of the coal industry of Alberta is shown by figures which have just been compiled regarding the operations of coal mines in the province in 1913. Tons of coal mined in Alberta during 1913 numbered 4,306,346, being an increase of 859,997 over 1912. During the past eight years the coal output for Alberta has increased 500 per cent.

The Edmonton district has the largest coal fields, not only in Alberta, but in the Dominion. These areas are being opened up as fast as railway communications and capital make their operation possible. At the present time the Crow's Nest holds first place among the coal producing districts in Alberta, having an output of 1,849,435 tons. Lethbridge comes next with 966,020 tons; Edmonton third with 863,430 tons, and Calgary fourth with 627,461 tons. A large number of new mines were opened up during the year, mostly in the Edmonton coal field. Some of these were closed down again, on account of the fact that at the present time they are not served by railways.

Men Employed.

An increased number of men found employment in the mines of the province during 1913, the total number of men engaged in the mines, both above and below ground being given as 8,608. Machinery is coming to be used more and more in getting out the coal. In the lignite field more than half the coal is mined by machinery, but no machinery is used for coal cutting in the bituminous or anthracite fields. Twenty-nine mines are using electricity. Telephones have been installed in the larger mines, and are proving of great service, both in assisting the management and in obtaining assistance when accidents occur.

Mine rescue stations have been established, two in the Lethbridge district and the other between Coleman and Burmis. Others will be established shortly in the northern part of the province. The stations are equipped with up-to-date apparatus and complete appliances for rendering first aid work very readily, 221 persons having presented themselves for training during the year, while 51 have been granted certificates for proficiency. There were 28 fatal accidents in mines in the province during 1913. Most of these occurred in the smaller mines.

STEEL PRODUCTS HAD GOOD YEAR.

THE first statement of Ontario Steel Products Co., the latest of the smaller Canadian mergers, reveals net profits of $106,437 for the first year of operation to June 30, 1914. These profits have been determined for the year, after providing for depreciation of properties, reduced market value of securities and the entire cost of organization. After meeting the bond interest of $36,000, the company earned 9.39 per cent. on its $750,000 preferred stock, on which a dividend of 7 per cent. was paid. This left $17,937 available for distribution on the $750,000 common stock, being equivalent to earnings of 2.39 per cent. Current assets are set down in the balance sheet at $472,062, being $353,149 in excess of the $118,913 current liabilities. Securities to the amount of $26,144 are included in the current assets. It is stated that these are set down at "market" prices, on July 1, 1914.

In view of general trade conditions it is surprising that net earnings should have held up so well. The year's net of $106,437 compares with the combined net earnings of the three factors in the merger in 1913 of $113,819. Income, however, has grown from $82,347 shown at June 30, 1910. Net assets, exclusive of good-will as at July 1, 1914, show a total of $1,211,481. Making up this total is the amount of $858,332, at which the real estate, plant, machinery and water power rights is appraised, together with surplus liquid assets over liabilities of $353,149.

TO KEEP THE FACTORIES OPEN.

TO keep the Canadian factories busy all winter and to keep our money in circulation at home is the object of a memorandum that has been forwarded to members of the Federal Government now considering Canada's greatest problem, that of keeping her workmen busy, even if at reduced hours, in order that they may earn something.

"Considering the reduced demand," says a prominent Canadian manufacturer, "and the stagnation of business, I am certain that if our people would demand Canadian-made goods my factory would be humming, and every other factory of its character in our country."

Attention is also drawn to other lines which are manufactured in Canada, and of the great importations from the States in similar trades. There was $500,000 worth of bath tubs, sinks and laundry tubs imported, mostly from the States, in the twelve months ending last March. There was $360,000 worth of labels for canned goods, bottles, shipping crates, etc. There was $90,000 worth of men's braces and suspenders. There was $250,000 worth of boots and shoes, $525,000 worth of drain and sewer pipes, $700,000 worth of brooms and brushes, $320,000 in baby carriages and toy sleds, $320,000 in collars and cuffs, $560,000 in ladies' corsets, $1,500,000 in clothing of various kinds, $400,000 in electric light carbons, $8,000,000 in electrical apparatus of various kinds, $1,000,000 in hardware, $700,000 in locks of various kinds, $125,000 in nails, and $900,000 in fence wire.

MAINTAINING EMPLOYMENT.

E. G. HENDERSON, of Windsor, Ont., president of the Canadian Manufacturers' Association, who was in Ottawa recently to see the Government in connection with business of interest to all the members of the association, intimates that every Canadian manufacturer is going to do everything possible to keep as many as possible in employment during the time the war is in progress.

"Our members are going to do this even if it means a sacrifice on their part," he said. "It is the duty of manufacturers to their country. In many cases it may not be possible to keep men employed on full time all along, but married men will be given the most consideration. The best way the general public can assist the manufacturers to keep their men employed is to buy Canadian-made goods as much as possible."

Robert Hobson, president of the Hamilton Steel & Iron Co., who was also in Ottawa at the same time, says that his firm is prepared to sell goods at a little below cost, if necessary, so that the purchase of their products will be made attractive. He looks for an improvement in the steel and iron business in Canada, owing to the production in Germany and other European countries being stopped to a large extent.

Personal

A. W. Ellson Fawkes, waterworks engineer of Calgary, Alta., will resign the position.

Captain T. C. Irving, Jun., vice-president of the Robt. W. Hunt & Co., inspecting engineers, Toronto, has left with the 2nd Company Canadian Engineers for Val Cartier, Que.

H. C. Cox, president of the Canada Life Assurance Co. has been elected a director of the Canadian General Electric Co. to fill the vacancy created by the death of his brother, the late E. W. Cox.

Prof. Reginald W. Brock, director of the Geological Survey of Canada, has resigned. He will become professor of applied science in the University of British Columbia.

Robert Hobson, president of the Hamilton Steel & Iron Co., Hamilton, Ont., says his firm is prepared to sell goods at a little below cost if necessary, so that the purchase of their products will be made attractive.

R. M. Hamilton, for many years general superintendent of the McGregor Gourlay Co. Works at Galt, has been appointed works manager of the Canada Machinery Corporation, Ltd., with supervision of the manufacturing departments of their various plants. His headquarters will be at Galt, Ont.

Tenders

Ottawa, Ont. — Tenders for public buildings, Peterborough, Ont., will be received up to Monday, September 14, 1914, Plans, specification and form of contract can be seen and forms of tender obtained at the office of Thos. Hastings, clerk of works, Postal Station "F," Yonge Street. Toronto, at the Post Office, Peterborough, Ont., and at Department of Public Works.

Ottawa, Ont. — Tenders for public building, Watford, Ont., will be received until Monday, September 14, 1914. Plans, specification and form of contract can be seen and forms of tender obtained at the office of Thos. A. Hastings, clerk of works, Postal Station "F," Yonge Street, Toronto, Ont.; at the Post Office, Watford, Ont., and at the Department of Public Works.

Service Data for High Speed Bearing Loads and Velocities

By Gerald Stoney, F.R.S.

The observations contained in this article make a timely contribution to a subject that is more or less largely engaging the attention of designers and operators of high-speed mechanical engineering equipment in a wide field of application. The information given, being for the most part that obtained from test and experiment and actual service, carries with it, therefore, merit of exceptional value.

THERE are three principal types of friction in all bearings:—

1.—Contact friction, where both surfaces are dry, and this type was investigated as early as 1781 by Coulomb, who found for pressures from ¾ lb. to 100 lb. per sq. in., and speeds up to 10 ft. per second, that the friction was independent of the pressure per square inch and the velocity, but was proportional to the total force pressing the surfaces together, and was dependent also on the nature and material of the surfaces.

2.—Greasy friction, where there is more or less complete lubrication and a more or less complete film of oil between the surfaces. This has been investigated by many experimenters, but concordant results have not been obtained, as so much depends on the degree of lubrication. Generally speaking, however, friction of this kind is proportional to the load, and is independent of the speed—i.e., the coefficient of friction is constant.

3.—Complete lubrication where there is a complete oil film between the surfaces and there is no metallic contact, This usually occurs in high-speed journal bearings where bath or forced lubrication in some form is provided.

Experimental Results.

The chief published experiments on high speed bearings are those of O. Lasche, and the general result of his tests show that so far as friction is concerned it is not well to use a large shaft and a long bearing, although experience shows that for high speeds and heavy loads long bearings are necessary. They have also to be large to avoid vibration and critical speeds, and also the risk of fracture due to vibration. To avoid this latter danger the bending stresses have to be kept to a figure which would be considered very low in ordinary practice, as there have been several cases of fracture of shaft ends. If the pressure is too high, or the oil is too thin, a bearing may run all right so long as there is no vibration; but if vibration occurs, the oil film may be driven out and seizing takes place.

This is especially liable to happen with the staffs of electrical machinery, such as the armatures of dynamos and rotors of alternators, where there is always a liability to vibration due to their going out of balance; and it is probable that much lower pressures are advisable in such cases than in those of turbine rotors, which from their construction are not as a rule so liable to go out of balance. The effect is reduced in very high speed staffs, above say 2,000 revolutions per minute, by the use of the well known Parsons flexible bearing, where there are two or more tubes outside the bearing bush with a small clearance between them in which the viscosity of the oil tends to damp out vibrations.

Size of Bearings.

In turbine work, a rule much used for deciding the size of bearings has been that the product of the speed by the pressure should not exceed a certain figure, but it is doubtful whether this rule is of much value, as it really assumes greasy friction and not perfect lubrication. In land work a product of 5,600 has rarely been exceeded, or 75 lb. per sq. in. at 75 ft. per second. At lower speeds, higher pressures are used satisfactorily, as, for example at about 35 ft. per second a pressure of 130 lb. to 150 lb. per sq. in. is admissible.

In a discussion on Professor Christie's paper before the American Society of Mechanical Engineers in 1912, Hodgkinson stated that speeds of 80 ft. per second and 100 lb. per sq. in. were commonly employed in America, and where there is no risk of heavy vibration there does not seem any reason why higher pressures should not be used. It has to be remembered that the heat to be carried off does not increase with the pressure, and that the real danger lies in the possible breaking down of the oil film by excessive pressure or vibration.

Marine Turbines.

In marine turbines the journal speeds are much lower than on land, and rarely exceed 30 ft. per second, and the pressures are usually 80 lb. to 100 lb. per sq. in.; but there is a strong tendency to increase this latter figure, and it is probable that pressures of 150 lb., or even possibly 200 lb. per sq. in., could be used, especially if the oil temperature does not exceed 100 deg. to 110 deg. Fah., as is usual in marine work. The temperature of the oil is limited by its loss of viscosity at high temperature and by its liability to carbonize and oxidize, and thus cause deposit in the pipes, oilways, etc. In land practice temperatures of 120 deg. to 140 deg. Fah., are common, but it is not well to go above 150 deg. or 160 deg. Fah., as most oils seem liable to oxidize and cause deposit above this temperature. At about 250 deg. Fah. most oils cease to lubricate, as their viscosity becomes too low.

The Friction Feature.

From Lasche's experiments it was found that the friction is approximately inversely proportional to the temperature measured from freezing point; but after a certain temperature the friction rapidly increases and seizing takes place, due to the loss of viscosity. In all high-speed bearings artificial means have to be used to carry off the heat, radiation from the bearings not being sufficient. The general plan is to have such a flow of oil through the bearing as to cause the heat generated to be carried away without an undue rise of temperature. Water-jacketing the bearings has been used in some cases, but it is not as satisfactory in general as the plan of supplying sufficient oil to carry off the heat. Oil-coolers have therefore generally to be provided to cool the oil. In some cases also the oil is circulated round the outside of the bearing in suitable passages so as to assist in cooling it, and this is probably necessary in the case of very large bearings running at high surface speeds. The heat to be removed is not only that caused by friction, but also that caused by conduction from the steam; on the other hand, the bearings near the condenser are cooled by the exhaust steam and heated by the gland steam. From Lasche's tests the heat produced in bearings running at a temperature of about 122 deg. Fahr. is that due to a shear of the oil-film of about 0.46 lb. per sq. in. of the projected area, and this gives as the B.t.u. per hour:—

$$\text{B.t.u.} = 2.1\, d\, l\, v$$

where d is diameter of bearing in inches,
l is length of bearing in inches,
v is surface velocity in feet per second.

The constant varies inversely as the temperature above freezing point. A formula which has been often used in marine practice is $\text{B.t.u} = d\, l\, v^{1.38}$, which gives slightly greater results for the usual speeds in marine work, and an oil temperature of about 100 deg. F.

It may be taken that this is approximately the heat that has to be carried off by the oil. Taking the specific heat of oil to be 0.31, and allowing a rise of

*From a paper read recently before the North East Coast Institution of Engineers and Shipbuilders.

10 deg. Fah. in the oil, we require 20 lb. or about one-third of a cubic foot of oil per hour per square inch of projected bearing surface when the surface speed is 30 ft. per second, and 40 lb., or two-thirds of a cubic foot, of oil per hour with a surface speed of 60 ft. per second. In practice these quantities are often increased by from 30 to 50 per cent., to allow of the unequal distribution of oil between the bearings, and to ensure that there is no undue heating, also in some cases to allow for the flow of heat from the steam.

Ring lubrication was experimented on by Lasche, but the results were found to be very variable, and in general he says that the tests show ring lubrication to be very uncertain and that it should not be used in cases where external cooling of the oil is necessary. As a result of some tests made on a 9 cm. diameter bearing, more oil came out of one side than the other.

Thrust Bearings.

Thrust bearings are generally of the usual collar type with the bottom and top halves separately adjustable to take up end play; and in land turbines, which are practically balanced, the pressures are very low, never exceeding 20 lb. per sq. in., and even in marine turbines 50 lbs. per sq. in. is never exceeded.

There are no tests available as to the friction of such bearings, but it is probable that it is fairly high, as perfect lubrication is difficult to attain, and, as an approximation, the total area—that is, the area of the top and bottom halves together—might be added to that of the main bearings in estimating the quantity of oil required and the surface of the oil-cooler. Such bearings have generally a high coefficient of friction, owing to the low pressures employed, since, as it is impossible for a wedging action to take place and thus admit the oil, such as has been described as occurring in the case of journal-bearings, the lubrication is rarely perfect. Towers found at moderate speeds that the pressure which could be safely carried was about 60 lb. per sq. in., as against 600 lb. in a journal-bearing, and that the shear resistance of the oil film was greater, being 1.5 lb. per sq. in., this giving about sixteen times the so-efficient of friction for a thrust-bearing as for a journal one.

The theoretical consideration of the conditions necessary for perfect lubrication, as set out in Osborne Reynold's Royal Society paper in 1886, referred to above, and also his own investigations, led Michell, in 1905, to devise a thrust-bearing which would admit of perfect lubrication. In this thrust-bearing there are segmental blocks pivoted at the theoretical center of pressure, which is about 0.6 of the length from the leading edge. By this device perfect lubrication is attained, and pressures up to 1,500 lb. per sq. in. can be safely carried at high velocities, with a consequent reduction of the coefficient of friction to about 1-60th of what it is in an ordinary thrust-bearing. Another advantage is that the end play in the thrust-bearing can be greatly reduced.

The same idea has been further developed by Sir Charles Parsons, K.C.B., F.R.S., in patent 8266 of 1912, where the blocks are centrally pivoted. It has been found that, in cases where the pressure comes on gradually, this works equally well in practice, and has the advantage that the shaft may run in either direction without the complication of shifting the point of support. These principles have also been applied to journal-bearings by Michell (patent 23,-496 of 1911) and Sir Charles Parsons (patents 8,266 of 1912, 29,810 of 1912, 953 of 1913, and 5,619 of 1913), enabling greatly increased pressures to be used, with a resultant reduction of the coefficient of friction, and also a large reduction in the length of the bearings, and thus of the whole plant. The reduction of friction may in some cases reduce the consumption of steam between 1 per cent. and 2 per cent. in a turbine plant.

Ferranti (patent 5,035 of 1910) has also worked on the same lines, as well as Kingsbury in the United States (American Patent 947,242 of 1910), and there are full details of the latter's thrust-bearing in the Journal of the American Society of Naval Engineers, November, 1912.

In the U.S.S. Neptune a single collar, 13½ in. in diameter, carries 45,000 lb. thrust at 72 ft. per second mean speed surface, or a pressure of 500 lb. per sq. in. and, in general, such turbine thrust-bearings are designed for about 500 lb. per sq. in. at 60 ft. to 75 ft. per second. Much higher pressures can be safely carried, as is shown by some tests carried out by the Westinghouse Co., where pressures up to about 7.000 lb. per sq. in. at 54 ft. per second were carried without heating. The coefficient of friction of such a bearing may be from 0.0008 to 0.003 and, for such a pressure as 500 lb. per sq. in., may be safely taken as about 0.002, or, say, one-tenth to one-fifteenth of that of an ordinary thrust-bearing.

Steam Turbine Thrust Bearing Tests.

The Westinghouse Co., of Pittsburg, made an interesting set of tests on such a thrust-bearing for a steam turbine, the pressure being varied by throttling the balancing-pipe to the dummy piston. The following are the particulars of this bearing:—

Outside diameter of collar, 4¾ in.

Inside diameter of collar, 2⅜ in.

Number of pivoted blocks. 10 in.

Total area of pivoted blocks, 10.4 sq. inches.

Revolutions per minute, 3,470.

Mean surface speed, 54 ft per second.

The blocks were steel faced with white metal, 1-16 in. thick, and were pivoted behind their center of area, and with all the blocks in use, 1,010 lb. per sq. in. was carried without heating. As this was the limit of force which could be applied, the number was first reduced to four blocks, and then to two, the corresponding pressures per sq. in. being respectively 2,620 lb. and 5,420 lb. per sq. in., which were carried without difficulty. The surface was then reduced to 1.9 sq. in., and the pressure rose to 5,910 lb. per sq. in. It was further reduced to 1.2 sq. in., with a pressure of 10,000 lb. per sq. in., but here the white metal flowed in all directions until the area was increased so that the pressure was reduced to 7,000 lb. per sq. in., but no heating occurred.

It is worth noting that the white metal flowed equally in all directions irrespective of the direction of rotation. It is thus seen that the limit of pressure with such a bearing is the flowing of the white metal and not the failure of the lubrication, and that with pressures of 500 lb. per sq. in. there is an enormous margin of safety; it is probable that three times this pressure will be found quite safe in practice.

CANADIAN MOTOR CARS IN AUSTRALIA.

IN some of the Australian provinces there is no government registration of motor cars, hence it has only been possible to ascertain the number of cars and the names of the manufacturers registered in Victoria, New South Wales and South Australia. The total number of cars in these territories together with the proportion of Canadian cars, down to recent dates, is shown thus:—

June 30, 1914—Total motor cars in Victoria, 8,339.

June 30, 1914—Total Canadian cars in Victoria, 1,350.

May 21, 1914—Total motor cars in New South Wales, 13,901.

May 21, 1914—Total Canadian cars in New South Wales, 2,065.

May 15, 1914—Total motor cars in South Australia, 4,512.

May 15, 1914—Total Canadian cars in South Australia, 1,029.

Aggregating the three provinces, 26,-752 cars were registered, of which 4,444 cars were of Canadian manufacture. Excellent direct representation, combined with the undoubted value of the leading lines of Canadian cars, is responsible for these encouraging results in face of competition in the Australian market of motor cars from all parts of the world.

Attracting Industries by Bonus or Concession

Staff Article.

Considerable rivalry exists in our towns and cities, large and small, in the matter of locating factories. Many and varied are the inducements offered prospective firms, bonus and concessions of some form or other being most common. Particular reference to these is here made.

THE policy adopted by municipalities of attracting new industries by means of concessions in some form or other is, on principle, questionable. If, however, the matter is looked upon from a purely business standpoint, then another view might be taken. It does not necessarily follow that if a policy is bad in principle that it is equally so in practice. It is to some extent a question of cause and effect—the reason why municipalities grant concessions and the effect produced on the community by so doing.

The basis of the whole question is really competition or, perhaps better still, rivalry. Take two towns equally advantageous as industrial centers; in the nature of things there is bound to be keen rivalry and, under present conditions it is only to be expected. Suppose a prospective industry comes along; the board of trade, backed by the town council at once get together and through their secretary or commissioner offer inducement or concessions in order to land the industry. The rival town also puts up an attractive proposition which usually brings both upon an equal basis again. The advantage, therefore, lies principally with the industry and partly with the town that gets it, although it might have located there anyway if neither town had offered extra attractions. It is reasonable to suppose, following the above argument that, all things being equal the towns would attract just as many industries without offering concessions as they would by doing so.

The system of granting concessions or a bonus is of comparatively recent origin, that is, since the country really began to make the industrial progress as we see it to-day. It is perhaps unfortunate that the system was ever introduced because it is extremely doubtful if it has done any real good in developing the trade of the Dominion. It is more than likely that the various industries now operating in Canada would be here just the same even if they had received no assistance. The representative of a concern, say in the United States, when looking for a suitable location for a Canadian branch, would not in the first case worry about free sites or cheap water, he would look for cheap power, a good railroad service, and accessibility to markets. If upon selecting a district, the industrial commissioner or board of trade secretary came along and offered further inducements, he would naturally accept them, but not locate because of the concessions. Apart from the concessions it is absolutely essential that a town should have an official ready to explain the attractive features of the district.

Bonus System.

The system of giving a bonus, which fortunately has almost disappeared, is not sound in principle and is open to abuse. More than one town regrets the day when it handed over a few thousand dollars to a third-rate concern, which only stayed in business long enough to collect the bonus and then died a natural death. Governments may be able to afford to nurse infant industries but municipalities should certainly not take such a responsibility even with a reputable firm for there is a danger of the bonus outweighing other and more important considerations; a condition which is at once detrimental to both industry and the community in which it is located. Firms of good standing do not look for a cash bonus, but rather for a location with natural advantages. A town that is a good distributing center, and that can offer cheap power and good transportation facilities does not have to give a bonus.

Bond Guarantees.

Another system sometimes adopted is for the municipality to guarantee the bonds of the prospective concern. This system, while not being in the same class as the above, is to some extent open to similar objections. It is obviously, however, a more business-like proposition that the proprietors of the company should take all the financial responsibility and it is certainly more conducive to good management and efficiency. There is a danger here for the management to think more about selling the bonds than the future of the business. There are exceptions, of course, but the above deals with the question from a general standpoint.

Concessions.

When considering the question of concessions, it should be borne in mind that from a manufacturing standpoint, industrial centers differ as regards natural advantages although in some cases they are often very similar. The method of dealing with prospective industries must naturally vary according to conditions. In actual practice, however, the majority of our cities are working along very similar lines. Assuming that it is necessary, owing to competition, for a city to offer concessions, care should be taken that too much is not given away. Where cheap power is available together with good transportation facilities, including of course, low freight rates, and accessibility to markets, then surely that is about as much as any company can reasonably expect. There are many industrial centers in Canada which can offer all the above inducements but on account of this civic rivalry, the board of trade, the authority usually in charge of such matters, comes along with concessions generally in the form of a free site, cheap water and either remissions of taxes or a low assessment for a term of years. Now the point is, does the city really benefit by the concessions or rather would it not get along just as well without giving these extra inducements? Would not the industry flourish just as well without the assistance of the concessions? Is not the bait really unnecessary? One would almost think that it was quite unnecessary, but here is where the rivalry comes in. If one town offers concessions so will the others.

The promoter of a high class company will naturally take all he can get without, of course, sacrificing any material advantages such as many localities offer, but in some cases the concessions do not cut much of a figure, the natural advantages being pre-eminent. In many cases everything counts and consequently there is much rivalry between our various municipalities. The fact that free sites and cheap water, etc., do not involve any considerable financial outlay on the part of the community and on the surface do not appear to amount to much, may lead the people into thinking that they are getting something for nothing, hence a large favorable majority when the by-law comes to be voted on. If the industry be of a substantial nature the gain to the city is considerably more than what the concessions represent, as it means, in many cases, a considerable increase in population and consequently so much more money locally distributed. In the case of small industries, the advantage is proportionately less.

Civic Rivalry.

It is a debatable point, whether civic rivalry as regards industries is advantageous to the community generally. If municipalities relied upon their natural advantages for development, would not more stable conditions result and would not the industries be as well off? It is more than probable that if no artificial means were employed, industries would naturally gravitate to the most suitable locations, which is not always the case under the present conditions. It would appear to be an advantage to the country if those localities which had legitimate attractions for industries should develop as industrial centers rather than have factories scattered about in districts where they have a struggle for an existence. It is better for industries generally to be more or less concentrated at several logical locations where they can help one another in many ways. There are exceptions, such as pulp and paper mills and industries doing, what might be called, purely a local business.

The system of granting concessions exists in practically all our industrial centers, except the larger cities whose natural advantages are such that further inducements are unnecessary. The time may come when the system will no longer be popular, for there are signs already that this may come to pass. Our industrial centers are not nearly as extravagant in their offerings as formerly, which is a good sign. Localities that really have the necessary facilities for manufacturers will surely develop, while those that have not and that have been boomed by some extravagant concessions will gradually find their legitimate level. This process of weeding out will result in our manufacturing centers developing on substantial lines and so benefit the country generally.

ENGINEERING AS A PROFESSION.

ANTHONY G. LYSTER, president of the Institution of Civil Engineers, and late engineer-in-chief to the Mersey Docks and Harbor Board, made some significant remarks on modern engineering prospects when distributing the certificates on its 125th celebration, to the Crystal Palace School of Engineering students, recently.

He said that after 44 years of wide and strenuous experience in the engineering world he hoped to be able to say something to the students that might be of help in their future careers. He could not help drawing a comparison between the opportunities afforded to him as a young man to learn engineering and those which students enjoyed to-day. In his days text books on engineering were practically unknown. Students had to pick things up the best way they could, and engineering was carried on by rule of thumb methods and a few cut and dried formulae. How different things were to-day, when students could obtain a sound scientific and practical grip from the very commencement of their studies.

While congratulating the school on its good results, he hoped students would continue to make the best of the fine opportunities they had there. They had to cultivate first of all a sense of observation, and a desire to find things out for themselves in a practical way. It was a common fallacy to believe that if a man dropped right away into a post at £1,000 a year he had all he wanted, for they had to go on moving and fighting for better things because it was new experience that was of the greatest value to engineers. The problems they had been studying were solved from a collection of data all ready for them, but they would find in the actual problems of practical engineers that they had to get their own data, and it was only real experience which helped them to get that. They had to diagnose and analyse, and never make the mistake of getting their opinions formed before they gathered the facts. People told them to-day that the engineering profession was very full, but he remembered just the same thing was said to him 4 years ago; it was not true, and they must not let such things dishearten them.

Difficulties of Employment.

It was a fact that as civilization was spreading throughout the world there was more difficulty for engineers to get work in this country. In fact, it was only those who were able to get to the top who could find decent jobs. In the colonies, in Egypt, and in India, from whence he had just returned, there was a vast field of enterprise all waiting for engineers to expand and do well in. Every day the world was adding to its information as to what was the best way of using the great forces of Nature, of which they knew so little at present. In the future it was the engineer who was going to be able to take advantage of that information and put it into practical effect.

In conclusion, Mr. Lyster made some remarks to the students on citizenship. They must never, he said, let their profession obliterate the fact that their first duty was to be good citizens. To-day they were face to face with a very serious situation in Europe, and they could see what it meant for every young man to take a part in the defence of his country. When he was completing his engineering education in Germany, the Franco-Prussian war was in progress, and he never saw such striking examples of the vast importance of being prepared. When he came home, he at once joined the Volunteers, and he hoped all young engineers to-day would join the Territorials.

CANADIAN STEEL OUTPUT.

MANUFACTURERS' statistics of the steel output of Canada are now available through the Statistical Bureau of the American Iron and Steel Institute, and these cover the production of steel ingots, castings, and all manner of finished rolled forms of iron and steel during 1913. The production of all kinds of steel ingots and castings in Canada in 1913 amounted to 1,042,503 gross tons, against 853,031 tons in 1912, an increase of 189,472 tons, or over 22.2 per cent.

Of the total in 1913, about 1,006,149 tons were ingots and about 36,354 tons were direct steel castings, against about 820,792 tons of ingots and about 32,239 tons of castings in 1912. The production of steel ingots and castings in 1913 was much the largest in the history of the Dominion. The growth in late years has been very rapid. Since 1908 the output has increased over 100 per cent. The total for 1913 includes about 1,852 tons of alloy-treated steel castings, against about 1,294 tons of similarly treated steel ingots and castings in 1912.

In 1913 there were sixteen plants in four provinces which made steel ingots or castings, as compared with fourteen plants in four provinces in 1912. The number of idle steel works in 1913 was four, as compared with three in 1912.

The production of Bessemer and steel ingots and castings in 1913 amounted to 273,391 tons, against 207,569 tons in 1912, an increase of 65,822 tons, or over 31.7 per cent., while the production of open-hearth steel ingots and castings in 1913 amounted to 768,663 tons, against 645,062 tons, or over 19.1 per cent. Almost all the Bessemer steel made in the two years was in the form of ingots.

Of the total production of open-hearth steel in 1913, 736,562 gross tons were ingots and 32,101 tons were castings, against 617,061 tons of ingots and 28,001 tons of castings in 1912. In both years, all the open-hearth ingots were made by the basic process, but the castings were made by both the acid and the basic processes. One plant made steel by the duplex process in 1912 and 1913.

The total production of steel ingots only in 1913, omitting direct steel castings, amounted to 1,006,149 tons, against 820,792 tons in 1912, an increase of 185,357 tons, or over 22.5 per cent. In 1913 there were six plants in two provinces which made steel ingots, against four in two provinces in 1912.

The total production of all kinds of steel castings in 1913, omitting steel ingots, amounted to 36,354 tons, against 32,239 tons in 1912, an increase of 4,115 tons. Of the total output in 1913 about 3,809 tons were made by the Bessemer process, against about 3,838 tons in 1912; about 32,101 tons were made by the open-hearth process, against about 28,001 tons in 1912; and about 444 tons were made by special processes, against about 400 tons in 1912.

In 1913 there were thirteen plants in four provinces which made steel castings, against twelve plants in four provinces in 1912.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

TURRET LATHE AND VERTICAL BORING MILL PRACTICE.—V.*

By Albert A. Dowd.

THE present forms the concluding article of a series on turret lathe and vertical boring mill practice, the setting and sequence of operations required in machining an automobile hub flange being featured.

Machining a Hub Flange on the Vertical Turret Lathe.

Fig. 9 shows a representative hub flange A, the method of holding and the layout of turret and side head tools. The work is held in special jaws B which are slightly tapered at C to conform to the draft on the casting. The flanged portion is supported at three points by the projection D on the jaws. A tool holder E of special length contains a high speed round nose tool F, the stem of the holder fitting the turret hole and being there provided with a pin driver as hereinbefore described. The boring bar J contains two tools, L and K, which are angularly set in the bar and possess backing-up screws M, by means of which the tools may be nicely adjusted for diameters. The square head set screws N hold the tools firmly in any desired position. The spacing of the two tools is such that the first tool L is entirely

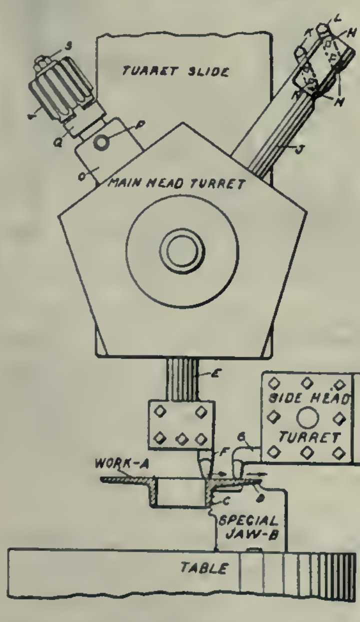


FIG. 9. MACHINING HUB FLANGE ON VERTICAL TURRET LATHE.

through the work before the second one K starts. The reamer T is of high speed steel and slips on to the tapered end of the arbor Q, being held in position by the nut S. The shank of the reamer floats in the holder O, which fits the turret hole and it is driven by the pin P. The two bent tools G and E in the side head turret are respectively roughing and finishing tools

Sequence of Operations.

First operation:—The tools shown in contact with the work in Fig. 9 are those

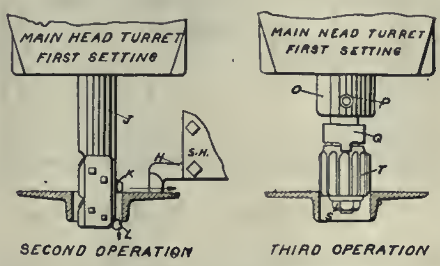


FIG. 10. MACHINING HUB FLANGE ON VERTICAL TURRET LATHE.

used in the first operation for rough facing the surface of the flange. In order to save time, the tool F is started on the inside of the flange at the same time that the tool G in the side head turret starts midway across the flange. Both main head turret and side head are fed outward at the same rate of speed, so that the time for facing the flange is cut approximately in two.

Second operation:—Fig. 10 shows the second operation, which consists of the rough and finish boring of the hole with the bar J in the main head turret. Prior to the starting of the bar the finishing tool H in the side head is started in the hole, and fed outwardly at a coarse feed. As soon as the heel of this tool has cleared the hole, the bar is started and the down feed is continued without interruption until the hole has been finish bored. It will be noted that by the use of this bar one indexing of the turret is saved.

Third operation:—The third and last operation on the piece is that of reaming the hole with the floating reamer T in the main head turret.

The tooling here given for the flange is extremely simple, but very rapid and effective.

MAKING SHEET METAL FLANGE CLAMPS.

By W. G.

THE tools herein described were used for producing aluminum clamping flanges in quantity for friction discs. It was at first decided to cast and machine them in the usual way on a capstan lathe, but, after some consideration, it was determined that the press would be the most economical and expeditious tool for the job. Upon this being settled, the necessary punches and dies were made as shown.

With reference to the accompanying drawings, Fig. 1 is a part sectional view of the cupping punch and die in working position. The piercing punch and die are shown in Fig. 2. Fig. 3 is a part sectional view of the flange trimming punch and die, and Fig. 4 shows elevation and plan respectively of the plate jig for drilling the bolt holes in the flanges. The cupping punch A (Fig. 1) is made from tool steel, and consists of a circular bar, having formed near its centre an enlarged shoulder or abutment collar A^1. The said collar has upon its lower face four shallow recesses, as shown, for the purpose of receiving the springs for operating the pressure plate. Part A^2 is the shank, which should be made of suitable diameter to fit the hole in the press ram. The opposite end A^3 is fitted with an elongated slot as shown, its object being to act in conjunction with the pin B^1 of the pressure plate B, thus making a stop for the plate when at its

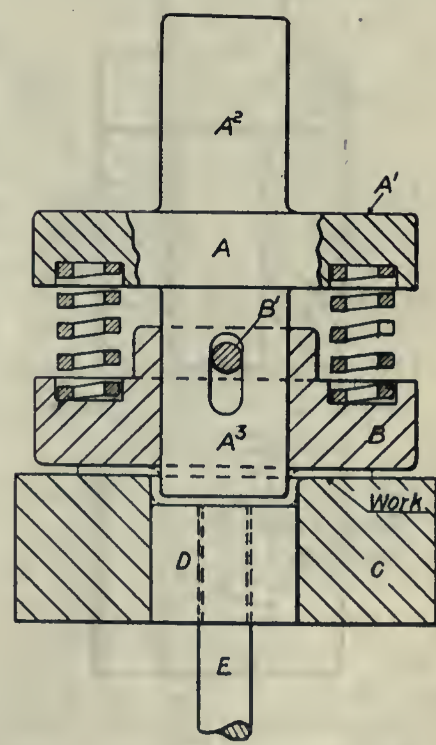


FIG. 1—FORMING PUNCH AND DIE.

bottom position.

Part C is the cupping die. This is made from tool steel, and consists of a circular blank, having a central hole of a diameter corresponding to that of the

*The former articles of this series appeared in our July 30, August 6-13 and 27 issues.

outside of the component. At D is shown the distance and ejector block. This should be made of good quality mild steel, surface hardened and ground. It is essential, however, that it should be a free sliding fit to the die hole, otherwise difficulty will be experienced when ejecting. The knockout rod E is screwed into the block, and is operated from below by the usual treadle gear.

The sequence of operations by the cupping tool is as follows:—The plain circular blank is placed on the face of the die C, and when the punch A descends, the pressure plate B being foremost, strikes the blank first, thus securing it to the die face. The punch continuing its downward movement, forces the central portion of the blank into the die until it reaches the face of the distance plug D. The punch and pressure plate now return clear of the die, leaving the component cupped and flanged, ready for removal by the upward motion of the distance plug.

The piercing tools, Fig. 2, consist of a tool steel punch F surrounded by a hard rubber stripper G. The die H is made from a circular bar of tool steel equal in diameter to the inside of the component; thus the die itself forms the

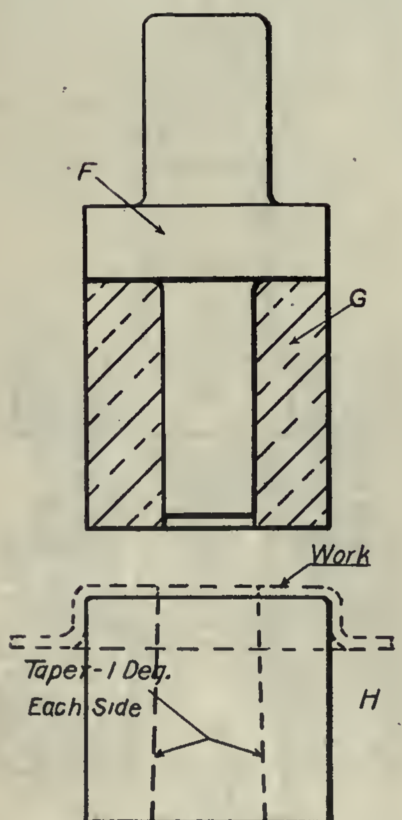


FIG. 2—PIERCING PUNCH WITH RUBBER STRIPPER.

necessary means of location. The trimming tools, Fig. 3, are of simple construction. The punch I is of the usual **blanking** type, and is provided with the pilot peg J. The trimming die K consists of a circular tool steel blank, having a central hole K' equal in diameter to the flange of the component. It is essential that the said hole should be

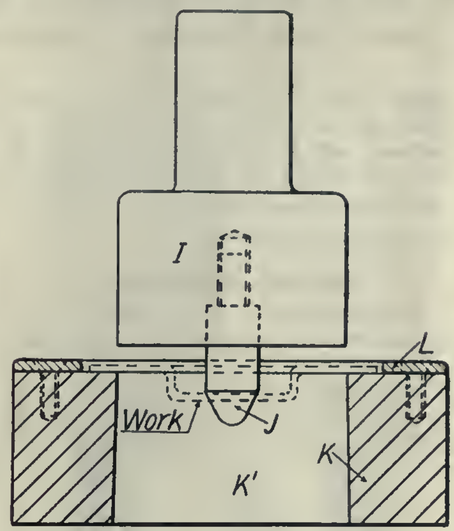


FIG. 3—TRIMMING PUNCH.

tapered in order to allow the work to pass through clear of the die, it having been found that a taper of 1 deg. on each side is ample for this purpose.

Part L is the locating ring, which is made of mild steel and secured to the die by screws, as shown. The hole in the ring should be somewhat larger than the irregular flange of the component, its object being only that of approximate location, the final accurate location being performed by the pilot peg J. The finishing operation (drilling screw holes in the flange) is carried out by means of the drill jig shown in Fig. 4. The jig body M consists of a mild steel disc, having bored through its centre a hole M', and for the purpose of locating the component, as shown, this hole must be a good sliding fit for the flanges. The projecting piece N is the clamping screw, which has a knurled head a little larger in diameter than the screw stem, the object of this being to prevent any undue leverage when clamping; otherwise it may have a tendency to badly mark or damage the work. The drill bushes O, P, Q and R are made from best cast steel, and are hardened and ground, care being taken to see that they are made a good driving fit to the corresponding holes in the jig body.

THE APPRENTICE QUESTION.

By R. Micks.

THE apprentice of to-day is the mechanic of to-morrow, and if he is not given the proper opportunity to acquire a knowledge of the different branches of the trade he has chosen to follow, we cannot look for a goodly number of first-class mechanics among those of the next generation. When a boy enters a foundry or any other manufacturing department to learn a trade, he should be encouraged and shown some consideration, for the work itself may sometimes be such as to daunt stout hearts and, if he be ambitious, he will soon amply repay one for the time and trouble expended.

In a large number of foundries which have come under the observation of the writer, the junior apprentice is little more than the moulder's little dog. Most of the rough, dirty work—and there is plenty of it—is turned over to him. This in itself is enough to discourage any boy, not to mention one of intelligence and self-respect, for he could learn to use a shovel quite thoroughly in a sewer at a much higher wage.

After an experience involving the raising of a great number of apprentices, the writer is in favor of giving each one a thorough training in all branches of the work, including core making, bench and floor moulding. As a result of mechanical changes in foundry methods, the good, all-round jobbing moulder is on the decrease; therefore, to fill all requirements his education should embrace cores, melting and other branches, as well as pounding sand.

The handy man is quite satisfactory on certain classes of routine work, but we must always have the experienced moulder on jobbing and intricate machinery castings if we would continue to produce good work. The chemist has done much for the technical end of the

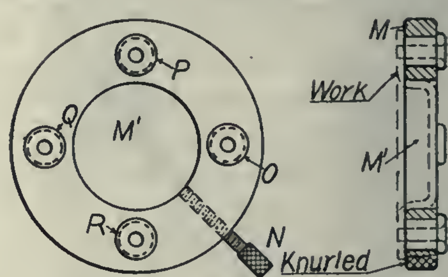


FIG. 4.—JIG FOR FLANGE HOLES.

foundry, but it remains for the foreman and superintendent to provide the good and thorough mechanics who are absolutely necessary. This is best accomplished by giving first consideration to the material, the diamond in the rough, the apprentice.

Pump Orders.—The Smart-Turner Machine Co., Hamilton, Ont., have recently closed the following orders for pumps:—The Cobalt Lake Mining Co., Cobalt, Ont., one centrifugal pump; the Deloro Mining & Reduction Co., Deloro, Ont., one centrifugal pump; the Canadian Porcelain Co., Hamilton, Ont., one centrifugal pump; the M. & M. A. Deans Co., Sprucedale, Ont., one duplex steam pump.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

With the further development of this course in arithmetic. it will be found by those who have followed the introductory lessons and profited by them that the various practical applications resulting from the succeeding lessons will be easily observed and their time and labor-saving features so appreciated as to be adopted at every available opportunity.

FEEDS.

It often happens that lateral and vertical movement is required when adjusting the position of parallel holes in machine frames when being operated on the boring machine, etc.

In the skeleton sketch chart 33, the line o-b equals the distance between the centers of the two holes; the line o-a the horizontal distance or lateral feed of the table, and the line a-b the vertical distance or elevation of the table. The formulae shown in the chart can be used for general cases. In chart 33, suppose the distance o-b was required to be the center distance of two gears of 72 and 24 teeth of 6 diametrical pitch or 8-in centers, the distance o-a=7.75 inches and the height x=12 inches, what will be the height (y), and the movement of the vertical and horizontal screws, if each division on the vertical adjustment moves the table .002 in. and each division on the horizontal adjustment moves the table .001 inch?

1.984 divisions or 19 turns and 84 divisions.

In chart 34 is shown a skeleton sketch of a machine where a head (not shown) is advanced by means of a nut on the screw (S), through a distance governed by the train of gears shown. The motion is intermittent; that is, the screw (S) is in motion while advancing the head and at rest while other operations are being performed. The screw (S) has a pitch of ½-inch. The pinions (PP) have 20 teeth, the gear (G) has 80 teeth. What number of teeth should gear (E) have to advance the head ⅝-in. for each revolution of the clutch (C); the bevel gears being of equal size?

The revolutions of the clutch (C) × the number of teeth in gear (E)=the number of teeth pinion (P) × the revolutions of screw (S), or

$$\text{Gear E} = \frac{\text{P} \times \text{rev. of S}}{\text{rev. of C.}}$$

For solution of above problem:

QUESTIONS AND ANSWERS FOR MECHANICS.

Question.—A milling machine man receives a gear blank 14 inches in diameter, with orders to cut it 3-pitch. How many teeth should he set his dividing head to space?

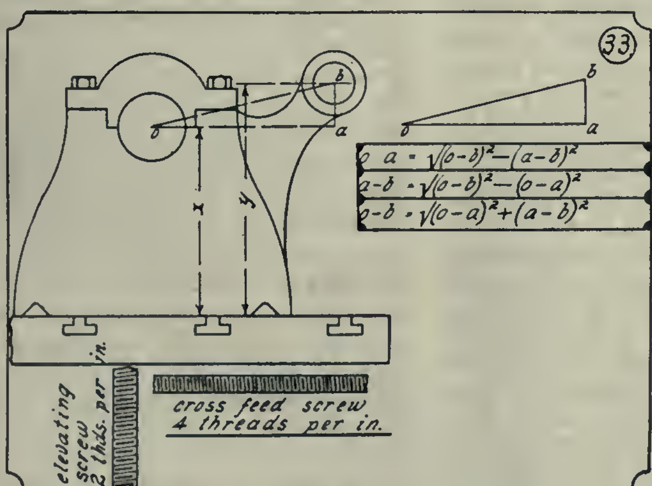
Answer.—From the previous rule to find the outside diameter, which is, add 2 to the number of teeth and divide by the pitch. For the number of teeth, multiply the diameter by the pitch and subtract 2, or number of teeth=(14×3)—2=42—2=40 teeth.

* * *

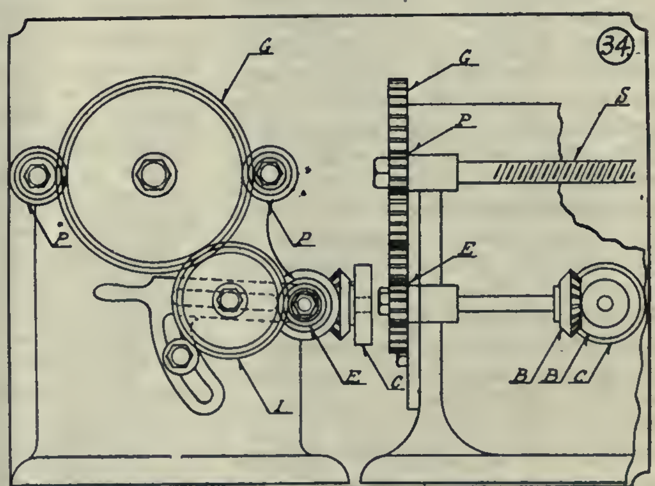
Question.—The pitch diameter of a gear is 18 inches, what should be its outside diameter if it be 2-pitch?

Answer.—$\text{Addendum} = \frac{1}{\text{pitch}} = \frac{1}{2}$ inch

Outside diameter = pitch diameter + twice the addendum or outside diameter of gear
$= 18 + \frac{1}{2} \times 2 = 18 + 1 = 19$ inches.



ARITHMETIC CHART 33.



ARITHMETIC CHART 34.

The divisions on each disc being 100, center distance or o-b=8 in., and horizontal distance or o-a=7.75 in.

By formula

$a\text{-}b = \sqrt{(o\text{-}b)^2 - (o\text{-}a)^2} = \sqrt{8^2 - 7.75^2} = \sqrt{64 - 60.0625} = \sqrt{3.9375} = 1.984$ inches.

Then $y = 12 + 1.984 = 13.984$ inches.

By formula, chart 32, for lateral feed:

$$M = \frac{N \times G \times d}{P} \times E = \frac{4 \times 5 \times 100}{2} \times 7.75 =$$

7,750 divisions or 77 turns and 50 divisions.

For vertical feed

$$M = \frac{N \times G \times d}{P} \times E = \frac{2 \times 5 \times 100}{1} \times 1.984 =$$

$$\text{rev. of S} = \frac{5}{8} \div \frac{1}{2} \text{ or } \frac{5}{8} \times \frac{2}{1} = \frac{5}{4}.$$

$$\text{Then gear E} = \frac{20 \times 5\text{-}4}{1} = 20 \times \frac{5}{4} = 25$$

teeth.

What gear would be required to advance the head in the previous example through a distance of 1⅛ in. for every revolution of the clutch (C)?

$$\text{Gear E} = \frac{20 \times (1\frac{1}{8} \div \frac{1}{2})}{1} =$$

$$\frac{20}{1} \times \frac{9}{8} \times \frac{2}{1} = 45 \text{ teeth.}$$

Question.—If the pinion which gives the traverse motion to a lathe carriage have 16 teeth of 10-pitch, supposing it to be geared 2 to 1 with the handle, how far would the carriage move for each turn of the handle?

Answer.—Diametral pitch = 10, therefore $\text{circular pitch} = \frac{3.1416}{10} = .31416$ inch.

For every turn of the handle the pinion makes half a turn, therefore total distance covered by carriage is $.31416 \times \frac{16}{2}$
$= 2.51328$ inches.

SAFETY IN TUMBLING MILL OPERATION.

IN cleaning rough castings by the use of dry tumbling mills or tumbling barrels, large quantities of dust are created as the castings tumble about and rub against each other. This dust must be properly taken care of so that it may not produce an injurious effect upon the health of employes working about these machines. In addition, tumbling mills must be provided with appropriate safeguards to overcome mechanical dangers incident to operation and use. The physical condition of the foundry and the construction of the tumbling mills themselves will largely determine how best to solve the dust problem. One of two methods will however, be found applicable to all cases:—a suitable exhaust system may be employed to carry off the dust, or each machine may be enclosed in a separate dust-proof compartment.

The use of an exhaust system is most desirable, as it carries the dust away from the machine to a place outside of the building; exhaust systems, however, can be installed only upon mills which have been expressly built for exhaust connection.

Dust Proof Compartments.

If the machines are of the non-exhaust type, the dust danger can be averted by providing dust-proof compartments in which the mills can be entirely enclosed while in operation. When the mill is located away from partitions or walls, or where a high compartment would interfere with proper lighting of the workshop or consume head-room valuable for other purposes, these compartments are built only high enough to accommodate the machine; otherwise they are usually built against existing walls or partitions and right up to the ceiling, thereby increasing air space within the compartment and facilitating the settling of dust.

For small compartments, the doors may be arranged to fold upward and lie upon the top of the compartment when the mill is at rest. For most machines, however, the size and weight of the doors will require that they be suspended on rolling door-hangers to slide horizontally if there is ample side room, or to slide upward if side space is limited. Steel rolling shutters are sometimes used instead of rising doors. The whole compartment should be tightly built of well-seasoned lumber to prevent excessive shrinkage and warpage, and the doors should be well fitted to insure fairly tight joints and ease of operation. Rising doors, to avoid falling upon workmen, must be carefully counterweighted, or provided with a suitable automatic latch, or both.

Guarding Against Mechanical Hazards.

While, obviously, there is no dust problem in the operation of wet tumbling mills, the mechanical hazards of both wet and dry mills must be guarded against alike, unless the mills are enclosed in dust-proof compartments during their operation, in which case only external belts or driving chains may need to be covered by appropriate guards. When not enclosed, tumbling mills present mechanical hazards which may lead to serious consequences. The corners of square box tumblers, or protruding fastenings or flanges on round or stave type mills, or even nails, slivers or core-rods which may work through perforated or loosely fitting cover plates, are apt to strike the workman or catch in his clothing. Exposed gears, belts and driving chains are additional potential sources of accidental injury. With a comparatively small expenditure, however, all of these dangers may be effectually safeguarded.

Although the workman's personal caution and watchfulness is always his own most effective protection, the mill itself should nevertheless be so guarded that the workman may not easily come into contact with it while it is running. Suitable guard rails or fences, made of pipe, heavy wire screen or wood erected at the exposed sides of tumbling machines and provided with a rising screen gate in front, will prevent contact of workmen with the machine when it is in motion. When rising gates may not be practicable, suitable doors may be arranged to slide horizontally, or removable wire screen guards fitting into pipe-rail sockets, may be used.

An automatic connection between the gate and the operating lever of the machine, whereby the opening of the gate will stop the machine, or the starting of the machine will close the gate, will render the machine inoperative when workmen are engaged in loading or unloading the barrel, and will keep workmen at a safe distance when the machine is running. In any event, whether controlled by gates or otherwise, such levers should be of the positive locking type, to prevent the levers from creeping over and starting the machine prematurely.

Accident Data.

Observation and study of accident reports show that workmen's fingers and knuckles are often injured when they remove or replace tumbling mill covers by hand, and many foot injuries are traceable to the falling of such covers upon workmen's feet. A light chain hoist suspended from a short trolley track above the machine and equipped with hooks to fit the cover handles, will tend to prevent such accidents and at the same time facilitate the work. The hoist may also be used to load and unload heavy castings in and out of the mill.

To prevent accidents caused by slight movement of the mill while it is being loaded or unloaded, a suitable locking device or brake should positively lock the barrel in position; each foundry foreman can devise an effective brake to suit the conditions peculiar to his own equipment. The usual method of propping the barrel in place with a bar is not reliable, as it is apt to be kicked or jarred out of place. Finally, foremen and workmen should see that clear passageways are maintained in front of and leading to tumbling mills.

In the nature of their construction and operation, tumbling mills present problems of safety and sanitation which require some thought for their solution, yet proper attention to the matter will develop effectual guards against the inherent dangers of tumbling mill operation, and at the same time the cleaning room can be made a reasonably clean and attractive workshop.—N.F.A. Bulletin.

New Vibratory Testing Machine.—A description of a new vibratory testing machine formed the subject of a paper before the recent annual convention of the American Society for Testing Materials. For a number of years several of the large railways have included a vibratory test requirement in their specification for stay-bolt iron and other large consumers, while not actually purchasing iron under such a requirement, have given the property to resist vibratory forces marked consideration in placing their contracts. A study of the machines and methods of testing by the Committee on Stay-bolt and Engine-bolt Iron of the Testing Materials Society indicated that the erratic results frequently obtained from specimens cut from the same bar and tested on the same machine, were due to the fact that the specimens, although apparently perfectly rigid in all cases, were held with different degrees of rigidity; furthermore, the root of the thread of bolts differed to such an extent in sharpness and smoothness as to exert a pronounced influence upon the number of vibrations the specimen would withstand. It was with a view of securing a machine that would overcome these difficulties and which would also permit making such tests rapidly with a high degree of accuracy, that the machine described was developed.

Welding Processes and Their Development*

Staff Article

A brief sketch is here given of the means and methods employed in the manufacture of mechanical apparatus, whereby a more or less permanent, uniform and sufficiently reliable attachment for a specific purpose has been attainable between two metals. The more recent developments in oxy-acetylene welding are especially featured.

FROM prehistoric times down to the present the art of welding has been employed, yet until the middle of the nineteenth century very little study had been given or research employed to this particular branch of the metal industry. During the last decade the adoption of sheet metal has become very marked, and the use of metals generally has become so extensive that their present field is almost unlimited. Thus, as this industry became enlarged, the methods of metal production improved along nearly all lines. Right to the mines the campaign of efficiency was pushed. Mining machinery was more largely pressed into service, and processes became simpler. Still, through all these marvellous improvements, the process of welding improved but little. Again, the popular idea has been that welding could only be applied to the process of joining pieces of iron and steel. Scientific research, however, conducted by eminent engineers in Europe has not only made the oxy-acetylene process of autogenous welding commercially practicable, but has enlarged the field tremendously, because it has now been practically demonstrated that numerous metals can be successfully treated under the autogenous welding principles.

Soft Soldering.

In order to appreciate thoroughly the fundamentals of autogenous welding, it is useful to briefly look into the other methods of obtaining permanent metallic joints. Soft soldering is generally used for joining pieces of thin metal together. It does not, however, make a strong joint, being used where the prime consideration is an air or water-tight connection. As its name indicates, the **soft solder** used has a much lower strength than that of the metals to be joined; thus, to increase the strength of the joint, the surface of contact must be increased so that firmness is obtained by adhesion. The melting point of the solder must necessarily be lower than that of the metals to be joined. The joint, therefore, cannot withstand any great amount of heat, neither can it undergo any serious strain. To overcome the latter, the process of grooving has been adopted. This consists in grooving the edges from 1/4 inch to 3/8 inch, adjusting them so that they clasp one another and closing with a hammer or machine. Soldering the joint concludes the operation.

A flux is always necessary to clean the joint and to prevent the forming or bring about the removal of any oxide that materializes during the process of soldering.

Riveting.

Another common method of making a metallic joint is that of riveting. This applies to thicker plates than those to which soldering can be applied. Riveting will, we believe, be used very widely for a long time to come. It offers a resistance which depends either on the adhesion of the overlapping plates or upon the rivets themselves, which act as a link. A good adhesion is not obtained unless the rivets are heated. The strength of a riveted joint depends upon the nature of joint—that is, whether it be a **butt** or a **lap** joint, and whether it is single, double, or treble riveted.

Brazing.

A further method of making a metallic joint is that of brazing. This can be readily called **hard soldering** It is characterized by the use of a metallic cement melting at a high temperature and possessing a high mechanical resistance. It is necessary to heat the edges to be joined to a very high temperature, and to use a cleaning flux, which also requires a high temperature to melt it. Brazing is an operation which calls for more or less skill, because of the high temperatures involved. A forge or blow pipe is necessary to the operation. The use of the forge is rather costly, and not very convenient; while the blow pipe requires great skill in manipulation, because the localization of the heat tends to burn the metal, especially in the case of brass.

Welding at the Forge.

Next we come to welding at the forge. This method, as before noted, is only applied to iron and steel. The joint is obtained by energetic hammering of two pieces together, which have previously been raised to the welding heat. The great difficulty here is in the exact appreciation at a glance of the welding temperature. The success of the fire weld depends on the exact external observation of temperature and the state of the surfaces to the united, because all interposition of slag or oxide hinder complete welding.

Electric Welding.

Another method that has been used extensively for over thirty years is that of electric welding. In many departments of work this application has become very useful indeed. It is generally confined, however, to special industries, such as the manufacture of thin plate utensils, chains, etc.

Other methods used are the thermit process and various forms of blow pipe welding. The blow pipe processes embrace the oxy-hydrogen and oxy-acetylene methods.

Meaning of Autogenous Welding.

Before going further, perhaps it will be best to explain the meaning of autogenous welding. It is a weld that is accomplished without the interposition of a metallic cement whose properties differ from that of the metals joined. Nearly all the processes mentioned here have their own limited field of usefulness, or else possess some great drawback. The oxy-acetylene process perhaps possesses the most general field of application. This process, however, has only become commercially practicable since methods have been discovered by which oxygen can be manufactured in large quantities and cheaply. It is interesting to note that oxygen is of all bodies the most widely distributed in nature. It exists in a state of mixture in the air, one-fifth of the volume of the latter being oxygen. Water is a chemical compound of oxygen and hydrogen, about one-third by volume being credited to the former. Thus, vast natural supplies of oxygen have been provided by nature.

The most widely known characteristic of oxygen is its property as a combustion agent. In oxy-acetylene welding the acetylene is burned in conjunction with pure oxygen. Acetylene is a highly inflammable gas even in ordinary air, thus when it is mixed with oxygen in the blow-pipe and ignited the combustion occurs in a most vigorous manner, and the heat generated is most intense. It will be seen, therefore, what a direct bearing the economical manufacture of oxygen in commercial quantities has had upon the oxy-acetylene business.

Obtaining Oxygen.

From water, oxygen has been obtained commercially by a process known as electrolysis. This process, described briefly, is the passing of an electric current through the water, breaking it up into its elements, hydrogen and oxygen. These gases are collected in separate vessels, oxygen rising from the negative pole and hydrogen from the positive pole. Another method of obtaining oxy-

* The First of a series.

gen from Nature's great storehouse is by the manufacture of liquid air. The air is taken from the atmosphere and then compressed. It is then cooled to a low temperature and allowed to expand; thus a very low temperature is obtained which causes the air to become liquid. The nitrogen and oxygen of the air seem to become liquid simultaneously, but the first jet of liquid air is rich in oxygen and the nitrogen is removed little by little by a process of rectification. By the fractional distillation of liquid air the oxygen has also been obtained. The oxygen thus manufactured is compressed to about 150 atmospheres and stored in small steel tanks holding about 125 cu. ft. of air. These small tanks are the form in which the oxygen is marketed commercially.

Acetylene.

Acetylene, the other gas used in the process, is a compound of hydrogen and carbon. This gas is obtained from calcium carbide. When water comes in contact with calcium carbide, acetylene is given off and a white residue of the lime remains. Carbide of calcium is made in large quantities by fusing a mixture of lime with either coke or anthracite in an electric furnace. However, to return to acetylene, it is obtained from generators in which the calcium carbide is treated with water. Under ordinary conditions, acetylene cannot be compressed, because under pressure it becomes a dangerous explosive. It is, however, extremely soluble in a liquid known as acetone. When dissolved in this liquid it is not explosive under pressure.

The most general method of storing acetylene is by the following method. Cylinders are filled with a porous material which is saturated with acetone, and the gas is compressed into these cylinders up to pressures as high as 250 pounds with absolute safety. Cylinders containing acetylene are made in various sizes and are on sale almost everywhere. However, in most oxy-acetylene welding outfit a generator is employed. High pressure generators deliver the gas at a pressure up to 15 pounds, while low-pressure generators deliver it at a pressure from 3 to 5 pounds. The oxygen is also used under pressure, and this secures a sufficient velocity at the outlet of the blow-pipe, which is essential to prevent back-firing. Various forms of blow-pipes have been designed, and are at present on the market. There are many which have good points and there are again a number from which results would only be fair.

The Practical Side.

With this more or less technical description of the theoretical side of the welding science, we arrive at the practical side. It must, however, be understood that to get good results from oxy-acetylene welding, and to be able to always get these results, the welder must combine a thorough knowledge of the scientific and theoretical side as well as an excellent practical knowledge of the art. The greatest trouble lies in the fact that it looks so easy. A beginner with a few days' practice, and sometimes after a few hours' practice, can make really good looking welds, yet only by close attention to the theoretical as well as the practical side, can one expect to become really expert.

The Expansion Feature.

The pieces to be welded should always be clean and should be placed in position rigidly so that they cannot move during the welding process. However, they should not be so secure that the expansion caused by the heat from the blowpipe is resisted. The factor of expansion should always be closely considered, and where the internal strains set up by the local application of the heat will tend to do serious injury to the casting to be welded, means should be taken to counteract and overcome same. Various methods have been devised to eliminate these strains, such as the heating to a high temperature of the whole piece, a part only of which is to be welded.

Weld Strength.

Some of the factors entering into the welding process which tend to lessen the strength of the weld should be studied and thoroughly understood by the operator of the torch. The largest field of application of this science is naturally that of iron and steel. It is a well-known fact that steel varies but slightly from iron in its chemical composition, and various properties can be added to or taken from, steel by heat treatment. The introduction or removal of very small quantities of carbon create great changes in the physical properties of steel, while the interpostion of a small amount of oxide which is readily formed at high temperatures, causes the bond to be weakened more or less. These conditions have to be studied closely and thoroughly understood. By so doing, the bad effects can be overcome and the weld be made autogenous. Furthermore, a great deal of care must be taken in choosing the welding rod. For iron and mild steels, the rod should be of soft iron and as far as possible Swedish iron of the first quality.

The problems which face the welder are not really as serious as they would seem, because the causes and methods of overcoming them have been carefully investigated and very simple antidotes have been discovered. Thus the process is destined to become one of the greatest importance.

U. S. PIG IRON OUTPUT.

MANUFACTURERS' statistics of the pig iron output of the United States for the half year ending June 30, 1914, have recently become available.

The production of all kinds of pig iron in the United States in the first half of 1914 amounted to 12,536,094 gross tons, against 14,477,550 tons in the last half of 1913, a decrease of 1,941,456 tons, or over 13.4 per cent. In the first half of 1913 the output was 16,488,602 tons. Comparing the output in the first half of 1914 with the output in the first half of 1913, there shows a decrease of 3,952,508 tons, or over 23.9 per cent. A few thousand tons of ferro-phosphorus, ferro-titanium, ferro-vanadium and other ferro-alloys are included for each of the half years.

The maximum production of pig iron in any two half-yearly periods was reached in the 12 months from July 1, 1912, to June 30, 1913, when the output amounted to 32,143,265 tons. The next largest output was in the 12 months of 1913, when 30,966,152 tons were made.

On June 30, 1914, there were three furnaces in course of erection and 13 were being rebuilt. Of the furnaces building, one was in Pennsylvania and two were in Minnesota. When completed, all will use coke for fuel. They will have a total annual capacity of 505,000 gross tons of pig iron. No new furnaces were built during the first half of 1914, but on June 30 a number of stacks were projected.

During the first half of 1914 there were five blast furnaces abandoned or dismantled, with a total annual capacity of 200,500 gross tons, as follows:—New Jersey, one, with an annual capacity of 60,000 tons; Pennsylvania, two, with an annual capacity of 120,000 tons; Virginia, one, with an annual capacity of 2,500 tons, and Michigan, one, with an annual capacity of 18,000 tons. Some of these furnaces had been idle for years.

Testing Crank Axles for Defects.—Kerosene is used in many European railroad shops for testing crank axles of locomotives, the process being extremely simple. Upon an engine being put into the shop for general repairs, the crank axles are thoroughly cleaned from grease and oil and given a bath of kerosene, after which they are wiped dry with clean waste or rags. Two pairs of wheels are then placed some little distance apart on a track, and rolled toward each other at moderate speed. The shock experienced when they come together forces out small particles of kerosene which may be secreted in minute cracks formed by crystallization or otherwise. Inspection after the impact

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

DUPLEX CONTROL HORIZONTAL BORER, DRILLER AND MILLER.

PRIOR to 1850 the boring of small holes was done under the drill press, or in the lathe when great accuracy was required. For work that could be handled on either of these machines, the usual method was to employ the portable boring bar with a traveling head and star feed. All of these methods were more or less slow and cumbersome. In 1854, Bement brought out a horizontal borer with spindle at a fixed height and a vertically adjustable work table. On account of great adaptability, together with the convenience of being able to operate it from either side, this machine has continued in popularity to the present day. In 1875, the Bement Co. made another advance in boring machine design by building a new type of horizontal borer. This machine had a stationary post with a vertically adjustable saddle, the table being at a fixed height and provided with cross and longitudinal traverse. An adjustable outer bearing was furnished for support of the boring bar. Since that time a large number of machines of this type and similar in design have been placed on the market. The serious defect of being controlled from one side only is generally apparent.

Realizing the importance of duplex control on machines of this class, the Niles-Bement-Pond Co. is now manufacturing the improved horizontal borer, driller and miller illustrated herewith. This machine is of the elevating spindle type, but is symmetrical throughout with respect to the spindle axis, permitting the operator to stand on either side and have all the controlling levers within convenient reach. It is adapted for work requiring great accuracy and at the same time is designed for heavy boring. Service and durability are prominent features, the entire design being free from delicate parts.

Perhaps the most striking feature of the design is the location of the spindle saddle within the post. This makes possible the symmetrical construction about the spindle axis which has been carried throughout the design of spindle post, bed, tables and control—an arrangement very essential on a large part of boring work. This design also affords most rigid support for the spindle. The thrust is taken on two tracks, one on either side of spindle, eliminating entirely the possibility of distorting strains.

The spindle is of the best quality high carbon, hammered steel, and is lapp-ground with great care. It slides in a long sleeve, which revolves in removable bearings, the main bearing being tapered so that adjustment can be made for wear. The spindle is driven through two large spline keys set into the sleeve and engaging with keyways in the spindle. It is fed and rapidly traversed by means of a screw in the saddle horn.

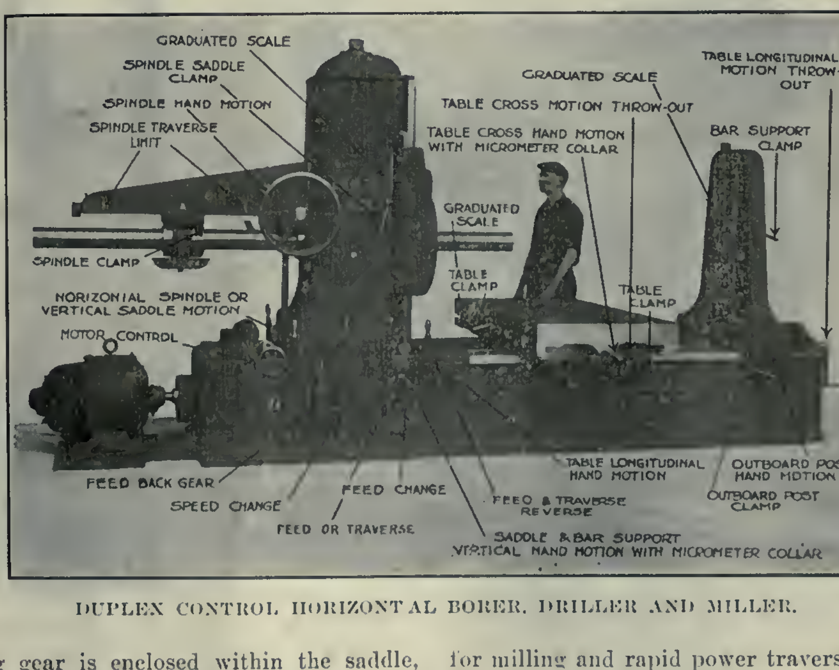
The front portion of the spindle has long bearings on **V** tracks planed on the faces of the column. The **V** bearings form the best possible method of preserving spindle alignment when the saddle is clamped for boring or sliding vertically for milling. Furthermore, with this construction, the hard back pressure due to boring adds to the truth of alignment instead of distorting the whole post structure. The saddle has vertical power feed for milling and also rapid power traverse. This motion is transmitted through a vertical screw, which is connected by gearing to a similar screw in the outboard post, so that the spindle saddle and outer bearing always move in unison. The spindle driving gear is enclosed within the saddle, with a portion extending outward and exposed for use as a face plate.

The spindle column is of box form, open through the centre, but connected at the bottom in one continuous casting. The column is held at the top by a cap tongued and grooved to it, the whole design making a very rigid structure. It is strengthened inside by ribs located in the best possible manner for resisting backward and torsional strains.

The saddle traverse has **V** tracks planed on the front of the column. The tracks have unequal sides; the faces toward the outside of the column are broad for presenting a liberal bearing surface for the saddle, while the faces toward the inside are at approximately right angles to the others for resisting side thrusts.

The outboard column is made in two parts. The lower portion is adjustable along the bed, and is gibbed thereto; while the upper part is bolted and doweled to the lower, so that it may be removed for long pieces of work and easily replaced in correct alignment. Provision is made for disconnecting the vertical lifting screw from the balance of the mechanism in order to avoid dismantling any of the gearing when the post is removed.

The table has a very large working surface with tee-slots for holding work. It is gibbed to a saddle with square locks having adjustment for wear. The table is provided with power cross feeds for milling and rapid power traverse for quick adjustment. It slides on a broad saddle long enough for support at the extreme position of its travel. The table saddle is adjustable along the bed by hand or by power through a screw running through the centre between the tracks of the bed. It is gibbed to the bed with square locks having adjustment for wear.



DUPLEX CONTROL HORIZONTAL BORER, DRILLER AND MILLER.

Power feeds are provided as follows: Horizontal feed of the spindle, suitable for boring and drilling; vertical feed of the spindle saddle and cross feed of the table for milling. In addition, automatic feed may be provided for circular motion of standard table, or in connection with a round table, if ordered. Feed screws are accurately cut and of large diameter. All feeds are reversible, and can be varied through the entire range for each spindle speed. The feeds are not affected in amount per revolution, as the spindle speed is changed.

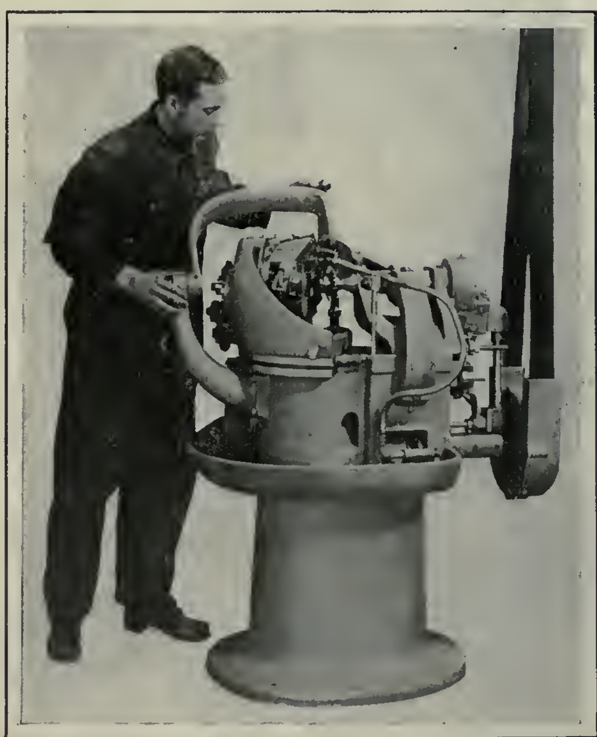
The bed is a cored-out box casting, unusually wide at the top, presenting a liberal surface for table saddle bearing. It has broad flanges inside with frequent support, and is braced inside with frequent cross ribs. It is entirely closed at the top to prevent chips from falling inside. Within are the driving, feed and traverse gears. The driving gears run in an oil bath and the feed and traverse gears are lubricated by the splash system. The gearing is readily accessible for examination by removal of large cover plates on both sides of bed. The bed has been designed to give maximum strength and rigidity so that the machine can be placed where no special foundation is available. If ordered, a facing head will be furnished, which may be either attached to face plate gear or fastened on the boring bar. It is provided with automatic radial feeds by adjustable fingers and star. Also, if required, an additional work support can be supplied, consisting of a comparatively narrow casting, which extends across the bed and has adjustment on same. It is of the same height as the regular work table, and has a tee slot in the top surface for clamping.

The drive is preferably by direct current variable speed motor of three to one range. The machine may also, however, be furnished with the following drives:—Cone and counter, single pulley through speed box, multi-speed alternating current motor, and constant speed alternating current through speed box. Inasmuch as the single pulley and constant speed a.c. motor drives require additional gearing, one of the other methods is recommended.

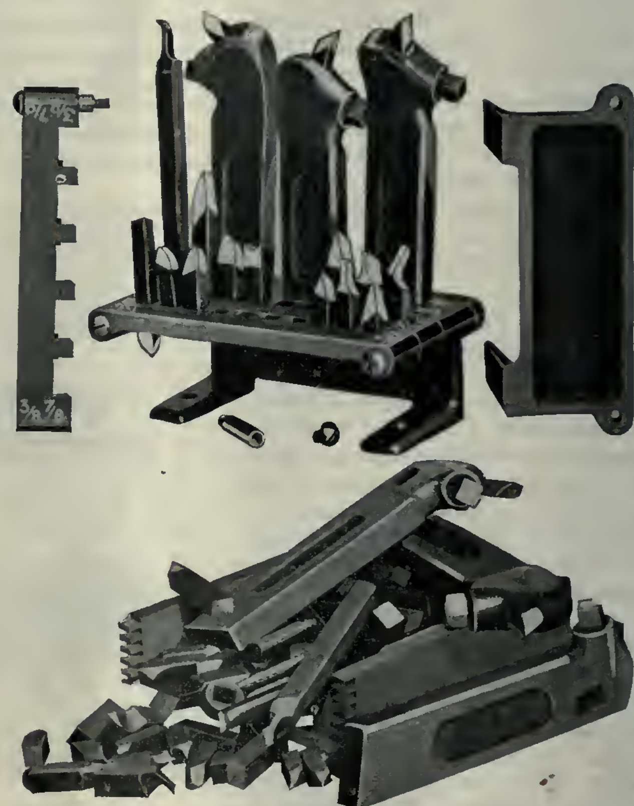
SMALL BEVEL GEAR GENERATING MACHINE.

A SMALL size generating bevel gear planing machine has been developed by the Gleason Works, Rochester, N.Y. It follows generally the construction of the builder's line of two-tool gear generating machines, but is intended for making smaller bevel gears of the finest pitches. It is mounted on a pedestal integral with an oil pan, and there are a number of new features incorporated to facilitate rapid changing of the work. The machine will handle any bevel gear having a cone distance of not less than 2⅛ in. and a ¾-in. face. The largest pitch recommended is 8 diametral, and the smallest for which the tools are forms a part of the regular equipment. made as standard is 32. It is possible to cut smaller pitches, but the extent to which this can be done is limited by the fact that the tool must have sufficient thickness at the point to stand up to the cut.

A rack and pinion with a lever and a micrometer stop is supplied for shifting the head to any desired distance from the cone centre of the machine. When the distance from the apex of the gear to the back of the hub is known, it is simply necessary to set the micrometer stop to this distance, and then bring the head up to the stop, the locking being accomplished by a single lever. The use of tool gauges is simplified considerably by a limit gauge which is 0.005 in. over and under the desired length, with a separate gauge for the pressure angle. The machine will generate a tooth in 4 sec. as a minimum and 40 sec. as a maximum. The extremes of tool speed are 400 and 120 stroke per min., and a slip gear arrangement is provided for throwing the tools out of gear while making changes.



SMALL BEVEL GEAR GENERATING MACHINE.



SECTIONAL TOOL RACK AND MIXED-UP CONDITION OF TOOLS.

The indexing mechanism, which is positive in action, runs in an oil bath, as does the feed mechanism. Square gibs are used for all of the wearing surfaces and the shaft bearings have bronze linings. The net weight of the machine is 1,250 lbs. and a floor space of 32 x 44 in. is required. An oil pump for flooding the work while the cut is being taken

SECTIONAL TOOL RACK

THE purpose of the rack to which our illustration and description refer is to furnish the means for keeping the tools shown in a systematic manner, a great many holders and a great deal of expensive steel and time being lost looking for these tools, for the reason that there is generally no way provided to take care of them when not in use.

The rack is made sectional, all sections being interchangeable, this feature making it possible to assemble racks to hold tools for different size or sizes of holders or steel. Each section is made to hold tools of only one size, and it is so constructed that no other size can be put into it, because a smaller tool will fall through, and a section will not hold a tool that is too large. For this reason tools are automatically assorted as to their size; being put in the rack with the cutting ends up, so that it can be seen at a glance whether a tool of the size wanted is ground to the shape required.

The racks are designed so they can stand on tool boards, be fastened to side walls, posts, or any convenient place on the machines to be equipped with them.

C. H. Driver, Racine, Wis., is putting these tool racks on the market, and we understand his success has been such as to warrant his equipping an extensive plant to meet the demand that has accrued.

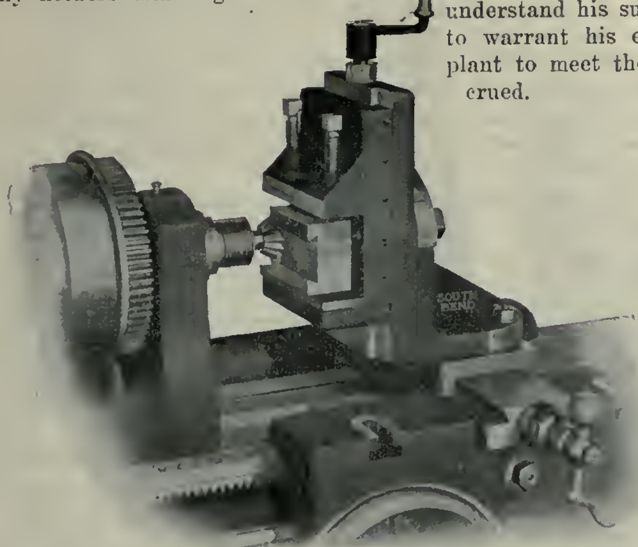


FIG. 1. ATTACHMENT FITTED TO LATHE.

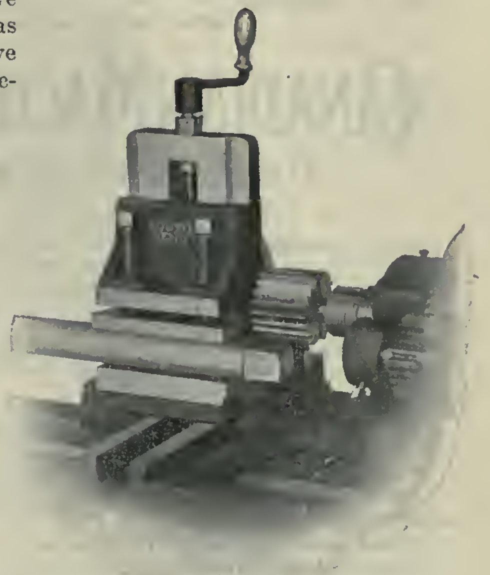


FIG. 3. SQUARING A STEEL SHAFT.

MILLING AND KEYWAY CUTTING ATTACHMENT.

THE milling and keyway cutting attachment described and illustrated on this page is a product of the South Bend Machine Tool Co., South Bend, Ind.; the decision to market it being the result of proven handiness and utility on lathes so equipped in their own shop. It enables a great deal of work to be performed on the lathe that otherwise would call for the use of a shaper or milling machine. The four illustrations shown represent what is known as the No. 3 attachment, as used on four different jobs. It fits on top of compound rest base, being located by a centre pin on base, fastened with two bolts and adjusted exactly like the compound rest.

The depth of cut is controlled by the feed of the carriage, the length by the cross feed screw, and the graduated screw at the top takes care of the vertical motion. The attachment swivels all the way around like the compound rest and is graduated in degrees. In addition, it swivels on the upright angle plate 180 degrees and is graduated. There is a graduated collar on the vertical screw, reading in one-thousandths of an inch. The attachment, although designed primarily for South Bend lathes, can be fitted by a mechanic to lathes of other makes which are equipped with compound rest. The regular equipment consists of milling attachment, two steel V blocks, one crank handle, one double end wrench, and two bolts and nuts for attaching.

FIG. 2. MILLING A KEYWAY.

Fig. 1 shows the milling and keyway cutting attachment No. 3 fitted to a No. 34-13 ins. South Bend lathe.

Fig. 2—View from back of lathe showing a ⅜ ins. keyway being milled in a 2-inch shaft. When shafts are taper where the keyway is to be milled, the vertical is simply swivelled to the desired angle.

Fig. 3 shows a steel shaft being squared by milling. The shaft is held in the vise with V blocks, and can also be milled square by turning the attachment at right angles and feeding the shaft under the face of the cutter, or by feeding the shaft across the end of the cutter.

Fig. 4 shows the milling attachment holding a shaft which is being key-seated for the Woodruff system of keying. The cutter is held in a special drilling chuck, which screws on the nose of lathe spindle.

FIG. 4. MILLING A KEYWAY (WOODRUFF SYSTEM).

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Vol. XII. SEPTEMBER 3, 1914 No. 10

PRINCIPAL CONTENTS.

YOUR COUNTRY'S CALL.

NO apology is needed at this juncture for our drawing attention in the columns of this journal to the fact that the Dominion of Canada has issued a call, now in effect and remaining so long as the Empire to which we belong has need, for men. What are we doing about it? Indisputably we are loyal, yes, and as the past two weeks have shown, we have been supremely generous. The evidences of loyalty have been so satisfactory as to be unquestionably permanent; the responses expressive of our substance have met the meantime need; but the call for men—you and I, has only been in part met. Some 25,000 or 30,000 out of several hundred thousand available and eligible is what the hand of the clock registers, and a conservative estimate places Canada's requirement and her Government's desire to meet the Imperial situation at four times these figures .

Sir John Gibson, Lieutenant-Governor of Ontario, in the course of a patriotic address preceding the ceremonial of opening the 1914 Canadian National Exhibition at Toronto on Monday of this week, said:

"The fate of our Empire is trembling in the balance. More men must be sent from Canada than the present contingent. Another contingent of 25,000 or 30,000 men must go and still yet another. Canada can send 100,000 men if necessary to fight for the Empire.

"The young manhood of Canada is on its trial. Those who have gone were largely Canadians of adoption only. Shall it be said that there is any backwardness on the part of our native young Canadians in fighting for the Empire. We have sung our loyalty in various anthems from the cradle. Shall there now be any hesitancy among our men in backing their words with actions?"

His Honor impressed firmly upon the audience his belief that Canada must yet do her full share in supporting Great Britain, and further expressed the hope that as our contingents go to the front there shall be a flocking of young Canadians to fill up the vacancies left in the militia. Every young man between the ages of 18 and 30 years should step into the ranks and learn to march, drill, and above all to shoot. They may not be called upon to put the knowledge that they acquire thus into service, but they may rest assured that by such action they are adding their mite to the protection of the Empire and incidentally building up a healthy Canadian manhood.

In view of the foregoing but more especially on account of the circumstances with which we are at least conversant if somewhat indifferent, isn't it about time that many of us between the ages named and upwardly beyond **took the shilling**. Mollycoddles we make bold to say are a small percentage of our male citizens, and after all they can be spared; in any case, nobody need continue to be one of the class. Canadian business enterprise is not going to be blotted out, although 100,000 of our able-bodied manhood take the field. There will be abundance of mature minds left to care for that, and plenty of able-bodied help as well. Don't rely, however, on the other fellow enlisting so that you escape the **Call of Empire**.

The appeal for the military and naval services of Canada's manhood is unique, both on account of the issues involved and of its fortunate rareness; the response should therefore be all the more hearty. Do we realize sufficiently, and do we read into the dispatches from the front that citizens of the British Empire like ourselves are lying in the trenches holding back a powerful enemy, and one whose aim is to snuff all of us out completely. At the desk, in the store, on the street, at the bench and in the factory, 100,000 men can easily be spared, and at the front there will easily be found room for them.

Don't leave it to little Belgium, France and the British Isles to roll up the enemy's attack, and don't wait till Russia gets up to the gates of Berlin, but be one of a Canadian host ready to stand shoulder to shoulder with all of them in their combination effort.

CANADIAN MANUFACTURERS AND THEIR OPPORTUNITIES.

OUR newspapers for dearth of real, live copy from the firing line have not been remiss in their efforts to keep us posted on what has transpired and is transpiring behind the scenes, so to speak. Voyagers on the Atlantic, real and imaginary during the last few weeks have been made to go the limit in the attempt to magnify the discomfiture, we had almost said hardships, they had suffered because paint of a sombre hue had given place to the smart color scheme on many of our liners, and because all lights were blanketed, except those needful for navigation. Hysterical women and scare-beckoning men have been commandeered to fill the breach which a rigid censorship of real news has uncovered, hence, as nature abhors a vacuum, the extravagant activity of distorted imaginings in the simple practice of safety first under somewhat abnormal circumstances. It is not our purpose to enlarge on the foregoing, neither are we finding serious fault with our contemporaries, the newspapers, although we would advise the poor beings who have had their senses shocked by the harrowing experiences they are reckoned to have undergone to stow themselves a few thousand miles further away from the army and navy of Germany, so that their excitement gets a chance to cool off.

What we are concerned with, however, is the sombre hue which our Canadian factories have assumed, and the wholesale blanketing of their lights that has taken place. It appears as though some of these phantom German cruisers that roamed the broad Atlantic and Pacific Oceans had captured the trade of Canadian manufacturers, destroyed their wireless, figuratively speaking, carried off their bank accounts, locked the factory doors and forwarded the keys as trophies of war to Berlin. In a word they have ceased to do business in the open, with the result that nobody knows whether they are dead or alive. Micawberlike, they are waiting until something turns up. As a contemporary very pointedly remarks, they have run to cover after phoning, wiring and writing all with whom they do business, to stop everything. They have recklessly suppressed their business campaigns in their every aspect, and it calls for neither great display of intelligence nor deep reasoning to warrant the conclusion that in normal times they most probably follow the same reckless, unsystematic plan of business conduct.

That our industrial managements should have unlimited confidence in the ultimate success of the Allies, and in the future prosperity of this Dominion, is good advice to give as far as it goes, and God knows, in this respect, no slackness has been apparent in both drumming and rubbing it in, so much so, that we are afraid it has lulled many to sleep, who awaken only to eat. Our business men don't need to be told to have confidence, unless it be in themselves, for they have it to the full we believe in both our Empire and this Canada of ours. What they want is courage and that not when in crowds or associations, but real, personal, individual courage. If an individual lack confidence in himself, then he lacks ability in whatever his sphere, and little courage as a consequence may be expected. Where then do our Canadian business men stand relative to their business capacity?

Opportunities by the score are being dangled before our captains of industry due to the export markets and home industries of the active belligerents having become a dead letter. What real effort are they making to grasp these opportunities, for they won't materialize without effort?

There is a disposition to treat the trade possibilities as so many fairy tales, assuring ourselves that there is nothing to them. Yes, we seem determined to wait till someone hands us our portion. Our attitude towards the business opportunities which have materialized is essentially wrong. We neglect the all-important fact that there is a time limit set on these, and that it will require both courage and energy on the part of all who would secure a share. Don't let us run away with the idea that this North American Continent has everything coming to it on account of the European War. Far be it, for although the balance of opportunity be meantime in our favor, enabling us to get a new and at the same time firm foothold, the opportunity will pass when, the belligerents with their craving for human blood sated, betake themselves again to the practice of the arts, crafts and manufactures. The ravages of war and the retrogression so evident in the industrial and commercial life of the world, on that account, will certainly be compensated for in determined, consistent, double-barrelled effort to regain whatever loss to trade prestige has resulted, and just on this account something more than a finger-and-toe hold on business meantime going a-begging, will be absolutely essential.

A PRACTICAL SHOP ECONOMY.

IN the great majority of Canadian industrial concerns, attention is given to the home production of much of the plant equipment. Standard machines are built today upon which it is possible to carry out the greater part of every manufacturing process, and most of these can be readily procured from stock and some at fairly reasonable prices. The usual practice is to buy the best standard or universal machine to perform the desired work and secure the greatest economy from this by making and attaching suitable jigs and fixtures. These attachments are, however, often cumbersome and heavy and impose more or less dead load on the machine which it was not intended to carry and which, as likely as not, catches its weak spot.

The building of such attachments is more or less costly, and if the expense thus incurred be added to the original price of the machine, the final statement will show an apparently excessive investment of capital. A very much more satisfactory way from every point of view is to build machines at home especially suited to perform certain work as automatically as possible. Mechanics who can design and make fixtures adapted to the machine to which they are to be attached as well as to the best performance of the desired work, are fully competent to build a special machine to do the same work.

All standard machines, especially machine tools, are built with a view to strength and accuracy, coupled with a high degree of flexibility, all of which must be paid for whether the work demand these qualities or not. The special machine may be comparatively simple and often much smaller than the regular one which is still further increased in bulk by the necessary attachments. The principle can best be carried out by plants operating smith-shops and foundries as well as machine-shops in their regular course of manufacturing, but we have noted a number of successes, in the direction indicated, achieved by firms who have been obliged not only to purchase forgings and castings, but to have the patterns made out as well.

In order to manufacture goods to meet competition successfully, the use of special machines must be more generally adopted throughout Canada, and if this machinery can be made in the plant where its requirements are best known, there will undoubtedly be realized a considerable saving by the firm concerned. The first requisite is a man particularly suited to take charge of such work, the qualities of a practical genius being more to be looked for than high technical standing.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh	$13 65	
Lake Superior, charcoal, Chicago	15 75	
Ferro Nickel pig iron (Soo)	25 00	
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 50	17 85
Victoria, No. 2X.......	18 25	17 60
Victoria, No. 2 Plain ..	18 00	17 35

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b, Montreal.	2.00
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh ...	1.20
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails..	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes..	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$21 00
Open hearth billets, Pittsburgh..	21 00
Forging billets, Pittsburgh.....	26 00
Wire rods, Pittsburgh	26 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Gal.	Lapweld Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload ...	$15 00	$14 00
Electrolytic copper	14 75	14 50
Casting copper	14 25	14 00
Spelter	6 50	6 00
Tin	50 00	55 00
Lead	5 00	5 00
Antimony	25 00	20 00
Aluminum	20 00	25 00

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt, casks, per cwt.	6.40
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.67
Linseed oil, raw	0.70
Linseed Oil, boiled	0.73
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.16
Lard Oil, per gal.	0.60

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3 45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2 90	3 15
Canada plates, all bright	4 00	4 10
Apollo brand, 10¾ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1½-in	$37.50	$30.00	$17.50
33/64 to ¾-in.	41.25	33.00	19.25
7/16 to ½-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	$1.10 lb.
Leather in sides	.95c

BELTING RUBBER.

Standard	60%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4.95
1 inch	8.05
1¼ inch	12.65
1⅜ inch	15.30
1½ inch	16.50
1⅝ inch	19.40
1¾ inch	22.50
1⅞ inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

IMPROVED BUSINESS OUTLOOK.

A DECIDED improvement in the tone of business is now observable. Excitement has materially subsided and generally speaking, all concerned with trade and commerce appear to have settled down to the realization that the only way to defend their country and keep its flag flying is to attend to business in a normal way. If Canada is to maintain her troops at the front and otherwise do her share towards the defence of the Empire, it will be absolutely essential for those who are not handling arms to see to it that their hands are kept busy producing. This cannot be dono by ignoring our liabilities and otherwise avoiding duty, using as an excuse for so doing the existence of war conditions very far removed from our own shores.

Adjustment to new conditions is taking place very rapidly. Many of our factories are moving as they have not done for some time. In one instance an agent representing a German house found himself without employment. He searched for a Canadian house handling a similar product, when he made application for permission to handle their products he found that its output had already been fully taken up. Other factories who have suddenly found their market cut off can either find a new market or adapt their plants to producing something for which there is a market. Our enquiries during the week lead us to the conclusion that some good work in this direction is being done.

Action of the Banks.

We have every reason to believe that the banks are treating their customers exactly in accordance with the lines of credit agreed upon. For ordinary current trade purposes they are not withholding credit and in some cases special consideration is shown. Treatment of this kind, however, cannot be expected by new customers. We are confident, however, that bank managers generally realize that they have an important duty to perform in assisting their customers to adjust themselves to conditions which were not foreseen, and they are doing everything it is possible for them to do.

Moving the Grain Crop.

Canada's foreign trade routes are now practically safe. It is fortunate, as we are on the eve of our big Western crop movement. Banks have extended to dealers in the West customary lines of credit. A week ago there was some doubt as to what course would be taken but during the week a change has taken place consequent upon the improvement in the situation in London and in regard to the control of the sea. It is being realized that whatever may be the fortunes of the allied forces in Europe there is no danger of Great Britain losing her ocean supremacy. This being the case there does not appear to be any reason why Canadian trade should not be maintained at practically normal. In some lines there will be stagnation, but on the other hand others will be exceedingly active. Let us again draw attention to the fact that the products of Canada in the main are necessities for which there is a greater and more pressing demand at the moment than there has been at any period in the history of Canada.

Montreal, August 31, 1914.—A week ago there seemed to be a prevailing feeling of confidence that once the allied armies of Britain and France were face to face with the forces of Germany that the advancement of the latter would be finally checked. It is well known that there has been a battle, but the results have not been as decisive as were looked for. Thus confidence has suffered a little and we find that business has again lapsed into a state of uncertainty.

During the past week a few shipments of steel have arrived from British ports, and these have been of sufficient influence to keep the prices of steel almost the same as last week. The trade, however, has been so extremely dull that there is really no occasion to alter the prices.

Machine Tools.

In this line of business no change can be looked for until the war situation improves. Those who import their products from Britain and Europe cannot of course get delivery, but even were this possible, sales on any large scale are meanwhile doubtful.

Pig Iron.

The pig iron market is no exception to the general dullness. European shipments are again very uncertain. A large number of foundries are closed down, while those that are still operating are only doing so to about one-third to one-quarter capacity. Prices do not change appreciably.

The Steel Market.

The situation has not changed to any extent regarding the prices of steel. It is reported that the United States Steel Corporation have sent out one hundred and fifty new salesmen to try to obtain some of the trade previously held by German firms. It is also reported that British steel rolling mills are asking for prices on Canadian and American billets. These were previously supplied by German firms. Some of these enquiries have been directed to Canadian firms dealing in steel.

Machinery Supplies.

The firms dealing in these supplies are enjoying quite brisk business, although orders are small. The supply side of the larger houses dealing in machine tools helps to keep their organizations together, thereby enabling them to meet the increasing trade when it materializes.

Metals.

The metal market seems to end each week's business in much the same condition as it entered. Tin has taken another drop of five cents per pound, and spelter has risen slightly. Aside from these changes, the market remains as before. The New York and London Exchanges still remain closed, so quotations are more or less of a nominal nature.

Toronto, Ont., Sept. 1, 1914—The European war continues with unabated fury, and no engagement of a decisive nature has been recorded. Until such time as the allied forces make definite progress the present situation cannot be expected to improve to any marked degree. Business is still marking time, waiting for an improvement in the outlook, which we hope will not be long in coming, although present indications point to a longer period of suspense than was, perhaps, at first anticipated. As far as our overseas trade is concerned, we can look with the greatest satisfaction at the way in which the trade routes have been kept open by the British Navy. With reverse conditions, trade would have received a very serious setback; but as it is, shipping conditions are improving daily, and, except for a diminution in shipments, caused by the war, sailings would soon be back to former schedules. The effect on our import and export trade will in some respects probably be felt for some time.

A wonderful wave of patriotism has swept over the country, and it is to be hoped that the same spirit will animate the community in their business dealings, and so help the country during the crisis. It is absolutely necessary to keep the wheels of industry moving and maintain production at as high a level as possible, for by so doing the effect of the war will be minimized and prove less of a burden to the community. It requires courage and confidence in the future and often sacrifice, but the result offers full compensation. If the keen interest and enthusiasm which is apparent everywhere can be guided into the proper channels, much good will result.

Steel Market.

The iron and steel markets are very quiet, and comparatively little business is being done. An improvement can hardly be expected until more satisfactory news comes from Europe; even then it is possible that it will not greatly increase the amount of business for some time, but it will have a distinctly stimulating effect, and so pave the way to better conditions. The general situation is similar to last week; manufacturers have withdrawn prices, and are only quoting against definite inquiries and for immediate acceptance. Marine insurance and ocean freight rates are both above normal, which is having some effect on trade.

There is a feeling gaining ground that the steel trade in Canada will benefit by the war, on account of the production being checked in the European countries involved in the conflict. It is too early to state with any assurance that this will be the case, but an effort will no doubt be made to capture some of the foreign business. Whether this will be successful remains to be seen, but it is probable that little will be done in this direction until financial conditions improve and exchange becomes nearer to the normal; the latter feature is an important consideration.

Although only some lines have advanced in price, there is a tendency for an all-round increase, particularly in the United States, which will, of course, affect Canada. A number of small orders for plates are being placed with United States' mills, but the tonnage is not heavy, the price usually being $1.25 Pittsburgh, or 5 cents above the market. The ferro-manganese situation is a little easier on the strength of shipments expected this month from England. This alloy is quoted around $100 a ton tidewater, and will probably remain at this figure, or possibly be higher, for some months. Galvanized sheets and black sheets have advanced, but the prices are fluctuating considerably.

Pig Iron.

The pig iron market is dull, and there is little demand. Moderate lots of domestic iron are selling at former prices, but no English or Scotch iron is being imported at present, and little is coming from the United States. Consumers are buying very little iron for the time being, and many foundries are working at considerably reduced capacity.

Machine Tools.

Little business is being done in machine tools, and the situation is unchanged. At the local Exhibition all space has been taken, and it may help to stimulate inquiries, and, it is to be hoped, result in business.

Machinery Supplies.

Business in supplies is dull. A number of machine shops have either closed up or are running on short time, consequently the demand for supplies has fallen off. Prices generally are stationary, but a number of manufacturers have withdrawn prices, and will only quote against definite inquiries. Babbitt has advanced on account of the increase in price of metals. Magnolia, however, remains unchanged. Cast iron fittings have advanced, also domestic leather belting.

Tool Steel.

The tool steel situation remains unchanged. There is little demand on account of the machine shops being so quiet.

Metals.

The metal markets generally are still in an unsettled condition, although steadier than might be expected under the circumstances. The tin market is quiet, with little demand. The price is the same as last week, but will probably go higher, as no relief in the situation is in sight. Spelter is erratic, and has advanced slightly, being quoted at 6c. Copper is weaker, and antimony has dropped to 20c, although the situation has not changed as regards the latter. London and New York Metal Exchanges are closed indefinitely.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

THE WORLD WANTS OUR PRODUCTS.

By H. Waddington.*

THERE'S a lion in the way. Such was the theme of an old-fashioned Scottish divine, and the terrors that he could instil into the minds of his hearers were in every case overpowering.

Unfortunately we have some of the same type with us in the financial and commercial worlds of to-day. We have a lion ready to devastate our trade, to ruin our possibilities, and to use our old friend Mantalini's phrase, to send everything "to the demnition bow-wows." But,—where is the lion? Analysis shows us that he is behind us and not ahead. The Britisher is essentially a trader and the Anglo-Saxon is an assimilator. Beaten in war he sometimes has been; in the final result, however, he has been the victor not through force of arms, but by the process of assimilation. What do we produce that the world in general does not want? We have no factories turning out luxuries such as the wealthy only can purchase. We do not make gew-gaws such as people can do without. We do produce the necessities of life and the world must have them.

The British lion tells us that the trade routes are now open and perfectly safe and Europe wants our food stuffs.

The German manufacturer has been shut out completely from markets for all classes of its manufactured products, some of which we can supply. The morning press tells us that our High Commissioner Perley has sent some men over to find out what we can do to help out the British building trade. Germany has hitherto largely supplied wire nails and builder's hardware to Great Britain, and this has now been stopped. Here is our opportunity. Instead of shutting down our factories, we should run full steam ahead, as the market is waiting, and we should have the stock ready when the orders come. We may rest assured that our neighbors to the south will be keen to corral everything as far as they can. We should not lag.

The tremendous withdrawal of men from the factories in the old land must of necessity cut down their output, and where is this to be replaced? The opportunity is ours. Cut out the pessimism and take hold of the possibilities. We are furnishing some of our best in the form of manhood for the army. Let us give of our best in food stuffs and manufactured products.

The lion is in the way, but we are to ride his back and help him clear away the obstruction. We are **not** to be devoured.

Everything we have is and will be in demand, our foodstuffs, our manufactured products, our men, our moral force, our manhood. We are here to develop ourselves. Hitherto we have leaned on John Bull. We have now reached maturity. Let the position be reversed. Let him lean on us and lean heavily. We have what he wants; he is willing to pay and to pay well, and we should have the desire to show that we are fully capable of standing alone as far as our needs are concerned and of helping the other fellow when he needs us.

Keep the factories running. In a few months' time we shall not be able to cope with the demands.

*Managing Director, Standard Reliance Mortgage Corporation, Toronto.

INDUSTRIAL HYSTERIA.

CANADIANS are showing symptoms of an acute attack of economic neurasthenia. No one can accuse us of being afraid to fight. Show us a German and we will tackle him, without hesitation. What we are afraid to do is to go on living. Instead of composedly and cheerfully taking up each day a task as the day appears, we are trembling in anticipation of unimaginable scarcity and poverty. It is not hard times that we expect, we have them already. It is not simply hard times made harder by war. We could understand that and meet it. It is times so stark and inflexible that iron is in comparison as a sponge and the traditional poker pliant as a thread. More prosaically, it is something formless, vast and ghostly, the more dreadful because our reason gives it no shape. If we were all to be doomed to death by slow starvation we should scarcely be more frightened.

We may admit that the war will disturb trade, remove bread-winners from their homes, pile up private and public debts, and generally mitigate the prosperity of the recent past. It is well to be prudent, to eschew luxury, to avoid over-production, and to provide means for helping the specially unfortunate. Having said this, we have said it all. The sun will shine, the harvests will ripen, all the staple commodities will have to be produced, and there will be just as much food and money in Canada next February as there was last February.—Montreal Journal of Commerce.

OUR MANUFACTURERS WAKING UP.

A STEADY stream of callers as well as letters, telegrams and inquiries to the Department of Trade and Commerce indicate that Canadian manufacturers are awakening to the opportunities of trade development resulting from the war, and particularly to extend their activities to those lines heretofore imported from Germany. No less than a dozen firms had representatives at the Department last week-end securing information along these lines, and all of them are very hopeful of being able to keep their factories going at full capacity.

This would be not only to supply the Canadian trade, but to capture trade to countries such as South America, which are extensive patrons of German industry. Statements are now being prepared by the Department and will be sent out immediately they are ready. They will show the extent and character of all German imports to Canada and to other countries where the trade with Germany may possibly be secured by Canada.

It is confidently believed that a decided stimulus to Canadian industrial activity will result from this campaign, which is regarded as truly patriotic and in the best interests of the country.

A CALL FOR CONFIDENCE DISPLAY.

FITZ-JAMES E. BROWNE, the well-known real estate and property expert, Montreal, recently addressed letters to over 200 leading business men of that city, inviting them to hear his talk on **Confidence**, which was to be given in his auditorium on the day following. He said:—

Dear Sir,—Have confidence. A drop of water does not make a sea—a pebble a seashore, or one man a regiment; but it is the multiplication of the unit that evolves power and enables the wheels of industry, finance and commerce to revolve and hum freely. Because one man has a **swelled head** and thinks he ought to own this universe, is that any good reason why everything should come to a standstill?

It would seem as if for the time being the people have been carried away by a wave of fictitious imagination and have lost their usual business composure. It always takes a crank to start a scare of panic, which is generally short-lived with business once more reasserting itself. The present commercial situation is no exception.

To light a city you must dam a river at the right place and install your generative machinery, which makes the electricity that lights the city.

To enlighten the public we must build a dam of confidence to check the crazy ideas, notions and lies that have been spread broadcast during the past few weeks by the yellow sheets of journalism, install our machinery of common sense, and by it generate a power of good that will enlighten the people so they will have confidence in the outcome.

We appeal to you as one of those having unlimited confidence in the future of Canada, and more especially of this city, to co-operate with us in this movement of confidence by investing in real estate in this city, thus proving your confidence, which we know is not misplaced.

MANY TRADE OPPORTUNITIES PRESENTING THEMSELVES.

EVIDENCE has come before the Department of Trade and Commerce at Ottawa in the remarks of several United States publications to show that the people of that country are realizing the opportunity that is presented for enlarging their export trade, now that active competition in the world's markets on the part of several European countries has been withdrawn as a result of the present war.

"To a certain extent," says a bulletin issued by the Department, "the arguments put forth by these publications are applicable also to Canada, yet while it is generally pointed out that an extended European conflict will prove of great benefit to Canada as a supplier of foodstuffs, the opportunity given to Canadian manufacturers to develop their export trade, through the temporary withdrawal from the sphere of world trade of such countries as Germany and Austria-Hungary, does not appear to be generally realized."

Austrian and German Trade.

The bulletin, in dealing with trade opportunities open to Canada, states first, "as a result of the war, Canada's direct trade with Germany and Austria-Hungary must necessarily suffer. In 1913, Canada imported from Germany goods worth $14,473,833, and she exported to Germany goods to the value of $3,402,394, a total trade of $17,876,227. With Austria-Hungary, Canada carried on a total trade to the value of $1,829,943, of which $1,674,349 consisted of imports and $154,594 of exports. It is thus seen that these countries, especially the former, had obtained a foothold on the Canadian market which will be lost during the progress of the present war. An opportunity is presented for other countries to increase their trade with Canada or Canadian producers to make up a part of the deficiency thus created."

The foremost market of which Germany will be deprived as a result of the war is the United Kingdom, which has been buying goods from Germany at the rate of about $145,000,000 a year. Germany's exports of agricultural machinery to Great Britain in 1913 were $131,189, as compared with $437,090 from Canada, and of sewing machines $500,000, as compared with Canada's $2,263.

Big Machinery Trade.

Under the head of general machinery, Germany has exported to Great Britain to the value of over $5,000,000 a year; of electrical machinery, over $31,000,000 a year; of electrical goods and apparatus, $41,000,000 a year; hardware, $4,000,000; boots and shoes, $250,000; brooms and brushes, $789,000, as compared with an import from Canada of only $7,917; and of paper, $2,017,575, as compared with an import from Canada of $587,010.

Germany's trade with various British Dominions has also been large, and here also is an opportunity for Canadian manufacturers. Australia's purchases from Germany amount to over $32,000,000 a year, as compared with but $3,996,387 from Canada. South Africa imports $17,000,000 worth of German goods annually, as compared with less than $4,000,000 from Canada.

TESTING TIME NOW.

We must continue to live by satisfying each other's wants. The interruption of established trade routes necessitates the opening of new ones. Our captains of industry are now facing a real test of their ability.

U. S. RECEIVES HEAVY EXPORT INQUIRIES FROM BRITAIN.

A large English works has sent out an inquiry for 50,000 tons of billets, sheets, tubes, rounds and other forms of semi-finished materials, while another inquiry is for 10,000 tons of small billets for British Isles. This is different from the 10,000 tons for Glasgow, previously reported. Another lot of 1,500 to 2,000 tons of small billets is pending.

NO TIME TO "TAKE TO THE RAFTS."

MORTIMER B. DAVIS, president Imperial Tobacco Co. of Canada, when interviewed a few days ago, gave the following expression of opinion:

"At a time like this, financial institutions, railroads, manufacturers, jobbers and retailers should strain every effort to keep their men employed at regular wages, even if it is necessary to manufacture and carry in stock a little more than the usual requirements. If this were done by a fair proportion it would eliminate, to a great extent, one of the conditions that we are anticipating this winter, resulting from the great war—viz., the problem of the unemployed, and would stimulate business through the purchasing power of the public. The present is an opportune time for the country to do this for the reason that for the past eighteen months a great deal of liquidation in everything has taken place.

"The commercial result of the war must benefit the North American continent. Goods produced and manufactured in Europe must be replaced in the course of time by American and Canadian manufacturers, and it is an acknowledged fact that when conditions of trade are prosperous in the United States the same condition exists here. Furthermore, the farmers, the greater part of our population, are not affected; in fact, they are benefited owing to the higher prices they will receive for their farm products; it is the people in the cities and small towns, employed in factories, etc., who should be looked after.

"At a time like this, people whose incomes have not been affected should continue to spend as heretofore. It would not be wise for large sums of money to be invested in new enterprises with a prospective profit that takes time to materialize, but, where money can be spent in a commercial way with a reasonable certainty of bringing quick returns it should be done."

Welland, Ont.—The employees of the Page Hersey Iron, Tube & Lead Co., had an ideal day for their third annual picnic at Port Dalhousie on August 22. About 325 took in the outing from Welland and the whole of the main office force of Toronto.

Foundry Department, the Massey-Harris Co., Toronto, Ont.

Staff Article

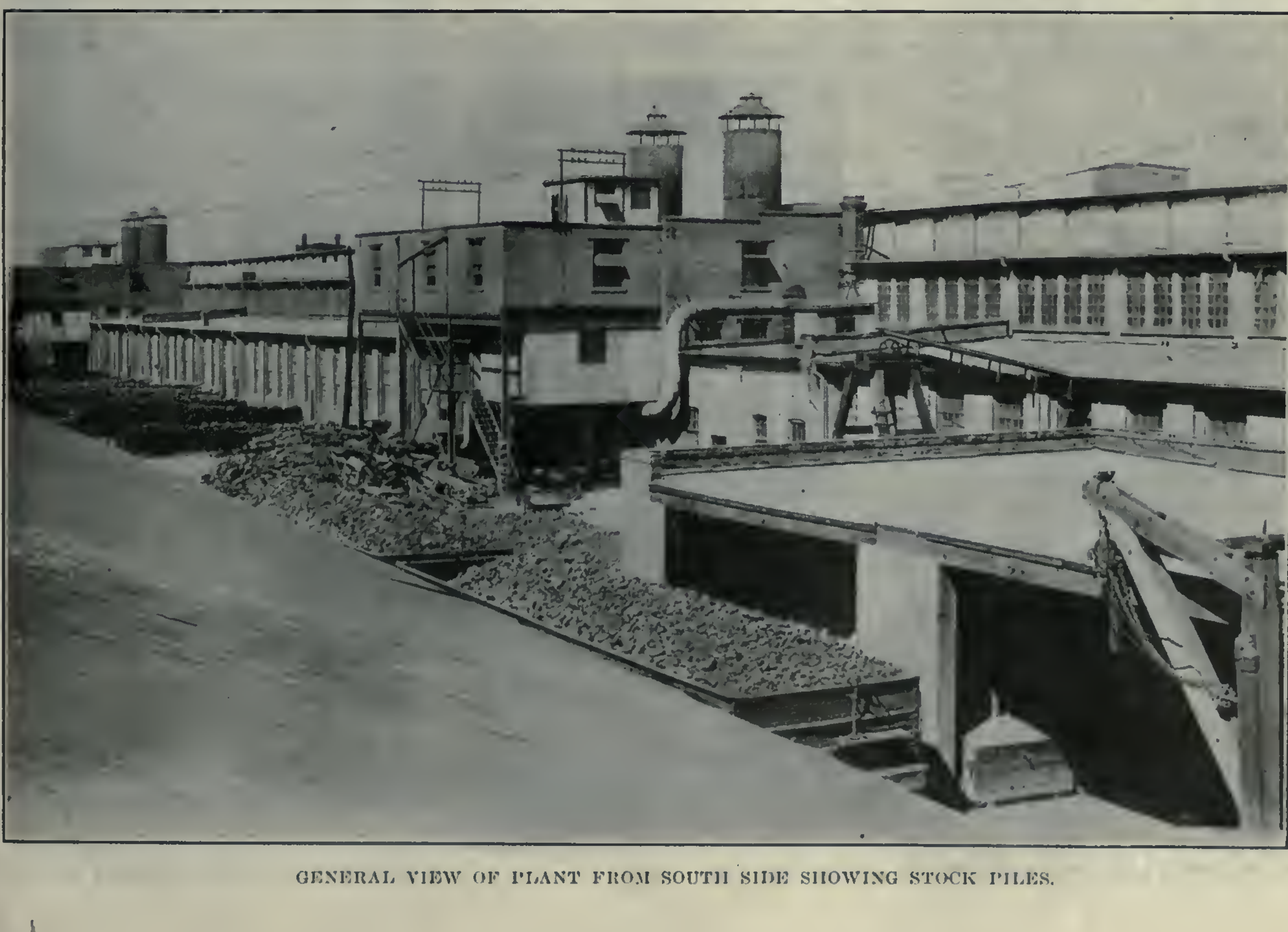
While there are not a great many foundry establishments in Canada of the size of the one here described, very much can be learned by the smaller concerns of the benefits accruing from the encouragement of a flexible system in which harmony and thoroughness are given prominence. The choosing of a staff on points of merit, rigid economy, the application of the most suitable appliances and the appointment of the right man to each job are stepping stones in the rise to prominence of this world-known institution.

BY the courtesy of the Massey-Harris Co., of Toronto, through their general superintendent, R. H. Verity, we are enabled to present to our readers the story of one of the most advanced and up-to-date foundry establishments in Canada, and indeed, one that ranks among the best on this North American continent. We have also been favored with the assistance of W. J. Cornish, the foundry superintendent, and by the fact that the plant was shut down for annual stocktaking at the time the photos were made.

The aggressive policy of the company in securing markets in many different and widely distributed parts of the earth enables the plant to run at full capacity throughout the year except for stock-taking and repair periods. The sales periods of Europe, Australia, South America and other countries do not overlap to a very great extent, which fact, besides militating against the effects of hard times or loss of crops in any one locality, enables the designing and experimental departments to keep Massey-Harris implements fully up-to-date. The output of the firm is over fifty per cent. exported and their products have a good reputation in every country in which they are sold. As a consequence, the company has become not only one of the most stable enterprises at home, but is the greatest and most enterprising advertiser abroad of goods **Made in Canada.**

The product of the plant is such as to require a large number of small castings rather than a smaller number of heavy ones. This necessitates particular forms of moulding and handling practice which have been brought by long experience and a capable foundry staff to a high state of perfection. Implements, in spite of the fact that in the foundry a decidedly superior class of workmanship is required, must be sold cheaply and, in the case of this firm, mostly against a protective tariff rather than favored by one. This makes it absolutely essential to reduce the cost of production as much as possible, and the layout of the plant and purchase of equipment is planned with this end in view. Profits in this line accrue more from bulk than individual output.

The foundry proper consists of a main building 1000 feet long by 90 feet wide, extending along the south side of King street. At the eastern end are situated the tumbling barrels and cleaning rooms, and above these the pattern and equipment departments. In the middle of each of the two central sections are placed the cupolas and monorail distributing systems, which reach every part of the plant. At the western end is the core department, which with its mixing machinery and moulding machine storage, occupies three floors. The pig and scrap iron storage yards extend the whole length of the building on the south side. A basement 400 ft. by 90 ft., below the main building, provides for ample stor-



GENERAL VIEW OF PLANT FROM SOUTH SIDE SHOWING STOCK PILES.

age of coke, sand, clay and other supplies.

Moulding.

The manufacture of so much small stuff requires an exceptionally large floor area, and the saving of the moulder's time occupied in getting about his floor, to the greatest extent, has presented no small problem to the men in charge. This is accomplished to a certain extent in the case of the snap moulders by fitting the benches with small wheels so that they can be moved back as the work progresses. Certain forms of moulding machines used have this advantage to an even greater degree, while in others, being necessarily stationary, this saving is not accomplished. The central part of the east wing is devoted to bench moulding almost entirely, multiple metal patterns and follow-boards being used. The central part of the west wing is given up to moulding machines of several kinds, the stripper plate type predominating. Along the walls in the bays for the entire length of both wings are located the air lines. All moulding machines requiring compressed air in any form, whether for moulding pressure, vibrators, air hoists, etc., are operated in the bays on both sides, giving the outer areas of the building a very animated appearance.

GENERAL VIEW OF EAST WING SHOWING RUNWAY.

Pattern Department.

As much as possible has been done to relieve laborious parts of the moulder's work. To this end, wherever practicable, the patterns are mounted on the various types of moulding machines. The pattern department, which may be either a great source of economy or by incapable supervision may be the cause of serious inefficiency, is under the care of a superintendent and foreman, both of long and trained experience in this class of work.

In conformity with the general policy of the company in manufacturing as much as possible of their machinery at home, not only patterns, but moulding machines, air hoists, flasks, and all other equipment, is built in this department. The question of the most suitable methods of arranging patterns is one that is given continual study, and is usually settled by the foundry superintendent, in conjunction with the general and pattern-room superintendents. The pattern department occupies a second floor space of about 5,000 sq. ft., and is provided with the best known appliances for the production of accurate duplicate patterns. These are made of brass, aluminum, iron, and various alloys, the material depending upon size, number required, shape and many other considerations. Patterns for implement parts, either of malleable or gray iron, do not constitute, by any means, whole output, those for dies and special machinery for use in general manufacturing representing many tons of iron castings every year.

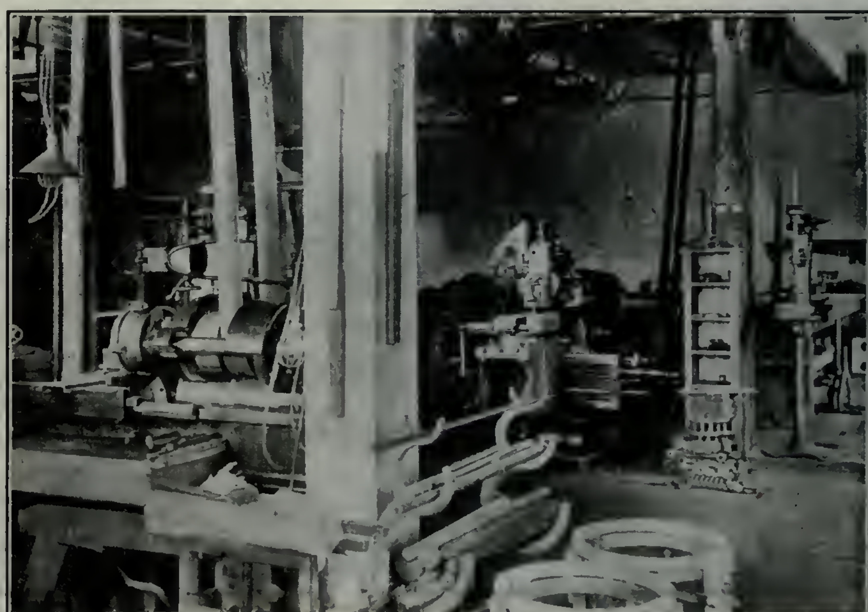
Metal pattern-making involves a large amount of expert hand work, still a great number and variety of machines are used. These include several Fosdick radial drills, Canada Machinery Corporation 18-inch lathe, 26-inch double and 53-inch flat Gardiner disk grinders, Bertram 28-48-inch extension bed lathe, 18-inch American lathe, and others.

Pattern Storage.

A new pattern storage building has just been completed on the north side of King Street, and is connected to the foundry by a spacious tunnel. It is of thoroughly fireproof, reinforced concrete construction, four storeys high, and contains approximately 40,000 sq. ft. of floor space. Pressed steel shelving of the latest type, made by the Lyon Metallic Mfg. Co. of Aurora, Ill., is installed throughout, and light is provided by an unusual area of wire glass supported by steel sash. The vast number of patterns is so arranged and indexed that any desired piece can be located whether in the foundry or vault without loss of time.

Cupolas.

There are four melting furnaces, all built by the Whiting Foundry Equipment Co. They have 96-inch shells, and are lined to different diameters on the inside. Each has a capacity of 18 to 20 tons per hour, and the daily melt amounts to from 70 to 80 tons. The blast is furnished by a Roots blower directly connected to a 60 h.p. Lancashire alternating current motor. A stand-by auxiliary steam plant is always ready in case of accident to motor or failure of the electric current. The mixing and melting is in charge of an expert, who is provided with blast gauges and full



FRONT OR MACHINE SECTION—PATTERN DEPARTMENT.

chemical information concerning all materials by the laboratory.

Laboratory.

The chemical and testing laboratory is a surprise in order and thoroughness, and the men in charge are under the direct supervision of the assistant general superintendent, who holds an important office in the Canadian Foundrymen's Association, as well as being high in technical standing. The chemistry department contains, besides a complete supply of reagents, titrating apparatus, fume cabinets, etc., also the most up-to-date electric equipment, including furnace pyrometers and the like. The main unit of the testing laboratory is a 75-ton Tinius Olsen tension and compression machine, with all automatic and recording attachments. There are also cross-breaking, percussion and other machines of the best types obtainable.

Three test bars are cast each day at critical points in the heat, and the results of complete physical and chemical tests are furnished the foundry superintendent for his accurate guidance. Also careful records are kept of each shipment of pig, coke and scrap which, along with experience of the melter, makes the obtaining of accurate iron mixtures practically possible. Not only does this system enable the Massy-Harris Co. to turn out castings of the greatest strength and most uniform quality, but all materials can be bought to specification, and that which is disqualified can be rejected. Poor material is thus kept out of stock entirely.

CUPOLA—BOTTOM DOWN.

Handling System.

The material transportation and cupola charging equipment is very complete. A narrow gauge industrial track with many branches and turntables, reaches every part of the iron storage yard. This is equipped with Whiting steel dump cars which, upon being loaded are weighed, raised to the charging floor and the contents automatically dumped by compressed air. An air hoist is also used for closing the bottom of the furnace when preparing for a heat.

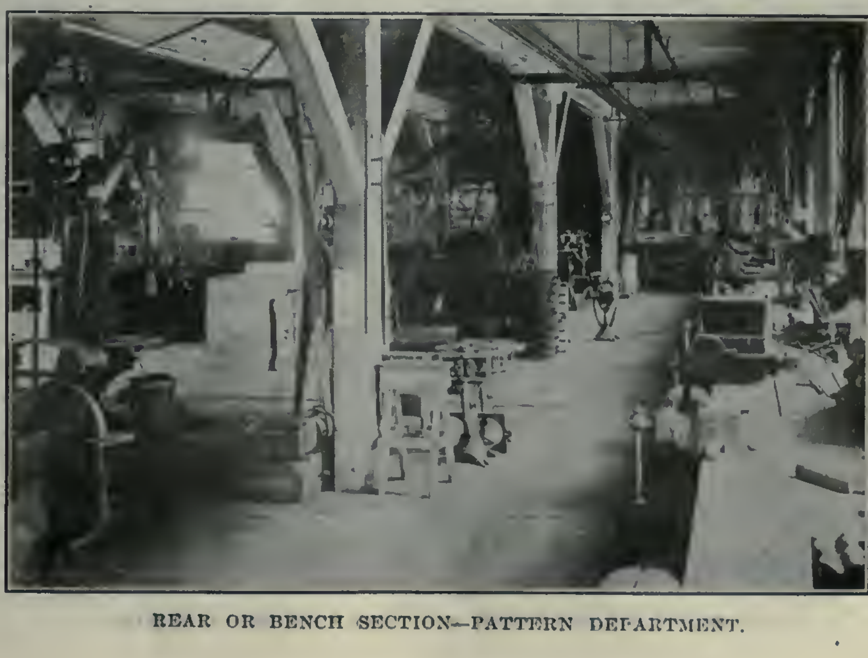
TYPE OF SHELVING —PATTERN VAULT.

Coke is received on the foundry siding direct from the ovens. The cars are dumped into a hopper beneath the track whence the coke is taken by a link-belt conveyor to the bins in the basement. From here it is raised as required by other conveyors to the charging floors, where it may be delivered to buggies, or convenient to shovel directly into the furnace. Complete conveyor systems are also provided for other materials such as sand, limestone, etc.

For the melted metal, a monorail distributing system is used which was designed and constructed in all its details by the plant engineers. From the overhead rail, pots holding 900 pounds of metal are hung by means of roller bearing trolleys, and so successful has been the designing that one man easily handles the gross weight of over half a ton. The pots deliver the melted metal to each man's floor, whence the pouring is done by the moulder himself with 60-lb. hand ladles. The tracks and switches are so arranged that the pots can return to the cupola by different routes and thus all interference is avoided.

The Core Room.

The core department occupies the best



REAR OR BENCH SECTION—PATTERN DEPARTMENT.

part of three floors and is in charge of a specialist and assistant who are directly under the foundry superintendent. The core materials, like other stock, is stored in the basement. From here they are hoisted to the third floor by means of bucket conveyors, and are mixed by machinery in the various proportions required by different kinds of cores. From this floor the mixtures are delivered to the benches and machines on the second floor through chutes in the required quantities.

The systems of making cores are varied to suit the needs. Those of straight cylindrical form are made on a motor-driven Hammer rotary core machine of the Brown Specialty Co. which has been altered and improved to meet the demands of the plant. So-called flat-backed cores are made in multiple boxes on a Mumford Moulding Machine Co. core jolter which is operated by compressed air. The great quantity of irregular shaped cores are made by hand in iron boxes, which are made in multiple wherever possible. The benches are made almost entirely of metal, particular attention being given to the obtaining of a good smooth working surface. The aisles between the benches all lead to the ovens, which consist of 16 sections, each group of four being heated by a separate coke fire. The ovens are of the latest Whiting type supplied with adjustable shelves, sliding drawers, etc.

Ventilation, lighting and cleanliness have received a great deal of attention and all possible has been done in this way to make the working quarters in the often unpleasant core room agreeable to the men. A great help and timesaver is embodied in the core records. As many as possible are standardized and listed and up-to-date lists are furnished the core room, pattern and experimental departments, and all others connected in any way with the use of cores. Thus, the making of unnecessary and duplicate boxes is obviated.

CHARGING FLOOR—LOADED BUGGIES.

Brass Furnace.

For the melting and casting of brass, aluminum and alloys, a special floor is provided, which is equipped with a Monarch crude oil furnace having a capacity of 1.200 pounds per day. Another smaller furnace is used for melting the softer metals. These furnaces have been found to be very convenient and economical, and require little attention as compared with the old-style coke furnaces, and several heats can be taken off in a day if required.

Night Work.

When the moulds are poured, the moulder's day's work is done. Two night crews then take charge of the plant. The duty of one is to remove the castings to the cleaning department, also to fill the tumbling barrels so that a supply of castings is ready to start work on first thing in the morning. The second gang shakes out the castings and prepares the sand for the following day's work.

TAP HOLES SHOWING ALSO MONORAIL SYSTEM WITH POTS.

Cleaning Department.

The tumbling barrels are arranged in three batteries, each motor-driven and self-contained. There are about 26 mills of all sizes, most of which were made by the W. W. Sly Mfg. Co. Many alterations and improvements have been added by the M.-H. Co. Each barrel is driven independently by a friction clutch, and appropriate jib cranes are furnished for handling the heavier castings and opening or closing the barrels themselves. A large number of grinders are also employed, most of which have been built by the firm. An elaborate exhaust system has been applied throughout. Each rumbler and grinding wheel is fitted with a separate pipe so that, considering the great amount of work being done, the air is remarkably pure and the greatest discomfort suffered by the visitor results from the noise occasioned by so many machines operating at once. Here, also accurate account of each moulder's work is kept as to the number of good castings and wasters. The poor ones are kept for his inspection and every opportunity is given him to improve his output. The cleaning department is in the direct route between the foundry and the factories so that, as the castings are cleaned, they simply proceed on their way to the department requiring them or to the storage bins.

The plant is fitted throughout with Turnbull electric elevators, while one is struck with the evidences of safety devices and the prominence given to warning cards which are printed in several languages. The sanitary arrangements compare favorably with many office buildings, emphasis being given in every case to strength and cleanliness.

In spite of the fact that so many men and a large number of foremen are required to carry on this work, if differences arise, each and every man may appeal to the superintendent. This is done without, in any way compromising the position of the foremen and the comparatively infrequent cases of serious trouble bear witness to the impartiality and careful administration of the man at the helm.

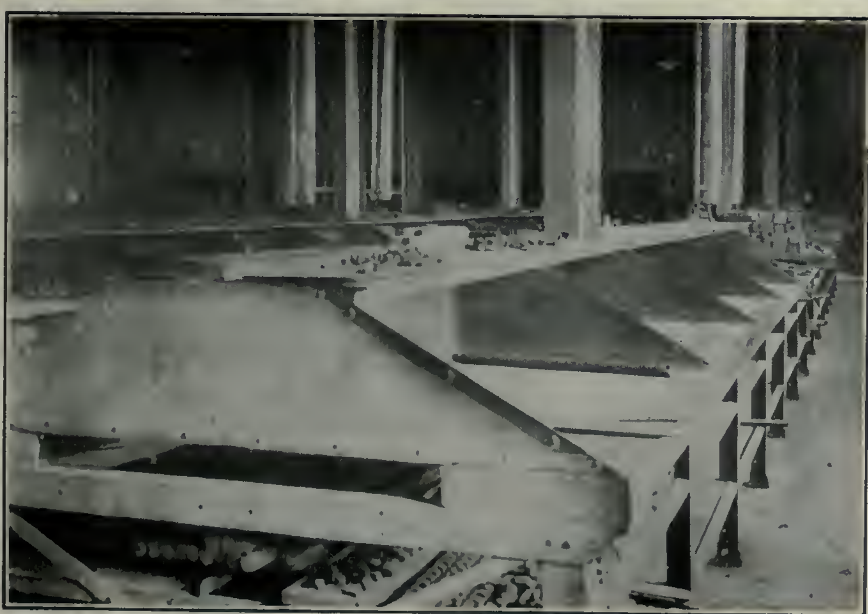
The organization of the foundry system is complete and intimate, and has for its end the harmonious co-operation of each branch for furthering the interests of the greatest number. For instance, much has been accomplished in the pattern room to save cleaning of castings, and expensive cores are often saved by the help of the moulding and pattern departments.

Trips of inspection and attendance at trade conventions are arranged by the company for all the higher officials and most of the better trade journals are made available to them. The management evidences a personal interest in each department head, his failures and his successes.

The result of this continued co-operation, personal interest and striving for efficiency as well as large sacrifices of dividends on the part of the company has been the gradual building up of the most broadly successful enterprise in Canada which is doing more and more to bring credit to her people and to establish her reputation beyond the seas.

FOUNDRY STAFF.

Standing:—Wm. Cornish, Supt.; Chas. Daniel, Foreman; C. H. Grobb, P'tn. Supt.; Robt. Humphries, Foreman Cleaning Dept; J. Hamilton, Ass't. Core Room. Sitting: P. S. McDonald, Demonstrator; J. Poole, Asst. Cleaning Dept.; Wm. Cole, Timekeeper; Jas. Conlan, Melter; F. Weigel, Foreman Core Dept.



ROW OF CORE BENCHES.

TEMPERATURE CONDITIONS IN COKE OVENS.

A recent issue of Stahl and Eisen contains an important contribution by Professor Oskar Simmersbach, of Breslau, in which the temperature conditions existing during the period of carbonisation and the composition of the volatile product have been carefully determined. The experiments were carried out in a Koppers regenerative oven. The oven was charged with 8¾ tons of coal containing 22.7 per cent. volatile matter, 6.32 per cent. ash and 12.1 per cent. water. This yielded 79.86 per cent. coke. The coal was carbonized for a period of twenty-nine hours. The temperature rose gradually during this period, the concluding readings being 1090° C. at a quarter the distance from the charging side, 1120° C. in the centre, and 920° C. at a quarter the distance from the discharging side. These temperatures correspond to the centre of the carbonized mass. In the gas space above the coal, the finishing temperatures were respectively 870°, 860° and 810°. The resulting coke contained 88.53 per cent. carbon, 2.56 per cent. volatile matter, and 8.91 per cent. ash.

Keep the Flag Flying.—It should take more than the temporary check British commerce has received to compel our manufacturers to lower their colors, says a contemporary, and what is true of British commerce is likewise of Canadian. Already we hear from Berlin that everyone in the German capital now realizes that German overseas commerce has been destroyed, and that the elimination of the Fatherland as a factor in the world's trade is complete for many years at least. Surely with this before them it behoves our manufacturers to go with all their power for the new fields open, rather than adopt a policy of false economy.

C. J. Gibson has been appointed Town Engineer of Bowmanville, Ont.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience.

FINISHING ECCENTRICS IN MEDIUM-SIZED PLANT.

By J. P. Sanderson.

THE production of work in the medium-sized plant with a reasonable speed and a degree of interchangeability commensurate with present-day methods often involves problems more difficult of solution than either the jobbing shop or the large institution, which has an unlimited market to cater

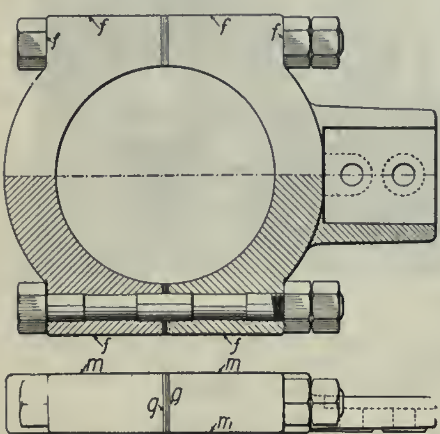


FIG. 1. ECCENTRIC STRAP, SHOWING LOCATING POINTS.

to. The greater number of plants in Canada and the United States embraces those whose market and capital investment are not large enough to justify the installation of special machinery, while, at the same time, jobbing shop methods would be far too slow and expensive. The plant from which the following article was taken is engaged largely in the manufacture of hoisting engines, the rest of the product being made up of cable-ways and saw mill machinery. The eccentric straps spoken of are used on two types of engines—the double cylinder hoisting engine, being reversing type, requires four, while the double cylinder donkey type takes only two. The output of from one to three engines per day along with extras makes the requirement of straps about 40 per week.

The castings are made in batches of 500, which are easily finished on the drill presses in a week, while one Kempsmith milling machine does its share of the work in half that time. The moulding is of no special interest, the work being done with a matched plate on a squeezer moulding machine. In the cleaning-room especial attention is given to the first locating points (f), Fig. 1. The first machine shop operation consists of very lightly disc grinding both sides of the rod half and one side of the other half, as shown by (m) Fig. 1. This little extra grinding permits of setting up two pieces or a complete pair in the milling machine, and can be done at the rate of about 125 pairs per hour.

Milling the Faces.

The second operation consists of milling the faces, marked (g), Fig. 1. The fixture for this purpose is shown in Fig. 2. It consists of a flat raised plate B, having locating tongues to fit into the grooves of the miller table. Much of the webbing and parts added for strength only are not shown, so as to avoid complication. The work is located vertically by the three small rectangular pads indicated by dotted lines in the plan view and horizontally by the four posts (p) provided with set screws and lock nuts. Enough play is allowed here to provide for the slight inequalities of machine-made castings.

The fastening is accomplished by means of the locating piece (b) and the bar clamp (c). These are both operated by eccentrics (g) on the handles (h h). The motions of these cams can be adjusted by the nuts on the other ends of the clamping bolts. The piece (b) is simply a forging shaped like the letter L, the vertical part of which is drilled to receive the two small rubber pads (f f). It is drawn up against the inside of the two eccentric parts by raising

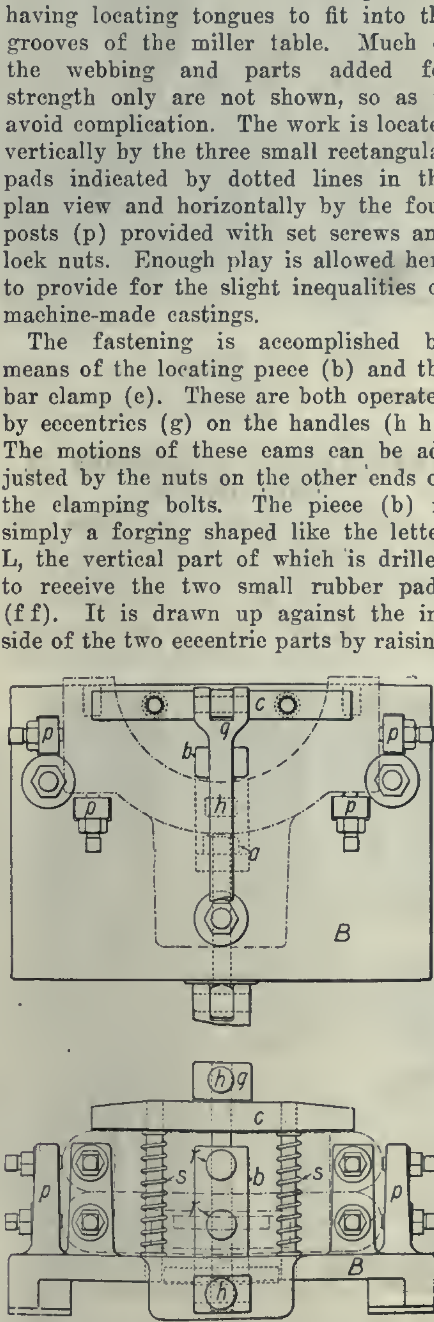


FIG. 2. FIXTURE FOR MILLING CLAMPING SURFACES OF STRAPS.

the lower lever (h), which is made very short, as pressure enough to hold the work against the back posts (p p), while it is being clamped down, is all that is required.

The clamp (c) is tightened against the work by pulling the upper lever (h) downwards and forward, which lever is long enough to conveniently give the requisite pressure. The springs (s s) are stiff enough to raise the clamp and keep the lever in a vertical position when the fixture is opened. The operation is very simple. The top lever being raised and the back one being lowered, the two components of a complete strap are slipped into place, the rod half on the bottom and the front half on top

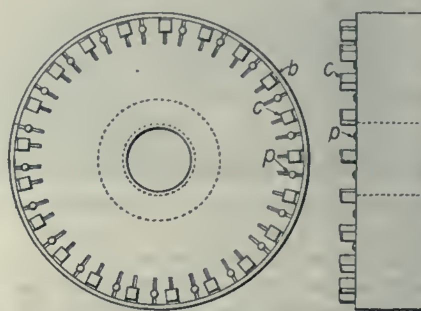


FIG. 3. TYPE OF MILLING CUTTER EMPLOYED.

(ground side down). Pulling the pieces against the stops and clamping them down takes but an instant, and the work is ready to proceed.

The Milling Cutter.

The milling cutter used is shown in Fig. 3. The body of this tool is made of the best cast iron obtainable, and supports the square tool steel cutters clamped by standard taper pins, as is often done. A steel band (b) is shrunk over the whole, both for the purpose of adding strength and protecting users from being caught by the many grooves on its periphery.

The peculiarity about the cutter is that the teeth are ground to cut both ways, and on both inside and outside edges. Its size is such that one leg of the strap is milled by the up-going side of the cutter, while the other leg is being machined by the down-going side. Thus the machine is only fed a distance equal to the width of one leg of the casting. The machine is also fed in both directions, one pair of straps being removed and another being placed in position between each feed reversal; the cutter running continuously. The grinding of clearance on both sides of the teeth makes a little extra work for the toolroom, but the time saved and the finish produced well repays for this.

The Drilling Fixture.

For drilling the bolt holes, two fixtures shown in Fig. 4 are used. These consist of angle plates, as shown, provided with locating surfaces (f f) for the finished faces of the straps; otherwise they are located by the pins (k k) and small back pads at (f f). The work is placed in the position shown by the dotted lines. It is first pressed against pads at the back by the two cams (d) operated by short levers (h). The clamping up is done by the two eccentric cams (c c), which force up the blocks (a a) by means of the lower levers (h h).

The blocks (a a) are of cast iron, and are fitted to slide freely in slots cut in the angle plate. They are kept in place by steel plates (p) and screws, as shown. Also a small piece of sheet metal is used to keep borings out of the slots. The drill bushings (b b) were hardened and fitted in the usual way.

For doing this work an auxiliary spindle was added to each of two radial drilling machines. This spindle has a vertical feed, but is not connected with the horizontal feed screw, being simply moved by hand to any desired position and clamped there. When out of use it is placed at the end of the arm close to the body of the drill and the key in the horizontal driving shaft removed. These extra spindles enable both holes to be drilled simultaneously and, besides this, have been found very useful for a great many other pieces of work.

Two machines and two jigs are engaged in this work, and are easily operated by one man. High-speed drills are used, and the two drills give the machine about all it wants to do. The holes for attaching the eccentric blade are drilled in a very simple little jig. The work is located by the two holes already drilled, and the drill bushings are carried by a hinged piece which fits into the depression prepared to receive the flat blade. These holes are also bored with high-speed drills from a multiple head arranged for the two holes required.

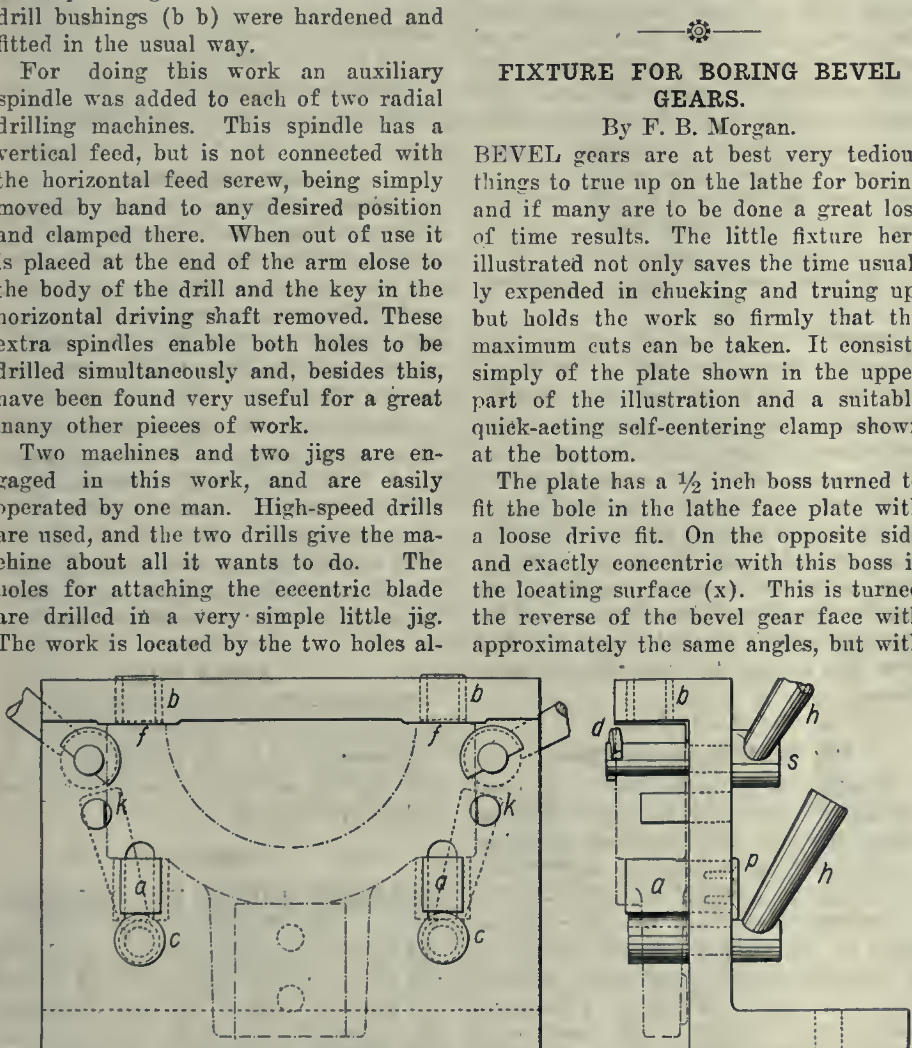


FIG. 4. DRILLING FIXTURE FOR CLAMPING BOLT HOLES.

Completing the Work.

The bolts are drop forgings finished in the turret lathe, and the liners of three thicknesses are prepared on a small punch press, the process of punching, blanking and flattening being carried on in a progressive operation. After assembling, the straps are bored in a simple holding fixture on a heavy turret lathe. Previous to this, however, they are given a coat of paint so that, when finished, there will be no paint to interfere in the fitting of strap to eccentric.

Throughout the whole procedure the object has been to produce a positively interchangeable part and still keep all the shop machinery available for other work as well. Accurate limit gauges are provided for the various operations as well as a carefully-prepared sample of the completed job. A rigid inspection of the pieces is made before going to the stock-room.

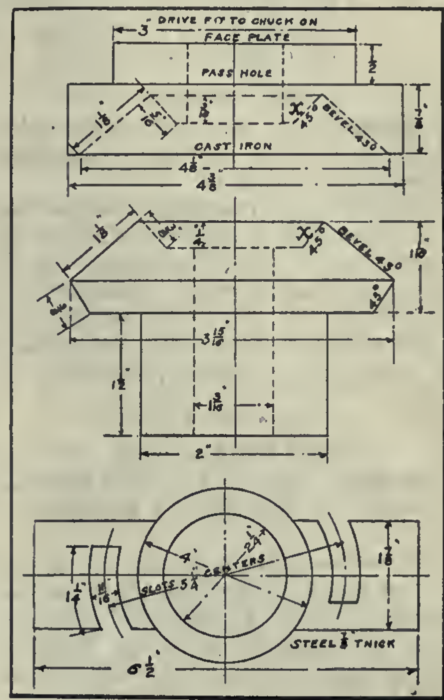
FIXTURE FOR BORING BEVEL GEARS.

By F. B. Morgan.

BEVEL gears are at best very tedious things to true up on the lathe for boring and if many are to be done a great loss of time results. The little fixture here illustrated not only saves the time usually expended in chucking and truing up, but holds the work so firmly that the maximum cuts can be taken. It consists simply of the plate shown in the upper part of the illustration and a suitable quick-acting self-centering clamp shown at the bottom.

The plate has a ½ inch boss turned to fit the hole in the lathe face plate with a loose drive fit. On the opposite side and exactly concentric with this boss is the locating surface (x). This is turned the reverse of the bevel gear face with approximately the same angles, but with plenty of clearance. Plates have been used quite satisfactorily without the small inside bevel, but where the gears are machine moulded or are fairly uniform, this is a considerable advantage in its use, although care must be taken not to make it too large.

The strap practically explains itself. Its main features are the circular slots and the locating boss. The studs are made of ⅝-in. machinery steel and are fastened tightly into the face plate. They serve also as drivers for the work. This fixture is simple and can be made by the mechanic in spare time. Each plate and clamp is suitable for quite a range of gears, and but a small number would be required for a complete equipment.



FIXTURE FOR BORING BEVEL GEARS.

A TRADE FOR EVERY MAN.

SPEAKING on "The Gospel of Labor" at the Broadway Methodist Tabernacle, Toronto, on the evening preceding Labor Day, Rev. Dr. Young emphasized the importance of every man having a trade or profession. The observance of this rule, he said, would relieve many cases of distress when children of wealth, unexpectedly thrown on their own resources, would be confronted with the necessity of earning their own living. It was not a disgrace but an honor to have a trade, the preacher maintained. Time and again great men had come from the ranks of labor. There was no bar to prevent a child of labor or even a laborer himself from reaching the goal of success.

Organized labor, he continued, is entitled to respect and honor for the good it has accomplished in the bringing about of improved conditions in the lives of workingmen. While all great revolutions have been marked at times by certain excesses, yet these are only incidental, the natural outcome of extreme enthusiasm; so the great labor movements have sometimes been accompanied by excesses, but these should not be considered in any detrimental spirit. The world to-day owes much to organized labor.

Question and Answer Series for Foundrymen

Foundrymen having difficulties in connection with their work are invited to forward particulars of them to this department for solution. The greatest possible care will be taken to give only reliable and tried-out advice on all questions submitted.

Brass Mixture.

Question.—We would like to get a dependable formula for brass separator bushings.—A. K. H.

Answer.—An excellent mixture for this purpose is as follows:—Copper, 83 parts; tin, 5 parts; phosphor—tin, 2 parts, and lead, 9 parts. Another mixture which has given good results contains copper, 83 parts; tin, 7 parts; lead, 9 parts; and yellow phosphorus, 2 ounces.

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Flux for Aluminum.

Question.—Kindly tell us what you consider the best flux for aluminum.—R. T. S.

Answer.—Chloride of zinc is an excellent flux for aluminum. It is not expensive, is easy to obtain, and gives the very best results. It should, however, not be used in liquid form unless great care be taken.

• • •

Porous Automobile Cylinders.

Question — We make automobile cylinders, and have experienced a great deal of trouble from shrink holes in the bosses. We have changed our mixture several times, but it does not seem to remedy the trouble. What would you advise to overcome this difficulty?—J. M. C. Co.

Answer.—This is a question of uneven cooling and not of the composition of your iron mixture, as the light parts of your casting cools quickly, leaving the heavy boss fluid. Gate your mould if you can on the thinner parts of the casting and cut down the thick section on your pattern if possible. You can also place chills against the heavy parts. Small chills can be placed in the core, and will fall out with the core sand.

• • •

Loss in Melting.

Question.—After making several tests in our foundry, we find our good castings average only 75 per cent. of the iron charged in the cupola. We know this loss is very high, and would like your opinion as to the cause or causes.—J. T. R.

Answer.—You do not state whether you charge the bad castings of each heat against the loss or not. In any case, your loss is entirely too high, and there must be some mistake in estimating the amount of iron charged and the amount tapped out. Not knowing what grades of scrap you use, it is difficult to state definitely what your average loss should be. Pig iron will average 6 per cent. loss, and scrap will vary from 7 to 15 per cent. loss, depending on its condition when melted.

• • •

Cast Iron Pots for Melting Lead.

Question.—We have been making cast iron pots for melting lead, and as long as coke was used as a fuel had no trouble. Since using oil, the pots burn out rapidly, and show pin holes and cracks. We tried a mixture of steel scrap, 300 lbs.; machinery scrap, 1,000 lbs.; we also tried a mixture of steel scrap, 100 lbs.; machinery scrap, 1,800 lbs.; and No. 3 foundry, 100 lbs. The first mixture gave the best results when we added 5 lbs. ferro-manganese to each ladle of 1,800 lbs. We melt much more iron than we need, and pour it into pigs, and by so doing find that we get a cleaner and closer grain product. Tell us how we can overcome our difficulties.—A. G. B. Co.

Answer.—It is not advisable to melt your iron more than once, as melting it and pouring it in pig only increases the sulphur. The oil contains a higher percentage of sulphur than the gases from the coke fire, and the pots are kept at a high temperature with more free oxygen in the oil fire than in the gases from the coke; in which case the iron is burnt. If you will secure a better mixture of air with your oil and less free air in the chamber arond the pots, you will find that the life of the pot will be much longer.

• • •

Dry Sand Facing for Brass.

Question.—Can you give us a good formula for dry sand facing for making sharp, smooth, light castings in yellow brass, such as chandelier work? We mix about a barrel at one time.—R. T.

Answer.—There are several preparations on the market suitable for use as a facing in making fine brass castings. They come mostly in powdered form and are dark red brown in color and make very fine sharp, smooth castings. If the moulds are to be skin dried, they must be sprayed with stale beer or molasses water, but if the mould is to be dried or baked in the oven the sand should be tempered with molasses water at first to give a bond so that the impressions will withstand the rush of metal. The quantity of molasses to be used depends on the class of work you are making. The writer has found a mixture of two of water to one of molasses very satisfactory.

• • •

Brass Mixture for Fittings.

Question.—Will you kindly give us a mixture for gasoline engine fixtures also one for propeller wheels using all new metals but getting as cheap a mixture possible.—S.L.M.

Answer.—A very good mixture for brass fittings is:—Copper, 85 per cent.; zinc, 10 per cent.; tin, 3 per cent., and lead 2 per cent. This mixture can also be used for propellers but a better one is:—Copper, 88 per cent.; tin, 10 per cent., and zinc, 2 per cent.

• • •

Mixture for Soldering Iron.

Question.—We would like a first-class mixture for electric soldering irons. J. D.

Answer.—A mixture that has been found to work well in soldering irons is as follows:—Copper, 96 per cent.; zinc, 3 per cent.; phosphor-tin, 1 per cent.

• • •

Core Difficulties.

Question.—We are making castings with some very small intricate cores in them, and have had a lot of trouble from the cores blowing. We have tried several different mixtures of sand but have not obtained good results. Can you give us a core sand mixture that will stop this trouble.—T.S.

Answer.—If you will get some ground silica sand commonly known as sugar sand, I think it will overcome your trouble. This sand can be mixed 80 to 90 parts to one of raw linseed oil, and very seldom needs a vent in small cores. You can get this sand from any foundry supply house by the barrel or car.

• • •

Buying Coke.

Question.—What rule would guide you in buying good coke?—T. W. P.

Answer.—Good coke should be low in ash, high in carbon, and as free as possible from sulphur.

METALLIC MOULDS FOR CASTINGS

By Walter T. May.

MAKING castings in metallic moulds is not at all a new process, although during the last few years it has been developed on somewhat new lines, and is being still further developed in places where large numbers of identical castings are needed. Probably, with some limitations in regard to size, firms making articles with parts which are interchangeable will eventually use these permanent iron moulds very largely, especially as with a little care there need be only the minimum of machining done to the castings, thus making it possible to turn out sufficiently finished castings for many things. In the cheaper class of goods turned out by the thousand, the production of cast parts practically finished is of much importance, owing to the fact that the less the things are handled the easier their first cost can be kept.

It will usually be found that, to ensure economy in production the cost of plant will be somewhat heavy when its first installation alone is considered, but the saving in cost of manipulation afterwards gives a large ultimate profit. It is in this way that American practice enables makers to cut prices very largely, because in the first place work is standardized, and as far as possible interchangeable, thus reducing the numbers of parts; then the best appliances for turning out the parts are obtained, no hesitation being shown in scrapping as appliance if a better can be had, and what is quite as important, wages rather rise than fall as the various appliances are introduced.

Initial and Production Costs

In the case of permanent-mould making, the makers of the moulds are well paid, and for this reason the mould is costly, but as against this must be set off the low cost in producing castings from the moulds, as even against the best machine moulding there is a large reduction in both cost and time. Supposing a mould costs $5 and produces 1,000 good castings, the cost of moulding runs out to approximately a half cent per casting, as against from 12 to 18 cents by hand work, and the castings being to all intent and purposes identical in size and form, they can be very economically handled in the machine rooms.

As against these reductions there is probably a small increase in the cost of working the moulds, this being dependent on the organization of the moulding floor; but when worked in series in a systematic manner, and with a continuous running cupola or a battery of crucible furnaces of a size to keep up continuity of working, the increased cost of manipulation can be kept down to quite a small thing. One or two moulds only would be a nuisance as a rule, but with sufficient to keep a regularly organized staff of men going steadily, the work would be done at a small expense and with considerable rapidity so far as the number of castings produced in a given time is concerned. Instead of taking an hour to produce a mould in sand, four castings could be produced in the hour under favorable conditions, as the moulder would be eliminated after the metal mould was secured, men trained to handling the casting operations only being necessary.

Metal Mould Troubles.

At first, metal moulds work badly, as they have to get seasoned to the work, and a good many wasters would be turned out at first; but as the moulds get seasoned the wasters disappear, and eventually become rather rare. There is, however, this to be said about wasters; they cost only the amount which is expended on melting and pouring, which, as a rule, is a comparatively small item, while it is not comparable with the loss involved where wasters are produced in ordinary sand moulding, which involves the loss of the moulder's time in every case.

The metal of which the moulds are made should be low in combined carbon and high in graphitic carbon, while the silicon content should not be too high. High silicon and combined carbon would probably cause the moulds to grow and become deformed, while cracking would certainly take place. The moulds are not chills, and should not be allowed to get much above 350 degs. F., while working, this not being difficult to manage owing to the castings being turned out as soon as set, or at least in the case of iron at about an orange-red. With other metals generally a lower temperature would be used both for pouring and removal from the mould, the shape of the castings, the metal used, and individual practice being the determining factors for turning out the castings. To ensure the quick removal of heat, the moulds must be thick, say, from 2 in. upwards, according to the bulk of molten metal dealt with, each mould having to be treated according to its own particular purpose.

Hinged moulds should work freely, but without excessive play, and built-up moulds should have freely-fitting guide dowels to keep the parts in their proper positions. Wrought-iron handles will have to be cast in, as everything gets too hot to hold with the bare hands, and unless proper facilities are afforded in this direction trouble will certainly occur. Venting is only needed to carry off the confined air, as gases will not be generated, owing to the fact that clean metal must be used, and in most cases a slight amount of venting at the joints of the moulds will be all that is necessary. In regard to the metal used in making the castings, it must be clean and fluid, and in the majority of cases it is desirable to use some flux of a deoxidant character to remove all traces of undesirable matter.

In melting it will be found that the greatest fluidity occurs soon after melting point is reached, and that, with accretions of temperature, the molten metal becomes dull and sluggish, refusing to run up sharply, and in some cases only producing porous castings of a very unsatisfactory character, quite independently of the form of mould used. To some extent fluxes can be used to recover this overheated metal when it is again melted, while, provided the right form of flux is used, passable castings can be secured, but this should not be required, since proper melting makes their use unnecessary.

Where iron cores are used, these should be made of soft cast iron like the moulds, and for some time a coating of plumbago should be used with them, both for getting into good condition and to act as a lubricant. Their removal from the castings should take place at the interval between the solidification of the metal and the commencement of contraction, which, although brief, is yet long enough to enable the cores to be taken out. If the metal contracts before the cores are taken out, much difficulty will be experienced in removal. There is nothing to prevent sand cores being used, provided they are dried thoroughly and coated with plumbago, but provision must be made for venting when these are used. In removing iron cores, where possible, they should have a spiral or screwing motion imparted to them.

The Operator Feature.

In dealing with metal moulds, the greatest trouble will be found with the operators, as at first they will find it difficult to get the exact time at which the mould should be opened and the casting thrown out, very many men treating these moulds as chills. For this reason it is at first desirable to deal with such things as wheel blanks or articles of a like character which do not surround any part of the mould, and from these work to other forms, as at first it is somewhat difficult to judge the proper time for opening the moulds.

Given good soft iron moulds, clean metal, and operators who take an interest in the work, making castings in permanent moulds should very largely reduce costs of producing articles where large number of similar parts can be utilized, as practically the moulder's work is eliminated after the moulds are once made, thousands of castings being obtainable from each mould when they are properly handled. Practically all metals and alloys can be dealt with, but there will necessarily be differences in their treatment. Above all, it must be remembered that the process is not a new one, but simply a development of a practice which has been in use for a considerable number of years in a slightly different form.—From a recent article in the Foundry Trade Journal.

Locomotive Cranes recently have been fitted with small turbo-generator sets to furnish current for lifting magnets with which the cranes are equipped. This eliminates the dragging back and forth of power wires along the track on which the crane operates.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

POWER CALCULATIONS.

WORK is measured by taking account of force and distance. The British unit of work is the foot-pound or one pound of force through one foot of dis-performing work is required, another dimension must be taken into account. This is time. Thus power is the ability to do a certain amount of work in a stated time. The unit of time varies, but the minute is usually adopted. That is, a horse power represents 33,000 foot-pounds of work performed in one minute. This may mean the lifting of 33,000 pounds one foot high, 330 pounds 100 feet high, or it may represent the moving of a body 1,000 feet in a horizontal direction against a frictional resistance of 33 pounds. It matters not whether the direction of the applied force is vertical, horizontal or circular so long as the three dimensions are known namely, its value in pounds, the distance it moves in feet and the time in minutes required to travel the above distance.

* * *

Question.—An elevator lifts 21 people 60 feet in 3 minutes. Counting 12 people to the ton, what is the work done and what is the power of the machine?

Answer.—If 12 people weigh 1 ton, 21 would weigh $\frac{21}{12}$ tons or $\frac{21}{12}\times 2{,}000$ pounds $= 3{,}500$ pounds.

$3{,}500 \times 60 = 210{,}000$ foot-ponnds, which is the work done.

210,000 foot-pounds in 2 minutes = 105,000 foot pounds per minute, and as one horse power=33,000 foot-pounds per minute, therefore the power of the elevator is

$$\frac{105{,}000}{33{,}000} = 3\frac{2}{11} \text{ horsepower.}$$

* * *

Question.—If it requires 300 pounds pressure on the tool of a lathe to take a cut 3-16 inch deep at a 32 feed, what horse power motor would be required to operate the machine. The diameter of the work is 28 in., the speed of the driving pulley which is geared 4 to 1 is 40 r.p.m. and the efficiency of the gearing is 85 per cent.

Answer.—The work makes $\frac{40}{4} = 10$ r. p. m. Circumference of the work is $\frac{28}{12}\times\frac{22}{7}=\frac{22}{3}=7\frac{2}{3}$ feet. Speed, therefore, is $7.33\times10=73.3$ ft. per min. Force is 300 pounds, and horse-power then is $\frac{73.3\times300}{33{,}000}=\frac{73.3}{110}=.666$ h.p. On account of the gearing losses, this represents 85% of the required power. Power needed then is $\frac{.666}{85}\times100=.784$ h.p.

* * *

Question.—The arm of a prony brake is 3 ft. long. If the engine run at 120 r.p.m. and the load on the scale be 20 pounds, what actual power is the engine developing?

Answer.—The number of foot-pounds developed would be the circumference of a circle of 3 ft. radius multiplied by the r.p.m., multiplied by the load on the scale. This is $6\times\frac{22}{7}\times120\times20$, and

$$\text{horse-power}=6\times\frac{22}{7}\ \frac{120\times40}{33{,}000}=2.74 \text{ h.p.}$$

* * *

Question.—Instruments show that the electrical power input to a boring mill is 27.8 amperes at 220 volts. A previous test of the motor showed the stray power and other losses to be 3.8 amps. What horse-power is required to operate the machine?

Answer.—One horse-power=746 watts. Number of watts used is $24\times220=5{,}280$. Amount of horse-power is $\frac{5280}{746}=7.07$h.p.

* * *

Question.—In the above example, the large gear is 35 inches in diameter. If the speed be $1\frac{1}{2}$ r.p.m. what is the direct pressure against the gear teeth?

Answer.—The circumference of the gear is

$\frac{35}{12}\times\frac{22}{7}=\frac{55}{6}$, and surface speed $=\frac{55}{6}\times\frac{3}{2}=\frac{55}{4}=13.75$ ft. per min.

7.07 horse-power $= 7.07\times33{,}000 = 233{,}310$ foot- pounds.

Pressure on gear teeth $=\frac{233{,}310}{13.75}=$ 16,968 pounds or $8\frac{1}{2}$ tons.

* * *

Question.—A triple threaded worm drives a 72-toothed gear. How many revolutions will be made by the gear for every 100 made by the worm?

Answer.—For every revolution of the worm, the gear advances three teeth. For 100 revolutions of the worm the gear would advance $3\times100=300$ teeth or $\frac{300}{72}=4.16$ revolutions.

* * *

Question.—How fast could a 3 ton elevator be raised by a 4 h.p. motor, considering the unbalanced weight of the elevator to be 500 pounds and the efficiency of the machinery to be 75 per cent?

Answer.—A four h.p. motor with gearing of 75 per cent. efficiency could perform $\frac{33{,}000\times4\times3}{4}=99{,}000$ foot-pounds of work.

The loaded elevator weighs $(3\times2{,}000)+500=6{,}500$ lbs. With a power of 99,000 foot-pounds per min., this load could be raised $\frac{99{,}000}{6{,}500}=15.23$ feet per min.

* * *

Question.—A pump working 8 hours per day is required to keep a tank, which is elevated 60 feet, full of water. The tank is 14 feet in diameter, 16 feet high and is three-quarters emptied every day. With friction and mechanical losses amounting to 40 per cent., what size motor would be required to operate the pump?

Answer.—The volume of the tank is

$$7^2\times\frac{22}{7}\times16=\frac{7\times7\times22\times16}{7}=2464 \text{ cu. ft.}$$

Weight of water$=2{,}464\times62\frac{1}{2}=154{,}000$ pounds or $\frac{3}{4}\times154{,}000=115{,}500$ pounds to be raised in 8 hours. The height is $60+16=76$ feet. 115,500 ponnds in 8 hours$=\frac{115.500}{8\times60}=240.625$ ponnds per min. To raise this 76 feet requires 76×240.625 foot pounds or $\frac{76\times240.625}{33{,}000}$ h.p. With a loss of 40 per cent. The rating of the motor would be,

$$\frac{76\times240.625\times100}{33{,}000\times60}=.923 \text{ h.p.}$$

U.S. BRASS FURNACE PRACTICE.

BRASS Furnace Practice in the United States is the title of Bulletin No. 73, issued by the Bureau of Mines, Washington, D.C., containing the results of an investigation undertaken to ascertain the melting and fuel losses in present brass-melting practice and to indicate, as far as possible, methods by which these losses might be reduced. Dr. H. W. Gillett, alloy chemist of the Bureau, conducted the investigation, and is the author of the bulletin.

Magnitude of the Industry.

The magnitude of the industry and other important features are indicated in the accompanying extracts from the preface of Charles L. Parsons, chief of the Division of Mineral Technology of the Bureau:

There are in America to-day some 3,600 plants melting brass and bronze, and 1,000 of these melt non-ferrous alloys exclusively. Allowing for the present recovery of waste metal, it appears that in current practice, between the purchase of the raw metal and the completion of the finished product, at least 5 per cent. of the original metal is lost. In the melting of non-ferrous alloys, taking into consideration all such alloys and all furnaces and fuels used, it is shown that from 90 to 95 per cent. of the heat units in the fuel do no useful work. On the basis of $120,000,000 being the value of the metal passing through brass and bronze furnaces each year, a 2½ per cent. melting loss, equivalent to 5 per cent. loss on metal bought, means an annual loss of $3,000,000 in metal alone. Simply reducing the average metal loss to that of present best practice would mean a saving of over $1,500,000 a year. If fuel efficiency and crucible life could be brought from present average to best practice, half million dollars more, at least, could be saved.

Proper Records and Control.

The lack of proper control and of proper records in most furnace practice has been brought out through the investigation. Few of the plants are under technical control. The firms that keep proper records, and hence have the necessary knowledge, invariably employ a trained metallurgist to supervise the melting furnaces, and these firms almost always have the lowest losses. The lack of technical control is emphasized by reports of metal losses varying from one-tenth of 1 per cent. to 22 per cent., and fuel efficiency from 1½ to 16 per cent. The need for thorough technical control in the majority of our foundries and casting shops is clearly evident.

Operators' Inefficiency.

Another waste not so readily expressed by figures, but which none the less really exists, is the loss of efficiency of the workers in the industry through occupational disease and accidents due to a lack of safety precautions. A few of the firms reporting have given careful consideration to the prevention of disease and accidents, and it is shown that by the enforcement of simple, proper precautions, occupational disease may be eliminated and the non-ferrous alloy industry placed beyond reproach as to the health and safety of its employees. Investigation has also magnified the need of an efficient electric melting furnace in the alloy industry, and a pyrometer which can be used as a workman's tool. These two problems are now under investigation by the Bureau of Mines.

Melting Loss and Copper Consumption.

The losses, both of metal and fuel, in melting brass and bronze are large. The net loss of metal, if all recovery of any sort be deducted and if all the brass and bronze alloys be included, will average not less than 2.5 per cent. Extreme figures reported are 22 and 0.1 per cent., the former figure being unusual and not representing regular practice and the latter not being verified. Extremes of 8 and 0.5 per cent. are well substantiated. The total melt will average about twice the raw metal bought, because of the remelt of crop ends and scrap in rolling mills and of gates and sprues in foundries. Some foundries making light castings melt 3 lb. of metal to get 1 lb. of castings. A ratio of 2 lb. of metal to 1 lb. of castings is common, and 1½ to 1 is low. If, then, the whole industry be considered, a loss of 2.5 per cent. on the gross melt is equal to about 5 per cent. on the raw metal bought.

The consumption of copper in the United States in 1911 was about 680,000,000 lb. If two-thirds of this total, or 450,000,000 lb., be considered as having been used for making brass and bronze, and if the average copper content of the alloys used be assumed as 80 per cent., the deduction would be that about 560,000,000 lb. of brass and bronze products was made from new copper. It seems conservative to estimate that at least two-thirds of the copper consumed in the country is in the form of brass and bronze, as W. S. Lathrop states that one corporation, making mainly wrought yellow brass, uses in its various plants approximately a third of all the copper consumed in the United States. To this must be added the old metal used. Half as much old scrap or alloyed ingot as new metal—that is, 280,000,000 lb., seems a fair estimate, so that 840,000,000 lb. should represent the total metal bought. The average value of brass and bronze being taken at 15c a pound, by this method of figuring $126,000,000 would be the value of the metal passing through the brass and bronze furnaces of the United States in a year. For purposes of computation the estimate of $120,000,000 has been taken.

A 2½ per cent. melting loss, equivalent to a loss of 5 per cent. on the metal bought, thus means $3,000,000 a year lost in metal alone. Could this be reduced to the 2½ per cent. loss (equivalent to 1¼ per cent. on the melt) shown by good practice, a saving of $1,500,000 a year would result. If the fuel consumption and crucible life were brought from the average practice up to good practice, and if furnaces that cut down or eliminate crucible cost and allow greater production with less labor cost were used wherever practicable, a saving of at least another half million would be made, or a total of $2,000,000 a year that the non-ferrous alloy industry of the United States might save merely by bringing average furnace practice up to the standard of the best practice.

Fuel Efficiency.

The fuel efficiency is found to vary between 1½ and 16 per cent., the average being 4 to 9 per cent. If all fuels and all furnaces be considered it is doubtful whether the average fuel efficiency is more than 7 per cent. of the theoretical.

Dr. Gillett sent out about 2,000 lists of questions to 1,650 plants, only 230 of which sent any data, and about 50 of these stated that they had no records. The information obtained was supplemented by personal visits to some 80 foundries and rolling mills in 13 States. It is believed, however, that the data obtained represent the practice of the great bulk of firms melting brass.

ILLUMINATING ENGINEERS' SOCIETY CONVENTION.

AT the Illuminating Engineering Society Convention, which meets in Cleveland, Ohio, from September 21 to 26, the accompanying list of papers, among others, will be read and discussed:—

Factory Lighting—By Hogue and Dicker.

Planning for Daylight and Sunlight in Buildings—By Marks and Woodwell.

Notes on the Ulbricht Integrating Sphere and Arc Lamp.

Effect of Room Dimensions on Efficiency of Lighting Systems—By Ward Harrison.

A New Standard Light Source—By L. A. Jones.

Artificial Daylight: Its Production and Use—By M. Luckiesh and F. E. Cady.

Characteristics of Gas-filled Lamps—By G. M. J. Mackay.

Recent Improvements in Gas Lamps—By a Welsbach representative.

The Locomotive Headlight—By J. L. Minick.

Present Practice in Machine Shop Lighting—By Powell and Harrington.

The Development of Daylight—By E. J. Brady.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

IMPROVED MOTOR DRIVEN PATTERNMAKER'S GRINDER.

C. H. BESLY & CO., Chicago, have brought out an improved motor-driven patternmaker's grinder, the following illustrated article being relative to same. This combination machine (Fig. 1) which is claimed to be a big labor saver on wood pattern work, has a steel disc wheel faced with Garnet paper for grinding flat surfaces and external curves; and a drum sanding attachment for grinding internal surfaces —both straight and curved. The construction throughout is fully up to the standard of the very highest grade of machine tools, the flat disc wheel, adjustable work tables and various work-table attachments, graduated, insuring extreme accuracy in angularity and dimension at trifling labor cost.

With this machine an apprentice is capable of performing much of the work which heretofore had to be done by a skilled workman. Cheaper pattern lumber can also be employed, as the machine will grind any kind of wood, and even nails or screws which may protrude to the ground surface. What has heretofore been considered trimmer work can be done quicker and better on the grinder, as well as much of the turning and smaller machine planing, and a large portion of the hand work, such as sanding, planing, cornering and general hand fitting and finishing.

In addition to doing the work quicker, the grinder produces straighter flatter surfaces, better glue joints, more accurate angles and dimensions as well as better finish. Ground surfaces are claimed to make the best glue joints known for wood patterns, and with this machine an ordinary workman can make as good a glue joint as an expert. Same applies to jointing split core boxes. An apprentice can renew the grinder abrasive material, but it takes an expert to sharpen knives for trimmers, machine and hand planes, etc.

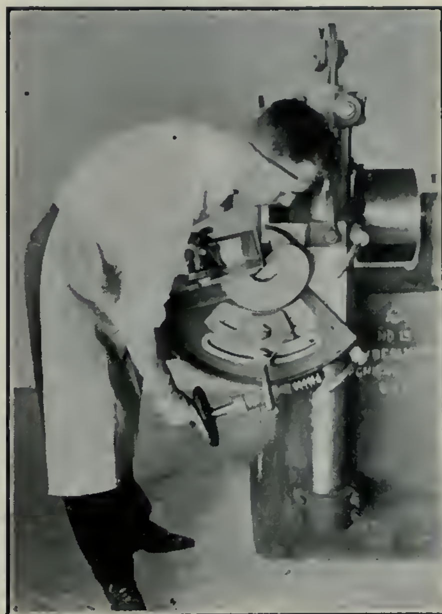


FIG. 2. MOTOR-DRIVEN PATTERNMAKER'S GRINDER.

The grinding wheel is of steel 30 ins. diameter and similar to wheels used on disc grinders, except that, for grinding wood, the abrasive sheet or circle is cemented to the wheel while in position on the machine and without the use of a press. A special quick-drying cement is used for this work. A worn out circle may be removed and a new one made ready for use in a few minutes time.

The spindle construction is similar to other high grade disc grinders, in that provision is made for taking up all end play so that extremely accurate work may be accomplished. The disc wheel is served by an adjustable work table 14 ins. wide by 40 ins. long, which may be tilted by means of the worm gear hand wheel (Fig. 2), and locked at any angle from 75 degs. to 135 degs. from the plane of the grinding disc. Large distinct graduations are provided to indicate this angular position.

In order to be able to change the angular position in one operation, the table is hung from one end and tilts from an adjustable circular gibbed bearing so stationed that edge of table always remains 1-32 ins. from face of grinding disc regardles of the angular position of the table top (Fig. 2). This is an important feature because ordinary tilting tables incline to move away from the grinding disc when tilted; naturally

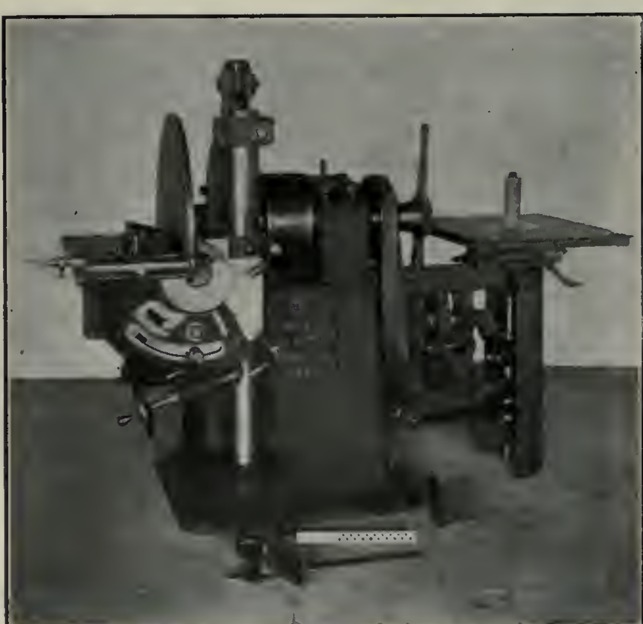


FIG. 1. MOTOR-DRIVEN PATTERNMAKER'S GRINDER.

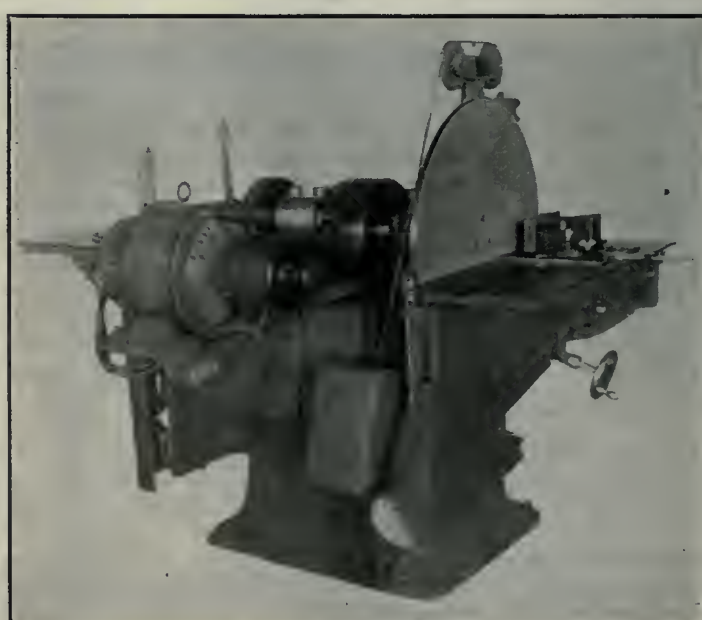


FIG. 3. MOTOR-DRIVEN PATTERNMAKER'S GRINDER.

requiring a second adjustment to bring them up to the face of the wheel. The work table has vertical adjustment of 25 ins., and may be swung away from the grinding disc for convenience in resetting the wheel or for facing off extra large patterns. It is also counterweighted, and each adjustment is locked with a single handle nut insuring easy and quick manipulation. Four work table attachments, indispensable on wood pattern work are provided as follows:

The sizing circle guage for grinding cylindrical or conical work like core prints.

The sliding bevel gauge, graduated for accurately squaring or beveling.

The sizing bevel gauge graduated, which carries an adjustable stop screw so that work may be ground accurately to size and duplicated.

The angle plate for free hand cornering of thin work.

The work table top has a groove paralleling the face of the grinding disc, and the work table attachments slide in this groove. These attachments are shown on floor and on work table in Fig. 1.

The drum sanding attachment has a work table 24 ins. x 28 ins., which may be tilted and locked at any angle from 85 degs. to 105 degs. from axis of sand drum. Large, distinct graduations are provided to indicate the angular adjustment. The sand drum shown is 2½ ins. diameter by 12 ins., long, but drums from 1 in. to 6 ins., diameter of any reasonable length may be used. The work table has a central angular opening 8½ ins., diameter into which are fitted circular plates with center holes to accommodate drums of various sizes. The sand drum runs at 2,250 r.p.m. and is given a vertical reciprocating movement, while running, to equalize the wear on abrasive. This movement is adjustable from 0 to 4 ins. A self oiling friction clutch coupling is provided between grinding spindle and drum sanding attachment to enable operator to stop the drum sander regardless of the disc wheel.

Fig. 3 shows an improved motor drive for the machine, this form of drive having, the makers state, proven more satisfactory than gears or silent chain. A standard motor, equipped with belt tightening attachment is mounted on an angle plate at back of a standard belted grinder, and the drive is through endless leather belt as shown. The motor is of 3 h.p. intermittent rating, and it will be noted that an extra wide belt is used to prevent slippage due to fine wood dust getting on pulleys.

The following general specification indicates a few additional features concerning the capacity and scope of the grinder:

Disc wheel 30 or 40 ins. diameter by ¾ ins. thick.

Spindle pulley 12 ins. diameter for 6 ins. belt.

Spindle 2½ ins. diameter by 37¾ ins. long.

Length of each bearing bushing 8 ins.

Diameter of work table post, 4 ins.

Height to center of spindle, 38 ins.

Floor space of bed casting, 30 x 42 inches.

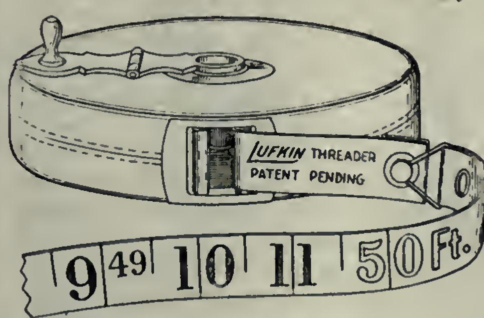
Operating floor space for machine, 8 ft. x 12 ft.

Shipping weight, motor driven 3,000 lbs.

METALLIC TAPE THREADER.

THE Lufkin Rule Company of Canada, Ltd., Windsor, Ont., have recently put out a patented measuring tape attachment, known as a **Threader**, which will hereafter be furnished with their metallic woven tapes without extra charge. The threader is a loop and stud arrangement, by means of which the tape, though securely fastened to the winding drum of the case when in use, can yet be readily detached from it and a new tape as readily attached, no manipulation of the case, case screw or drum being required to do this.

Woven tapes are sometimes torn by



METALLIC TAPE THREADER.

accident or through long use often become soiled and worn in such a way that they must be replaced while the case is yet in very fair condition. The line usually outwears it, and representing approximately half of the value of the outfit it is of considerable importance that it be a simple matter for anyone to insert a new tape in the old case as often as necessary and thus get the fullest measure of use out of the case as well as the tape. Metallic tapes without cases are quite generally stocked by supply houses, etc. ,and can always be easily obtained. Attachment is perfectly and easily accomplished by means of the threader.

A NEW HIGH TEMPERATURE CEMENT

A NEW high temperature cement recently placed on the market by the H. W. Johns-Manville Co., New York, is so composed that it vitrifies at as low a temperature as 900 degs. F., and withstands 2,760 degs. F. before melting. At 1,500 degs. F. is has a carrying capacity of 2,030 pounds per cubic inch, indicating especially high mechanical strength.

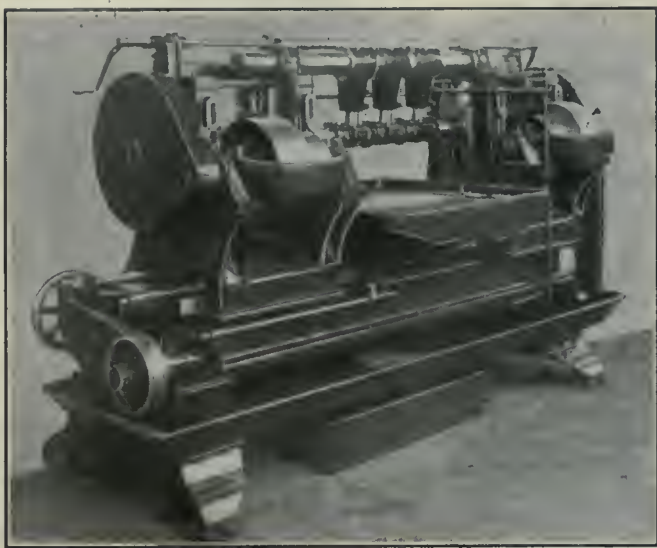
This new cement—the latest of several high temperature cements produced by this company to meet different conditions within recent years—is claimed to be adapted for comparatively low temperature furnace work. It is especially recommended for building door jams and lining doors in low temperature furnaces and as a fire-brick for repairing and patching parts of low temperature furnaces; building stoker gates in water tube boilers, building baffle walls; lining covers of brass melting furnaces, incinerators and hardening furnaces; building dampers of incinerators, and as a firebrick mortar for repairing and patching doors in re-heating and glass annealing furnaces subject to severe abrasion. J-M No. 26 cement can be applied to gas retorts for patching while they are hot.

There are many conditions under which it is necessary to surround iron bars with a refractory material and this new cement admirably fulfills the requirements, particularly in the construction of annealing furnace doors, which are usually of very large dimensions, and where it is necessary to use vertical and horizontal bars as a reinforcement to the frame. This cement used in conjunction with cushions of asbestos paper around the bars has been found very efficient for this purpose.

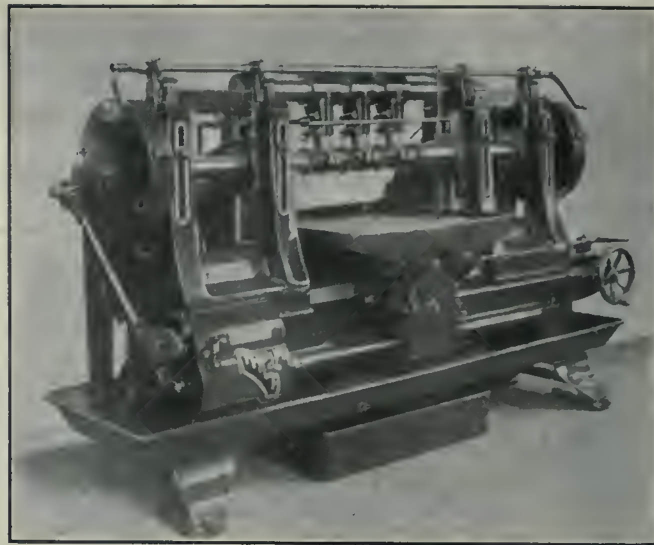
HENDEY DUPLEX LINCOLN MILLER.

THE illustrations show the size No. 16 Duplex Lincoln Miller of extra heavy design made to meet the most exacting demands of high speed production, by the Hendey Machine Co,. Torrington, Conn. The bed is massive and has extra wide top surface with square lock for supporting and aligning headstocks and saddle. The main spindles have taper journals on front end running in annular bearings lined with Lumen metal. The spindles have No. 12 Brown & Sharpe taper hole in front end with threaded nose, and an arched bar is cast integral with power shaft bearings, thereby helping to maintain their alignment on guides, and also acting as a belt guard.

Heavy connecting links serve to tie the power shaft and main spindle bearings together, two links being applied to each head for automatically controlling the engagement of gear train in .the spindle drive, no matter what elevation may be given to spindles. The gears are fully encased by guards which have compression grease cups for lubrication of gears. The spindles have unit control for elevating in unison. The overhead arm. or tie bar has three pendants for arbor support, and fitted with split bearings hinged, so that the bottom half falls away to facilitate quick removal of arbor. The table is fitted with power quick return, being geared for an approximate speed of 100 ins. per minute. It also has high sides for confining cutter lubricant.



HENDEY NO. 16 DUPLEX LINCOLN MILLER.



HENDEY NO. 16 DUPLEX LINCOLN MILLER.

This machine when fully equipped with fixtures and cutters for manufacturing operations is capable of a high rate of production. It is made in different lengths of bed, and is furnished with tables of different working dimensions. It can be had with or without oil pan, pump and piping equipment as desired.

SYSTEMS OF COKE OVENS.

THE July issue of the Revue de Metallurgie contains an extensive study of the principal systems of regenerative coke ovens, by M. Charles Berthelot, chiefly concerning their stability, and their economic applications. The points considered include the obtaining of the maximum coke yield, the maximum yield of by-products, the quality of the gas, and the solidity of the design of the oven. The ovens examined consisted of:—

(1)—Recuperative ovens, Solvay type.

(2)—Longitudinal regenerators in parallel, Otto, Collin, Still, Piette, Simplex, and Carves.

(3)—Longitudinal regenerators in series, Coppee type.

(4)—Transverse regenerators in parallel, Koppers.

(5)—Transverse regenerators in series, Lecocq.

The various furnaces are examined at considerable length, and note is made of the great increase in variable surplus gas by the introduction of regenerative ovens.

NEW SUCTION LUBRICATOR

A NEW and novel lubricator, made in three sizes for ¾-in., 1-in. and 1½-in. pipe connections, for use particularly on devices operated by compressed air, has just been brought out by the Vulcan Engineering Sales Co., Chicago, and is illustrated in the accompanying cut. The principle involved is one of suction. A chamber containing an absorbent is kept saturated from large oil storage chamber surrounding it, and air passing through the lubricator becomes sufficiently charged with oil to properly lubricate all surfaces with which it subsequently comes in contact.

This device is entirely automatic, because suction action takes place the instant air moves, and it ceases immediately the air is shut off. The take-up of oil is extremely moderate though continuous when air is being used. The apparatus can be attached to the air line in any position and operates in any plane or at any angle and can be filled in no matter what position. It is claimed, therefore, to be universal and fool-proof, and likely to prolong the life of pneumatic equipment, besides conserving the amount of lubricant used, thereby increasing efficiency and reducing maintenance costs.

NEW STYLE SUCTION LUBRICATOR.

A NEAT ELECTRIC SWITCH.

THE Duncan Electric Co. of Montreal have placed on the market a new line of standard electric fixtures. Their policy has been to simplify the various pieces, the new rosettes, sockets, extension plugs, switches, etc., being planned to give the least possible trouble to wiremen.

The latest addition to the list is a switch which when connected up is flush with the wall. Through a neat little rectangular-shaped brass plate a small brass lever extends, on the end of which is screwed a spherical brass ball; the switch being operated by throwing the lever up or down. The features of the switch are its ornamental flush mounting on the wall and the simplicity of its parts. The little switching lever is insulated from the current by the introduction of a porcelain link in the operating levers.

FLUSH WALL SWITCH.

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PRINCIPAL CONTENTS.

LABOR'S ANNIVERSARY DAY.

A FEATURE of the many Labor Day gatherings was the whole-hearted loyalty expressed towards our Empire in its fight for a world-wide freedom from the dual curse of autocracy and militarism, and the determination to aid in accomplishing the desired end by giving of themselves and their substance. The world to-day owes much to organized labor, although bubbling-over enthusiasm has been responsible for a number of excesses, yet it should not be forgotten that much of the civilization and liberty we now enjoy and hold as sacred as life itself, were in their initial stages marred by afterwards regretted excesses.

BUSINESS DEPRESSION A 20TH CENTURY SCANDAL.

THERE is a growing disposition on the part of the general public to investigate for themselves the recurrence of periods of business depression and to ignore the abstruse and for the most part unphilosophic utterances and declarations of self-styled financiers. Business depressions both on account of their almost measured regularity and of their severity are positively a 20th Century scandal, and thanks to the cultivation of a higher degree intelligence among the great mass of our people, and therefore a minimizing of the tendency to be led and directed blindly by a self-elected few whose judgment and capacity in the matter of handling a nations' cash resources has never exceeded normal, there is a prospect that the old regime and old order of things are destined for replacement.

The trouble with business enterprise to-day in Canada is that it is not being financed by our banks as it ought, and until a race of men who have been reared outside of the antiquated confines of a Canadian banking system displace the sleek, smug devotees of a tight-lidded cash-crammed chest, the needful relief will not be forthcoming. Canadian bankers are reared to a system which is equally inflexible as the law of gravitation, and while initiative, genius, discovery and progress have marked most other trades, professions and institutions, the business of banking may still be summed up for the most part as a species of what-we-have-we-hold.

Much loose talk is being indulged in with reference to establishing a Canadian moratorium in whole or part, and to conserving the interests of depositors. At the same time, much of this gossip is more or less inspired, which leads us to say that it is quite apparent our bankers have added to their other superfluous attributes that of being panic-stricken. No wonder is it that our factories and industrial establishments are being put under the ban, and that too at a time when opportunity is knocking loudly at their door. Further, why this unnatural because uncalled for conservation of and concern for depositors' interests? The dissemination of news relative to the latter feature, and the dangling of a probable moratorium establishment are just such things as will bring about a money panic and a run on our banks by depositors.

There will be no need to worry about depositors withdrawing their savings, if our banking institutions will but be enterprising and loosen up so that the business we have had all along be followed in a normal way, and the splendid opportunities we now have of extending it be reasonably taken advantage of.

We are informed that our banks were never so well fixed in the matter of cash resources, in spite of the fact that our people have their stockings in process of filling in their homes. This time-worn tale we note is again doing duty, but as on many former occasions the laugh is on the bankers.

Banking reform of all others projected is the most urgent in this Dominion of Canada to-day, and only its bringing about will draw progressive men to dispense its provisions. The riot and excess of speculation and illegitimate enterprise financing and the throttling of our commercial life with its attendant hardship and misery which we have become accustomed to in their periodic alternation will then, and only then, under capable direction and appreciation of our nation's needs, approach to and maintain a standard which will fluctuate little either side of common-sense par.

Machinery Display at the Canadian National Exhibition

Staff Article

Although perhaps more so than in recent years, a bigger change in the personnel of exhibitors of machinery and general mechanical engineering equipment falls to be noted, the Machinery Hall is as usual crowded, and the various other locations and departmental sections easily maintain the reputation of former displays. Our machinery manufacturers are to be congratulated on the enterprise they have shown in fostering the country's industrial wellbeing.

THE display in the Machinery Hall at the Toronto Exhibition is quite up to the usual high standard, a fact at once gratifying to those who are interested in this section of our National Show. It was anticipated by many that the present unsettled conditions in the industrial world would adversely effect the machinery exhibits, but this fortunately is not the case. All the available space is occupied and the exhibitors are showing an enthusiasm calculated to reform the most confirmed pessimist. That the majority of exhibitors are looking for good times ahead is reflected in the character of the exhibits. Many of the old familiar names are to be seen on the signs above the booths, although a number of former exhibitors are to be noted as missing on this occasion, their places have, however, been taken by others. The need for a new Machinery Hall becomes each year more apparent and most pressing, and while it is hardly to be expected that the authorities will do anything before at least another year has passed, the first favorable opportunity should be grasped. Several exhibitors complained to our representative of the roof leaking, causing thereby discomfort to those in line of the shower bath.

Among the Exhibitors.

Among the time honored exhibitors are to be seen the A. R. Williams Machinery Co. at the old stand, with their usual extensive display of tools. The Canada Machinery Corporation have the same location as last year and are exhibiting a line of new tools, among them being an all-geared head lathe and a radial drill. In the next booth is the exhibit of Corvan & Co., consisting of an interesting line of woodworking machinery. The Preston Woodworking Machinery Co. have increased their space this year and are exhibiting a number of high class machines.

The chapman Double Ball Bearing Co., are located in the center of the Hall and are also showing a new line this year in the form of an elevating truck for warehouses and factories. The utility of this truck is obvious after witnessing a demonstration. Close by is to be found the Dodge Mfg. Co. who are exhibiting a complete line of their well-known transmission appliances.

Among the new exhibitors, perhaps the most striking is that of the Victor Saw Works, Hamilton, Ont. This company occupy a booth at the east end of the Hall and have an effective display of Victor saw blades. The various stages of manufacture are featured on a board, while other displays show the different sizes produced, each being accompanied by a statement setting forth the particular work for which it is best suited. An interesting feature is a number of specimens of alloys used in the steel from which the saws are made. An arrangement of photographs and flags with a globe in the center illustrates graphically the world-wide use of Victor saws.

To the tired visitor, the booth of the Wilt Twist Drill Co., will be specially welcome. Here lounge chairs have been

VIEW OF GROUNDS AND LAKE, CANADIAN NATIOAL EXHIBITION.

provided for all those who care to avail themselves of the opportunity, of being able to learn of the company's product under comfortable conditions. The Pratt & Whitney Co. are new exhibitors this year and are showing their well-known lines of drills, reamers, etc. A booth attracting many interested visitors is that of the Carter Welding Co., who are demonstrating an Oxygraph machine. This mechanism, which is similar to a pantograph will cut steel plates, with an oxy-acetylene flame, to any desired shape. Welding broken castings with a Davis-Bornonville oxy-acetylene outfit also forms part of the exhibit.

Over the way is the booth of the L'Air Liquide Society also demonstrating the efficacy of the Oxy-Acetylene system for welding and cutting. Various samples of work done by this process show the high standard of attainment possible, also the many kinds of work that this apparatus is capable of overtaking. The company have on view a power or hand-welding machine, also a hand welder.

An interesting machinery exhibit is that of the Canadian Fairbanks-Morse Co., in the Agricultural section. Here are to be seen stationery and marine oil engines, while in an adjoining tent is a complete 25-bag flour mill in operation. The wheat is seen being passed through the mill to make flour and finally bread, etc., all in one tent.

The W. D. Beath Co.'s exhibit of runways attracts considerable attention as do also that of the General Fire Extenguisher Co., who were demonstrating the Grinnell head. Baines & Peckover have an extensive display of steel products.

Exhibitors, Exhibits and Representatives

Canadian Tool Steel Co., Toronto.—Picks, blacksmiths' tools, hammer heads, etc., made of Ductite steel: also the Dickson patent wrench. Representatives: R. I. Henderson, Fred C. Fowler.

Carter Welding Co., Toronto.—Davis-Bournonville Co., oxy-acetylene welding outfits. Demonstrations with oxygraph cutting machine. Representatives: W. Carter, H. W. Carter and P. Sorley.

Canada Machinery Corporation, Ltd., Galt, Ont.—Wood working tools, consisting of chain morticer, 24-in., planer, matcher and molder; tenoning machine with cut-off saw; 12-in. molder; iron working tools consisting of a 20-in. x 10 ft. all geared head lathe; 27 in. x 16 ft., LeBlond lathe, and 4 ft. radial drill. Representatives: W. Baird, N. Blain, W. Irving, R. Dryden.

Canadian Ice Machine Co., Toronto.—Refrigerating plant in operation consisting of a 2-ton York machine, double pipe condenser, freezing tank, etc.; parts of a 4-ton York machine showing general construction. Representatives: C. E. Allison, C. H. Bower.

Canada Hart Wheel Co., Hamilton, Ont.—Complete line of abrasive wheels, razor hones, etc., and saw sharpening machine. Representative: F. S. Morrison.

Cowan & Co., Galt, Ont.—Two chain saw morticers, vertical hollow chisel morticer, 6 in., four side molder, power feed rip saw, surface planer with round cylinder grinding and jointing attachment. Representatives: W. Cowan, S. F. Barrows.

Consolidated Electric Co., Toronto.—King Edward electric motors, ½ to 25 h.p.; electric fittings, conduits, switches, etc. Representative: J. G. Howorth.

The Canadian Fairbanks-Morse Co., Toronto.—Exhibit in agricultural section of gasoline engines, direct connected pumps; various sizes of 2 and 4-cycle marine oil engines up to 25 h.p.; pneumatic water systems. Representative: R. B. Dargavel.

Climax Good Roads Machine Co., Hamilton, Ont.—Climax hand balers in two sizes for 200 and 100-pound bales respectively. Representative: H. Robinson.

Commercial Oil Co., Hamilton, Ont.—Full line of oils and greases; special transmission grease; liquid and stick belt dressing; complete line of Sharp spark plugs. Representatives: A. W. Houlding and F. C. Walsh, with J. M. Mackenney, representing the Sharp Spark Plug Co., Cleveland, Ohio.

Canada Metal Co., Toronto.—Complete line of Babbitt metal, heavy pressure bearing metal, solder, lead pipe and ingot metals, also plumbers' supply department fully equipped. Representative: W. G. Harris, W. G. Harris, Jr.

Dominion Belting Co., Hamilton, Ont.—Maple Leaf stitched cotton duck belting for power transmission and conveyors; belt dressing. Representative: J. Scott.

W. D. Beath & Son, Ltd., Toronto.—Demonstration of overhead industrial tracks and runways.—Representative: W. D. Beath.

The Canadian Morehead Mfg. Co., Woodstock, Ont.—Morehead line of steam and condenser traps. Representative: E. J. Bickle.

The Canadian General Fire Extinguisher Co., Toronto.—Automatic sprinkler fittings, steam supplies, Chapman valves, Grinnell heads, automatic sprinkler demonstration Representative: C. H. Burt.

The Dodge Mfg. Co., Toronto.—Complete line of transmission machinery, including steel and split wood pulleys, bearings, hangers, etc. Representative: J. F. Haas.

The Chapman Double Ball Bearing Co., of Canada, Toronto.—Complete line of ball bearings up to 6 7-16 in. power and hand operated efficiency testing plants. Friction clutches, thrust bearings, etc. Elevating truck for factories and warehouses. Representatives: W. J. Murray, Chas. Murray, J. B. Wilson and W. C. J. Hoekin.

British Aluminum Co., Toronto.—Full line of aluminum products. Representative: E. Jannell.

Cleveland Pneumatic Tool Co., Toronto.—Full line portable pneumatic drills, grinders, sand, rivetting and chipping hammers, rock drills, Bowes and Never Leak couplings, etc. Representatives: J. A. Day, C. O. Garner.

General Machinery Co., Toronto.—G. M. C. automatic water systems; demonstration of Luitweiler pumps. Representative: W. McLachlan.

Galt Foundry Co. Galt Ont.—Demonstration of the McNaughton Grate. Representative: F. W. Donaldson.

The Boiler Repair & Grate Bar Co., Toronto.—Demonstration of shaking grate. Representative: A. H. Hett.

The Elliot Woodworker, Ltd., Toronto.—Demonstration of the Elliot woodworker. Representatives: F. Elliot, G. Elliot.

The Jones & Moore Electric Co., Toronto.—Full line of Century electric motors. Representative: W. Dalton.

R. A. Lister & Co., Toronto.—Demonstration of a Lister-Bruston automatic 60-light plant and a 5 h.p. oil engine operating. In the agricultural section are a number of oil engines adapted for farm work, also Mellotte cream separators. Representative: L. Burbidge.

D. K. McLaren Co., Montreal.—British Oak Tanned Belting, D.K. Balata Belting, Philips pressed steel pulleys, D.K. wood split pulleys and general line of mill supplies. Representative: W. S. Hamilton.

J. L. Morrison & Co., Toronto.—Bookbinders' and printers' machinery. Representative: W. Doldring.

The Massey-Harris Co., Toronto.—A number of gasoline engines in operation, pumping outfits, power sprayer, etc. Representatives: B. Graham, N. A. McIntosh.

The National Equipment Co., Toronto. —Peerless automatic water systems for domestic purposes, and demonstrating a 125-gallon per hour pumping outfit; also an exhibit in the Transportation Building of the Wayne Gasoline and Oil Storage Systems. Representative: W. T. Bradley.

The Nash Temperature Control, Ltd., Toronto.—Nash automatic controlling devices for ings. Representative: J. M. Watson.

The Schaeffer & Budenberg Mfg. Co., Brooklyn, N.Y.—Display of indicating and recording gauges, indicators, tachometers, pyrometers, etc. Representative: Curt E. Georgi.

The L'Air Liquide Society, Toronto.—Demonstrating oxy-acetylene welding; hand or power welding machine for boilers, tanks, etc.; hand welding machine for light work, acetylene generators and numerous specimens of work. Representatives: J. Macmillan, T. Girouard, G. Cooper.

The Pratt & Whitney Co., Dundas, Ont.—Display of P. & W. twist drills, reamers, taps, dies, and milling cutters; also a 10 in. tool maker's lathe. Representatives: J. D. Dixon, Webb.

Preston Woodworking Machine Co., Preston, Ont.—Belt sander, power feed saw, 12 in. molder, 36 in., band saw, 24 in. panel planer, 36 in. high speed ball bearing shaper and Newport attachment for molding machines. Representatives: W. J. Murray, W. E. Near.

The Siche Gas Co., Toronto.—Oxy-acetylene welding and cutting plants, Siche gas for lighting, Oxyweld for welding, Allan-Liversidge acetylene generators for automobiles, etc., acetylene heaters and stoves. Representative: L. R. Arnett.

The Victor Saw Works, Ltd., Hamilton.—Victor hand frame and power hack saw blades. Display of saw blades showing different stages in manufacturing, and alloys used in making saws; rail cutting frame with clamps. Representatives: C. O. Yackman, W. S. Pollock.

Wilt Twist Drill Co., Walkerville, Ont.—Complete exhibit of Wilt twist drills and reamers. Representatives: W. A. Tingle, H. K. Clark.

The Holden Co., Montreal.—Complete line of portable electric and air tools, rock drills, and railway supplies. Representative: J. B. Wilson.

The Garlock Packing Co., Hamilton.—Full line of Garloch packings and Keystone grease. Representative: N. G. Davis.

The Arnold Co., Toronto.—The Arnold Automatic Fuel Economizer.

Baines & Peckover, Toronto.—Line of Saville's tool steel, Triumph Superb; crucible, vanadium and cold rolled steel; expanded metal, babbitt metal, chain, wire rope, etc. Representatives: W. M. David, T. A. Steven, H. W. Marshall, A. McGregor, W. P. Williams.

Cling Surface, Buffalo, N.Y.—Belt treatment, demonstration showing high efficiency of slack belts with Cling Surface. Representative: J. A. Faatry.

S. F. Bowser & Co., Inc., Toronto.—Exhibit in Transportation Building: Gasoline and lubricating oil systems, Red Sentry pump for automobile, curb filling stations. Process Building: Lubricating oil systems, filtering systems, etc. Representatives: R. W. Williams, A. McIntosh, A. E. Moffatt, E. T. Murphy, and H. T. Stern.

Belt Grip Pulley Co., Buffalo, N.Y.—Leather-faced pulleys for high-speed drives, leather castors. Representatives: A. E. Finch, C. G. Hurlburt.

H. F. McIntosh & Co., Toronto.—Sales agents for Star expansion bolts. Representatives: M. McIntosh, W. J. Stacey.

J. J. Martindale, Toronto.—Demonstration of the Tuec stationary vacuum cleaner for office buildings, residences, hotels, etc.

The Prest-o-Lite Co., Inc., Toronto.—Prest-o-Lite for automobiles, motor boats, etc.; compressed acetylene for lighting, welding, etc. Representative: H. R. Weckerle.

Mackintosh Hutchinson, Toronto.—Demonstration of the Hutchinson portable combination woodworker with dado, ripping, cross-cut and boring attachments in two sizes, with 1½ h.p. and 3 h.p. motors respectively. Representatives: M. Hutchinson, H. Trevett.

The Positive Clutch & Pulley Co., Toronto.—Demonstrating the positive combined jaw and friction clutch, heavy duty combination pulley, all-steel pulley and wood split pulley; gas engine friction clutch. Representative: R. A. Fraser.

A. R. Williams Machinery Co., Toronto.—Le Blond 17 x 8 heavy duty lathe, Barnes 24-in. drill, Harper planer, Famous woodworker, Drummond foot-power lathe, Warner & Swasey universal turret lathe, Brown & Boggs press, Perfect emery grinder, Morris 1-ton worm gear chain block, Lennox throatless shear, Evinrude gasoline engines. Representatives: T. Reid, E. C. Croak.

B. B. Kelliher, chief engineer of the G. T. R. has sent in his resignation on account of ill-health. Mr. Kelliher has been engaged for fifty years on railway construction.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 50	17 85
Victoria, No. 2X.......	18 25	17 60
Victoria, No. 2 Plain ..	18 00	17 35

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b, Montreal.	2.00
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh ...	1.20
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes..	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70. 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$21 00
Open hearth billets, Pittsburgh..	21 00
Forging billets, Pittsburgh.....	26 00
Wire rods, Pittsburgh	26 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload ...	$15 00	$14 00
Electrolytic copper	14 75	14 50
Casting copper	14 25	14 00
Spelter	6 50	6 00
Tin	50 00	45 00
Lead	5 00	5 00
Antimony	25 00	20 00
Aluminum	20 00	25 00

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt, casks, per cwt.	6.40
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.67
Linseed oil, raw	0.70
Linseed Oil, boiled	0.73
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.16
Lard Oil, per gal.	0.60

CHAIN.

¼ inch	$5.65
5/16 inch	4.70
⅜ inch	4.00
7/16 inch	3.65
½ inch	3.45
9/16 inch	3 45
⅝ inch	3.35
¾ inch	3.25
⅞ inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2 90	3 15
Canada plates, all bright	4 00	4 10
Apollo brand, 10¾ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1½-in	$37.50	$30.00	$17.50
33/64 to ¾-in.	41.25	33.00	19.25
7/16 to ½-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	$1.10 lb.
Leather in sides	95c

BELTING RUBBER.

Standard	60%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

¾ inch	$ 4.95
1 inch	8.05
1¼ inch	12.65
1⅜ inch	15.30
1½ inch	16.50
1⅝ inch	19.40
1¾ inch	22.50
1⅞ inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Sept. 7, 1914.—Conditions have undergone a slight change for the better during the past week. A great deal of excellent work has been done by the press in educating the people to appreciate the importance of the great wave of industrial prosperity which may soon overtake Canada. However, the seed has largely fallen on barren ground as yet, for there are many yet to teach and enlighten. Consternation reigned supreme in business circles during the opening days of the war, and those men who were then panic-stricken are now more or less ashamed of themselves. Their mistake has taught both them and their neighbors a wholesome lesson. Thus it is seen in business circles that conditions are gradually improving. The Government at Ottawa is arranging matters so that both the Grand Trunk Pacific and the Canadian Northern Railways will be able to obtain the necessary cash against the country's guarantee, while the City of Montreal has made most favorable arrangements with the Bank of Montreal for its finances during the next five years. The financing of the Western wheat crop has been a source of much speculation, but it is now understood that arrangements have been completed and the banks have extended practically the same lines of credit as were in existence last year. All these actions on the part of the banks and the Government seem to have had a great influence on the spirit of the people generally. Of course, it cannot be denied that trade is still in a demoralized condition, even although a decided improvement in the general complexion of business is noticeable. There is no doubt now that the allies are slowly, surely, and irresistibly weaving their net around the enemy, and soon our forces will be ready to strike. When the blow falls, a crisis in the history of the world will have been reached, and Germany as a factor among the powers of Europe will cease to exist.

Steel Market.

Little or no change has taken place during the last week. Prices have scarcely moved, and sales have been very light indeed. There is, however, a pretty general feeling that the steel business will shortly pick up and continue to improve gradually, if slowly.

Pig Iron.

The market in pig iron has been very slack. Prices fluctuate little, the trade in British pig being practically nil.

Machine Tools and Supplies.

The outlook for machine tools is still unimproved, although those houses dealing in supplies as well as tools still report a fairly large number of sales. All are of the small variety, and the total does not represent a very great turnover.

Metals.

The metal market seems to be holding its own. The sales for the week are not large, and the prices remain the same. Tin is the only metal whose probable change in price is looked for.

Toronto, Ont., Sept. 8, 1914.—Business conditions, generally speaking, are unchanged except that perhaps a more confident spirit exists than has obtained since the outbreak of hostilities. This however, may be caused by the fact that we are getting more accustomed to the situation. A spirit of caution prevails, but as time passes that will be relaxed, and being a natural sequence of the war, if not overdone, is to be commended. One thing to be feared is an excess of caution accounting almost to a scare, which is to be avoided at all costs. Manufacturers are becoming more accustomed to prevailing conditions, and are beginning to realize that while trade may be restricted in some lines for a time, there are possibilities for expansion in other lines.

The advantages that will accrue to Canada on account of the war will only be known after a full investigation into the possibilities of developing trade, both home and export. There are many points to be considered, and it is too early to say what lines are most likely to be developed. That fact that the Department of Trade and Commerce, and in addition several Boards of Trade, propose to make determined efforts to secure trade in markets formerly held by Germany, augurs well for the industrial development of the Dominion in the future. A great opportunity is before the country; let, therefore, full advantage be taken of it, and no time be lost in availing ourselves of the conditions with which we are confronted. Our friends over the border are alive to the opportunity, and will be quick to take full advantage. A strong effort should therefore be made to capture all the foreign trade that it is possible to obtain.

The spirit emulating the exhibitors in the Machinery Hall of the Canadian National Exhibition now being held here is well worth noting. Notwithstanding the temporary depression in the trade, these concerns have exhibited at considerable cost, in many cases without hope of immediate return, but all confident of the future. There is no panic at the Exhibition this year, but instead a general feeling that business will be good in Canada as soon as conditions become settled. Firms carrying on business in this spirit will be the first to benefit when the psychological moment arrives. With the above in mind, it is to be earnestly hoped that manufacturers will keep their factories running to the fullest extent possible, for by so doing they are rendering the country a national service.

Steel Market.

No change is to be noted in the iron and steel markets this week; business is quiet in most products, as customers are waiting until the situation becomes clearer, and the money market easier. The effect of the war on the steel trade is pretty well realized so far as it concerns present markets, the net result being that steel producers have been obliged to curtail operations. The difficulty is not so much a question of obtaining raw material as in finding a market for the finished products. The home market is very quiet and is likely to remain so until conditions improve generally. The difficulty of financing projects is one of the chief reasons for the falling off in the home demand. Because of the latter, strenuous efforts will be made to obtain new business, and already the Dominion Steel Corporation has sent a representative to the Old Country to investigate opportunities for trade with English markets. This is the forerunner of a general movement to investigate the possibilities of extending our export trade.

It is reported that the C.N.R. will now be able to obtain in London, part, if not all, of the money guaranteed by the Dominion Government, in which case the work will be proceeded with according to the original programme. The disbursement of such a large sum of money, at such a time as this, will be extremely beneficial to a considerable section of the community. The fact that the money can be obtained at the present juncture should have a reassuring effect in financial circles. The Ontario Government has formulated a scheme whereby a considerable sum of money will be expended this fall and winter, in making and improving public highways. This also will help the labor situation, which may be serious later on in the year.

Prices on steel products have not changed. The United States Steel Corporation has recently received a number of orders for foreign account, attributed to the war, while several enquiries have been received by U. S. mills for export tonnage. The ferro-manganese situation is about the same, although there appears to be a possibility that the British Government will prohibit the export of this metal, and so cut off one of the principal sources of supply.

Pig Iron.

The pig iron market is quiet, both consumers and producers waiting for an improvement in the outlook. Such buying as there is being done, is only to satisfy immediate requirements and generally in small quantities. Prices have not changed.

Machine Tools.

Business is light, dealers reporting few sales. Quite a number of machine tools have in the past been imported from Germany, and the fact that this market is now cut off, should help Canadian concerns, and encourage them to develop these lines, thereby increasing their home business with a prospect of developing an export trade. Importers of English tools are not experiencing any difficulty in filling orders.

Machinery Supplies.

Business in machinery supplies is quiet, and prices generally are unchanged. There will be little improvement in the supply business, until conditions are more settled, and machine shops are more active.

Tool Steel.

There is not much demand for tool steel at the present time, the situation having undergone little change.

Metals.

The metal markets are quiet, consumers only buying for immediate requirements, and then usually in small lots. The price of tin has weakened, although the situation has not improved, it being just as serious with regard to obtaining supplies from abroad. All other metal markets are steadier, and there has been no change in prices.

THE BRITISH SPIRIT IN BUSINESS.

IT is not merely in the field of battle that the British people face the great issue without panic and without fear. There are industrial battles which require pluck and nerve and generalship as great as are expected of the men upon active service. Sir Algernon Firth, president of the Associated Chambers of Commerce of Great Britain, speaking recently at Bradford of this aspect of the stern conflict before the nation, said he had been asked his opinion as to the formation of distress committees.

Speaking for his locality and Yorkshire, he said they did not want distress committees at present. What was wanted was continued employment for the people. Full employment could not be expected, but if partial employment for three or four days a week could be provided there was no need for starvation. As employers they could not expect to come out without loss, but they had got to suffer their loss like men and stand their corner.

The position at the present time was that the Government had agreed to extend the national credit and responsibility to support the bankers, who in their turn would support the business men in finding employment for the population. Business men could, if they desired, stop their works, remove themselves to a safe haven, and leave their workpeople to their own devices, but that was not what they in Yorkshire were going to do. They were going to stand by the workpeople and continue the industry.

There speaks the Briton with his bulldog tenacity and his sense of human brotherhood. The factory gates will stand open so long as the manufacturers can find markets anywhere for their products. They will forego profits rather than see their workmen dispersed and left to shift for themselves. In Canada, our captains of industry can best show that they, too, are of the true British breed by devoting all their thought and energy not to hunting safe places wherein they and their hoarded wealth may find shelter from the storm, but to fighting the battle of industry with courage and fortitude and bringing those under their keeping safely through the crisis.—Toronto Globe.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

CANADA'S PAPER INDUSTRY.

THE international situation influencing the future of the news print industry in Canada continues to develop points of importance. Although few conversant with the condition of the Canadian paper market at the present time may feel elated by immediate prospects, the fact remains that the general course of events in this country and the United States, is playing strongly into the hands of Canada.

"A survey of the news print mills in the United States and Canada and some knowledge of the annual reports presented at recent meetings, bring out a fact of the most vital significance," says a pulp expert in discussing the situation.

"Those United States mills, which have been far-seeing enough to acquire abundant pulpwood limits, and are equipped with plenty of water power, which they can afford to use for mill purposes, and in addition are blessed with facilities for cheap water transportation are making some money, and probably will continue to, but there are numerous other news print mills, the directors of which face a perplexing situation.

1,000 Tons of News Print Per Day.

"First of all, the abolition of the tariff imposts on cheap papers, has encouraged Canadian mills to load the American market with 1,000 tons of news print paper per day. That enormous and increasing importation means a lowered demand for United States products, a position which the paper mill owner south of the border faces with helpless amazement, for however reasonable and emphatic his protests to Washington may be, the ear of Congress is not turned in his direction.

"During the past two years or more, many of the United States mills have sought to escape what was an obvious doom by altering their product from news paper to cheap book paper, but here again they encountered a branch of the industry already overcrowded to the point of disappearing profits. The last statement of the American Writing Paper Co., in which it was indicated that dividends would have to come from the available surplus, reflect a condition anything but encouraging to the news print maker contemplating a change of market.

Continuous Water Power.

The denuding of the forests throughout the paper manufacturing States has brought on another problem from which the Canadian mills escape. Twelve months of good water power per year is not at all unusual with the large Canadian companies, while seven months power is about the average south of the border. That means that for five months a year the American mill must buy pulp supplies from Canada or elsewhere, adding many dollars per ton to the cost of the output. Instead of improving with the years, this shortage of water during certain seasons has become more and more aggravated. Such a condition, of course, supplies a profitable market for Canadian exporters of ground wood, but even that advantage is being circumvented by the growing custom of Canadian limit owners to turn their raw material into paper and keep the big end of the profit in their own pockets.

British Capital in Control.

"British capital is master of the paper industry in Canada, but it can only be a matter of a few years until ventures similar to the Donacoma mills become quite common and American money shows itself alive to real opportunity.

"Three factors control the success or non-success of the pulp and paper mill: —Cheap and plentiful water power, abundant pulp wood supplies contiguous to the mills, and good transportation facilities. In all three, Canada holds the whip hand. Whichever of the great Canadian mills one cares to examine each item is seen to be present in remarkable degree. Laurentide, Price Bros., Booth's, Ontario and Minnesota, Spanish River, or any of the other big plants are in practically every case possessed of splendid water powers and continuous supply, good pulp limits, and first-class transportation by rail and water.

Conservation Laws.

"By improved conservation laws there can be no reasonable grounds to fear the same carnival of waste and carelessness that has reduced the pulp forests and water powers of the United States to such an alarming extent. With any sort of moderate care the chief assets of the Canadian mills should be made perpetual At all events Canada has awakened to the danger of extravagance in time to guard the bulk of her resources. In the United States, however—and this fact means everything to the future of the paper industry—the idea of conservation arrived half a century too late."

CANADA'S TRADE WITH COUNRIES IN WAR ZONE.

MAKING the returns of the trade of Canada for the twelve months ended April 30, 1914, it would appear that the war would only affect the Dominion's relations with Belgium, France, Germany and Holland. Canada should be able to continue a free trade with all other points as in other years. Canada's total imports for these twelve months from the four nations in the immediate war zone totaled $35,659,125, which represented only 5.7 per cent. of the total volume of her imports in that time. Total exports for the period were $19,406,282, which represented 4 per cent. of the total exports of the twelve months.

Trade in War Zone.

The figures with regard to this trade make the following comparison (being for the twelve months ended April in each year):—

Imports.	1913.	1914.
Belgium	$4,108,561	$4,377,154
France	15,460,129	14,026,037
Germany	14,295,819	14,465,080
Holland	2,149,898	2,790,854
Total	$37,014,407	$35,659,125
Exports.	**1913.**	**1914.**
Belgium	$4,663,884	$4,750,759
France	2,697,871	3,857,048
Germany	3,500,416	4,338,303
Holland	2,795,806	5,460,172
Total	$13,657,957	$19,406,282

While it is not certain that our trade with European countries other than Germany will utterly cease, it is evident that there will be a heavy contraction in the coming year from last year's figures. France, for instance, sends us $2,044,495 worth of spirits and wines alone. With France at war with Germany there will be a big decrease in her make of all wines and a consequent falling off in shipments to Canada as well as elsewhere.

Trade With Germany.

An interesting idea of Canada's trade with Germany is contained in the Government statistics. The latest statement available giving full details is for the year ended March 31, 1912. Total exports for the year were $3,814,914, against imports of $11,146,746, demonstrating that the total trade between the two countries reached a volume of $14,961,660.

The Canada Gazette last week warned Canadians that no trade must be made with Germany at the present time. Thus it is manifest that our trade in this direction will absolutely cease for an indefinite period (at least until the present war comes to an end and peace is re-established).

The principal articles of export from Canada to Germany, according to the latest available blue book figures, are:—

Breadstuffs	$1,853,724
Fish	252,850
Furs	65,601
Agricultural implements	632,494
Iron and steel mfrs.	646,761
Miscellaneous metals, etc.	255,510
Oils	75,804
Sausage casings	8,579
Seeds	59,371

Articles Imported.

The principal articles imported from Germany, to the amount of $50,000 or more, were as follows:—

Clocks	$107,131
Cocoa beans, etc.	60,696
Combs	69,228
Lace	152,065
Socks and stockings	304,687
Cottons and mfrs., duty	687,966
do. free	43,757
Aniline and coal tar dyes	187,054
Potash	59,955
Drugs, etc., duty	125,552
do. free	386,622
Earthenware	295,672
Electric apparatus, duty	51,857
do. free	1,487
Fancy goods	929,641
Flax, hemp, jute, duty	48,321
do. free	5,590
Furs and mfrs., duty	282,255
do. free	1,004,536
Glass and mfrs., duty	230,918
Gloves, etc.	255,258
Gutta-percha, duty	50,463
do. free	53,087
Hides and skins	182,276
Ivories, piano keys	88,039
Jewelry	171,297
Leather and mfrs.	32,080
Brass and mfrs., duty	57,198
do. free	26,312
Gold, etc., duty	53,215
Cutlery	267,667
Machinery, duty	225,511
do. free	28,667
Iron and steel mfrs., duty	1,115,331
do. free	603,258
Miscellaneous metals, duty	185,222
do. free	31,942
Musical instruments, duty	118,842
do. free	28,003
Packages of all kinds	123,795
Paints and colors, duty	118,076
do. free	48,563
Paper and mfrs., duty	178,209
do. free	16,208
Settlers' effects	102,435
Silks and mfrs., duty	240,534
Sugars, etc.	605,208
Tobacco and mfrs., duty	8,612
do. free	89,087
Wool and mfrs., duty	776,494
do. free	9,320

LIGNITE IN SASKATCHEWAN.

THE plant which is now being erected at Estevan by the Saskatchewan Government for the purpose of testing the lignite coal of that district has been placed in charge of S. M. Darling, who has had experience of the work in North Dakota.

In this connection it is to be noted that the current issue of the Public Service Monthly, published by the Saskatchewan Government, contains a full report of the results obtained from the lignite of North Dakota, which is of the same character as the lignite of South Saskatchewan. The chemical composition of this lignite does not allow of its being successfully briquetted in its natural condition. To market the lignite commercially on a large scale, it must be destructively distilled, carbonized, or partially carbonized, and the resulting gas, oil, or tar, ammoniacal liquor and carbon residue, utilized separately.

By carbonization of the North Dakota lignite, the products, in round numbers, are:—gas, per ton of lignite, 10,000 cubic feet; oil or tar, 20 gallons; ammoniacal liquor, 35 gallons, and carbon residue, 1,200 pounds. The gas is of high heating value, and while containing a good percentage of illuminant, has about 15 per cent. of carbon dioxide, which almost entirely destroys the illuminating power. The carbon dioxide can be removed by passing the gas through lime, but the process is too expensive for commercial application. The gas can be used as an illuminant by mantle; but it is for fuel and power that its main available serviceableness can be made useful. The oil yields, on distillation, various light oils, benzine, etc., 36 per cent. of creosote oils and 22 per cent. of hard pitch, while the ammoniacal liquor yields several products for which there is a growing market, particularly in the case of sulphate of ammonia, as a fertilizer. The carbon residue, 1,200 pounds to the ton of lignite, can be briquetted, using 6 per cent. of the lignite pitch as binder. The briquettes burn with a short flame, no odor, no smoke and no clinker, and they can be used wherever anthracite or bituminous coal is burned. They retain their structure in the fire until completely burned, and do not disintegrate or lose value under the weather; they can therefore be shipped considerable distances without loss. The lignite coke is described as an ideal gas producer fuel, effecting a great saving over the present method of producing electricity by means of boilers and steam engines.

It is now an accepted fact among engineers that hydro-electric development in Saskatchewan is an impossibility. The rivers to the north carry so much silt and mud that the working parts of any turbine yet devised would be cut to pieces before the machinery could begin to pay for itself. The question of a large central power plant at the Estevan mines to generate electricity for transmission over a wide area is essentially one of the quantity of current that can be sold, the distance it must be transmitted, and evenness of load. If the current needs be transmitted a long distance to a large centre of population, there must be intermediate towns in which substantial quantities can be sold. It is simply a question of population. Of course, with cheap power, the population will come. Meanwhile, the immediate demand is for solid fuel.

PATENT PRACTICE AND THE WAR.

THE present war has naturally materially interfered with patent practice on the European Continent, and some time yet must elapse before points in doubt can be settled. We are, however, says Ridout & Maybee, patent agents, Toronto, in a communication to us, just in receipt of information from abroad of much importance to Canadian inventors or owners of Continental patents.

France has suspended indefinitely the requirement for the payment of taxes on French patents, so that all patents will remain valid until a future date, which will be set by special decree, and on which all arrears of taxes must be paid.

The German office has provided a general extension of time for three months from the 1st of August last for the filing of amendments to pending applications. This appears like a sublime confidence on the part of Germans in a short and successful campaign. Canadians having patent applications pending in Germany will not suffer, for the present at least, by the inability of their attorneys to do business in Germany, and if the war continues, further relief may be given.

The stories of the confiscation of British patents held by Germans and Austrians seem to be untrue. We have no official advices to that effect. It is not a probable course of action, as a government has the right to use any patented inventions it may need, and also the right to set the compensation, but as the citizens of a country with which we are at war have no legal status in our courts, infringement would necessarily go unpunished. It will still be possible to do business with any European country with which we are not at war, but communication with such countries may be subject at times to delay.

SOUTH AFRICAN MARKET FOR PLOUGHS.

FROM the best information obtainable, says a U. S. consular report, it appears that 80 to 90 per cent. of the ploughs in use in South Africa are of the moldboard type. One of the most experienced American salesmen of agricultural machinery and implements stated that all through South Africa, just as in the United States, the particular type of ploughs best adapted to a given district depends entirely upon the nature of the soil. He emphasized the fact that certain ploughs made for use in the Southern section of the United States were found to be entirely unsuited to the soil in certain other States in the West. A practical mechanic, sent out by one of the large American concerns, says that, generally speaking, disc ploughs are suited to the soil of the Western part of Cape Province and all parts of Natal. He further stated that, also generally speaking, moldboard ploughs are best suited to the soil of the Orange Free States and the Transvaal. It is made clear, both by selling agents and practical mechanics handling American agricultural machinery and implements, that no hard and fast rule can be applied in determining what type of ploughs is best adapted to different parts of South Africa. In each instance the character of the soil in a given locality has to be taken into consideration.

Missionary Work Returns.

Those American manufacturers of ploughs who several years ago sent experts to demonstrate the good points claimed for their implements, and to remain in the country and watch the development of the business for several years in succession, have succeeded in building up a steady demand for their ploughs. It seems that very little advantage is to be gained simply by sending a salesman through the country on an occasional trip unless a really good practical man is left behind to follow up the work, supply spare parts for repairs, and to make helpful suggestions in cases where farmers are not getting satisfactory results, as well as to prevent competitors from unfairly undoing the pionees work which has already been done.

While the entire country has suffered lately from drought and labor disturbances, the consensus of opinion is that greater attention will hereafter be given, both by the Government and private individuals, to developing its agricultural resources. The carrying out of the irrigation projects now in course of construction or to be undertaken in the near future, will bring thousands of acres of land under cultivation which have heretofore lain idle. Both business men and farmers have come to realize that mining, hitherto the chief industry of this country, is a vanishing asset, and that the future of South Africa is wrapped up in its agricultural developments. Population considered, there is likely to be a growing demand for modern agricultural machinery and implements. The white population of the whole country is slightly over 1,200,000, but their per capita purchasing power is unusually high.

RUSSIAN IRON INDUSTRY.

THE iron industry in Russia has its principal centre in the Odessa district, and, therefore, it is principally this district which is affected by the increased activity in the mining of coal and iron in Russia. The state of affairs is such that it is now doubtful whether the Russian iron industry can cope with the growing demands made upon it by naval shipbuilding yards, railways, and engineering works. There has also been a renewal of house building, into the construction of which there enters an evergrowing quantity of iron and steel. The following figures show the output of pig iron, half-finished and finished products during each of the past five years, together with the estimated output for 1914:—

	1909. Tons.	1910. Tons.	1911. Tons.	1912. Tons.	1913. Tons.	*1914. Tons.
Pig iron	2,821.000	2,999,000	3,630.000	4,111,000	4.756.000	5,207,000
Half-finished products	3,079,000	3,482,000	3.885.000	4,433.000	5,110.000	5,594,000
Finished products	2,628,000	2,966,000	3,272,000	3,676,000	4,224,000	4,627,000

*Estimated.

A semi-official estimate indicates that from 2,400 to 3,200 miles of railway per annum for a series of years will have to be equipped with rails, quite apart from the demand for rails for repairs. This includes narrow gauge lines, though the ordinary gauge lines predominate largely. During the years 1909 to 1912, both inclusive, there was no particularly great activity in the construction of rolling stock, and on this account the demand is likely to be large for the next few years.

MOTORS FOR NEWFOUNDLAND FISHERMEN.

CANADIAN firms in a position to supply motor engines and motor fuel will find a valuable market is Newfoundland. The fishing fleet within the past two years has been installing motors in its boats, with the result that not only is there a brisk demand for engines but there is also a steadily increasing consumption of gasoline. Last year, according to statistical returns, motor engines valued at $140,000 were imported into the colony, and this year it is estimated that imports will approximate $500,000. The representatives of two United States concerns have spent the entire summer in and around St. Johns, and up to the end of July they had been able to place 275 orders. Engines of five, seven and nine horse-power composed the bulk of these orders, but in some instances higher powered engines were purchased. The prices for the smaller powered engines ranged from $180 to $225. So far as could be learned, no Canadian firm is actively engaged in soliciting this market. A few years ago a Nova Scotia concern, now in liquidation, sold a considerable number of motors. The two United States companies referred to seem to have largely gained control of the market. The fact that there is a rebate on the duty for engines for fishermen's use provides a stimulus for this trade.

In the matter of motor fuel, Canadian firms should be at a great advantage. Oil from the United States sells at 50 cents a gallon which is only 4-5 of an Imperial gallon. Gasoline in Canada can be purchased at 25 cents per gallon. As indicative of the demand, one fisherman requested one of the motor engine representatives from the United States to secure for him 50 drums of gasoline as an initial order. Inquiries for supplies of oil are also constantly noted in St. Johns.

Canadian firms in a position to supply either engines or fuel would do well to investigate the conditions in Newfoundland, for while the market for engines may not be an expanding one, that for motor fuel will steadily increase, and with the advantage of price in favor of Canadian concerns, a profitable business might be built up. Oil for the use of fishermen is also subject to a rebate of duty.

The Object.—The object of the average normal nation is to have more prosperity, to raise more taxes, to build more battleships, to seek more markets, to sell more goods; to have more prosperity, to raise more taxes, to build more battleships, to seek more markets, to sell more goods; to have more prosperity, and so on until something unforeseen happens.—Life.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Quebec, Que.—The Ross Rifle Co. will build an extension to its plant.

Quebec, Que.—The Masson Company will shortly erect a concrete and steel plant. Modern machinery will be installed.

Victoria, B.C.—Tenders have been received for the electrical, mechanical and heating equipment for the new Provincial Jail. J. C. M. Keith, architect.

Toronto, Ont.—The Board of Control have refused to reopen the contract for the high level station pumps and consequently it will remain with the Turbine Equipment Co.

New Liskeard.—The Wabi Iron Works Co. is running with their full staff in all departments, with every prospect of keeping their men busy. During the past week several large orders have been received.

Brockville, Ont.—The Warwick & Walters, Co., of Montreal, makers of gas and oil engines and accessories, are contemplating establishing a plant here. The company propose to rent an existing building and equip same with the necessary machinery.

Niagara Falls, Ont.—S. Austin & Sons, Cleveland, Ohio, are the general contractors for the new plant for the chain factory here, which is to cost $160,000. The building will be 150 x 440 feet, two-storeys high, of steel and reinforced concrete construction.

Prince Rupert, B.C.—An enterprise, which will mean much to the industrial life of Prince Rupert, made its first important advance on August 28, when the first of a series of twelve pontoons of the big 20,000-ton floating dry dock of the Grand Trunk Dock and Ship Repair Co. was floated. The next pontoon will be launched this month.

Toronto, Ont.—The war, while checking Canadian industrial enterprises generally, is at the same time helping to establish armament firms in Canada. The Canada Gazette of last week contains notice of the incorporation of the International Military Equipment Co., of Toronto, with a capital stock of $100,000. The incorporators include: C. McL. Moffat, army officer; Joseph Doust, stationer; W. R. Haile, financier, and S. B. Dawson and F. J. Stanley, brokers.

Redcliffe, Alta.—The plans and specifications for the building which the Imperial Brass Co. of Chicago will erect here for use as a brass factory, have arrived and may be seen at the office of H. O. Wheeler by contractors who may contemplate figuring on the contract. It is understood that the plans and specifications call for a building to which an addition may be added at any time.

Electrical

Peterborough, Ont.—The city will proceed with the hydro-electric scheme, satisfactory financial arrangements having been made.

Stouffville, Ont.—Board of Trade officials of this village are keen to launch a campaign to carry the Hydro Radial by-law, which is to be submitted on October 19. They have assurances from the Provincial Hydro-Electric Commission that Stouffville and the other midland towns will be the first in the Province to have a combined radial and power system if the proposed by-laws carry without a hitch.

Municipal

North Bay, Ont.—The council contemplate installing an incinerator.

Vancouver, B.C.—The Council has decided now to spend $15,000 on the water tower as was originally intended.

Toronto, Ont.—The Board of Control will spend $70,000 on paving material. Tenders will be called.

Winnipeg, Man.—Mechanical filters will be installed in a new public bath which the city is building.

Athabasca, Alta.—The town will build a reservoir and install a filtration plant. C. L. Huff is town engineer.

Point Grey, B.C.—The Council has ordered a combination chemical and pump wagon from the La France Co., at a cost of $12,200.

Toronto, Ont.—The Board of Control has voted $20,000, the city's share of the expenditure on the York Highways this year. The total amount spent was $60,000. George S. Henry, M.P.P., appeared before the board and asked to have the money provided.

Joliette, Que.—Tenders for "Hydraulic Plant" are being received. Plans, specifications and blanks for tenders may be obtained from Surveyer & Frigon, Civil Engineers, 56 Beaver Hall Hill, Montreal, after paying $5.00 for each set; this sum to be refunded upon return of plans and specifications.

Ottawa, Ont.—Unless some compromise is effected between Dr. McCullough, Chief Provincial M. H. O., and Mayor McVeity, the plans and specifications of the proposed new mechanical filtration system for Ottawa will not be passed upon by the Provincial Board of Health until its next general meeting. The cost of the new system is estimated at $2,000,000.

New Toronto, Ont.—Work in connection with the new waterworks scheme is now progressing speedily. The foundation of the new pumping station has been laid and the large well at the foot of Sixth street is in course of construction. The laying of the 18-inch steel intake pipe is also well in hand and will be completed in seven or eight weeks according to the contractor, J. F. Curley.

Canora, Sask.—At a meeting of the town council on August 26, the following tenders were recommended for acceptance:—Laying a force main, Flanagan & Murphy at $10,011; Pump house, Flanagan & Murphy at $5,345; Steel water tower, Dominion Bridge Co., $5,744; Cast iron pipe and specials, Can. Iron Corporation $17,887; Valves and hydrants, Jenkins Bros., $1,049; Chipman & Power, Winnipeg and Toronto are the engineers.

General Industrial

Windsor, Ont.—The J. T. Wing Co. are building a factory here. L. Weis, of Detroit, Mich., is the contractor.

Toronto, Ont.—The Ontario Government are operating successfully a red roofing tile plant at Mimico, Ont.

Ottawa, Ont.—It has been stated that the Government will give as far as possible additional orders for steel rails required in its railroad construction, that the work in steel mills may be kept up as long as possible.

Rigaud, Que.—An explosion in the powder works of Curtis & Harvey occurred recently. The cause of the explosion, which destroyed one of the

The Plant of the Canadian Buffalo Forge Co., Berlin, Ont.

By J. H. Eastham

On account of lack of room to extend their Montreal factory, and with a view to centralizing their trade now established from coast to coast of the Dominion, the Canadian Buffalo Forge Co., after inspection of various possible sites decided to locate at Berlin, Ont. That this progressive concern is alive to Canada's domestic needs and export trade is easily apparent from the description here given of the plant layout and its equipment.

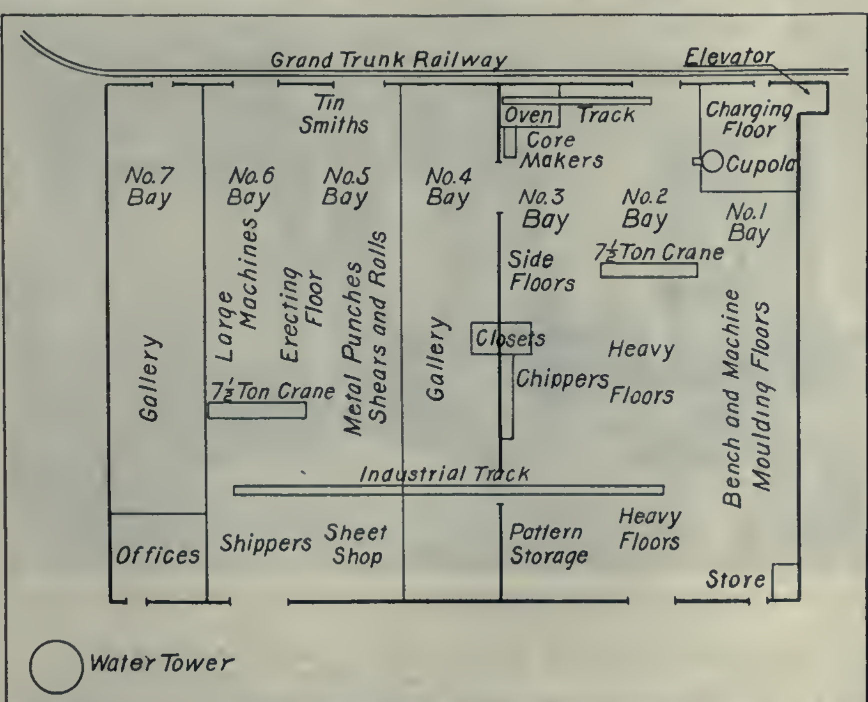
AS in the case of most industries which have changed their location or have recently established themselves in Canada, the Canadian Buffalo Forge Co. have taken the wise precaution of acquiring as the initial step, not only suitably situated land for transportation purposes, but sufficient of it for a well-ahead future development. Eight acres of land to the south of the City of Berlin were purchased and the erection of a number of manufacturing buildings was started in September of last year.

The plant as at present constituted has been in operation since May 1 of this year, and comprises a foundry and blacksmith shop in three bays, sheet iron fan and blower department in two bays; erecting shop, one bay; machine shop, one bay; a total of seven bays covering 210 ft. by 160 ft., every bay being 160 ft. by 30 ft., placed east and west in the order named. The company are fortunate in possessing unusually good receiving and shipping facilities, a siding from the Grand Trunk Railway serving each bay independently as shown in the ground plan at Fig. I.

CANADIAN BUFFALO FORGE PLANT EXTERIOR, LOOKING SOUTH.

Foundry.

The foundry, laid out in three bays, of 160 ft. by 30 ft. each, is particularly well equipped for handling heavy jobbing castings in addition to the company's regular lines. Raw material is received at the north-east corner, a Roelofson eleeetric elevator at this point serving a reinforced concrete charging floor 33 ft. by 30 ft. in area, tested to 500 lbs. per square foot. Undue handling of coke and iron is thus to a considerable extent avoided.



PLANT LAYOUT, CANADIAN BUFFALO FORGE CO.

For present needs, one No. 3½ Whiting cupola, 52 ins. diameter inside shell, and lined to 40 inch., has been installed, ample room being left for the erection of another of equal or larger proportions should increasing business require it. A Buffalo Forge Co. fan, 46 ins. diameter driven by a direct coupled **Crocker-Wheeler** motor of 30 horsepower at 1,472 revolutions per minute, gives a blast pressure of 13 ounces, and an average melt of six tons per hour.

To facilitate the cheap output of the smaller parts on their standard hearths, such as drilling machinery, etc., which runs into many thousands annually, the company have installed a No. 20 **Arcade Modern** molding machine. This machine is placed in the eastern bay of the foundry, as near to the cupola as convenient, the remainder of the bay (for descriptive purposes here termed No. 1), being occupied by bench and side floor moulders.

The center or No. 2 bay, spanned by a 7½ ton **Niles** crane, operated from cab or ground, is used for the production of heavier castings. No. 3 bay is utilized by light floor moulders, blacksmiths and coremakers, for pattern storage, and chippers. Two 5 ft. by 2 ft. rumblers, wood cased to deaden sound are located in this bay for chippers' use.

The blacksmiths are served by double hearths of cast iron type, blown by the company's **200** silent-electrically driven blowers, of **2E** type, a small monorail crane being placed over the brick lined furnace required for the heavier forgings.

In the north-west corner of this bay, and immediately over the boiler room, one coke fired core oven, 12 ft. long by 10 ft. wide by 8 ft. deep, has been erected, provision being made for the use of the waste heat from the boiler stack during the winter months for drying purposes.

In addition to the admirable sprinkler system installed throughout the plant, the works manager, S. Halfyard, has devised an excellent spray system for the foundry roof, a series of nozzles operated from the floor drenching the area for several yards round the cupolas at the beginning and close of each heat. The risk of fire from sparks is thus entirely eliminated.

ERECTING BAY, GALLERY AND MACHINE SHOP, LOOKING SOUTH.

Fan Erecting Department.

The sheet steel fan and blower erecting shop, parallel with and adjoining the foundry, is roomy and well equipped, two bays, covering collectively 160 ft. by 60 ft., being equipped with one Buffalo Forge Co. punch and shear with armour plate body; one punch of similar type, one brake, one guillotine shear, two sets of rolls, and one large hand brake.

In this department also, for patternmakers and general carpenter's use, one Cram combination woodworker of the company's own make, and several rip and straight-cut circular saws have been placed, their central position rendering them easily accessible to shippers for crating purposes.

The north end of the two bays, Nos. 4 and 5, is occupied by tinsmiths. An air compressor with 8 ins. cylinder is placed on this floor temporarily, whilst the gallery covering No. 4 bay as shown on ground plan, is at present with the exception of patternmakers tools and benches, used mainly for storage.

Erecting Shop.

No. 6 bay devoted almost exclusively to erecting and shipping purposes, is 160 ft. long by 30 ft. wide, and is spanned by one $7\frac{1}{2}$ ton Niles crane of same type as that in No. 2 bay of the foundry. It has excellent facilities for shipping and receiving goods by rail at its north end, or by teams at its southern entrance.

Machine Shop.

Bay No. 7, 160 ft. long by 30 ft. wide, is equipped with machinery as follows:

One Kearney & Trecker, Milwaukee miller.

One Mitts & Merrill, keyseater.

One McGregor Gourlay miller.

One Jones & Lamson geared head lathe.

One American Tool Works geared head lathe.

One Hoefer Mfg. Co., form head drill.

One Stirk, Halifax, England, 36 ins. x 10 ft. planer.

One London Machine Tool Co., lathe.

One R. McDougall Co., Galt, lathe.

One Reed-Prentice lathe.

One Gisholt Machine Co. lathe.

One Bertram, Dundas, lathe.

One Hoefer Mfg. Co., drill.

Two shapers; one boring machine; three radial arm drills, one being of 14 ft. radius; one universal miller; one machine hack-saw; one centering machine; one small gear hobber; two pipe threading machines; one large gear hobber; one pipe cutter; one 12 ft., 6 in. toggle press; one 10 ft. squaring shear ($\frac{1}{4}$ in. capacity); one 10 ft. squaring shear of No. 10 gauge capacity.

Hans Renold chain is used on all main drives. The line shafting, 3 11-16 ins. diameter running in Chapman ball bearings, Canadian Crocker-Wheeler motors is driven by current supplied by the Ontario Hydro-Electric Commission. The gallery in this bay is utilized for the assembly and painting of the smaller and medium sized blacksmith forges and drilling machines manufactured and catalogued by the company. The main switchboard, heating and ventilating equipment, the latter also a product of the firm, is also located in this section.

The south-west corner of this bay is occupied by the general offices, which consist of two stories. On the ground floor are located the time office, general stores and foremen's lavatory.

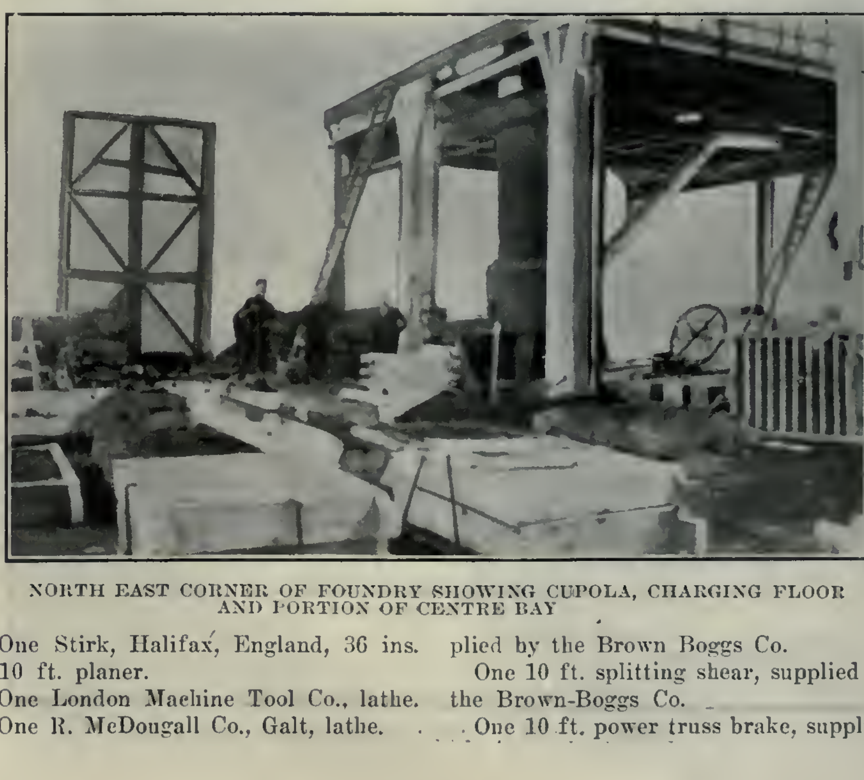
Sheet Metal Shop Equipment.

One Lennox throatless shear, supplied by the Canadian Lennox Throatless Shear Co., Toronto.

One 10 ft. drop brake supplied by the Brown Boggs Co., Hamilton, Ont.

One set of 8 ft. heavy power rolls, supplied by the Brown Boggs Co.

One set of 4-ft. light power rolls supplied by the Brown Boggs Co.



NORTH EAST CORNER OF FOUNDRY SHOWING CUPOLA, CHARGING FLOOR AND PORTION OF CENTRE BAY

One 10 ft. splitting shear, supplied by the Brown-Boggs Co.

One 10 ft. power truss brake, supplied

by the Double Truss & Cornice Brake Co., Buffalo.

Two 8 ft. hand truss brakes, makers as above.

One flanging machine supplied by the Buffalo Forge Co., Buffalo, N.Y.

One power punch, one hand punch and one combination punch and shear, all supplied by the Buffalo Forge Co., N.Y.

The interior of the various buildings is faced with white glazed brick which, together with the ample natural lighting provision tend to make operating conditions in every respect ideal. Artificial lighting has also been given careful consideration, there being installed in each department and in such manner as to shed their full lighting effect without interfering with present or future overhead crane arrangements or extensions, a full complement of 250 Watt lamps. Ellis & Howard, Berlin, Ont., are the electrical contractors.

The roofs and crane girders are supported on Georgia pine columns set in cast iron bases on concrete foundations.

Two shower baths and four hand basins are provided in each department for the use of the employees.

STEAM BOILER MAINTENANCE AND INSPECTION.

WHAT follows is an abstract from a paper by H. A. Baumbart of the Hartford Boiler Inspection & Insurance Co., of Cleveland, O., read before the annual meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers.—

Great progress has been made in steam boiler design and construction during the past twenty years. In fact, there are but few, if any, boiler manufacturers who would to-day construct a boiler for a given pressure without taking into consideration safe rules as adopted by provinces and municipalities or as recommended by good steam engineering practice.

Retiring Age for Boilers.

The subject of a proper retiring age for old steam boilers is one which comes frequently to light and is a most fruitful source of controversy. Of course there can be no question as to the propriety of condemning to forced retirement those boilers whose diseases of one sort or another have reached the chronic stage, and are no longer curable, but there is at once the basis for a deal of argument when an inspector approaches the owner of a boiler with the statement that it must be replaced because of old age, especially if it is known to have all the apparent qualifications, except youth, for many additional years of service.

In the past many curious properties have been attributed to old boilers; one of the most interesting was the notion that they could not explode violently. It was supposed that an old boiler would merely rupture, allowing the pressure to be relieved much as if the safety valve had opened. This idea was definitely disproved many years ago along with many other fallacies and much popular mystery concerning boiler explosions.

Service Deterioration.

We all know that steel used in boiler construction will deteriorate with use. It undergoes a slow loss in strength and ductility. The process is hastened by the presence of a moderate excess of phosphorus. Deterioration of this character cannot be determined by the usual method of inspection. It is, therefore, difficult to state definitely at what time in service the boiler should be abandoned. It places a great responsibility upon the inspector. He must consider, in addition to the general appearance of the boiler, the conditions under which it has operated, and he must also make allowance for defects in the material which are not visible.

Experience shows that boiler plate, subjected to the high temperature of the furnace, does deteriorate to the extent that after about 20 or 25 years' service, the boiler should (if we follow the motto "Safety First") be taken out of service. Because an inspector reports that he considers the boiler unsafe for further use, it does not imply that he can predict the day and the hour when it will explode; it does mean, however, that the factor of safety is too low, and to continue the boiler in service for any considerable length of time presents a hazard too dangerous to be undertaken.

Boiler Explosions.

No mysterious agency enters a boiler to cause an explosion. A steam boiler explodes or fails from one cause only, and that is the fact that the boiler or the part which fails could no longer resist the strain placed upon it. The applied pressure may be sufficient to rupture a sound boiler, or the boiler may have reached such a state of deterioration that the ordinary working pressure becomes an over-pressure. In the majority of serious explosions, the primary cause was due to the lap seam form of construction.

Many accidents are due to overheating of the shell plate or tubes. The overheating may result from various causes. The common cause is due to a deposit of scale, sediment, oil, or a combination of oil and scale on the internal surfaces. The presence of oil or grease, although in moderate amounts on the internal surface of a shell plate or tube, is a dangerous condition, and, unless removed promptly, will result in a damaged or possibly an exploded boiler. Great care should be exercised to prevent oil entering a boiler.

By referring to the records of the Hartford Steam Boiler Inspection and Insurance Co., I find the following data given in Table I on boiler explosions for the United States during 1911-13.

TABLE I.—DATA ON BOILER EXPLOSIONS IN UNITED STATES, 1911-13.

Year.	Boiler explosions.	Persons Killed.	Persons Injured.	Persons Total.
1911	499	222	416	638
1912	537	278	392	670
1913	499	180	369	549

The annual property damage is estimated at $500,000. The above records include boiler accidents of every description, some of which were of minor importance. This record is not an alarming condition and, in fact, we are very much encouraged because of the great interest now taken by engineers everywhere insisting upon proper construction and inspection of steam boilers. In many localities compulsory inspection is required by law. The situation therefore as regards safety is gradually improving.

We have not reached the stage of no boiler accidents. Such a condition will never exist. There will be boiler explosions as long as steam boilers are used as a unit of power. We have not yet reached the stage of perfection in the manufacture of material, neither have we reached perfection in the art of boiler design. We learn as much from the result of failure as from the result of success. Further experiences in the operation of steam boilers may teach us that some radical change in design or character of the material is required to make boilers that will not explode under constantly increasing pressure and temperature.

Care and Management.

Another condition which must be considered in connection with the safe operation of steam boilers is their care and management. It frequently happens that a boiler explosion, or some other calamity resulting in loss of life, occurs at places where it is least expected. This proves that, in spite of the advanced precautions that science has provided, reliance must still be placed in human intelligence and faithfulness to a large degree and that sometimes these fail.

It is recommended that boiler owners and users provide every possible method of safeguarding human life and property by purchasing only such boilers as have been thoroughly inspected during course of construction and by seeing that they are also inspected during the life of the boilers. It also devolves upon the owner or user of a boiler to select only such persons as are fitted to care for them.

The Goldie & McCulloch Co., Ltd., Galt, Ont., have been awarded a large contract for safes by the Royal Trust Co., of Montreal. The order is an exceptionally large one and will keep the safe department busy for some considerable time.

The Evolution of the Railroad Shop on This Continent

By A. I. Totten *

The railway shop of the present day is constructed to a radically different design from that in vogue only a decade and a half ago. In the accompanying article which recently appeared in the General Electric Review, the writer deals with the changes that have taken place and shows how the old sources and means of power supply have been advantageously supplanted by electricity.

THIS continent has just passed through an era of steam railroad shop construction unparalleled in the history of railroads. The poorly lighted, antiquated buildings located at division points have been demolished, and in their places there have been erected structures which are representative of the best engineering practice, and which are designed to provide maximum economy in the performance of repairs on cars and locomotives. When we consider these modern shops it is difficult to realize that but a brief fifteen or sixteen years have passed since the first shop to be built along present lines was placed in operation.

The Earlier or Unit System.

In older days it was the custom to locate small shops at objective points on the system, where changes in locomotives on through trains were effected. These shops were designed not only to take care of the general overhauling of locomotives and cars but also to provide storage facilities for engines when not in service in the form of a rond-house and the necessary adjuncts consisting of turntable, coaling station, sand house, oil house, water tank, etc. This is what might be termed the "unit system," inasmuch as each division had the exclusive handling and repairing of all locomotives assigned to it. With the introduction of cranes and other labor-saving devices it was ascertained that, in order to reduce the unit cost of repairs, this expensive machinery which was provided must be worked at its full capacity. Therefore, the practice was instituted of placing large main shops at central points for the performance of the heavy general repairs on locomotives assigned to several divisions, and the light running repair work was done at small shops or in roundhouses located at terminals or division points.

The handling of the various parts of the older types of locomotives and cars did not entail the difficulties now encountered in the transference of material in and around the various buildings, which must of necessity be scattered to a considerable degree to allow for trackage space, and also to reduce the fire risk which might otherwise prevail. The weights of engines have steadily increased from 135,000 pounds in 1890 to 830,000 pounds, which represents the weight of the triplex locomotive recently constructed for the Erie Railroad. With the increase in size of the rolling stock, the various components comprising the complete units have become heavier and heavier, and parts which were formerly handled readily by manual labor must now be lifted and transferred to the point desired by hoists and cranes.

Introduction of D.C. Electricity.

The introduction of electricity in the shop was made initially for the purpose of producing artificial illumination which would supplant that furnished by oil, candles or gas. The development of the direct-current motor provided a means for driving shafting in the various buildings; and thus made it possible to discard the numerous boiler and engine installations that were distributed throughout the plant and to supplant them by a central power-house from which the current could be transmitted over wires to the motors in the different buildings. This did not materially affect the output of the shop, but it reduced the cost of power by decreasing the amount of fuel and labor required for its generation.

In view of the general satisfaction which resulted from the successful operation of the group-drive system just described, railroad engineers as well as electrical manufacturers perceived the advantages that would accrue by equipping the larger machines, having variable-speed characteristics, with individual motors. An individual equipment of this sort would provide means by which speed variation could be readily obtained by a controller and resistance, thereby conserving the operator's time through eliminating the necessity for shifting belts on cone pulleys, as had been required previously. This was accomplished by what is known as the multiple-voltage system, so called because several line voltages were provided by balancer sets installed in the power house and connected across the terminals of the generating apparatus. The application of the proper potential for the motor speed desired was obtained by a controller located at a convenient point for manipulation by the machine tool operator.

Inasmuch as the motor capacity varied in almost direct proportion to the voltage applied, it will be readily appreciated that this system was not wholly suited for machine tool operation where practically constant horse power should be maintained over the entire speed range. In fact, the difficulties experienced in the operation of the multiple-voltage system demonstrated the inapplicability of this method of speed control for machine tool operation. A further study of the subject resulted in the introduction of the adjustable field control motors, which admirably fulfilled the requirements of the service and are representative of standard up-to-date practice.

With the introduction of electricity for power purposes in railroad shops came the traveling crane, varying from five tons to one hundred and fifty tons in capacity. This replaced the hand jack, pneumatic hoist and manual labor. The work of lifting locomotives from their wheels and replacing them thereon was accomplished in seconds instead of hours, and the handling of heavy parts through the shops and yards was performed rapidly and with a minimum amount of labor and cost. The individual machine hoists were discarded as unnecessary; but strange to relate they are now being replaced, as it was ascertained that a considerable amount of the tool operator's time was lost while waiting for the traveling crane to handle material around the machine.

Alternating Current Motor Introduction.

We have up to this point mentioned direct current only for shop operation; but with the introduction of alternating-current motors on a cost and operating basis comparable with direct-current motors, as regards constant speed service, they naturally became quite a factor in railroad shop installations. It is difficult to compare the relative merits of alternating and direct current as applied to railroad shop operation. The alternating-current motors must receive credit for the absence of commutators and consequent freedom from trouble due to this source, but they have not the adjustable speed characteristics of the direct-current motors and hence are not as well adapted to the operation of variable-speed machinery.

There are a number of shops entirely operated by alternating current where the speed adjustment of machine tools, having variable-speed characterisitcs, must be obtained with gear change devices. In the majority of the larger shops both alternating and direct current are used, the former being either

*Railway and Traction Engineering Department, General Electric Co.

purchased or obtained from prime generating units and the latter furnished by motor generator sets or rotary converters driven by alternating current. A number of shops, however, especially the smaller ones, are operated exclusively by direct current.

As a general proposition, under average conditions, the alternating-current direct-current combination is preferable for large installations; alternating current exclusivly for small shops where current is purchased from central stations, and direct current for small shops where current is generated on the premises. Where the alternating-current, direct-current combination is installed, the use of direct current should be confined exclusively to the variable-speed machine tools and alternating current should be used for the operation of transfer tables, cranes, turntables, etc., as well as for the constant-speed drives and illumination of the premises. Under these conditions, the proportion of alternating-current to direct-current generator capacity would be about three to one.

Compressed Air Feature.

In addition to the electrical energy requirements for railroad shops, a large quantity of compressed air is necessary for the operation of pneumatic riveters, drills, chipping hammers, etc., which are used in large numbers throughout the plant. It is also required in lesser quantities for numerous other purposes such as painting, glass frosting, sand hoisting, train testing, cleaning motors and machines, pneumatic hoists, etc. The air compressors, ranging in capacity from 500 to 3,000 cu. ft. of free air per minute, are generally placed in the main power house and are connected by pipes to the various outlets located in such a manner as to best fulfill the requirements of the service. These compressors are, for the most part, steam-driven but the growing tendency of railroad companies to purchase current from an outside source has created a demand for motor-driven compressors, the rotating element of the motor being mounted directly upon the crank shaft of the compressor and transmitting power thereto without the interposition of gears or belts.


INTERIOR OF PORTION OF C.P.R. "OGDEN" SHOPS, CALGARY, ALTA.

Large Motor Driven Compressors.

There is a serious objection to large motor-driven compressors, however, due to the wide range of compressed air consumption which prevails in railroad shop plants. In the case of the steam-driven machine, the governing apparatus admirably controls the speed of the compressor to suit the existing demand but, with the motor-driven machine, the speed remains constant and a throttling suction governor or by-pass control relieves the machine when the compressed air consumption falls below the capacity at the fixed speed. This is not an economical arrangement from a current consumption standpoint, and the wear on the machine is practically constant regardless of the amount of air supplied.

In view of the large size of these compressor units, which require the supply of from 80 to 500 k.w. of energy, it would not be feasible to have them start and stop automatically with the rise and fall of air pressure. To overcome the objections cited, and also to reduce the losses caused by long lengths of pipe connecting the various buildings, there now seems to be a tendency to distribute throughout the various departments small air compressor units which have a capacity of from 50 to 200 cu. ft. With units of this size, the motors can be automatically regulated without imposing undue strains on the machinery or the transmission line.

The innovations noted, were not effected without radical changes in the operating organization. The division master mechanic, who formerly had exclusive supervision of the locomotives assigned to his division, was compelled to release his sovereignty during the time they were undergoing heavy repairs in the main shops, for these shops were governed by shop superintendents who were responsible only for the economical and satisfactory repairs to the equipment.

Shop Design.

The designs of the shops have not been symbolic of unity of sentiment with respect to the various features of construction. The greatest divergence of opinion existed with respect to the arrangement of tracks in the erecting shop which, it might be explained, comprises the keynote of the entire building arrangement and equipment. The longitudinal track design demands two cranes in the erecting shop, each capable of lifting one-half of the weight of a locomotive. The transverse track design requires only one crane of such capacity as to lift the entire weight of the heaviest locomotives in service. With the transverse arrangement, transfer tables were sometimes installed so that the functions of the cranes were limited to the hoisting of engines only after they had been placed on the track upon which the repairs would be conducted. The transfer table is not required if sufficient clearance between the floor and the roof trusses is provided to handle locomotives over each other for the length of the shop. It is not, however, entirely the personal preference of the engineer which decides the arrangement to be followed for, in some cases, the plan of the available land upon which the shops are to be erected proves to be the governing factor.

The locomotive repair shop capacity is generally stated with respect to the number of tracks or pits in a transverse erecting shop and in terms of the number of locomotives that can be accommodated in a longitudinal erecting shop. It is apparent that a certain approximate fixed relation should exist between the floor space required in the different departments and the number of locomotives accomodated in the erecting shop. This relation must be correct and the capacity of the machinery must be properly proportioned in order that maximum efficiency and consequently maximum output for the capital expended may be obtained.

Railroad Shop Output.

The output of a railroad repair shop is generally expressed by the relation between the number of locomotives which can be contained in the erecting shop and the number of locomotives repaired in each month, or is defined as the number of locomotives per pit per month. This figure will vary from 0.5 to 3.0, depending upon the average amount of repairs to be performed and the floor space together with the machinery available in the departments contingent to the erecting shop. It is clearly evident that the highest efficiency will be obtained, as well as the maximum output for capital expended, if the installed machinery is such as to enable the erecting shop to turn out the largest number of engines per unit of floor space.

It is not essential to combine the locomotive repair shop and car repair shop in one plant, and the tendency in recent years has been to separate the locomotive and car departments. From a labor standpoint, it is not desirable to operate jointly a car and a locomotive repair shop as dissatisfaction is likely to result between the lesser skilled and lower priced labor employed on the former and the more skilled and higher priced labor employed on the latter.

The Steam Requirement Feature.

In contemplating the advisability of purchasing current from central station plants for driving the shops, the question arises as to whether or not the operation of high-pressure boilers can be discontinued when steam for running the generating units is not required. The stumbling block to the discontinuance of high-pressure boiler operation has heretofore consisted of the steam hammers in the blacksmith shop. These could not be economically operated by compressed air under the existing conditions. A recent design, covering a motor and air compressor combination which forms a part of the hammer equipment and furnishes compressed air instead of steam to the hammer cylinder, may overcome this contingency. The use of steam will generally be required for shop heating in winter and also for heating the lye vat solution during the entire year. These conditions can best be fulfilled by the installation of low-pressure boiler units of suitable capacity to take care of these requirements.

Future Development.

We are now confronted with questions respecting the future development of the locomotive repair shop. Will further progress be made or is the era of the steam locomotive rapidly passing, to be pointed out to the next generation as an ancient system of propulsion for railroad trains?

Few industries, if any, have been benefited to a greater extent by electricity than have the railroads. It is the agent that operates the signals which guarantee a safe passage for the trains; it operates the shops; it illuminates the shops and yards; it pumps the water to fill the tenders; and it propels the freight and passenger trains in increasing numbers every year. We can now purchase electric locomotives at a cost per pound less than twice as great as the cost per pound for steam locomotives and obtain from them a yearly mileage two times that of the steam locomotives which makes the net first cost of motive power approximately the same for a definite service.

Will the elaborate steam locomotive repair plants be superseded by more simple shops for the electric locomotives costing not more than one-fourth as much as the present steam locomotive shops? Will the average cost of repairs for electric locomotives, namely, 4 cents per mile as compared with the the average cost of repairs for steam locomotives of about 9 cents per mile, be a large governing factor in the future of the transportation problem? The next decade should provide the solution.

Oxy-Acetylene Process of Autogenous Welding

The subject matter of this article is taken from a paper read recently before the Institution of Naval Architects and from part of the discussion which followed. In view of the growing prominence of autogenous welding, considerable value attaches to the various observations.

THE oxy-acetylene process of autogenous welding which has been largely employed of late years, owing to the comparative simplicity and the facility with which it can be carried out, has a very wide field of usefulness. The oxy-acetylene blowpipe gives a flame producing a clean and easily controlled heat, which can be adapted to almost any position. The extreme adaptability of the process has tempted many to apply it without due regard to the whole of the conditions obtaining in practice, with the inevitable result that many cases of failure have occurred.

Several accounts of failures of boilers, valves, etc., repaired by oxy-acetylene welding have been published. The failures of boilers which have been published are not confined to cases of plates cracked in service and subsequently repaired by autogenous welding, the welded part having in turn given way, but cases of the seams of fire-boxes, and of the connection of crown plates to the cylindrical portion made by flame welding methods giving way, sometimes with disastrous results, have been recorded. In some of these cases, the welds were clearly defective owing to the presence of oxides, on account of an excessive proportion of oxygen having been present in the welding flame, or to the use of fluxes in insufficient amount, or of an unsuitable nature. In other cases, the welds have been imperfect and spongy, owing to the presence of gas cavities, or of particles of slag included within the metals.

In view of the fact that the welds which have failed, and of which particulars have been published, all appear to have been made by experienced operators, it is not surprising that in many quarters the oxy-acetylene and other hot flame autogenous welding processes are considered unreliable and viewed with suspicion.

Restrictions Enforced.

The Marine Department of the British Board of Trade have made rules and regulations fixing the limits to the use of such processes in boiler work, while the Government of Belgium has forbidden the use of autogenous welding in boiler construction, and in the case of extensive repairs. These restrictions, however, will probably be relaxed in the future, as the conditions affecting the strength and other qualities of the welded portion, in comparison with the original metal, become more thoroughly understood, and experience is gained of the behaviour of welded material under various practical working conditions. The writers consider that until results of such experience are available due caution should be exercised in the use of autogenous welding for boiler and high pressure work. As far as ascertained, the published results of investigations into the quality of welds made by fusion methods have, with one exception, dealt only with the changes brought about in the structure of the material, changes in the static tensile strength, and examinations for unsoundness and oxidation.

The authors, as the result of an extended experience in the testing of steel and other metals, fully realize that although the results of static tension tests frequently indicate that the weld is almost strong as the unwelded material, they may be quite at variance with the results of dynamic tests or the behaviour of the material in practice. Working conditions are usually such that the material is liable to repeated shocks, and in the course of their examinations, the authors made a large number of tests in order to compare the behaviour of the welded and unwelded material under repeated impact, and also to compare the results of such tests with the static tensile tests. A large number of welds of mild steel were prepared, and submitted to static tension and repeated impact tests, in the ordinary condition, and also after various treatments. The first series of tests were made on round bars of mild steel, containing approximately 0.25 per cent. carbon, five-eights of an inch diameter.

Results of Tests.

The tensile test bars were turned parallel for 1½ in. and of ⅜ in. daimeter, in order that fracture would take place in the weld. The elongation was measured on a 1 in. length, and it would appear from these results alone that an average weld might be expected to possess something like four-fifths of the strength of the unwelded steel, and that the ductility would be about one-fifth. The maximum strength in tension would appear not to vary to any great extent, but the ductility appears to vary considerably from the average, as the lowest strength recorded is practically 80 per cent. of the original material, and the lowest elongation only 9 per cent.

Hammering has increased the ductility and reduced the strength slightly, while reheating after hammering has produced a further increase in ductility, and at the same time increased the maximum stress. Again, reheating to the same temperature, without previous hammering, has produced a somewhat large increase in the ductility and a further small increase in strength; whilst in the case of the specimens quenched in water and then reheated, the strength has risen to almost that of the unwelded material, although the elongation has been reduced.

It appears from these results, and others which the authors have obtained, that under no circumstances does the ductility of the weld approach that of the unwelded portion.

A number of welded bars of the same material, tested under repeated impact, were prepared 6¼ ins. long and notched in the centre of the welded portion, the diameter at the bottom of the notch being four-tenths of an inch. The results of eighteen tests of welds after various treatments indicate that an average weld might be expected to withstand about half as much as similar material unwelded. Hammering has apparently been the most effective treatment so far as increasing the fatigue-resisting properties of the material, but it must be borne in mind that the heating during the welding is extremely local, and consequently the metal in the immediate vicinity of the weld is liable to be at a comparatively low temperature, and there is a danger, when hammering, of vibrating a portion of the metal when it is at a black heat, which, as is well known, is productive of brittleness. If hammering is resorted to, the metal should be reheated to a full red heat (800 deg. Cent.) in order to remove strains or brittleness which might be set up during the process. Reheating or annealing also appears to be of little value, so far as increasing the fatigue resistance of the welded portion is concerned.

Comparison of Results.

Comparing results, it is of interest to note that the form of treatment which gave the highest strength in tension has given the lowest result in the impact tests. The results given were obtained upon test through the centre of the weld and not in the weld itself. This is due to the fact that in heating to fusion the ends of the pieces to be joined, the neighboring metal becomes heated to a temperature sufficient to make it brittle. The actual weld where fusion has taken place has a structure characteristic of cast metal. The portion immediately adjacent to the weld exhibits a coarse meshwork of overheated, brittle metal.

The results of the repeated impact tests show very clearly that the thicker the plate the less reliable is the weld, and the greater the reduction in strength. Thick material also generally shows less improvement by annealing; in fact, under ordinary working conditions, it is usually impracticable to anneal the material. In consequence of the highly local heating action of acetylene, there is considerable danger of contraction stresses being set up in the metal, and undoubtedly this contributes to the greater reduction in strength of thick material.

The case of a welded plate only one-eighth inch thick came under the authors' notice some time ago. It was sent them to examine and report upon, with regard to the relative strength of the welded and unwelded material, by a firm of tank makers who had recently introduced acetylene welding of the seams instead of lapping and riveting. Transverse bending and tensile tests showed that the joint was stronger than the neighboring metal. The material being too thin to obtain ordinary fatigue test pieces, narrow strips were cut about half an inch wide, some with the joint running transversely, and some with the joint running longitudinally to the strip. The strips were placed in a vise and bent backwards and forwards through 90 degrees until fractured. It was found that the welded strips required at least as many right angle bends as similar strips of unwelded metal to produce fracture.

Unequal Cooling Effects.

The metal being thin, was quickly heated locally to fusion without damaging the neighboring metal, and cooling being rapid, the material in the neighborhood of the joint was probably in a much tougher condition than before the operation. The danger of stresses due to unequal cooling being set up would also be reduced to a minimum in such material. As the thickness of the plate increases, a larger portion of the neighboring metal becomes overheated, the cooling is slower, and the danger of contraction stresses being set up increases.

The authors, as the result of a large number of tests and experiments upon autogenous welds, conclude that, although there is a wide field of usefulness for oxy-acetylene and similar processes for joining or repairing steel plates, bars, etc., which are not required to resist very severe stresses, considerable caution must be exercised, and due regard paid to all the conditions before making use of them. A very serious responsibility attends the use of autogenous welding in cases where the parts are likely to be subjected to considerable mechanical strain. In any case, where failure tended to endanger life and limb, welds, if not entirely prohibited, should be accepted with extreme caution. Autogenous welds always represent a somewhat uncertain quantity, as there is no means, except by destructive tests, of ascertaining whether a weld is good or bad.

Uncertainty of Autogenous Welds.

Mr. J. T. Milton gave some very interesting and valuable experiences regarding the welding that was passed by Lloyd's Register. He said he gave his cordial approval to the fact that the Marine Department of the Board of Trade had made rules and regulations fixing the limits to the use of such processes in boiler work; and that the Government of Belgium had forbidden the use of autogenous welding in boiler construction, and in the case of extensive repairs. Autogenous welds represented an uncertain quantity, and there was a serious responsibility attending them, which called for the greatest caution in their use.

After a very big experience with welds, Lloyd's Register had adopted that policy. Great pressure had been put upon them to accept repairs by autogenous welding, but they had not seen their way to accept them in cases where their failure would mean serious disaster. On the other hand, where failure would not involve disaster they had accepted hundreds of those repairs, and they had proved quite satisfactory. For the repair of shell plates and boilers of ships they would continue to prohibit that method, just as they did for crank shafts and large and important forgings.

It was necessary, too, to be warned that there was always a certain amount of unreliability about autogenous welding.

While the experiments referred to in the above paper were made on small pieces, the results might be very different if they were made with repairs on long lengths of plating, where they could not get entire uniformity of stress across the structure. He felt certain that if the same experiments were carried out on a larger scale they would show less advantageously than on the small scale. Only a little time ago a vessel had to be repaired after smashing her stern frame in a collision, and the work was done by autogenous welding. On account of the element of doubt, however, the owners had the ship taken into dock and a new stern frame was fitted. Unfortunately those interested in autogenous welding would not accept the offer then made by Lloyd's to test that piece of repair work.

AGRICULTURAL MACHINERY IN RUSSIA.

RUSSIA, as a market for agricultural machinery has lately been engaging the attention of the various British consuls resident in that country. Although present disturbed conditions do not warrant any considerable extension of this trade, it yet has important possibilities, and is one that has a special interest to Canadians. In 1913 Canada exported to Russia $1,841,483 worth of agricultural machinery.

Details of the Trade.

The following details of the trade with Russia in agricultural machinery are from a report by the acting British Consul-General at Odessa:

The demand for up-to-date labor and time-saving agricultural machinery of foreign manufacture increases annually. The local factories are so occupied with the manufacture of small and simple machines that they are unable to devote their energies to the installment of plant for the manufacture of more complicated machines, apart from the fact that they lack proper systems of economical production. United States manufacturers retain about 90 per cent. of the trade in self-binders and reapers, the balance being made up of Canadian, United Kingdom and German makes, of which the last bear an infinitesimal proportion to the total. A large American syndicate controls the market in these machines, making it almost impossible for the smaller producers to compete.

Thanks to United Kingdom manufacturers having fallen into line with their competitors in the matter of giving credit extending over three years, they have regained the prestige which they lost some few years ago, and the sales of British threshing machinery have now reached record figures. It is remarked that purchasers invariably give the preference to British threshing machinery, as on account of its greater weight it is more economical and durable. United States firms have tried to enter the market, but have met with little success. Many of the Russian factories are making small-sized horse and motor-driven threshing machines, and the motor-driven variety may in course of time seriously affect the sales of steamdriven sets.

American and German manufacturers hold the trade in seed drills and corn planters, but large quantities are now being made by local factories.

Harrows of the disc pattern have met with the approbation of purchasers, and are supplied by United States, Canada and German firms.

Germany continues to do a good business in the better classes of ploughs, both single and multiple, and the United States are also competing to a small extent. The bulk of the single ploughs sold, however, are of local manufacture.

The better qualities of chaff and root cutters are imported from the United Kingdom and Germany, but local factories are manufacturing inferior qualities in large numbers.

B. C. MANUFACTURERS' ASSOCIATION.

AT the annual meeting of the B. C. Manufacturers' Association held at Vancouver on September 2, the following officers were elected for the ensuing year: President, K. J. Morrison, Vancouver; vice-president, J. A. Cunningham, Vancouver; vice-president for Vancouver, H. H. Welsh; for Victoria, Mr. J. C. Pendray; for New Westminster, J. R. Duncan; honorary treasurer, E. G. Byres; chairman of committees; Reception and membership, H. Schaake, New Westminster; Vancouver, J. W. Curran; Victoria, W. H. Sweeney; tariff committees: Vancouver, J. H. Hanbury; New Westminster, W. R. Gilley; Victoria, H. Pendray; railway committee, Vancouver, J. Ramsay, Victoria, A. M. Kirk; New Westminster, W. L. Darling; parliamentary committee: Vancouver, Geo. Trorey; Victoria, G. A. Kirk; New Westminster, N. Nelson; commercial committee: Vancouver, E. B. McMaster; New Westminster, J. Reid; Victoria, Mr. S. R. Newton; press and advertising: New Westminster, W. L. Darling; Victoria, H. R. Houston; Vancouver, Harry Duker; vigilance committee: Vancouver, J. H. Hamilton; Victoria, W. A. Jamieson; New Westminster, A. Wilberg; insurance committee: Vancouver, W. H. Leckie; Victoria, T. M. Brachan; New Westminster, E. B. Davis.

THE IDEAL RAILROAD SUPERINTENDENT.

F. D. Undedwood, president of the Erie Railroad, gave the American Association of Railroad Superintendents at its recent Chicago meeting his opinion of what a real superintendent should be. His letter to the association was read by the secretary, E. H. Harman, of St. Louis. "A retrospect," said Mr. Underwood, "shows me that I fell far short in all the essential qualifications I now attempt to portray. Even now I would like another chance on a red-hot division to prove I could be a better superintendent than I was." Here are some of the things Mr. Underwood impressed on the superintendents:

A superintendent should not do physical acts that can be done by some one else. The bawling and hauling we old-timers did is unwise from several points of view.

A man who is never angry is not an efficient boss; the spur of anger should be concealed and used only to stimulate the stroke—never paraded.

There are in all walks of life those who bluster, plead, lie, and bring pressure from many sources. The processes used to carry their point are ingenious, plausible, and persuading. Quietly side-track them when sure you are right; never willingly recede from a position that is fair.

Breaking a rule or doing something outside of the rules is many times an offence to be condoned, provided the offender has brains. His action showed him fearless and perhaps expedient. There are the seeds of a good man in every rebel. Mentally pussy-footed sort of men are not desirable. An argufier—sometimes called a sea-lawyer—has his uses.

Never condemn a measure you want to kill; praise it, tell in how many times and places it would be fine, then put in the local misfit color.

Buy in Canada. — The purchasing agents of the Grand Trunk and Grand Trunk Pacific railways have been ordered to buy everything required by these lines in Canada and Great Britain wherever possible. For some years past German firms have been selling the companies large orders of steel goods and other railway supplies and all orders outstanding have been cancelled.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

A READER'S APPRECIATION.

By J. S. Drysdale.

READ **Canadian Machinery** with interest every week, and like many others, I get some very useful ideas, which I always put into practice at the very first opportunity. I have put to the test the various hints and found them of good service, and feel that I should pass on my experiences to others; for although some may have tried them on their own account, and, like myself, have found them all right, numbers may never have thought of them. The accompanying kinks may be useful to my fellow-craftsmen.

Grinding Pump Valves.

Not long ago I had a small steam pump to repair, and as the valves were all in bad shape, I started to grind them, but found that the flour of emery was too coarse and was scratching the valve faces. As I could not get any finer emery in the factory, I hardly knew how I was going to get through with the grinding job; so when home for lunch, I took some Dutch cleanser back with me, with the idea of seeing how it would work on the brass, which, by the way, was very soft. In a very short time, it is my pleasure to state, I had the eight valves ground up in good shape and without a scratch.

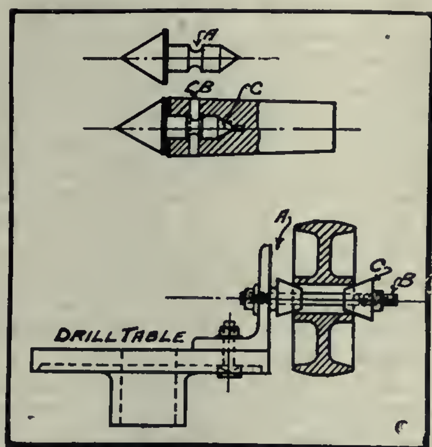
Hammer Heads Loosening.

I have often found trouble with hammer heads getting loose through the wedges coming out, and to overcome this I use a small steel burr on washer with a knife edge ground on it, and driven into the handle. On large hammers I use two washers. When the washer is driven into the wood handle it is there to stay, for as soon as it goes in, the wood closes into the hole of the washer, so that it cannot come out.

REVOLVING DEAD CENTRE.

By G. Barrett.

IN the accompanying illustration, the upper part, Fig. 1, represents a very simple and easily made form of revolving centre for the lathe tail stock which is particularly useful for small work, although it can be used to advantage on jobs of any size. A short time ago the writer had a large quantity of footsteps to turn for textile fly-frames. They were of annealed cast iron and the speed run for shimmering up caused them to run out at the centre through overheating. The trouble was gotten over by designing the revolving centre shown. This is made of cast steel and is bored about $1\frac{1}{2}$ inch deep to accommodate the smaller piece as seen in the figure. This piece is also of tool steel and has a groove of $\frac{3}{8}$-inch radius turned on the shank to accommodate a $\frac{1}{4}$-inch fasten-



REVOLVING DEAD CENTRE.
WHEEL DRILLING FIXTURE

ing pin and allow the necessary play. The groove is also used to carry lubricant, which is admitted through a hole drilled in the outer piece. As the centre revolves freely with the work, the latter revolves but does not heat and remains true. All wearing parts being hardened, the apparatus retains its true running qualities for a long time and will be found a great help in turning brass, wood and soft metals.

WHEEL DRILLING FIXTURE.

By G. Hamilton.

THE lower part of the above illustration shows a practical fixture for holding wheels, sheaves, pulleys and the like, while drilling oil or set screw holes. It consists of on angle bracket, A, to be bolted to the drill press table. It is fitted with a $\frac{7}{8}$-inch stud of machine steel which carries the loose-fitting cone bushings C. Wheels of a wide range or size and bore can be quickly set up and rigidly held for drilling purposes.

By bolting the bracket to the table upside down, a much larger wheel can be taken under the drill and as many holes as desired can be drilled at one setting. Anyone who has worked in a number of shops knows something of the time lost in hunting blocks, packing, etc., to say nothing of broken drills now and then. The same principle can be used for drilling drums, drilling and tapping set collars and many other such jobs.

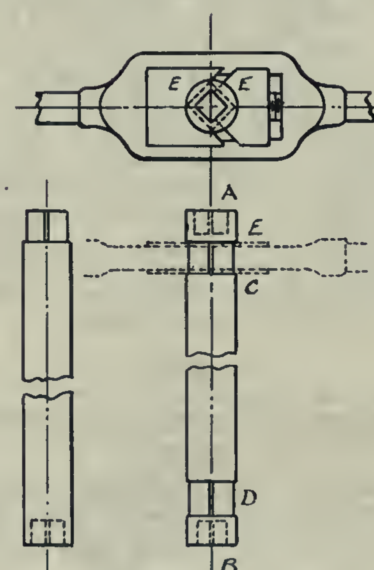
DOUBLE END TAP-EXTENSION.

J. E. Cooley.

A COMMON type of tap-extension made and in general use is that in the accompanying sketch. As seen, one end of the rod is milled square for the tap-wrench, and the other end has a square broach, in which to hold the tap. One extension is required for each size tap.

A suggestion for making one tap-extension serve for two different tap sizes is shown in Fig. 2. The ends A and B are broached out square, and on the outside of the rod, just below the depth of the broaches, as C and D, two places are milled square on which to fasten the tap-wrench. The jaws of the wrench are first opened wide enough to insert them over the end of the rod, and then closed up against the milled sides, as at E—E.

Formerly all wrenches were of the solid type having one size hole, and it was only then possible to use the single



DOUBLE END TAP EXTENSION

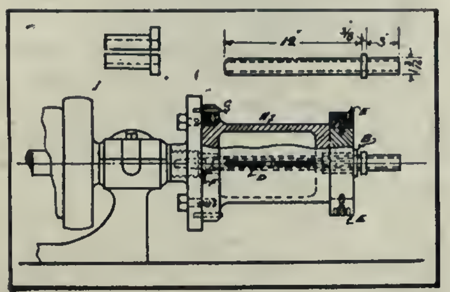
type tap-extension. The adjustable-jaw tap-wrench is now mostly used, and it is seen that tap-extensions can be double ended.

CHUCK FOR BORING LONG COLLARS.

By B. George.

THE boring of long collars with comparatively small holes is difficult, to say nothing of being very tedious. The writer has had them to do by the thousands, and has tried a great many schemes and devices for expediting the work. The collars vary in size, being 1 3-16 diameter in the rough, the bores ranging from $\frac{5}{8}$ in. to 15-16 in., and being 5 in. long over all. As they are annealed, they wear badly in the steady rest. They are unsatisfactory in other ways as well.

The chuck A, Fig. 2, is made of cast



CHUCK FOR BORING LONG COLLARS

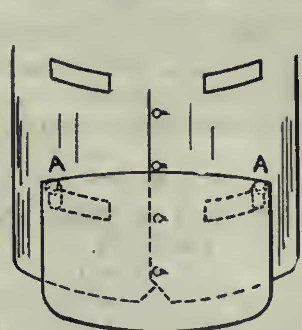
iron and is cored out, leaving $\frac{1}{2}$ inch of metal after being turned. It is bored and faced to suit the mild steel bushing, which is shown in place at B. One of these bushings is made for each size of collars. The rear end of the chuck is faced and fitted with two $\frac{3}{8}$-inch dowels C for locating on the face plate of the lathe, There are also two $\frac{1}{2}$-inch slots D, the length of the chuck, and a steel ring made to fit the end E.

A special collet F is turned to fit the lathe spindle, and is bored taper to locate one end of the work, Fig. 1. The steel bushing B is split, which not only enables it to be tightened on the work by means of the set screws E, but it also clears the fins on the castings caused by the parting of the moulds. The boring is done with a flat drill at the rate of thirty per day, and the turning required is done afterwards on a mandril.

IMPROVED DRAFTSMAN'S APRON.

By "Hartford."

CONSTANTLY rubbing against the edge of the drawing-board wears away the front of the vest. A small apron to pre-



IMPROVED DRAFTSMAN'S APRON

vent this is worn by many draftsmen, being usually fastened on by means of tape tied around the back.

A more simple means for attaching one of the aprons is seen in the enclosed sketch. Two narrow strips of tin, as A-A, are bent in the form of clips and sewed on the back of the apron. These are slipped over the edge of the vest pockets and hold it on securely.

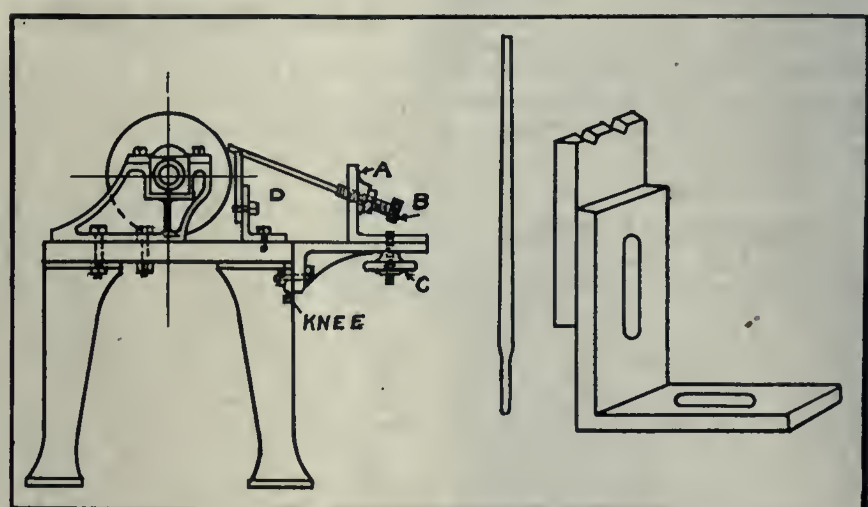
GRINDING MACHINE FOR TEXTILE SPINDLES.

By G. Barrett.

THE illustration shows a simple grinding machine for spinning mule ring frames and winding machine spindles. These are ground to a central point at the end to run in the footsteps of the above-mentioned machines. The end view indicates a spindle in the grinding position. The arrangement consists of a base plate 2 in. long, 2 in. thick, and 18 in. wide, with two brackets to form the bearings for the wheel spindle. There is also a knee piece cast integral with the base plate to accommodate the front bracket. This, in turn, supports the bracket A, which is of cast iron, and is drilled and tapped at an angle of 25 degrees to suit the screw B. The screw is centered for the top end of the spindles to bear against, while the bottom end is being fed against the wheel.

The rest D is a wrought iron bracket adjustable in two directions to accommodate wear of the grinding wheel. The two vees at the top serve as rests for the work. A larger view of the spindle to be ground is shown in the central part of the figure and the adjusting bracket is shown to the right.

By this arrangement and the clamping screw C, it is possible to get any desired angle on the spindle points, as well as to set up for any length of spindle. When arranged for a particular size of spindle, the speed and accuracy attained is very satisfactory, a boy being able to turn out an average of 13 gross per day.

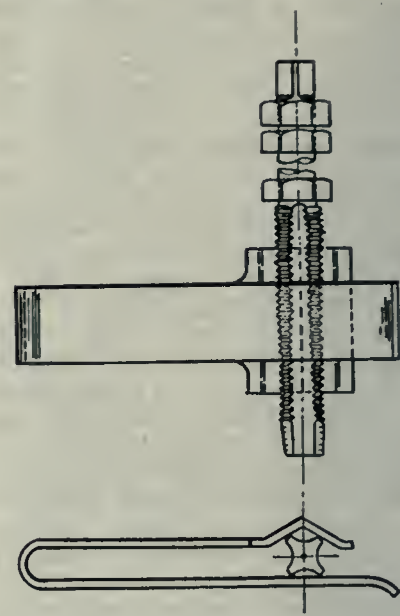


GRINDER FOR TEXTILE SPINDLES

NUT-TAP HOLDER.

By E. C.

WHEN taking a nut-tap out of a chuck in order to remove the tapped nuts from the end, it is necessary to use a small bunch of waste with which to take hold of the tap, as it is too hot to handle with the bare hand. This method has never been a desirable one, as the waste is soon soaked with oil, and the chips become imbedded in the hand.



NUT TAP HOLDER

A simple holder for this purpose is shown in the accompanying illustration. It is made from sheet-steel, cut out and bent in the shape as shown and then tempered, and forced over the threaded end of the tap; the tap being then removed from the chuck and the nuts taken off.

W. H. Connor who resigned his position as treasurer of the Pembroke Steel Equipment Co., has accepted the position of treasurer of the Flax Co., Ottawa.

NEW PROCESS DEVELOPMENTS

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

TROPENAS CONVERTERS VS. ELECTRIC FURNACES.

AN interesting article on this subject appears in a recent number of Metallurgical and Chemical Engineering. The following claims are made for the electric furnace:—

(1)—The metal obtained is lower in phosphorus and sulphur contents than converter steel.

(2)—Segregation in electric steel is less than in converter steel.

(3)—Starting with cold steel scrap, electric steel is cheaper to produce than converter steel.

(4)—Absolute uniformity.

The author gives some interesting data in substantiating these claims. In the first place, the Tropenas process is by no means depreciated, and one would be led to think that the author's description of the simplicity of the process is somewhat over-rated. The advantage of the electric furnace in its capability to melt small scrap, borings, etc., is mentioned, whereby, although the electric furnace is not as efficient a melting furnace as a cupola, it can use cheaper raw material, and thereby offset the loss in efficiency to its adavntage.

Another interesting point noted is that, whilst a converter can be operated only once without great increase in the cost of production, the same cannot be done with the electric furnace except at great loss. In regard to the application of small furnaces of either type to the manufacture of large castings, the author is in favor of the Tropenas. He quotes an instance of an 8-ton casting being poured successfully with a single 2-ton converter. Six blows were made to secure sufficient metal, each blow being poured on to the top of the other in the ladle. It took 1 hour 45 minutes to make the steel, and no skull was left. This, of course, bears out the general practice that converter steel can be made very hot. Of the deleterious influence of sulphur and phosphorus, all steel casting manufacturers are well aware, and by the refining which is possible to the electric furnace this may be reduced to a minimum and the consequent troubles avoided.

ANNEALING MALLEABLE CASTINGS.

THE same journal contains an article by O. W. Storey on the subject of annealing malleable castings. The author deals with packing materials, temperature of annealing, time of annealing, rate of cooling. The iron experimented with had the following analysis:—

Total (combined) carbon, 2.60 to 2.70 per cent.

Silicon, 0.65 to 0.70 per cent.

Sulphur, 0.055 to 0.060 per cent.

Phosphorus, 0.140 per cent.

Manganese, 0.27 per cent.

Particular attention is given to the production of black heart castings, and it is shown that the packing material itself can influence the interior, but oxidising materials produce decarbonized skin, more especially if the material be loosely packed.

In regard to the temperature of annealing, it is found that with an annealing time of fifty hours this iron required an annealing temperature of 860° C. to secure a complete break-down of the cementite. Annealing at 750° for fifty hours resulted in a partial breakdown.

A quick rate of cooling after annealing results in a steely structure, and if the rate of cooling is sufficiently slow through the critical range, viz., 830° to 740°, all the carbon will be precipitated, while the rate of cooling below 740° has little effect. The time of annealing depends, of course, upon the temperature. The higher the temperature the quicker the anneal, although short anneals result in a poorer grade of material. The reactions of the annealing process have been studied, and the removal of carbon is attributed to the reaction between Fe_3C and CO_2, the resulting CO being then reoxidized and continuing the reaction.

The analysis of the gas taken from a sample being annealed at 870° contained 13.2 per cent. CO_2 and 26.8 per cent. CO, whilst a second sample taken from one annealing at 980° contained 4.6 per cent. CO_2 and 71.2 per cent CO.

TIN RECOVERY FROM TIN-PLATE WASTE.

THE recovery of tin from tin-plate waste has become quite an industry. There are three general methods of separating tin—mechanical, chemical and electrolytic. The most important of these methods is the last. The electrolyte employed is usually hot caustic soda; loosened chips of tin-plate packed in wire baskets acting as anodes, while the iron bath walls or iron plates suspended therein act as cathodes. The average tension is said to be 1.5 volts. When separated, the tin is spongiform. Other methods of electrolytic de-tinning are in use in Germany, among them an alkaline method which is said to offer great advantages over the acid methods formerly used, and a chloride method applied by Lambottle of Brussels; this is the most extensively used. The principal requirements for the successful application of it are absolute exclusion of moisture during the process of de-tinning, the avoidance of an unduly high temperature, and proper washing of the de-tinned waste.

MATHEMATICIANS THE FUTURE LEADERS.

Professor A. Ranum predicts that if progress continues along the lines followed, the pure and applied mathematics of today will surely lead, sooner or later, to a variety of practical applications and new inventions that will startle the world. The material and utilitarian progress of to-morrow will depend largely on the scientific progress of to-day. Moreover, the increasing demand for accuracy and efficiency in engineering can be met only by broadening and strengthening its mathematical foundations. Many an engineering student of to-day will live to see the time when those engineers who are leaders in their profession, who are capable of meeting novel conditions where originality of thought and action is required, will be men who are better equipped on the scientific side than we think necessary to-day; they will be men who are thoroughly trained in the use of many of the higher branches of what we now call pure mathematics.

Sir John Jackson (Canada) Ltd., have offered and placed at the disposal of the Ministers of Militia and Marine the services of the whole of their engineering staff, employees, plant and equipment, at Victoria, B.C., for any construction or other work, should they require such services for the defence of Victoria and vicinity. The firm employs a large staff of skilled engineers on the contract for the breakwater at the Outer Harbor, Victoria, and as the plant is most extensive and comprehensive, it is felt that, should occasion arise, the assistance which would be rendered the Militia and Naval Departments of the Government would be invaluable. In the building of entrenchments, the throwing up of defence works, the erection of additional forts and harbor fortifications generally, the service which the staff and plant of the company would perform would represent a tremendous asset to the Government.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals, will be found a most useful companion study, and should not be overlooked.

MISCELLANEOUS.

Question.—Wanted for actual tests, the comparative horse power for driving both high and low-speed blowers of the same capacity, the blowers to be used for collecting shavings in a planning mill.

Answer.—With the same blast areas, high and low-speed blowers of the same capacity will require the same horse-power. Low-speed blowers generally have larger blast areas and consequently larger exhaust pipes. This avoids the back pressure, in a small exhaust pipe, which is one of the chief causes of increased horse-power.

* * *

Question.—With an elevator of one-ton capacity and a total distance to be lifted of 150 feet, which would be the more economical to operate, an elevator to be lifted the 150 feet in one minute, or one to be lifted the 150 feet in two minutes? The motor would, of course, have to be larger for the one minute work, but it would need to be used only half as long.

Answer.—The amount of current per car mile for a one-ton elevator would be about the same at 75 feet and 150 feet per minute, which are moderate speeds. If higher speed were used, the consumption per car mile would be materially increased. Like other apparatus, there is an efficient speed for which the elevator is designed to operate; an increased speed will require power to overcome the increased inertia and decreased speed will waste power in added gear reduction.

* * *

Question.—A steel stack is 50 feet high, and is mounted on a base 10 ft. high. Twenty feet from the top is a ring, to which are fastened four guy cables. If these be attached to the ground 45 ft. from the base, how many feet of cable will be required?

Answer.—The height of the ring to which the guy ropes are attached above the ground is $50+10-20=40$ ft. The length of one cable is $\sqrt{(40^2+45^2)} = \sqrt{3625} = 60.24$ ft. Four cables would require $60.24 \times 4 = 240.96$ ft.

* * *

Question.—An ash hopper is shaped like an inverted pyramid. The length of one side of the top is 12 ft. and its height is 14 ft. How many square feet of steel plate will be required, and how many cubic feet of ashes will it contain when filled to within two feet of the top?

Answer.—To find the area of a triangle, multiply the base by half the height. The base, in this case, is 12 ft. and the height is the hypotenuse of a triangle, whose height is 14 ft., and whose base is 6 ft. The height then is $\sqrt{(6^2+14^2)} = 15.23$ ft.

Area of one side is $\frac{12\times15.23}{2}$. Area of four sides is $\frac{12\times15.23\times4}{2} = 365.52$ sq. ft.

The volume of the hopper is the area of the base multiplied by one-third the height, and the length of a side of the base two feet from the top is a case of proportion, or is $\frac{12\times12}{14} = 10.28$ ft.

Area of base $= 10.28\times10.28 = 105.67$, and volume of ashes contained is $\frac{105.67\times12}{3}$

$= 422.71$ cubic feet.

* * *

Question.—What would be the cooling surface of a surface condenser having 7,020 tubes, each 0.75 in. in diameter and 14 ft. long? Allowing 3.5 sq. ft. of cooling surface per kilowatt, what capacity generator could be served by this condenser?

Answer.—Circumference of one tube is $0.75\times3.1416=2.36$ in. Surface of one tube$=14\times12\times2.36=396.48$ sq. in$=2.75$ sq. ft.

Surface of 7,020 such tubes is $70.20\times2.75 = 19{,}305$ sq. ft. Capacity

$= \frac{19305}{3.5} = 5515.6$ kw.

* * *

Question.—In the above problem, at a steam consumption of 12.8 lb. per kilowatt-hour for the turbine, how many pounds of steam would the condenser handle per hour?

Answer.—$5515.6\times12.8=70{,}599.68$ lb.

* * *

Question.—What would be the radiation loss in B.t.u per year from a steam pipe 6 in. in diameter and 40 ft. long under 150 lb. steam pressure?

Answer —Experiments have shown that the radiation loss of steam pipes is 3 B.t.u. per hour for each degree difference in temperature between the pipe and surrounding air. Taking the average temperature of the air at 80 deg. F., and considering that the plant runs 24 hours per day for 300 days, and assuming outside diameter of pipe to be 6⅜ in., surface of pipe$=\frac{6.375\times3.1416\times40}{12}$

$=66.759$ sq. ft.

Temperature of steam at 150 lb.$=366.5$ deg. F.

Difference between temperature of steam and air is $366.5-80=286.5$ deg.

Loss per year$=286.5\times66.759\times300\times24$ $=137{,}714{,}328$ B.t.u., or the total heating value of $\frac{137{,}714{,}328}{14{,}000} = 9{,}837.45$ pounds, or about 5 tons of coal.

* * *

Question.—How many gallons of gasoline could be stored in a bumped head cylindrical tank 6 ft. 8 in. long, with an additional spherical rise of 4 in. in each head and an inside diameter of 3ft. 6in.?

Answer.—Volume of the cylindrical part is $42\times42\times.7854\times80 = 110{,}835.65$ cubic inches.

To find the volume of a spherical segment, add three times the square of the radius of the base to the square of the height. Multiply the sum by the height and by 0.5236.

The volume of the two spherical ends is, therefore,

$[(21^2\times3)+(4^2)]\times4\times0.5236\times2=5608.8$ cubic inches.

Volume of tank$=110{,}835.65 + 5608.8$ $=116{,}444.45$ cu. in., or $\frac{116{,}444.45}{277{,}274}$

$= 419.96$ gals.

* * *

Question.—A flywheel has an outer diameter of 124 in., the rim thickness is 5 in., and its width is 16 in. What would be the weight of the rim? If it were discovered to be 2¾ pounds out of balance, how many 1½-inch holes, 1½-in. deep, would have to be drilled in the heavy side to bring it right?

Answer.—Mean diameter$=119$ in. Volume $= 5\times16\times119\times3.1416=29{,}907.032$ cubic inches.

Weight $= 29908.032\times0.26 = 7776.088$ pounds.

Volume of one hole$=1.5^2\times7854\times1.5$ $=2.05$ cu. in.

No. of cu. ins. required to make 2.75 pounds $= \frac{2.75}{.26} = 10.57$

No. of holes required$= \frac{10.57}{2.05} = 5.15$

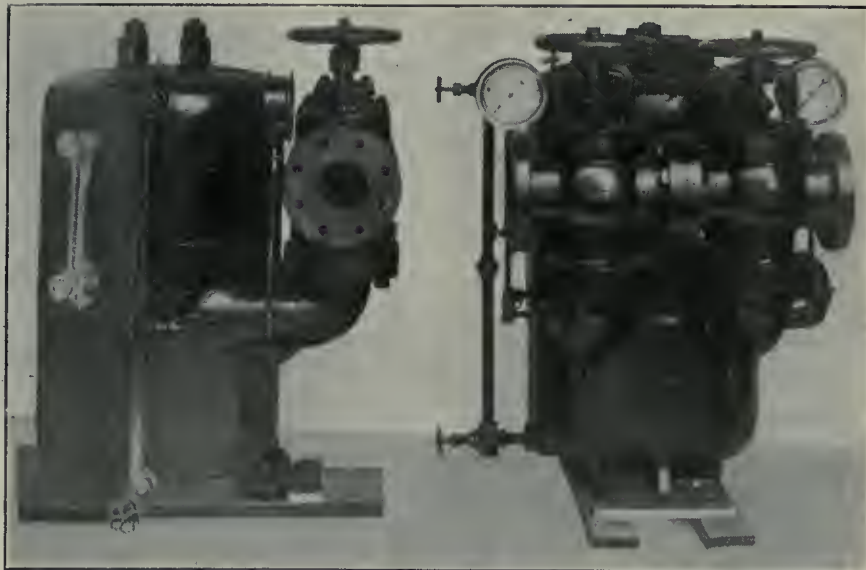
MARINE AUXILIARY EQUIPMENT OF CANADIAN MANUFACTURE.

A new and interesting development following the growth of Canadian shipbuilding is the establishment of manufacturing plants for marine auxiliaries. Needless to remark, it is quite important for the makers of auxiliaries to be in close touch with the shipyards and vessel owners in order that the most suitable style of equipment may be offered for each vessel and spare parts furnished at short notice.

The Canadian Griscom-Russell Co. has been manufacturing for some time in their shops in Montreal the complete Reilly line of marine specialties such as feed water heaters, salt water evaporators, filters and grease extractors, along exactly similar lines to those by the Griscom-Russell Co., New York. One of their recent contracts was for two No. 47 Reilly multicoil feed water heaters with by-pass for installation on the dredges of the Canadian Stewart Co., operating in connection with the Toronto Harbor Improvement. The accompanying illustrations show the size and construction of these heaters. The heating surface consists of 47 coils of seamless copper tubing rolled into coils of small diameter. These coils are connected to the top and bottom manifolds with copper to copper unions which require no packing and allow easy removal of any coil. The large door in the heaters gives ready access to heating surface for inspection. These heaters are undoubtedly the largest marine feed water heaters ever built in Canada.

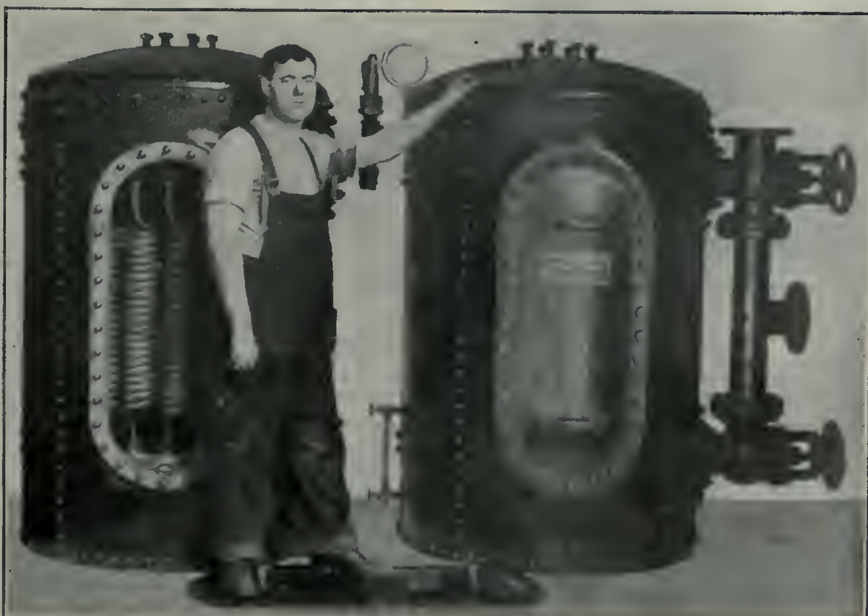
A high temperature of feed water is secured by the water passing through the coils whose small radius breaks up the column of water and thereby increases the efficiency of the heating surface. A number of these heaters of smaller sizes have already been built to Government and private order.

The Canadian Stewart dredges are also equipped with two 4-in. Reilly multiscreen feed water filters and grease extractors, their general construction being shown in the illustration. The filtering surface consists of heavy Terry cloth, being something in the nature of thick Turkish towelling. On large dredge work, it is especially desirable to have an efficient filter so that the boiler feed water be free from sand and other impurities stirred up in the surrounding water by the action of the dredge, and as surface condensers are usually installed on large dredges it is important to have an efficient grease extractor to remove oil and grease from the water in the hot well before feeding the condensate to the boiler.



TWO 4-IN. REILLY MULTI-SCREEN FEED WATER FILTERS AND GREASE EXTRACTORS.

An essential part of any filter is accesibility to the filtering medium and simplicity in cleaning. This cleaning is accomplished in the Reilly filter by a large bottom blow-off for the heavy precipitate and surface blow-off for oil and grease. An internal steam cleaning connection is provided so that the filter may be by-passed and the filtering surface boiled out without removing the cartridges. When it is desired to remove the cartridges, they are readily withdrawn through a large manhole in the top of the shell and may be boiled in soda for a thorough cleaning of the filter material. These filters are usually built for high pressure service, being placed between the feed pump and the boiler. In some cases, however, they are designed so that the water is cleaned of sand before passing through the feed pump.



TW ONO. 47 STANDARD REILLY MARINE FEED WATER HEATERS WITH BY-PASS VAL VES.

Locomotive Superheater Regulating Valve.—It is proposed by a South American engineer that in a locomotive superheater of the fire-tube type the regulating valve should be placed on the outlet side of the superheater instead of the inlet side. The superheater consists of a header with two chambers connected by tubes, and the regulator valve slides on seatings in a chamber on the outlet side. The valve rod passes through a cylindrical boss in the partition between the saturated and superheated steam chambers, and it fitted with a piston to make a steam-tight joint. The valve consists of two parts, one sliding inside the other and pushed outwards against the seatings by a spring.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

AUTOMATIC LATHE FOR STRAIGHT TURNING AND FACING.

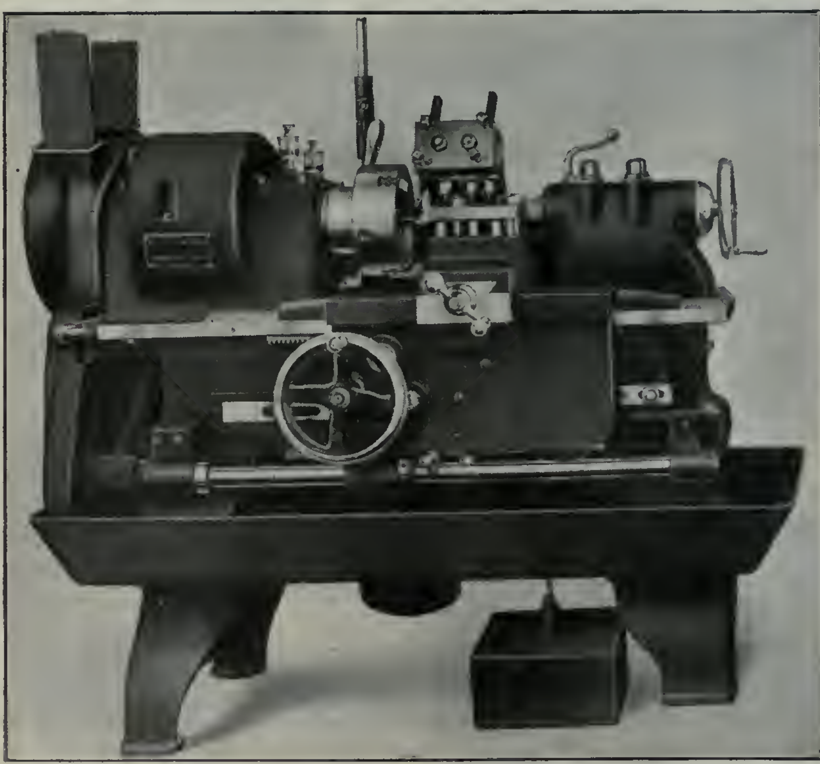
THE lathe shown in the accompanying photograph is extremely rugged, being generally heavier than ordinary machines of its type or capacity. It is built throughout on 20-inch. heavy duty lathe lines to insure absolute absorption of vibration, and to withstand the severest service. The power is also in excess of any demand likely to be made upon the lathe. The wide double belt drives to a large diameter pulley, then through a pair of herringbone gears (running in oil) to main head spindle. This arrangement gives a constant spindle speed, no mechanical changes being provided.

A feature of these lathes is the one feed and the one speed idea, thereby guaranteeing a maximum production when machine has been set at proper feed and speed for a given operation. Change gears can also be used if desired to vary the feed to suit the class of work, although, when once set up, the feed is rarely changed. In order to obtain the desired spindle speed, the countershaft speed must be changed accordingly.

The object of this tool is to furnish a second operation machine that will produce a large quantity of work, and which will be equal in quality to that produced on the very best type of engine lathe. In the construction careful consideration has been exercised in the distribution of material, combined with the highest class of skilled workmanship.

The head spindles are made of chrome nickel steel, heat treated, while the bearings are hardened, and run in phosphor bronze journals. Sight feed oilers are used for lubrication of all head bearings. The driving pulley which is mounted on a shaft at rear of head, and which arrangement eliminates all belt tension on the main spindle, is well guarded to protect the operator, the same guard covering all end works gearing.

The tailstock is extremely rigid, being of the four-bolt type. It is made in one piece in preference to the regulation two-piece tailstock, as this feature tends to prevent any chance of side-ways shift of tail spindle. The carriage and apron are also heavily constructed, the rack pinion being made of hardened steel, engaging with a hardened rack on bed.



AUTOMATIC LATHE FOR STRAIGHT TURNING AND FACING.

A cam feeding-in attachment is incorporated in the construction of the apron and carriage, constituting an adjustable bracket on the side of the bed carrying cam surfaces; and a link motion inside of the apron that transmits a cross feed action to the front tool block. The longitudinal travel of the carriage causes the link motion and cam surfaces to deliver this feed-in motion to the block, feeding the tools into the work to a predetermined diameter.

The back arm facing device is an attachment mounted on a large shaft or bar, which bar is supported in bearings cast integral with the head and tailstock, and bored in perfect alignment with the main spindle. A cam attached to the rear of the carriage actuates the bar by means of a roll carrier arm, which projects from the bar, and is in contact with the cam surface. The longitudinal travel of the carriage which carries the rear cam, causes a rotating motion to the bar, which feeds the facing tools in toward the centre of the spindle. It will be noted that the longitudinal travel of the carriage actuates both the feeding in of the front tools, and the feeding in of the facing tools. When the work is completed, the feed is automatically tripped, and the carriage and all tools almost instantly return to their starting position.

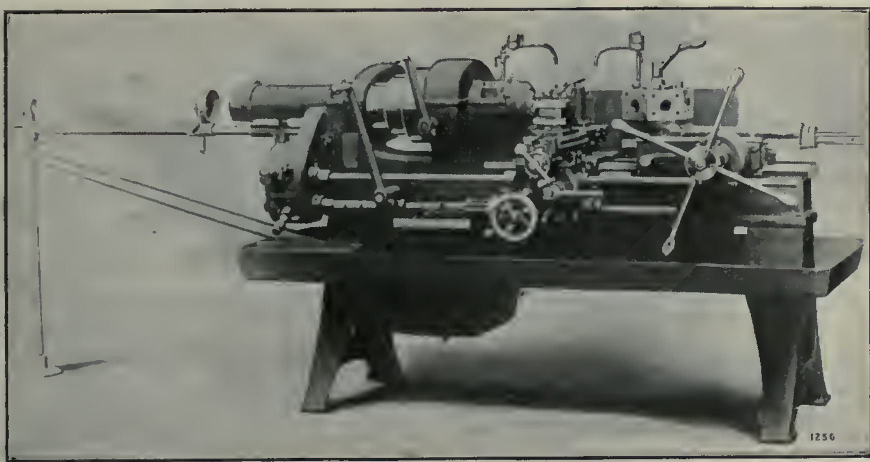
The complete cycle of operations on a piece is as follows:—The work mounted on an arbor is placed between centres, the countershaft started, and the feed-latch lifted into position. Both feeds are thus started, the work progressing until all diameters are turned and all shoulders and ends faced down, after which the feed is automatically tripped and all tools return to their starting position. This completes the cycle of operations, and the machine is then ready to receive another piece which has already been pressed on another arbor. Thus it will be seen that it is quite possible and practical to permit one operator to have charge of two or more machines. It will be noted from the cut that the entire machine is compactly designed, the idea being to eliminate any spring due to long arbors or excessive over-hang of tail spindle. The floor space required is 5 ft. x 3 ft. 4 ins.

These lathes were designed specially for the Ford Motor Co. by the Reed-Prentice Co., Worcester, Mass., and have, we understand, greatly exceeded the expectations of the former company's mechanical experts in operation performance.

The Boving Co. of Canada, Ltd., Toronto, has been awarded a contract for two hydraulic presses for the Northumberland Pulp Co., Cambellford, Ont.

UNIVERSAL TURRET SCREW MACHINE.

THE Warner & Swasey Co., of Cleveland, Ohio, have put on the market what is known as their No. 4 Universal Turret Screw Machine. New features incorporated in this product consist of the power longitudinal feed for carriage, the arrangement of the carriage for chasing threads, and the fact that the carriage and turret are driven by separate shafts. These features add greatly to the efficiency of the machine and have been developed as the result of the company's wide experience in building turret screw machines.



UNIVERSAL TURRET SCREW MACHINE.

For a long time screw machines have been built with power cross feed on the carriage, but this is the first machine to be fitted with power longitudinal feed. In order to add to the possibility of working with the carriage, it is driven by a separate feed shaft. Another important feature is the fact that the feeds of this carriage can be reversed entirely independently of the feeds of the turret; thus, the turret can be fed toward the chuck while the carriage feeds away from the chuck if necessary. In this way, two diameters can be turned at once, or the outside of a piece may be turned with the carriage while the hole is being bored from the turret. The longitudinal feed to the carriage has six independent adjustable stops for gauging the length turned. These stops trip the power feed and act also as dead stops.

Referring now to the chasing attachment; by placing the chasing lever in its horizontal position, the chasing follower is brought into engagement with the chasing leader, and when the thread has been chased, the chasing lever is lifted, thus bringing the returning follower into engagement with the returning leader, and throwing the chasing follower out of engagement with its leader. As the returning leader and follower are threaded in a direction opposite to that of the chasing leader and follower, the carriage is thus returned to its starting point. It is not necessary to reverse the countershaft nor spindle for returning the chasing tool to its starting point. Each leader and follower cuts threads in multiples of 1 and 4 of its own pitch.

The turret slide has a length of feed of 10 inches, which is an extremely long travel for this size machine. It has also a very long bearing in its saddle. The saddle is provided with supplementary taper base, and this slide is fitted with taper gibs on each side, these being fitted for re-alignment of the turret after it has worn slightly, although in the ordinary course of events it will not be necessary to adjust any of these parts for quite a long time. The power feed to turret is through a taper friction instead of the ordinary form and worm gear.

Referring to the taper attachment, the cylindrical arm of this fits into a corresponding boss on the back of the bed, while at the other end of the arm is the T block. The base of the attachment bolts into the T slots at the rear of the cutoff slide, and to this base is fitted the tool-block itself, this being in turn operated by the taper bar at the back, this taper bar being adjustable for tapers up to 3 inches to the foot. In doing taper work it is not necessary to disconnect the cross feed screw, inasmuch as the taper is not obtained from the cutoff slide itself, but from the tool block of the attachment. This tool-block is arranged for either inside or outside tapers. The taper attachment does not interfere with the operation of the turret or square turret, and both cylindrical and taper work can be done on the same piece with the carriage without removing the taper attachment.

The machine can be fitted with geared head, may be driven by single pulley, or with the 3-step cone head—the latter being the standard. The automatic chuck and wire feed handle bar stock up to $1\frac{1}{2}$ inches capacity. The machine swings 16 inches over the bed and $8\frac{1}{2}$ inches over the carriage cross-slide; the total longitudinal travel of the carriage is 17 inches and the cross travel, 8 inches; and the longitudinal travel of the turret is 10 inches.

NEW TYPE HOIST.

A NEW type of hoist has recently been placed upon the market by the Ingersoll-Rand Co., New York City. It is intended for light lifting work, having a capacity up to half a ton, and, due to its light weight, which is under 300 pounds complete, it is particularly serviceable as a portable hoist for mines, for contract work, for manufacturing plants, for power houses, and in railroad shops and shipyards.

Manufacturing and power plants will find the device handy for moving light machinery and for hoisting ashes, waste material, and for loading trucks, freight cars, etc. It is a particularly desirable appliance for the foundry, where heavy weights have to be moved. In shipyards, in railroad shops and in connection with construction trains the hoist, which is known as the **Little Tugger**, can be put to innumerable uses.

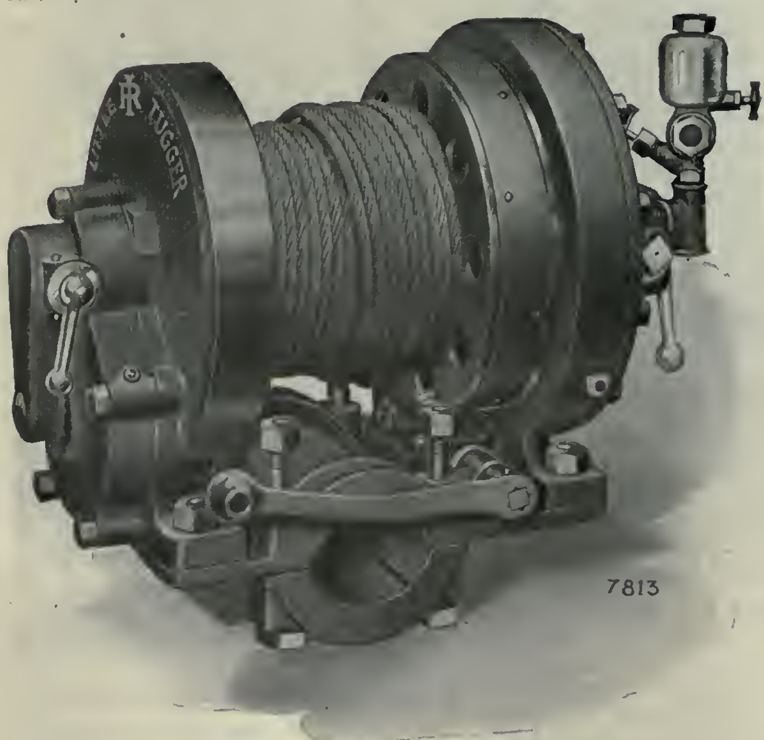
The main base is arranged so that it can be bolted to a timber, and by means of a cap which accompanies the hoist, it can be clamped quickly to a circular member, such as a mine column or arm, shaft bar or pipe. The dimensions of the hoist are $21\frac{1}{4}$ inches by $16\frac{1}{2}$ inches, and the height is $20\frac{1}{8}$ inches. The drum is 6 inches in diameter, with a space of 7 inches between flanges. This accom-

LITTLE TUGGER HOIST AT SHAFTHEAD

modates a length of 700 feet of $\frac{1}{4}$-inch rope, or 450 feet of 5/16-inch rope. The capacity is 1,000 pounds at a rope speed of 85 feet per minute, and a pressure of 80 pounds. It operates with either compressed air or steam.

The motor or engine is of the reversible square piston type, giving four impulses per revolution of the engine. There are no dead centres, so that starting is possible in any position. The drum is mounted independent of the engine shaft, and is operated through the medium of a clutch and gears. Safety is secured by a powerful worm-operated hand brake lined with **Raybestos.**

Referring to the illustration, the engine is on the right and the gear case on the left-hand side, and between the two are the brake and drum. The lever on the left controls the gears and clutch, while that on the right controls the direction of operation. The bottom lever operates the brake. The speed of hoisting is entirely at the will of the operator, and when he releases the throttle, it returns automatically to central position, shutting off the power and stopping the hoist. Oftentimes the hoist will be used for haulage purposes, and the release feature enables one man to handle this class of work. He can leave the control lever and carry the rope to the car.

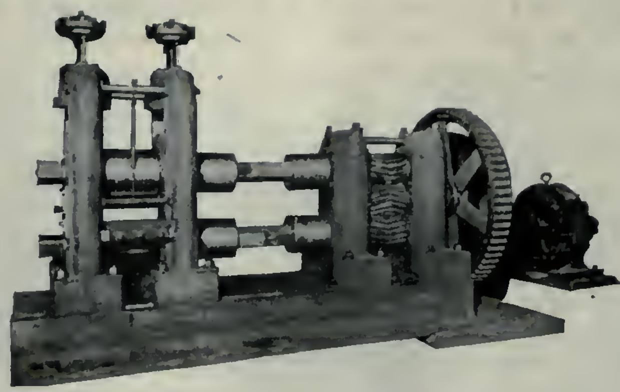


THE LITTLE "TUGGER" HOIST

There are no moving parts exposed except the drum, all gears and shafts being covered, an especially desirable feature for underground operation where the light is none too good, and where there is constant danger of workmen's clothes or bodies getting caught in the machinery.

MOTOR-DRIVEN ROLLING MILLS.

THE illustrations show two interesting types of rolling mill manufactured by the Standard Machinery Co., Providence, R.I. The direct motor drive shown has many advantages over belted drive from line shaft. In certain classes of work it is desirable to operate below full speed, therefore controllers are supplied with the motors shown, allowing continuous operation at any point between half speed and full speed of the rolls. Motor drive allows the placing of the mill to secure the most advantageous handling of material, regardless of the location of line shaft.



ROLLING MILL FOR COLD ROLLED STEEL.

The large mill, which is driven by a 90 h.p., 850 r.p.m. Westinghouse Electric Co. alternating current motor, is used for the cold rolling of steel. The housing rolls are 11 inches in diameter, and 12 inches face, and the intermediate roll is 5 inches in diameter. The gearing is triple trained and is very substantial. The use of roller bearings effects a large saving in power. The mill is designed for economical operation and long wear in heavy service.

The small mill, driven by a $3\frac{1}{2}$ h.p., 1150 r.p.m. Westinghouse Electric Co. direct current motor, is for manufacturing jewelers' use. The hand wheels for setting down the rolls are equipped with micrometer adjustment for accurate work. The rigid construction and carefully cut gears insure the work coming out smooth and free from waves. With the motor located as shown, the entire outfit requires no more space than the rolling mill itself.

ROLLING MILL FOR MANUFACTURING JEWELLER

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Vol. XII. SEPTEMBER 17, 1914 No. 12

PRINCIPAL CONTENTS.

"IF I HAD MY WAY."

THE title of this editorial is intensely human, because of its universality, and because of the expressed sentiment being more or less personal to all of us. We have each wished to have things planned, ordered and carried out in accordance with our views and opinions, on occasion, forgetting meanwhile, if not altogether regardless of the effects on others, that our way in its individual essence would lead only to a dead end. In the spheres of politics, sociology, business and finance, the spirit of our title is everywhere rampant, and its practice is in part effected wherever possible, and would further if dare be. In a word, autocracy is a leading constituent of our mental fabric. Wilful Willie willed to have his way, but as many less prominent people have found, it has been determined otherwise, hence the all-European War.

We reckon, and judging from appearances that in the present instance are in no way deceptive, there has been a particularly strong inclination on the part of Canadian manufacturers to exercise what seemed to them a prerogative, to wit, to take no chances while the war lasts, or for the period, however indefinite, that surpluses were unlikely to materialize. In the case of employees too, there has been at this time a pronounced tendency in many cases towards resisting the installation of shorter hours of labor or of a remodelled remuneration system whereby not only more hands would find work, but there would be retained to and maintained for any particular enterprise or organization its personnel in expert efficiency.

In desiring our own way, we are consciously or unconsciously looking out for our little individual selves, and among the many lessons that are being and will yet be taught us by the relative effects of this European War in which we are involved is that, whether we be employer or employee, self-seeking or self-assertion at the expense of another or others—having our way, must be banished in every form and particular.

DISCOURAGEMENT OF INITIATIVE.

IT is an even chance that, be this European War long or short, the field for the development of Canadian, or for that matter the enterprise of the different countries now more or less on the qui-vive for its extension will after all be much the same as it has been, and that the actual lengthening of the cords of industry and commerce will be little, if anything, in excess of what would have been realized in normal times. The tightness of money will of course contribute largely to such an outcome, and being sufficient excuse in many cases for the other—lack of initiative—the net result cannot be much else than as you were.

Our whole social and industrial fabrics are simply bottled up in what we are pleased to call system, and we are patiently waiting until somebody comes along and uncorks us in the midst of to-hand opportunities. The rut of system has so far engulfed us that it seems well nigh impossible to get out of it to do pioneer work, which is both the call and the opportunity to-day.

No far-fetched reasoning is involved in diagnosing an employer's attitude towards the display of initiative from that of his employees, for initiative profitable alike to man and master can to some degree at least be practised by the former even in spite of the most iron-bound system and without upsetting same; yet if either because of pure "cussedness" or absolute lack of inborn or drummed-in intelligence, or both, men of this stamp are allowed to pursue their way unchallenged, then so far as initiative is concerned, we are justified in classing the employer with the employee.

Instead of fostering initiative in men, the tendency is to discourage and stifle it in business matters. We seem to overlook the fact that aside from the prescribed hours of labor, mental or bodily, during which we must keep to the track, there are hours as important not only to ourselves and our relations, but to those from whom we receive employment, in which initiative is especially demanded, and who shall say that its real effective exercise will be the outcome, if the major portion of a man's waking hours be put under a non-initiative ban.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	Toronto.
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 50	17 85
Victoria, No. 2X.......	18 25	17 60
Victoria, No. 2 Plain ..	18 00	17 35

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b, Montreal.	2.00
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh ...	1.20
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes..	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright ......85, 10, 7½, 10, 5 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off	

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$21 00
Open hearth billets, Pittsburgh..	21 00
Forging billets, Pittsburgh.....	26 00
Wire rods, Pittsburgh	26 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 50
Copper, crucible	10 00	10 00
Copper, unch bled, heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	10 75	11 00
No. 1 compos'n turnings	8 50	8 50
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings ...	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload ...	$14 75	$13 50
Electrolytic copper	14 50	14 00
Castings copper	14 00	13 50
Spelter	6 00	6 00
Tin	40 00	40 00
Lead	4 85	5 00
Antimony	20 00	16 00
Aluminum	20 00	25 00

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt, casks, per cwt.	6.40
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.67
Linseed oil, raw	0.70
Linseed Oil, boiled	0.73
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.16
Lard Oil, per gal.	0.60

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3 45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2 50	$2 60
Canada plates, ordinary, 52 sheets	3 70	3 85
Canada plates, all bright	3 90	3 95
Apollo brand, 10 3/4 oz. (American)	3 90	3 90
Queen's Head, 28 B.W.G.	4 30	4 35
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1 1/2-in	$37.50	$30.00	$17.50
33/64 to 3/4-in.	41.25	33.00	19.25
7/16 to 1/2-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	$1.10 lb.
Leather in sides	95c

BELTING RUBBER.

Standard	60%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4.95
1 inch	8.05
1 1/4 inch	12.65
1 3/8 inch	15.30
1 1/2 inch	16.50
1 5/8 inch	19.40
1 3/4 inch	22.50
1 7/8 inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

RETURNING CONFIDENCE IS NOTED.

QUITE obvious signs of growing confidence have been noticeable during the week. Banks are inclined to freely lend money for strictly commercial transactions, but are, of course, endeavoring to avoid every kind of speculative business, even if that business is to be found in manufacturing and jobbing. Factories who find it possible to dispose of their output will not suffer from lack of banking accommodation. Enquiries warrant the opinion that the banks are now doing their utmost in this direction.

Montreal, Que., September 14, 1914.—Business still continues to go on much as it has done during the last six weeks. Small hand-to-mouth orders seem to be still most prevalent. No large orders are coming in, and with the banks handling their end of the business admirably, the small volume of trading is being done very smoothly. Deliveries of British goods are being received from time to time and although deliveries are not being guaranteed, shipments seem to be arriving with more or less regularity. Recent reports from England state that but 2.6 per cent. of the male population are unemployed, and if such a condition be existent, it is certainly up to us here to emulate it.

Steel Market.

No change has taken place during the past week. Quotations vary from different mills, but taking conditions all around, the prices are very firm. A large falling off in contract work is to be noted, most orders being of the small variety. A brisk business is however being done.

Pig Iron.

Although the European pig iron supply has been cut entirely, no great inconvenience is meantime felt as a number of Canadian foundries are operating at a reduced output. Prices remain firm, however.

Machine Tools and Supplies.

The outlook for machine tools and supplies is not over bright. Sales of late having been somewhat scattered. The demand for supplies still keeps up.

Metals.

The idea that Britain would require more or less of her supply of metals from America, and also the uncertainty in regard to the delivery, caused most metals to go up in price considerably. As conditions are being better understood prices are again dropping to normal.

Toronto, Ont., Sept. 15, 1914.—There is no appreciable change in business conditions this week, but a more optimistic spirit is noticeable. The community is rapidly adapting itself to the war conditions, and getting over the uneasiness which prevailed. The decided improvement in the news from the front is also having a beneficial effect, and is helping to dispel some of the gloom which previously overshadowed everybody to a greater or less degree. Prospects generally are more reassuring, and a continuation of successful military operations will do much to improve the financial situation and relieve the nervousness in business circles. With a greater feeling of confidence, combined with courage, trade should show considerable improvement when money is easier to obtain. Some industries are doing well as a direct result of the war, while others are not so fortunate; the former, however, help to improve the industrial situation as a whole.

The future for trade looks promising. There are greater possibilities for opening up new markets and introducing new industries in Canada, an opportunity of which full advantage should be taken. The splendid way in which Canada has come forward with men and material in aid of the Mother Country during the crisis has created an impression in the Old Country that will not readily be forgotten. The enhanced popularity of Canada in Great Britain on this account and the gratitude shown by the people will be a great factor in stimulating trade, especially when the war is over. British capital will flow into this country for the development of natural resources and industries to a greater degree than was ever before experienced.

Steel Market.

There is little or no change in the iron and steel markets this week, conditions generally being the same, for although the outlook is brighter, this is largely of a sentimental nature. The difficulty of financing new building projects is being felt, and few orders are being placed for structural material. The same remark might apply to almost all lines, for conditions are practically the same. Although it has been reported that the C. N. R. has been successful in obtaining a loan in London, no statement has yet appeared with regard to the expenditure of the money.

All our steel mills have either curtailed operations or closed down entirely. Although they are endeavoring to get in touch with new business, it will be some time before the possibilities for expansion of trade in this direction take definite shape. There will no doubt be an increased demand from foreign markets for steel products formerly supplied from Europe, but how far Canada will benefit, providing the mills can supply the market, remains to be seen. We understand that Canadian manufacturers of wire nails have received a large number of inquiries from England for these goods.

New home business in the United States has fallen off, and the export trade has not developed as fast as was expected, although it is anticipated that this will eventually increase as the result of the war. A tendency towards a quiet market is looked for during the remainder of the year. Prices are firm, and no changes have to be recorded. The ferro-manganese situation is easier. A considerable quantity has been shipped from England, and the United States Steel Corporation is reported to be selling this material at $85 a ton.

Pig Iron.

Little business is being done in pig iron, and the few sales being made are for small tonnages. During the month of August over 46,000 tons of iron ore was received at the Victoria Furnace, Port Colborne, Ont., for stock.

Machine Tools.

Business in machine tools is slow, although dealers report quite a few sales. Little improvement can be expected, however, until conditions improve and money is easier.

Machinery Supplies.

There is not much business being done in machinery supplies, and prices as a rule have not changed; the exception being belt lacing, which has been advanced 10 per cent.

Metals.

The metal markets generally are quiet, and only a moderate amount of business is passing. The copper market is dull, and prices have declined. Tin is weaker again, and is now being quoted at 40c. Shipments of this metal are being made from London. Antimony is dull, and has dropped to 16c. Other quotations are unchanged.

CANADIAN IMPORTS OF IRON AND STEEL GOODS, HARDWARE, ETC.

PERHAPS one of the most widespread effects of the present war on the Canadian import trade will result from the cutting off of the supplies of iron and steel goods, hardware, etc., that have been coming from Germany. For the year ended March 31, 1914, iron and steel goods amounted to $2,824,900, or nearly one-fifth of the total import of German goods into Canada. A great assortment of goods goes to make up this amount, among them being included tubing to the value of $539,130, and steel tires for locomotives, etc., to the value of $348,059. Of special significance are Canada's purchases of cutlery from Germany, which amounted for the year concerned to $379,890. This is second only to the imports of cutlery from the United Kingdom, and exceeds those from the United States by over $150,000. German machinery was last year bought by Canadians to the extent of $252,689, while other iron and steel goods imported included wire of a value of $140,523; angles, beams, etc., worth $185,138; billets to the extent of $68,728; tools and implements worth $66,724, and iron and steel ware proper to the value of $93,037. This great assortment of goods being no longer obtainable from Germany, it rests with the Canadian iron and steel manufacturers to see that a large proportion of them are supplied at home.

A great quantity of small hardware has been exported from Germany to Canada every year. The Canadian tables do not enumerate the specific articles of hardware imported except in the case of iron and steel goods. The following figures, however, of the principal metals and manufactures thereof, other than iron and steel, imported from Germany last year, will give some idea of the extent of the import trade in German hardware. The figures are comprised in large part of finished manufactured products:—

Metal.	Value.
Brass	$130,389
Zinc	108,736
Copper	52,206
Tin	29,763

FOSTERING BRITISH TRADE.

THE British Trade Commissioner's office at Montreal is making an effort to enable importers of German goods to duplicate their requirements in the United Kingdom market, and C. Hamilton Wickes, the British Trade Commissioner there, states that he will be pleased to receive samples of any goods which had been imported by Canada from German or Austrian markets, so as to secure quotations for articles of a similar nature from the United Kingdom for importers requiring same.

In this connection, it may also be well to mention that there are many firms holding German and Austrian agencies in Canada who will be obliged to sever their connections, and if they desire to secure British representation to replace the foreign representation at present held, they should make application to His Majesty's Trade Commissioner, 3 Beaver Hall Square, Montreal, Que.

RE-OPENING OF PLANTS.

THE Standard Chemical, Iron & Lumber Co. have made the following announcement:—

The company has altogether fifteen plants, twelve of which are located in Canada, one in Germany, one in England and one in France. As a result of the war a serious dislocation of the company's business was anticipated owing to the fact that they exported largely to England, and also large quantities of crude alcohol to France and Germany. All the Canadian plants were therefore shut down immediately except the Longford and Fasset, Que., plants.

"During the past few weeks we have succeeded in making important contracts in England for next year's delivery, and have also been able to liquidate our stocks there owing to the complete shutting off of the continental supply of wood chemicals. We are therefore proceeding to open up our factories, having now started our Cookshire factory, and anticipate opening our largest plant at Sault Ste. Marie about October first. The other factories will be opened up gradually and early next year we anticipate running to full capacity. The moratorium in England is not being taken advantage of to any extent as far as we are concerned."

THE PATENT SITUATION.

PATENTS and trade-marks granted to a subject of any state with which Great Britain is at war are not declared to be void, but may be voided or suspended in whole or in part on application to the Board of Trade. The applicant must put up a fee of ten dollars with the application, and a fee of 60 cents for depositing foreign documents or other papers for purposes of record. The Board of Trade may then suspend or void the patent in whole or in part if it appear that the person applying intends to manufacture the invention, and if it appear to be in the general interest of the country or a section of the community or of a trade that such article should be manufactured or any process carried on. The Board of Trade may at any time in their discretion order the voidance or suspension in whole or in part of any patent as they may see fit without special application being made to them. It of course remains to be seen to what extent these provisions are taken advantage of. Contributed by Ridout & Maybee, Patent Agents, Toronto.

CANADIAN TRADE.

STATISTICS of Canadian trade for the first four months of the current fiscal year show a considerable falling off in imports and a slight gain in exports. The total trade for the four months ending with July was $306,908,377, a decrease of $51,196,503, as compared with the same period of last year. Imports totalled $172,041,715, a decrease of $55,627,860. Exports totalled $134,866,664, an increase of $4,431,257.

The chief increases in exports were in manufactures and animal produce. During the four months we exported goods of Canadian manufacture to the value of $21,697,493 and animal produce to the value of $17,283,097; increases respectively as compared with the corresponding period of last year of $2,627,598 and $4,199,863. Exports of agricultural produce for the four months totalled $42,615,242, a decrease of a little over nine millions.

For the twelve months ending July, the total trade of the Dominion was $1,061,365,504, a decrease of nearly $37,000,000. Imports, which totalled $577,936,319, fell off by $114,000,000. Customs revenue for the twelve months totalled $97,094,410, a drop of more than twenty millions.

British Trade Press and The Outlook.—A fully attended meeting of the representatives of the Trade Press of Great Britain was held in London on August 17, at which the following resolutions were unanimously adopted:—That this meeting of editors of trade journals representing most of the industries of the country, after studying the present commercial problems, has come to the following conclusions:—That our commercial prospects were never brighter, and that given patience, confidence, and reasonable sacrifice, there is certain to be a splendid return in the early future. That we strongly urge the public to pay prompt cash for their present requirements; the manufacturer to keep up his production; and the banks to afford all possible support to both wholesaler and retailer. That we request the Controller of Patents to exercise any power he may possess for revoking any British patents owned by hostile countries should they operate against British industry.

Trade Gossip

Wandless Bros., Fredericton, N.B., will install the heating apparatus in the post office building.

The Nobis Engineering Co., Toronto, has been awarded a contract for the heating system of the new Connaught Street school.

The Canada Iron Corporation has been awarded a contract for a quantity of cast iron pipe by the City of Hamilton, Ont.

German Patents.—The Department of Trade and Commerce, Ottawa, announces that German patents issued by Canada may be revoked at an early date.

The A. R. Williams Machinery Co., Toronto, have received an order to supply 3 gap-bed lathes for Valeartier from the Department of Militia.

Hamilton, Ont.—It is announced that the Intercolonial Railway is in the market for new passenger rolling stock, and that the order will probably go to the National Steel Car Co. Basil Magor is president of the company.

The Bromell Patents Co., Glasgow, Scotland, engineers and export merchants announce that they are carrying on business as usual and are prepared to make prompt shipments of all their manufactures. The war conditions have not made any difference to their export trade.

The A. R. Williams Machinery Co. have an interesting display in their window on Front street, in the form of a model battleship, H.M.S. Toronto. The sides of the ship are represented by cotton belting, the decks by circular saws, guns by drills and drill sockets, gun turrets by lathe chucks, masts by drills and holders, funnels by piping, ventilators by W. I. elbows, while dies and knives form the bridge and upper deck.

The Munning-Loeb Co., of Matawan, N.J., manufacturers of electro-platers' and polishers' supplies, announce that they have secured the services of C. G. Backus, who is one of the most highly experienced best equipped and widely known men in plating and polishing lines. Mr. Backus will have charge of their New York office, Room 1373-50 Church street, and will represent them in New York, New Jersey, Pennsylvania and Maryland. His knowledge of details of all plating and polishing processes is entirely at the service of their present or prospective clients whenever same may be required.

War Grist.—J. J. Turner & Sons have received an order for the Canadian contingent of 5,000 kit bags, 50 hospital tents, 100 wagon covers and 1,000 valises. Perhaps no other form of industry is benefited so much by the war as tent makers. The manufacturers of soldiers' uniforms are equally busy. There is also a big demand on shoe manufacturers, and many large makers of harness are very busy making bridles, halters and saddle equipment for the Canadian contingent. It is quite apparent that war conditions are benefiting the above and enabling their staffs to be regularly employed. As the war continues other manufacturers will gradually notice an increased demand for their goods, in lieu of the European commodities which have formerly occupied such a favored position on our market.

Cotton Mills Busy.—The stimulating effect of present conditions upon the Canadian cotton industry has resulted in the resumption of full working time in the ten mills of the Dominion Textile Co. During the eight months prior to the commencement of the war in Europe, the 7,000 employees of this company were working on an average only 70 per cent. of full time. Since the outbreak of hostilities they have been working full time, and if the present demand for Canadian cotton continues, as is likely to be the case, ovetime and double shifts in certain departments will be necessary. The operation at full capacity of the ten mills of the Dominion Textile Co., Limited, will mean the placing in circulation annually of upwards of $10,000,000. Most of this large amount of money will be spent in Canada—in wages, in freight and cartage, in coal, oil and other factory supplies, and in the many other items that enter into the cost of the finished product. As the ten mills of the company are scattered from Kingston to Halifax the benefits accruing from the circulation of this large amount of money will be spread over a wide area.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Sault Ste. Marie, Ont.—The British Construction Co. will build the dry dock here, and are in the market for machinery and machine shop equipment.

Sidney, C.B.—The Town Council is considering the purchase of a four-million-gallon capacity turbine pump, with motor, etc. N. Hay, engineer.

Toronto, Ont.—The Wolseley Motor Co. propose to make a large addition to their garage on Avenue Road. Page & Co. are the general contractors.

St. John, N.B.—The Board of Trade has received an inquiry from New Britain (Conn.) with respect to the opportunities here for the establishment of a machine shop.

St. John, N.B.—The Oil Motor and Mfg. Co., of this city, will sell the plant. Tenders to be in by September 19. Particulars obtainable from L. P. Tilley, Princess Street, St. John.

Brockville, Ont—Warwick & Walters, of Montreal, have decided not to establish a plant here, as was originally intended, on account of friction in the Town Council over the proposition.

New Denver, B.C.—The power plant of the New Denver Light & Power Co., is completed and the lights are on again. It is a little over a month since the old plant was totally destroyed by fire.

Medicine Hat, Alta.—The Saskatchewan Bridge & Iron Co., have resumed work on the construction of their plant. It is estimated that the buildings alone will represent an expenditure of $100,000, and expectation is that production will begin in about two months.

Sarnia, Ont.—The Sarnia Metal Products Co. is the latest addition to the industrial enterprises of the Imperial City, and the firm, consisting mostly of Sarnia men, is already having a $20,000 plant constructed on North Front street, near the street railway barns They will manufacture all kinds of corrugated iron, eavestroughs, material for galvanized garages, and other products from light sheet iron.

Fort William, Ont.—The erection of the Fort William plant of the Steel Company of Canada,, on which construction was started last year and not completed owing to the dull season of manufacturing, has been resumed and a large gang of men are hard at work on the completion of the building. J. O. Callahan, general manager of the Steel Company, and B. H. Pratt, of the contracting firm, are at present in the city superintending the work of construction, and have stated the plant will be ready for operation between November 15 and December 1 of the present year.

Electrical

Galt, Ont.—The Canadian Cereal Mill is now run by Hydro-Electrical power. An equipment for 250 h.p. capacity has been installed.

Montreal, Que.—J. C. Wilson, Ltd., are making alterations to their factory. The contract for the electrical work has been awarded to the Beaver Electric Co., of Montreal, at $30,000.

Winnipeg, Man.—The City Light and Power Department are now supplying the Dominion Government Buildings with electric light. The Winnipeg Electric Railway Co. formerly had the contract.

Kingston, Ont. — Kingston Utilities Commission is considering an offer from J. M. Campbell to supply 500 horse-power of electrical energy from Kingston Mills, at 1¾ cents kilowatt hour.

Hamilton, Ont.—A fire which occurred on Sept. 8, at the plant of the Canadian Tungsten Lamp Co., on Cannon St. east, caused the firemen considerable trouble. The damage is estimated at $1,000, which is covered by insurance.

Windsor, Ont—The Hydro-Electric system was inaugurated by Sir Adam Beck, last Saturday evening, at a ceremony in the local armories. In his address Sir Adam told his hearers that the completion of the transmission line to Windsor marked a new era in long-distance transmission of electricity. The line from Niagara to Windsor is 250 miles in length, one of the longest lines of its kind in the world. The estimated cost of construction of the line was placed at one million dollars, but he said the cost had been much lower.

AUSTRALIAN STREET CARS.

The Department of Trade and Commerce, Ottawa, has available, for the inspection of Canadian manufacturers, specifications and blue prints of the popular types of cars used on the recently established electric tramway systems in Melbourne. Information as to comparative costs is also obtainable upon application to the Commission of Commerce. Should additional particulars be desired, manufacturers are assured of their inquiries receiving the prompt consideration of the above Department.

Municipal

Brantford, Ont.—The council contemplate purchasing a motor-driven combination hose wagon.

Saskatoon, Sask.—The City Council may purchase fire-fighting equipment. T. E. Heath, fire chief.

Toronto, Ont — The Provincial Board of Health has approved of plans for waterworks extensions at Galt, Grimsby and Hamilton.

Ottawa, Ont.—The City Council have adopted the engineer's recommendations for purchasing new equipment for the main pumping station.

Owen Sound, Ont.—The council are considering a proposal to build permanent roads to provide work for unemployed.

Calgary, Alta—A by-law to provide eighty thousand dollars for extension of water works was passed by the ratepayers of Calgary.

Peterborough, Ont.—The city will take over the property of the Peterborough Light and Power Co. A cheque for $100,000 has been paid, in accordance with the expropriation agreement.

Montreal, Que.—Repairs have been completed on the lateral conduit, and the pumps have again been connected, so that the city is again using its regular water supply from the St. Lawrence.

Dartmouth, N.S.—A by-law will be voted on by the ratepayers on October 3, to authorize the issue of debentures to the amount of $90,000 for the erection of school buildings and equipment for same.

Oxy-Acetylene Welding Processes and Their Development*

Staff Article

In the present article attention is drawn to the fact that while for many classes of work autogenous welding has been successful from a general manufacturing and commercial viewpoint, there is every evidence that much still remains to be accomplished before equal success is achieved in the more involved field of mechanical engineering and machine construction.

WITH the application of oxy-acetylene welding to manufacturing, a great many interesting processes have been evolved. The joining together of two stamped plates by its means, making thereby a hollow body has effected a revolution in construction methods. Many articles previously produced at a prohibitive cost can now be competitively manufactured and marketed.

Among the latter are sheaths for swords and knives, walking sticks, umbrellas, radiators for heating plants, hollow steel drums, steel kalamein work, window sashes and all kinds of light sheet work. The same process is applied to pieces which require much greater strength such as bicycle frames, pipes, tubes, automobile frames and accessories and aeroplanes. In the manufacture of multi-cylinder internal combustion engines, the intake and exhaust manifolds are easily made up in this way.

Cutting and Welding Feature.

The combination of the cutting blow-pipe and the welding blow-pipe enables one to obtain cheaply articles formerly very difficult and costly to manufacture at the forge. Thus we can obtain by cutting and welding successively, plates, angle irons, and irons of various profiles, besides details of all manner of forms entering into metal construction. Further than this a very broad field for oxy-acetylene welding is that of repairing. It can be advantageously applied to an almost endless chain of repair work in iron and mild steel. It is often the only process which will allow of the recovery of broken, deformed, or worn-out details. In steel castings, blow holes can be successfully filled with homogeneous metal; cracks in castings can be repaired successfully and made quite as strong as they were originally, while in the sphere of marine engineering a wonderfully interesting field has been opened. When the harder varieties of steel come under the action of the blow pipe, many difficulties are presented, which up to the present have not been successfully overcome. It will therefore be safer to leave the welding of hard steels alone meantime.

Application to Cast Iron.

Next there comes the broad field of cast iron. The process of oxy-acetylene welding was not applied to cast iron until some years after its application to mild steels and wrought iron. It was then openly declared to be impossible to repair pieces of cast iron by the process. The reason given being that the metal under the action of the blow-pipe became as hard as flint, and in the majority of cases broke upon heating or from contraction when cooling.

As a matter of fact, the welding of cast iron is the easiest of all, or rather, that which gives the best results. The generic name "cast" iron or "castings" of iron is applied to alloys of carbon and iron in which the proportion of carbon is between 2.5 and 6 per cent. Cast iron cannot be forged, and consequently articles in this metal are obtained by casting. In a large majority of cases, the cast iron used for castings contains from 3 to 4 per cent. of carbon. The carbon can be present in very different states, either combined with the iron or dissolved in the metal to which it communicates great hardness. It may also be present in a free state in the form of particles of graphite disseminated in the mass.

In the first case, carbon combined or dissolved makes the metal very hard and difficult to work. This variety of iron is an alloy known as white cast iron. In the second case with most of the carbon in the free state, the metal is soft and easy to work, and is known as grey cast iron. Since the majority of welds in cast iron should be capable of being worked it is indispensable that its constitution should be that of grey iron, of which the great majority of castings are really made.

Grey Iron Welds

The obtaining of welds of grey iron depends solely on the state of the carbon in the metal. It is thus necessary to study the causes which facilitate or prevent its precipitation in the form of graphite. The rapid cooling of the metal in fusion tends to bring about the combination of the carbon with the iron; that is to say, the formation of white iron. On the other hand, slow cooling or reheating tends to bring about the precipitation of the carbon, thus producing a softer iron.

Silicon introduced into cast iron in the form of ferro-silicon takes the place of the carbon. This tends to alloy with the iron and compels it in some way to take the form of graphite, and thus facilitates the formation of grey iron. Manganese, on the other hand, opposes the precipitation of graphite and leads to white iron.

Conditions for Success.

These important effects being known, it is easy to state the general conditions to be observed for the formation of a line of welding in grey iron, that is to say, one easy to file and workable by tools:—

(1)—Slow cooling.

(2)—Introduction of silicon in the welding rod.

(3)—Absence of manganese.

As manganese is often present in cast iron in sufficient quantity to produce the formation of white iron during the welding process, it is much more necessary to observe the above conditions, than the local fusion, and consequent rapid cooling of the metal. The phenomena of oxidation, decarbonization and volatilization of which we will speak, are all conducive to the formation of white iron. According to the proportion of carbon which the cast iron contains, the melting point varies from 1050 degs. to 1200 degs., centigrade, a temperature at least 300 degs. centigrade lower than the melting point of chemically pure iron. The melting point of cast iron with which welders mostly deal with is about 1150 degs. centigrade.

The oxide of iron which is formed melts at about 1350 degs centigrade, and therefore cannot be melted and swept away by the flame as in the case of wrought iron or steel. It forms in consequence an agglomerate in the form of crusts surrounding each part exposed to the air. It is, therefore, necessary to destroy this oxide which prevents the combination of the molten metal and also burns the carbon, thus tending to form white iron. The excessive heat of the welding flame can bring about an alteration of the metal during welding; notably is decarbonization and the volatilization of the silicon.

Expansion and Contraction.

The quantity of heat required to melt cast iron is greater than that required to melt the same weight of aluminum or wrought iron. Cast iron is also a bad conductor of heat, as well as being devoid of elasticity and elongation before rupture. It is, therefore, always neces-

*Second of a series.

sary to foresee that in welding cast iron the phenomena of expansion and contraction can bring about breaks if the shapes of the pieces oppose free play of the metal in heating or cooling, and it is generally necessary to take very special precautions to avoid same.

The difficulties encountered depend almost exclusively on the phenomena just mentioned; the hardness of the metal melted by the action of the blow-pipe making it impossible to work on it with tools, as well as producing cracks and breaks either in the line of welding or elsewhere during the welding or cooling. These difficulties are eliminated to a greater or less extent by using a welding metal of good quality, free from manganese, and yet containing a high percentage of silicon. A further improvement is obtained by the use of a suitable cleaning flux. The effects of expansion and contraction may be overcome by preheating every part of the casting or by any other treatment producing the same results. The lack of elasticity renders cast iron particularly sensitive to the effects of expansion and contraction especially when the heat is localized.

Operators' Troubles.

Certain difficulties in working are sometimes most trying to welders: for example, the fluidity of the metal when melted does not allow of the realization of vertical welds, and it is, therefore, necessary to arrange the line of welding as nearly horizontal as possible which with certain shapes and sizes of pieces is most difficult.

The fluidity of molten cast iron makes it necessary in certain work to surround or hold up the edges to be welded in order to prevent metal from flowing away, and having to weld for a long time over a preheating oven renders the work difficult and tedious, but an operator soon gets used to holding the blowpipe with arms outstretched and in this position making perfect welds. Apart from cracks due to expansion and contraction and the hardness of the line of welding, the welds are susceptible to the following faults:—Lack of penetration, bad joining, interposition of oxide, blow holes, and sinking of the surfaces to be joined.

The edges of the weld should be bevelled if the thickness exceeds 1/8 inch, and welders who attempt to execute welds on 5-16 inch to 7-16 inch thicknesses without bevelling are sure to obtain bad results. In order to secure penetration, they push the molten metal with the rigid white jet, thus bringing about an alteration in the former, as also a partial adhesion. It is always well to introduce into the line of welding as much of the silicous iron as possible, and bevelling facilitates this introduction.

In many pieces of cast iron to be repaired by autogenous welding, in which the repair is a crack and not a break, bevelling can only be done by means of a hand grinder. This should be well done, notably the penetration should be regular and not excessive, so that there are no openings at the bottom of the line of welding. If an extension of the crack is feared by the expansion of the metal during preheating or the execution of the weld, a hole should be drilled a short distance from the end of the crack and in the direction the crack would naturally take, if it extended. The introduction of silicon into the weld through the medium of the welding rod renders still another service. It destroys the oxide of iron, prevents blowholes, and the decarbonization of the metal. Silicon cannot be replaced by any other element, and without it the autogenous welding of cast iron would be difficult to realize. A high percentage of silicon is necessary, because a quantity of it disappears in the course of welding, acting in the capacity of a deoxidiser. Practically it is incorporated in the welding rod specially made for the welding of cast iron, being anywhere from 3.5 to 5 per cent. Welds are then workable if the casting be not cooled too quickly, and if the welder keeps the small white jet of the blowpipe sufficiently well separated from the molten metal. If an excess of solicon be present in the welding rod, the welds produced are too soft. It is, therefore, important that its presence should be uniformly regulated in the welding rod. Manganese should, of course, be absent. Welding rods are manufactured in round sections about 20 inches long, and from 1/8 to 1/2 inch in diameter.

The Flux Feature.

A flux is necessary to destroy the oxide, and this flux must be less fusible than the metal. The oxide interposes itself in the metal and prevents the perfect joining of the molten bath of metal, while the flux acts as the melter of the oxide of iron and economizes the silicon. The cleaning flux is most appropriate in the form of a powder formed by mixing equal parts of carbonate and bicarbonate of soda, to which is added 10 per cent. to 15 per cent. of borax and 5 per cent. of precipitated silica. This product is supplied commercially at a price so low that welders have no necessity to prepare it for themselves. Other recipes for cleaning powders have been proposed which offer no special advantage, and sometimes have many faults. Certain welders are content to use borax, which as a cleaning flux is insufficient. The powder mentioned above equalizes decarbonization of the cast iron by a corresponding carbonization, a quality which borax does not possess. The silicon of the welding rod, in effect, liberates the carbon contained in the alkaline carbonates, and thus the metal can regain from the flux so constituted the carbon it loses by oxidation. The cleaning flux has also the advantage of protecting the molten metal from excessive oxidation, thanks to the slag which floats on the surface. The flux is used by plunging the extremity of the welding rod into the box or bottle, after the rod has been heated. It is best to avoid thinning the powder into the molten metal whilst executing the weld; the supply from the welding rod being always sufficient.

Preheating.

The execution of welds in cast iron presents no special difficulties when the parts have been properly prepared, preheated to redness when necessary, and using the proper welding rod and cleaning flux. In many cases welds are done with the casting partly or wholly in the preheating oven, the welder protecting himself from the heat by nsing plates of asbestos or simply plates completely round the parts to be welded. Currents of air must be avoided during welding, as these would bring about rapid cooling and cause breaks or cracks in the piece. For articles which do not require preheating it is advisable to take the chill of the metal, at least around the weld, by playing on it with the blowpipe previous to welding. If local heating be necessary at a different part to counteract the effects of expanding or contracting it is better to do this with a second blowpipe or group of Bunsen burners or benzol lamps.

The total heat of fusion of cast iron being high, it is necessary to use a blowpipe with a greater calorific power than for the same thickness of wrought iron welds. Sometimes when the melting point of the cast iron is notably lower and the conductivity less, a more powerful blowpipe is not used. For a thickness of 3-16 of an inch, for example, a blowpipe of 26.5 cubic feet would be necessary, if the casting were not heated to redness by an oven or flame. In the case of preheating, a blowpipe with a delivery of 17.5 cubic feet of acetylene would prove sufficient. The blowpipe is played on the edges to be welded until melting of the iron just takes place. The regular oscillatory movements are of less importance here on account of the behavior of the metal or melting. However, it is important that the two edges to be joined should melt at the same time.

As soon as the first fusion is obtained, the welding rod powdered with the cleaning flux is applied in the manner indicated in order to avoid oxidation. The melting of the welding rod should take place as much as possible in the molten bath in the bevel by the plunging in of the rod and then playing the blowpipe all around. This method should always be used for great thicknesses. In the case of thin pieces, the welding rod is melted by sweeping over the molten metal. The point, however, to remember, which applies to all welds, is never to let the metal of the rod fall drop by drop or to hold it too far away from the molten bath. We have already said that to avoid adhesion due to blowing the molten metal along the line of the weld which is not yet at a high enough temperature to receive it, the blowpipe should be held so that the flame strikes the metal almost perpendicularly. A very inclined position of the flame invariably produces trouble and bad results. The white jet of the blowpipe should never be in contact with the metal, and the point should be kept at a distance varying from 3-16 to ¾ of an inch, according to the thickness. This recommendation is very important, as cast iron under the very high temperature of the oxy-acetylene white jet can be degraded by the subsequent oxidation and decarbonization. If in repairing certain articles the molten metal has a tendency to flow away from the line of welding, it can be retained by the aid of plates arranged before welding. The use of clay or refractory earth, as a rule, is conducive to the formation of blowholes, and consequently this practice should be avoided. The plunging of the welding rod into the cleaning flux should not be forgotten as each supply of metal is added, but it is well to remember also that an excess of powder is detrimental. The welding rod containing the element silicon which is indispensable for obtaining a workable cast iron, should be supplied regularly along the line of welding.

Rapid Welding Advisable.

Avoid going over the welds after solidification without adding fresh silicon metal. The danger to be feared is the destruction of the silicon in the line of welding. This tends to produce white iron, or at least the formation of hard grains making it difficult to work. For the same reasons the welds should be rapidly executed without prolonged melting of the metal with the blowpipe.

As has been previously mentioned, the cooling of the cast iron welds should be as slow as possible. It has been found best for articles that have been preheated to replace them in the oven which has been used, and to cover them completely, so as to avoid local cooling. Many articles of cast iron properly welded break or crack in cooling, either in the line of welding or elsewhere, owing to the lack of precautions in view of local contraction. When a coke or charcoal fire has been used for preheating, the piece after being welded should be completely covered with cinders or charcoal, and refractory bricks or sheets of asbestos should be placed on the sides and underneath so as to avoid all draughts of cold air. The article should be left there until it is completely cold.

Sometimes it is necessary to allow twenty-four hours for cooling. For articles which do not require complete preliminary heating it is sufficient after welding to play the blowpipe in the part heated and remove it progressively; next cover with warm cinders, asbestos, or other bad conducting non-fusible material so as to ensure slow cooling. After complete cooling, the welds can be worked with the file, grindstone, chisel, etc., until all the unevenness is removed; thus an absolutely uniform surface can be obtained, on which it is impossible to recognize traces of the breaks or repairs. The oxy-acetylene flame when properly managed does not alter in any way the welded pieces of cast iron. On the contrary, the fusion and rapid solidification gives a fine and compact structure to the added metal, which explains why the metal in the welded part is often much less fragile than the rest of the casting.

Process Saves Wasters.

The process of welding by the oxy-acetylene flame can be employed not only for the repair of all castings broken or deteriorated by use through shocks, vibrations, etc., but also for the putting in order new pieces which have defects, such as blowpipes, pits, flaws, and fractures. This application is not too well known in many foundries as yet, but in the near future there is no doubt but that it will be largely used. It must be recalled that with a weld, if well done, the article treated can be considered equal to new, since the metal added is at least of as good quality as that of the metal in the casting, and when joined to it is perfectly homogeneous. Those foundrymen who hesitate from conscientious motives to apply autogenous welding to the repair of pieces leaving the foundry have only to reproach themselves in obtaining defective welds. Even badly applied, the process is a hundred times preferable from the moral point of view, to the use of cements for hiding blowholes, and sometimes flaws and cracks in articles leaving the foundry.

Foremen charged with the maintenance of works find in autogenous welding a valuable process for the rapid repair of cast iron parts broken in operation of the plant; not only from the economical point of view in not having to purchase a new piece, but also from the fact that the piece is rapidly returned to service.

Application to General Repairs.

Wherever cast iron is used, there lies a field of usefulness for the oxy-acetylene welding process. For example, the repair of flywheels, pulleys, gears, benches, frames of machines, cylinders, stamps, punching machines, autos, motors, steam engines, and vessels of all kinds. In the case of automobile cylinders surrounded by a water jacket, cracks frequently occur due to freezing, heating, shocks, and internal strains, and workshops and garages in the larger towns use mostly autogenous welding for their repair. It is necessary before commencing to weld to preheat the cylinder completely by placing it in a coke or charcoal basket or in an oven until it attains a red heat. The cracks, of course, have to be bevelled and prepared as already explained. After the welding has been completed, it is necessary to cool the casting very slowly. The majority of such cracks appear on the exterior surface of the water jacket or on the flanges or corners, and if the cylinder itself is damaged, the repair is more difficult, because the welding can never be done from the interior. The method is to remove a portion of the water jacket above the crack, and then proceed to weld in the usual manner, and immediately after weld the portion removed from the jacket into position again.

Automobile Repairs.

The success of repairs to automobile parts or similar articles depends above all on the proper preheating of the article and the slow cooling afterward. In the case of cast iron pulleys and flywheels, the execution is more or less easy, depending on the position of the break, the shape and dimension of the casting, and the thickness of metal to be welded. Certain flywheels are easy to repair because the expansion and contraction of the cast iron can take place without tending to produce breaks. Others, again, present difficulties which an inexperienced and thoughtless welder cannot overcome. When the dimensions of the article allow of complete preheating of the whole body and very slow cooling breaks or cracks are not greatly to be feared. On the other hand, however, when the size of the casting makes it impossible to raise to red heat the entire body previous to welding, it is necessary for the welder to exercise thought in overcoming the effects of the expansion and contraction during the execution of the weld, either by working in such a manner as not to have the heated part closed in by parts which are not sufficiently elastic, or by heating certain other parts of the article in order to compensate for expansion and contraction. Seeing the excessive variation in dimensions, shape and thickness of flywheels, pulleys and gear wheels, it is difficult to give concrete examples or methods of executing welds. The slightest displacement of the break in the rim in its relation to the arm or on the arms themselves often necessitate quite a different treatment in view of the phenomena of expansion and contraction. The welder must exercise his own judgment when undertaking the repair of any broken casting. In the majority of cases large articles cannot be wholly preheated, and in such cases it is necessary to judge in advance how expansion and contraction will act during the execution of the weld and on cooling. Sometimes the breaks are in such places that the repair if not impossible is very laborious, and in many such instances it will pay better to dispose of the casting as scrap metal.

The teeth of cast iron often get broken, thereby making the wheel useless. It is comparatively simple to repair these by autogenous welding. One generally proceeds to replace the broken tooth by adding metal to the base of the tooth and rejecting the piece broken off. A certain amount of skill is necessary in building up the weld without too much flowing on either side, and in keeping the joining of the metal perfect.

Autogenous welding is also employed for adding metal to worn parts of cast iron articles. The operation is the same as for building up teeth of wheels, care being taken that perfect joining of the metal is obtained. If the surface of the article thus prepared has to withstand friction, it requires to be constituted of hard cast iron. To obtain this, it suffices to use a non-silicous welding iron or one that is only slightly silicious. It is best not to reckon on machining such a line of welding after using non-silicous welding rods. The surface may be made even by a wide melting during the operation. Of course, it is understood if the surface of the casting has to be perfectly uniform the process is not applicable.

To sum up, the types of work in cast iron that can be autogenously welded are exceedingly varied, and to execute a number of them calls forth a great deal of thought and no little ingenuity on the part of the welder.

HIGH TEMPERATURES IN CAST IRON CYLINDERS.

IN the construction of internal-combustion engines, the thickness and quality of the material used for cylinders and pistons, and the effects produced by very high temperatures are matters which have to be very seriously considered. It is quite conceivable that a thick cylinder opposed to high temperature as well as to a high pressure inside of it will be actually more stressed than a thinner one. The same reasoning applies to the piston crown and the bottom of the cylinder covers. As was pointed out by J. T. Milton in his paper, the "Present Position of Diesel Engines for Marine Purposes," the metal in these parts is put into a state of compression by the high state of the temperature, the sides being subject to a similar stress due to the pressure. These considerations show the great importance of keeping the thickness of the metal at parts exposed to great heat as thin as possible consistent with their possessing sufficient strength.

It is known that cast iron appreciably changes its form and dimensions through continuous exposure to high temperatures, and so causes troubles similar to those which have occasionally been experienced in large steam engines. It is probably the fear of this action under severe heat conditions which led to the use of cast steel for cylinder covers. Most Diesel engine manufacturers have reverted to the use of cast iron for covers, and some of them give the metal a severe heat treatment before the completion of the machining operations. It is quite possible, however, that cast steel will be again used for these parts.

GRAPHITE LUBRICATION.

THE employment of graphite as a lubricating medium for machinery is a matter which has often been discussed among engineers. The mixing of graphite with oil, a system tried for engine lubrication and other purposes, has not always been attended with such satisfactory results as are to be desired, but there can be no doubt that, properly applied, graphite ranks among the most efficient of all lubricants. Countless experiments have been made to unite the substance with various metals in a molten state, but without success, and another system of application has consisted of graphite plugs inserted in bearing surfaces, but here the cost of drilling the holes for each separate plug and putting each individual one in its place has made the process too expensive for ordinary purposes.

In view of these circumstances it is with interest that we turn to examine a new method of utilizing graphite as a lubricant for white-metal bearings, particulars of which have been communicated to us by the vendors. This is known as the Randall graphite sheet lubricator and consists of a simple device in which solidified graphite cones of a slightly tapered formation are attached by hydraulic pressure to a fine copper-wire screen or fabric which may be cut to the shape and fitted with a minimum of trouble in any white-metal bearing in which it is intended to be used. A piece is cut from the sheet the full length of the bearing, wide enough to reach not quite to the top of the half bearing, and it is important when fitting to so cut the sheet that the plugs or cones have the straight rows running lengthwise, so that the cones are staggered in the path of the rotating journal, and each part of the shaft in the bearing as it revolves will then be in contact with some of the graphite cones.

After cutting, the Randall graphite sheet lubricator can be shaped with the fingers to a half circle a little smaller than the journal, around which, or around a mandril usually employed for the purpose, it is fixed by means of fine copper wire, wound spirally. The small or tapered ends of the cones should always be placed in contact with the journal, so that the wire cloth will be embedded near the bottom of the box. The mandril, with the graphite sheet lubricator attached as described, is placed in the box and the white metal poured in the usual way. The bearing box, mandril and sheet should all be warm so as not to chill the white metal too quickly. The metal will flow and set around the graphite cones, making them a part of the bearing. The result is practically a self-lubricating bearing which requires only a few drops of oil at long intervals.

To finish the bearings, the sides may either be scraped so that the journal will turn freely, or turned in a lathe, which ever is the general practice. In oiling, it is advisable to cut down from 75 to 90 per cent. of the quantity ordinarily used on regular white-metal bearings. Too much oil has a tendency to wash loose particles of graphite out of the bearing.

In considering the first cost of the Randall graphite sheet lubricator, it should be noted that in many cases it displaces sufficient white metal to pay for itself, and is claimed to increase the life of bearings three to four times. Results have shown that this lubricating device enables white-metal bearings to withstand heavy pressures and high speeds without heating. — Shipbuilding and Shipping Record.

C G.E. Service Corps.—A notable contribution to the service of the Empire has been made by the Canadian General Electric Co. By drawing on its technical staff, it has raised a corps of engineers, both electrical and mechanical, for service during the war, and has further undertaken the duty of maintaining the corps for that period.

Galt, Ont.—The Shurley Dietrich Co. are building an addition to their factory 100 x 205 feet.

Training and Educating Employees in a Motor Car Plant

By J. H. Weller *

The accompanying article is worthy the attention and careful study of every employer of labor, setting forth as it does not only the steps which have been taken to train and educate each new generation of employees, but the provision that has also been made, and to which perhaps the greatest importance should be attached, for the administration and training of competent departmental executives.

THE efforts of the Packard Motor Car Co., to train its men to become more efficient, thereby increasing their value to themselves and to the company, may be divided into three lines of activity; namely, the practice given apprentices in the operation of different machines; the instructions given the same apprentice in class-room; and the broad and comprehensive work being done among the factory foremen and their assistants.

The demand for tradesmen in an automobile factory is so diversified that the Packard management has found it expedient to establish a number of different apprentice courses. They now have in their employ boys who have apprenticed themselves to become machinists, tool makers, die sinkers, pattern makers, electricians, body makers, body trimmers, or body painters. These courses are of three years' duration, and the boys receive fourteen cents an hour at the beginning of their course with a semi-annual increase of two cents an hour. At the present time there are about sixty apprentices working in small classes in the different departments throughout the factory, and it is proposed to increase the number by carefully selecting boys who may be recommended.

Requirements to be Met.

Before the boy is allowed to enter upon his apprentice course he must meet certain requirements. He must be at least sixteen years old, and have the equivalent of an eighth grade education. He must pass a physical examination at the shop hospital to make certain that he is sound physically and mentally. After the apprentice has been accepted, he and his parents enter into an agreement with the company that the boy will work diligently to complete his apprentice course. As a guarantee of good faith the boy and his parents deposit $25, and to impress the boy with the seriousness of the contract he and the company's representative sign the indenture papers in the presence of witnesses and a notary public. One of the most important clauses of the contract is the one in which the company agrees to pay a bonus of $100 to those who satisfactorily complete their apprenticeship. Another clause which also urges the boys to perform their duties faithfully is the one which guarantees a two weeks paid vacation to those boys who in the eyes of their instructor have done commendable work.

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Apprentice Machinists in the Majority.

Fully one-half of the apprentices are learning the machinists' trade. These boys are divided into classes and placed in charge of competent instructors. The grouping of the apprentices is a matter that has been given most careful study, and so throughout the factory will be found experienced machinists devoting their entire attention to five or six machinists' apprentices.

It has been found desirable to limit to six, the number of boys placed under the instruction of one man, in this way insuring that the apprentices will not suffer from inattention because the foreman is too busy to give them much personal instruction, and that they are less likely to learn bad habits, mechanical and otherwise, from the thoughtless workmen in the shop. The divisions of the machinists' course are well defined, for every six months, these apprentices are sent to a different department under another instructor, or on a different machine in the same department.

The first six months are spent on drill presses, then the apprentice works on lathes for six months, then on milling machines for six months, then at bench and assembly work for six months, and finally he spends six months reviewing the training of two years and one-half. It is the purpose of the Packard Co. to furnish the instructors for the boys, taking other apprenticeships just as soon as the number in the different courses will justify the added expense.

Apprentices as Producers.

There seems to be a difference of opinion about the advisability of making apprentice boys produce work that is to be used in the finished article. It is the policy of the Packard Co. to require their apprentices to be producers from the first day they enter the shop. During the two months trial period, a boy is not trusted with work that demands very much skill. We believe the sense of responsibility which the boy feels when he realizes that he is helping to make a Packard car a credit to the company, puts him on his mettle, and he therefore tries to do the best work he can.

Training Foremen.

There is another group of apprentices in the Packard factory, but composed of older men, many of them being graduates of technical schools. Most of these are men who have shown superior ability, both mechanically and executively; in other words they have been chosen because they are able men. It is the purpose of the Packard management to give these men ample training to qualify them to be foremen, and it is hoped that later on some of the company's executives may be chosen from among the special apprentices.

Since these men are older than the regular apprentices their training is entirely different, and they are thrown more on their resources. At the same time care is taken to make sure that the foremen of the departments in which they are working do not neglect to get in close personal contact with them. To accomplish this end only a few of the special apprentices are allowed in one department. The men in this course are more mature, and in consequence their work is more accurately and conscientiously performed, and they therefore receive a larger renumeration than the younger boys; they being paid twenty-four cents an hour. This rate is constant for the entire course, which lasts one hundred and twenty weeks. The men spend ten weeks in each of the following departments:—Drilling, milling, lathe, screw machine, gear cutting, tool room (bench and machine), assembly, grinding, foundry and tool design.

Apprentice School.

An apprentice school has recently been opened at the Packard factory to aid in the task of teaching apprentices to think. It is aimed to offer to the boys the best possible opportunities to educate themselves, therefore practices in schools of recognized standing throughout the country have been carefully studied. This investigation leads to the belief that five hours a week should be devoted to class-room work, and apprentices are, therefore, required to spend two hours each week in the drawing class, and three hours studying mathematics and mechanics. The work in drawing is done in one two-hour period, while the mathematics and mechanics classes meet for one hour three times a week. Each boy, therefore, spends a portion of four days every week in the class room. This we believe is more satisfactory than it would be to spend a full half-day once a week in the class room, because the boys have less difficulty in mastering the work when only a few points are presented to them at a time.

The Drawing Feature.

The class room work is in charge of a man who has had a number of years of experience in teaching, and who is a graduate of one of our best technical colleges. The class is conducted in a large room on the fourth floor of the office building. The equipment for the work in drawing is designed for a class of twenty-five. Each set consists of a drawing table similar to the kind used in many drafting rooms, a drawing-board, and a complete set of drafting instruments. Besides the standard equipment there are larger boards for the use of the boys doing advanced drawing. In order that the work may be practical and applied as closely as possible to the design of an automobile, the boys make working drawings, or freehand sketches of different parts of the Packard car. An excellent set of machinists' tools is at their disposal, and they are required to take all their own measurements when making a working drawing of a machine part.

Drawing begins with a few plates to teach the apprentices the use of drafting instruments, then they are given a little geometrical drawing. This is followed by the fundamentals of projections; and the major portion of the course is confined to making working drawings. Supplementary to this work is the practice in reading working drawings. A few of the more advanced students study cams and gearing.

Mathematics Course.

The course in mathematics begins with a thorough review of arithmetic. The rest of the work involves the principles of algebra, geometry, and mechanics, and is presented by many applications to shop practice. The boys are also taught to use the trigonometric functions. Encouragement is had in the determination which some of the boys show to master the work, for although the noon hour begins at 11.30 o'clock, many of them are so anxious to solve the problems in mathematics, or grasp the work in drawing that they study until 12.00 o'clock, and often take the work home at night.

To stimulate the desire for good reading, there is a library of some of the best technical books, which is placed at the disposal of the apprentices. Besides this a branch of the city library is opened twice a week, and the boys are urged to broaden themselves by reading good books that are not technical.

Management's Enthusiasm in Work.

All this work of educating young men has been enthusiastically encouraged by the management, but it is considered as secondary to the more important work of educating their departmental executives. Manufacturers are beginning to realize that as their business grows larger and competition grows stronger it is almost impossible to secure a sufficient supply of properly trained and efficient department heads, and the Packard Co. has arrived at the conclusion that the only solution to the problem is to carry on a continual educational campaign among its present foremen and superintendents as well as among a few young men in minor positions, such as assistant foremen and gang bosses who will be available for filling any vacancies which might occur.

Supervisor of Labor Feature.

Further educational work consists of a series of personal talks with the men. This work is carried on by the supervisor of labor, who devotes all of his time to welfare and educational work, and who is endowed with full authority to handle the labor situation and the educational work for the best interests of all concerned. It is his duty to study each man individually. All of his good traits and habits, as well as his failing and weaknesses, are carefully noted. He is invited into a private room where one hour is spent in talking over the subject of departmental supervision.

During the course of these talks reference is made in a very friendly but candid manner to all his failings, and suggestions are made which are helpful to him in correcting them. He is given very explicit instructions as to the proper method of handling his help; how to develop the unskilled into skilled, expert and efficient workmen; how to get them interested in their own future welfare as well as that of the company; how to develop loyalty and make each man in his department feel that he is an important factor in the institution, and that the company has a personal interest in him; how he should meet and instruct new men coming into his department, and make them feel at ease and at home —tell them what he proposes to do for them and what he expects them to do for him.

His attention is called to the folly of simply giving them a job and then leaving them to work out their own salvation, with the little help they may be able to get from the workmen around them. Their attention is called to the importance of keeping efficient men in their departments for long periods of time; that their deportment positively must be such at all times that their men will respect them; that is, they must be sober, truthful, honest, busy, and above all, punctual; that they must be the first men in the department in the morning and the last out in the evening; that they positively must keep faith with their workmen, and keep every promise made to them; that they cannot abuse them, or swear at them, and when it is necessary to correct them, to call them to one side and privately talk with them with all kindness but with candor; that if they will not respond to that kind of treatment they should dismiss them, but in doing so they should do it privately, give every reason for so doing firmly but briefly. They are told that the company's policy is to retain competent and loyal men, and that sufficient evidence of prejudice or bad temper against loyal workmen will be considered just cause for their dismissal, and it is especially urged upon them as one of their most important duties to train themselves to be affable, honest, straightforward, earnest, and always ready to assist and advise their men, both as to their duties and their personal welfare.

The company believes that as executives sow, so shall they also reap. If they sow disorder and confusion among their men they will reap carelessness and dissatisfaction, but if they sow kindness and interest in their men they should reap honest, loyal and interested workmen. Foremen are told that the efficiency of their departments depends largely upon their ability as foremen to educate workmen and retain them in their department for long periods of time; and that if it were not for the educational work which they are expected to do among the inexperienced workmen, the company would have no further use for their services, except as workmen; for, if all of the men employed were skilled and efficient workmen they would need no mechanical foremen, but simply some clerical help to pass out the jobs to the workmen.

Proper Placing of Employees.

There was a time when foremen were allowed to discharge any man who appeared to be incompetent, or perhaps lazy, but at the present time they are instructed to change these men from job to job in order to try to fit them into a place where their services will be valuable and satisfactory. If, however, they are unable to get them properly placed, they must send them to the office of the supervisor of labor, who will transfer them to another department; or perhaps they are transferred a number of times to different departments until every means for finding a place where their services will be satisfactory has been exhausted, and they are not discharged until it has been proven to the satisfaction of the supervisor of labor that it is impossible to make men out of them. They are told that discharging men for ignorance does not relieve them of the responsibility or correct the evil, and that every time a workman is discharged it is necessary to hire a new man in his place who may make the same kind of mistakes, and thus the evil goes on indefinitely, or until the management discovers the foreman's weakness and dispenses with his services.

Business Onus of Foremen

The foremen are being taught to conduct their employers' business as they would if their own money were invested. They are given assistance in computing the cost of labor and material brought into and turned out of their department each day, also the cost of spoiled work. Comparisons are made between the expense of proper instruction and efforts that would have made good commercial material instead of scrap, and the cost of labor and material that went into scrap; and this alone has made such an impression that the company has been well paid for all the work they have done in the way of educating their executives. All of these things apply only to the educational work done in the manufacturing departments, and are conducted entirely independent of the educational work done in the sales and advertising departments. After these talks the foremen are closely watched for about sixty days and at the end of that time they are again called into the office and asked to go over the whole matter again and see what they have accomplished, and they are assured that this work is only the outcome of a desire to make each of them a greater and better executive.

An example of the success and importance of this work is seen in the turn-over of the force which one year ago was about two hundred per cent., while at the present and for several months past, it has been less than fifty per cent. The efficiency of the plant has wonderfully increased, which is shown by the increase in production, an improvement in quality, without any increase in productive force, and a considerable decrease in the non-productive force.

MACHINERY BELTING MARKETS.

BRITISH manufacturers of leather, hair, and cotton belting for machinery will be interested in a memorandum just issued by the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall street, E.C., showing the principal markets to which German and Austrian goods of this class have been exported. Although German exports of these products do not appear to rival those of Great Britain in value, they are in some directions very considerable. To these, however, no less than $493,500 worth of belting from Germany has been sold in a recent year, most of it being of other classes than leather, cotton, or wool.

In other countries the sales are also large. For instance, Germany sold to Russia recently in one year leather belting to the value of $658,500; to Sweden to the value of $114,750; Italy, 115,000. Of German woven hair or cotton belting, Russia took $353,500 worth; France, $70,750, and so on. Roumania is a large purchaser of all classes of German beltings, though latterly the country has developed an industry of this kind itself. France takes a considerable amount of woven belting from Germany. The Russian trade was formerly in the hands of British firms, but has been captured by German efforts. In 1912 Germany's total exports of belting were worth $3,675,000.

ELECTRIC LAMP INDUSTRY BENEFITS BY WAR.

THE tungsten and incandescent lamp industry in Canada will benefit through the industrial conditions created by the war. There have been large importations of tungsten and incandescent lamps from Continental Europe into Canada, and these importations will be greatly curtailed, if not completely cut off, as a result of the war. This will result — indeed has resulted already—in greatly increased demands upon the Canadian manufacturers of these articles.

When the war broke out the plant of the Canadian Tungsten Lamp Co., at Hamilton, was shut down for the summer. Under ordinary conditions operations would not have been resumed until September 15. In view of the probability of an increased demand on account of the war the plant was put in operation on August 15—a month ahead of the usual time. Since operations were recommenced the staff has been employed several nights a week in an effort to keep up with the demand.

Although the present output of the plant is 75 per cent. greater than under normal conditions, it is not sufficient to meet the increased demand. Recently three large orders, which under normal conditions would have kept the plant busy for three weeks, were refused because of the difficulty of filling orders already in hand.

The plant of the Canadian Sunbeam Co., in Toronto, was reopened on July 28 after the usual thirty-day summer shut-down. This plant has been operated ever since at full capacity.

HYDRO-ELECTRIC VS. STEAM.

IN an address before a recent session of the American Society of Heating and Ventilating Engineers, comparing hydro-electric generation of electric current with generation by steam, Reginald Pelham Bolton gave some interesting statistics as to how the advance in generating methods has assisted in conserving the fuel supply. Mr. Bolton took the stand that electric current may be more cheaply generated on the average by steam than by water, and said:—"The amount of fuel used for the production of a kilowatt of energy in modern plants has been undergoing a continuous reduction, as a result of the greater concentration of the production and the resulting use of better proportioned machinery.

The actual conservation which has been effected by the more economic use of fuel in electric power production far exceeds any results that could have been attained by the use of all the water power in present service. In one of our largest cities during the ten years from 1903 to 1912 inclusive, a total of 3,782,000,000 kilowatt hours was generated by the consumption of 6,284,000 tons of coal. In the year 1903 the rate of fuel consumption per kilowatt hour generated was 6.87 pounds. At the end of ten years this rate has been reduced partly by improvements and partly by the larger units operated, as well as by the improved load factor resulting from combining the demands of more consumers, to less than three pounds of coal per kilowatt hour.

The consumption of coal during the ten-year period, if it had been maintained at the rate prevailing in 1903, would have involved the consumption of 13,000,000 tons of coal. There was saved or conserved, by the process of improvement, more than fifty per cent. The use of very large boilers, used at a high rate of output, combined with large generators, has reduced the coal consumption per kilowatt of energy per hour to less than two pounds weight of bituminous coal, as in the Central Station of the Detroit Edison Co.

Our present demand for coal for all purposes is about 575,000,000 tons per annum. The commercial value of the material is mainly composed of the cost of labor and machinery for its extraction and the cost of transportation from its source to its point of usage. Our entire system of railroads and our vast advantages in water transporation are contributory to the economical distribution of coal, and in low cost of output we take the lead in the world with a production of 600 tons per annum per employee, as against 275 tons per annum per employee in the United Kingdom."

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

DRILL JIG FOR ANGULAR HOLES.

By J. P. Sanderson.

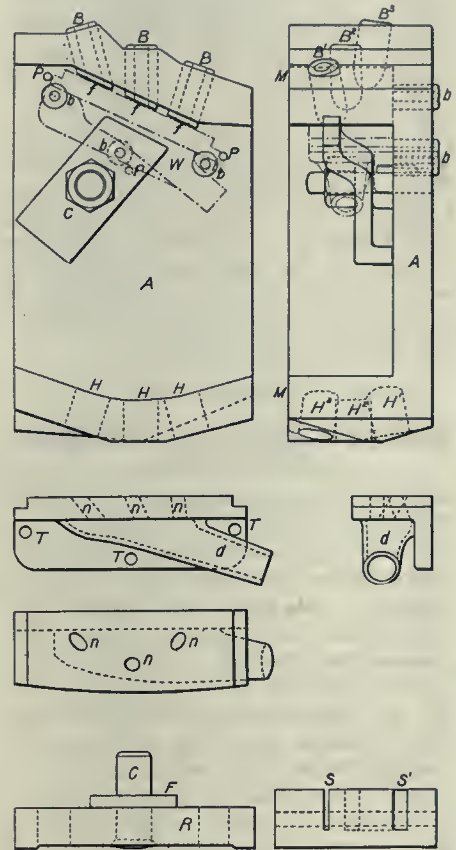
WHERE holes are to be drilled at somewhat acute angles to each other and considerable accuracy is required, the first idea of a jig is usually a very elaborate affair. The plan herein described may not be new to some but one might go the rounds of a large number of shops and not run across it, and the principle involved certainly has simplified a lot of otherwise tedious little jobs.

The work, in this case, consists of the brass nozzle chamber of a very small impulse turbine. It contains three nozzles as shown at (n) Fig. 1. These nozzles are simply drilled holes of suitable size and, as they must be drilled at a common angle to the circumference of a circle, the angles which they bear to each other are somewhat complicated. Besides the three nozzles, there are the three holes T, for the purpose of holding the casting in place on the machine, which are also drilled. The pipe connection (d) is milled off and threaded for a ⅜ in. fitting.

The jig Fig. 2, consists of a U-shaped iron casting of the general form shown. The top leg carries the three drill bushings B for the nozzle holes. The lower ends of these bushings are ground off to form the locating surface (f) for the work which is held tightly against them by the peculiar form of the clamp C. The job is located endwise and at the back by the short pins P. For drilling the nozzle holes, the jig is set up on the plate shown in the left hand part of Fig. 3. This consists of the cast iron base R into which is riveted the shouldered stud C. The part C. of this stud is a sliding fit in the three holes H of the jig which are surrounded with a counterbored surface to rest on the collar part F.

In operation, the plate R is first bolted to the drill press table so that the stud C is directly in line with the drill. A casting, afer having been machined on the face and back on the milling machine, is clamped in position in the jig as shown by the dot and dash outline Fig. 1. The jig is now placed on the plate R so that the stud C slips into one of the holes H and thus holds the jig in position to drill one of the nozzle holes. The hole H^1 is used to drill through the bushing B^1, while H^2 is used for B^2, etc.

The angles which these holes make with the face of the casting are the same, although they appear different in the drawings. This permits the use of a simple expedient to prevent an ordinary twist drill from catching on the slanting surface and being broken. A small steel block is drilled endwise



FIGS. 1-2-3.
DRILL JIG FOR ANGULAR HOLES.

through the center with a hole the same size as the nozzle holes, and is sawn with two slots, S at right angles, and S^1 at the same angle to the central hole as the nozzles are drilled in relation to the face of the nozzle casting. A brass rod is thrust into the hole in the block and, using the slots as guides, small sections are quickly cut off having one angular and one square end. By dropping one of these little pieces into each jig bushing before drilling the nozzle holes, they can be rapidly drilled without danger of breaking the drill, the angular end preventing the strip from turning round. At first sight this appears to be a tedious process but it has been found quite practicable. A couple of strokes with the hack saw does the trick and the time gained in drilling and the permitting of the use of ordinary drills more than makes up for the work of preparing the stubs.

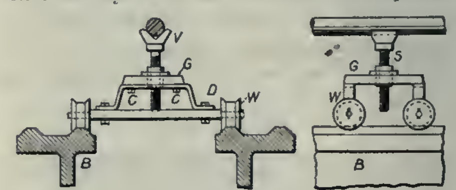
The three holes T are drilled through bushings (bb) in the back of the jig by placing it flat on the table on the faces MM and with the same setting of the work. The job is greatly facilitated by the use of a quick change automatic drill chuck. The pipe connection (d) is machined by placing the jig on edge with one end raised by means of a block which is kept for the purpose. This form of jig, while not the most suitable in cases where an unlimited quantity of work is to be done, has stood the test of a shop in which the castings come in large intermittent batches.

USEFUL SHAFTING CARRIER FIR LATHE.

By J. Davies.

THE accompanying illustration is that of a lathe attachment which recently came under the writer's observation in a Toronto machine shop. It is simple and very inexpensive, and will surely pay for itself in a very short time on a shafting lathe. Its purpose is to facilitate the handling of long shafts in the lathe, particularly when they require to be turned end for end, as is often the case. As nearly all the work is done on the ends of shafting, it is seldom in the way of the carriage, and, if necessary, one man can easily lift it down.

The cut is self-explanatory. The small cast iron wheels W are fitted to the square shaft axles. The square threaded screw S is surmounted by a swivel support for the shaft, as shown, and works in a cast iron nut. This nut is supported by a strong piece of wood, which is in turn fastened to the flat iron frames by the carriage bolts C; these, again, are bolted to the axles. The fixture is, of course, of no use for straightening shafting unless this be done by means of the usual hooks and screw. Its mobility allows it to be easily moved out of the way when the machine is required



USEFUL SHAFTING CARRIER FOR LATHE

for chuck work, and it will be found that it will rarely have to be lifted down.

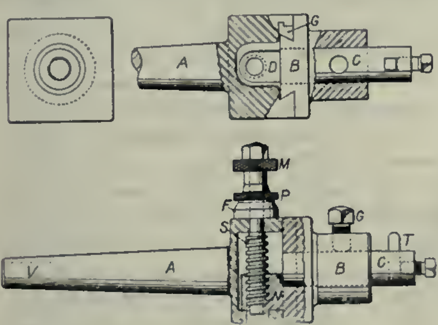
We have seen a device somewhat similar to this having a split nut, so that when the weight of the shaft is on it the screw is clamped tightly and the adjustment for height is not altered by turning the shaft around.—Ed.

ADJUSTABLE BORING TOOL.

By E. W. Tate.

IN the acompanying cut is shown an adjustable boring tool for milling machine work which has the advantage of a wide range of adjustment. The body of the device consists of the shank, which is turned from a square bar of machinery steel of suitable size. The part A is a standard taper to fit the milling machine spindle, the end being drilled and tapped for the draw bolt as shown. The large end is milled out to accommodate the nut D and shaped to form the dove-tailed slide for the head piece B. This sliding part, including the nut D, is made of a single piece of machinery steel and is kept snug by the gib G, which is tapered.

A number of boring bars can be made to accommodate different sizes of holes, the bar C representing the largest. The adjustment is accommplished by means



ADJUSTABLE BORING TOOL

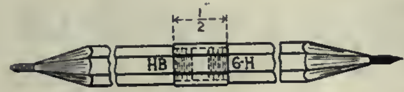
of the square thread screw S through the knurled nut M which is keyed to the screw shank. It can be clamped in any position by the cam nut P. The barrel F is graduated so as to show adjustments to 0.001 in. of boring bar. This fixture has been found particularly useful for boring jigs and other work containing a number of different sized holes as, with the help of one or two easily made bushings, drills as well as boring bars can be readily fastened into the part B.

The arrangement would be much more satisfactory to the safety first movement if hollow set screws were used instead of the old-fashioned ones shown. Also some other devices of a similar nature have done away with the protruding part of the screw shank by arranging this for a hollow set screw wrench as well.—Ed.

A PENCIL JOINT.

By W. H.

WHEN putting in the dimensions lines on a drawing, a hard lead pencil, such as a 6H is used, but when putting in the figures a pencil with soft lead is generally employed. Draftsmen often wish that a pencil could be had that would be adaptable in hard or soft lead, and thus save the bother of constantly picking up and laying down two separate pencils.



A PENCIL JOINT.

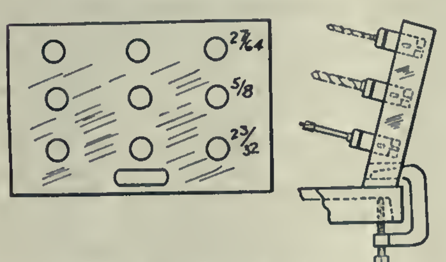
In the accompanying sketch is shown a kink, which serves as near as possible this purpose. A pencil joint made from ¼-in. brass tubing, and about ½ in. long, is tapped in the ends with a ¼-in. tap. A half length each of a hard and soft lead pencil is whittled slightly on the ends, and these are forced into the threads of the tube. The tube is, of course, filled hexagon-shape, and the pencils are replaced as fast as they are used up. The grades of the pencils should be marked on the ends as shown.

HOLDER FOR QUICK-CHANGE COLLETS.

By J. E. Cooley.

AMONG the handiest tools brought out in recent years and those that have greatly reduced the cost of drilling operations are the quick-change drill collets, so-called, because the collets can be inserted and taken out without stopping the spindle. It is often noticed where several collets containing drills, reamers, counter-bores, etc., are in use, that there are no means provided for keeping them together, as they often roll off the drill-press table.

In the accompanying sketch is shown a convenient means for keeping the collets together, and in the order in which the are handled. It consists of a piece of 2-in. plank, having several holes



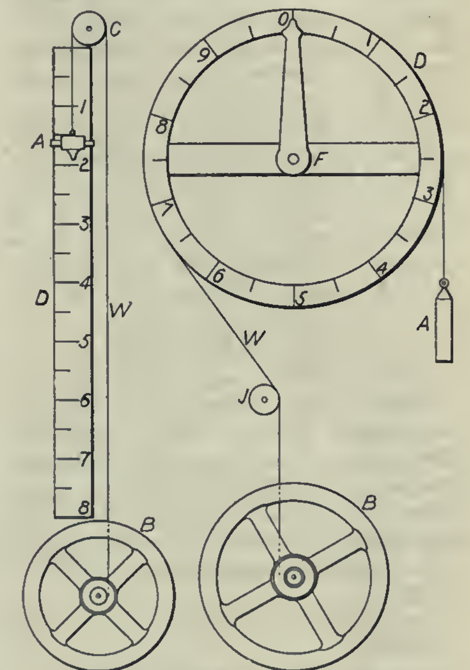
HOLDER FOR QUICK CHANGE COLLETS.

bored in it, as shown for holding the collets. The lower edge of the board is planed on an angle, and it also contains a slot cut, by which it can be fastened down by a clamp to the drill-press table. The front of the board should be painted black, so that the size of the tools in use can be marked near the holes with a piece of chalk, as suggested in the sketch. By having the figures thus plainly written out it will save considerable time hunting for the small stamped figures on a tool each time it is handled. When the tools are removed from the collets, the figures should be erased.

INDICATOR FOR AMOUNT OF VALVE OPENING.

By J. E. Noble.

IN many situations it is often necessary to be able to tell at any time, the number of turns a steam, air or water valve has been opened. A simple device for this purpose, was made up and put into service by the Western Gas Association and has given good results particularly where the valve was required to be used



INDICATOR FOR VALVE OPENING.

as a regulator of the gas flow. In the writer's opinion, it could be used to advantage in a great many shops and power plants.

In the left hand part of the figure, B is the valve wheel and A is a small grooved pulley. One end of the cord W is fastened to the valve spindle while the other passes over the sheave C and is attached to the small pointed lead weight A. A scale D which may be supported in any convenient way or place is graduated so that each division represents one turn of the valve wheel. The position of the weight A in relation to the lines on the scale shows at a glance the setting of the valve.

The right hand part of the figure illustrates the same principle applied to another form of scale. The pointer F is stationary while the scale itself forms the sheave and revolves, the cord being kept tight by the weight A. This form is most useful in cases where the full opening requires a great many turns.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

TANK CONTENTS QUERY.

EDITOR Canadian Macsinery.—Will you solve through your journal the following problem: —A horizontal cylindrical tank, 8 ft. in diameter and 23 ft. long, is filled to a depth of 26 inches with oil. How would you determine the quantity of the latter —H. Sorensen, Montreal.

Answer.—Find the area of the end of the body of oil and multiply by its length. The end is in the form of a segment of a circle, and the easiest way to find its area is to find the area of a sector of the same angle and subtract the area of the triangular part.

(1)—To find the chord or the width of the oil surface:—From the diameter of the tank subtract the depth of oil; multiply the remainder by four times the depth, and extract the square root of the product. Diameter = 96 ins.; depth of oil=26 ins., and difference=70 ins.

$$4\times26=104, \text{ and}$$

$$\sqrt{70\times104}=\sqrt{7280}=85.32 \text{ in.}$$

(2)—To find the angle of the sector:—We have a right angled triangle with all three sides known. The hypotenuse is the radius of the circle, which is 48 ins.; the base is $85.32\div2=42.66$ ins., and the other side is $48-26=22$ ins. The angle between the hypotenuse and the vertical side is half the angle of the sector.

$$\frac{42.66}{48}=.88875,$$ which is the sine of the required angle. From a table of sines we find this to be the sine of an angle of 62.64 degrees. The whole angle of the sector is then, $62{,}64\times2=125.28$ degrees.

(3)—To find area of sector:—Area of circle$=48^2\times3.1416=7238.246$ sq. in.

Sector of 360 degrees has an area of 7238.246 sq. in., and sector of 125.28 degrees, therefore, has an area of

$$\frac{7238.246\times125.28}{360}=2518.91 \text{ sq. in.}$$

(4)—To find area of segment:—Area of triangle $=\frac{85.32\times22}{2}=938.52$ sq. in.

Area of segment = area of sector minus area of triangle = 2518.91—938.52=1580.39 sq. in.

(5)—To find volume of oil:—Multiply area of cross-section by length, or

$$1580.39\times23\times12 \text{ cubic inches.}$$

1 Imperial gallon=277.274 cubic ins.

$$\text{Number of gallons}=\frac{1580.39\times23\times12}{277.274}$$

$$=1573.12 \text{ gallons.}$$

The answer in cubic feet would be

$$\frac{1580.39\times23\times12}{12\times12\times12}=252.42 \text{ cu. ft.}$$—M. L. S.

WANTED A DISTINCTIVE TITLE.

By J. P. S.

A GREAT deal has been said and written of late concerning the requirements of an engineer. In the United States and very largely in this country the man who builds the engine is called a machinist, and he who operates the throttle is spoken of as the engineer. In Great Britain and other parts of the Empire the builder is the engineer and the operator is the engine-driver.

There seems to be little objection in America to a man calling himself whatever he likes, and for this reason most of the professional cognomens have lost a large part of their original significance, and, as a consequence, no longer give the bearer of it the social status that it once did.

A very sensible application of the word is found in marine practice. Here the man in charge of all mechanical appliances of a ship is known as the chief engineer, and his subordinates are known as assistant engineers.

There is nothing to prevent this system being adopted also in power plants. The man in charge of large mercantile buildings or factories who supervises everything in the line of heating, plumbing, sanitation and power has nothing in the way of a calling that will place him in any way above his subordinates.

Gas Association Convention.—About one hundred and fifty delegates from all parts of Canada attended the Seventh Annual Convention of the Canadian Gas Association, composed of the managers and engineers of gas plants in the Dominion, which was held in Ottawa last week. The following officers for the ensuing year were elected: President, H. E. Mann, chief engineer, Montreal Light, Heat & Power Co.; first vice-president, R. A. Wallace, manager Quebec Railway, Light, Heat & Power Co.; second vice-president, J. M. H. Young, manager London Gas Co.; executive committee, A. A. Dion, general superintendent Ottawa Gas Co.; Arthur Hewitt, general manager Consumers' Gas Co., Toronto; Mayor Samuel Carter, Guelph; J. P. King, manager Stratford Gas Co. The next convention will be held in Montreal.

WHAT BE EFFICIENCY?

By J. Ellethorn.

"SAY, boss," said Mike the fireman to the engineer, "what do this thing efficiency in the power plant be that I do be hearing a lot of talk about?" "Well," said the engineer, "efficiency in the power plant means lots of things, and it all depends on who you are and what you want it to mean."

"The agent for Buncums boiler compound will tell you that most fuel is wasted because of scale which no compound will remove like Buncums. The CO_2 recorder man will surely convince you that without his recorder economy is impossible, and the next fellow will try and convince you that the CO_2 outfit is practically useless unless you use his scientifically perfect draft recorder along with it. The combustion expert is positive in asserting that the whole fault lies in improperly constructed furnaces, while the engine builder's agent is just as certain that it is absolutely impossible to secure efficiency unless you use his nearly perfect engine.

"According to what we are told, power plant efficiency is impossible without all of the foregoing, and with the addition of patent furnaces, shaking, dumping, traveling and other kinds of grates, automatic stokers, coal weighers, smoke testers, recording gauges, and about five hundred other devices which may all be good things under proper conditions; but, Mike, the owners of a power plant may have every up-to-date and ahead-of-date article or apparatus manufactured to save steam, water or fuel, to reduce friction and save oil, to work automatically and reduce labor, and still fail to get efficiency or economy."

"Well, well, for heaven's sake, boss, what can a fellow do, or is efficiency an impossibility entirely?"

"Listen, Mike, efficiency is quite possible and quite easy. The first requisite is a capable engineer who knows his business and who means business. The second and about as important is an intelligent fireman, or set of firemen, who do not depend on automatic machinery, no matter how perfect, to do their thinking; firemen, to be sure, who know about as much as the engineer, and who get nearly as good wages; firemen, in fact, altogether different from you, Mike, men who know what efficiency means, and who must needs be paid for knowing it. However, as things are, I will have to use you, and men like you, at the expense of efficiency."

A SHAFT FAILURE WITH A REASON.

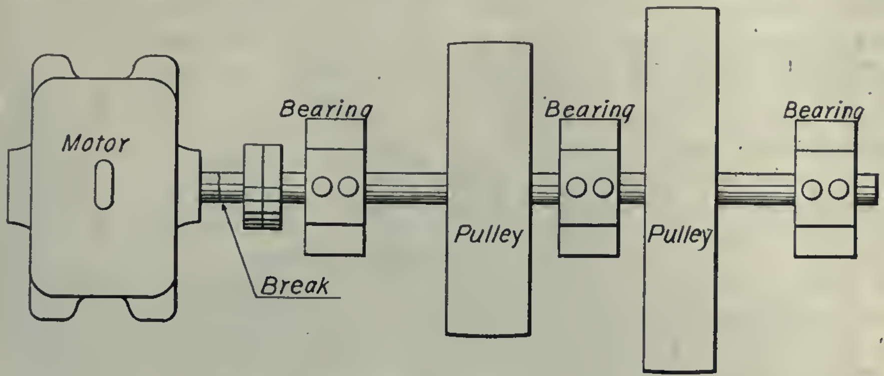
By H. Womersley.

IT is often difficult to place the responsibility for the non-success of new machines, and the millwright will often do well to go cautiously when prompted to place the blame for the non-realization of expectations upon the machine or its builders. On the other hand, the maker's reputation will be safeguarded by his assuming the responsibility of putting the machine into successful operation as well as manufacturing it.

The writer's firm recently furnished an electric alternating current motor to a small manufacturer for the purpose of driving a head shaft. The motor was fitted with ball bearings, and, before leaving the works, was tested out at full load for six hours and at 25 per cent. over-load for one hour. It was set in place by the customer himself, the connection to the head shaft being by means of a coupling, as shown by the illustration.

The machine had scarcely been running two hours when we received a telephone message saying that the rotor shaft had twisted in two. After directing that everything be left in position, the writer hastened to the scene of the trouble and found upon his arrival that the report was substantially correct. The shaft had been twisted off close to the coupling. The head shaft had been supported by two end bearings, as shown, and, upon our advice, an additional bearing was placed near the centre between the pulleys. A new rotor shaft was supplied; the broken shaft was replaced, and the machine has now been in successful operation for about five months.

In this connection a few practical hints on and facts in connection with shafting might be of interest. A revolving shaft having the power applied at one end always twists somewhat throughout its length. In other words, the end to which the power is applied moves slightly in advance of the other end where the work is done. The amount of twist varies directly as the length, directly as the moment of the load, inversely as the rigidity of the material of which the shaft is made, and inversely as the fourth power of the diameter. These laws hold good so long as the material is not stressed beyond the elastic limit.



MOTOR AND HEAD SHAFT SETTING.

The transverse strength or resistance to bending is directly proportional to the cube of the diameter and inversely proportional to the distance between supports. The transverse stiffness which determines the deflection is directly proportional to the fourth power of the diameter, and is inversely proportional to the load and to the cube of the distance between supports. The following formulae will be found practical, simple and good for quickly estimating the horse-power that can be transmitted by mild steel shafting:—

For head shafts which are well supported, multiply the cube of the diameter by the revolutions per minute and divide the product by the constant 100. For line shafts well supported use the constant 66 2/3, and for transmission shafts apply the constant 50.

It is an axiom among millwrights that turned shafting, when properly made, is more desirable than cold rolled. The process of manufacturing the latter produces an initial crystallization in the surface and incidentally a soft centre. While it is maintained that the elastic strength and the shock-resisting power of the material is increased, it should be borne in mind that its natural condition is of a soft nature so that the load must be carried mostly by the outer skin or stiffer part of the shaft. When the surface is broken for the purpose of placing keyseats the ensuing spring introduces all the difficulties of shaft straightening. Shafts turned from hot rolled mild steel bars, straightened before being turned, and well finished and polished, will give the strongest combination of stiffness, true running and minimum loss of power.

TREATMENT OF BOILER FEED

THE presence of carbon dioxide in the boiler feed water cannot be considered objectionable as a rule, but where the process of corrosion of the boiler sheets has already started it may accelerate it, says Professor Blacken of Riga. It can, however, be easily removed by caustic soda. Air must be considered as a harmful agent, since the protective action of oxygen in boiler practice has been neither observed nor proved. The air in the presence of chlorides and under certain conditions causes dangerous spot corrosion, and, since it is due to the action of the oxygen of the air mechanically carried into the boiler with the feed water, it is advisable to take care to admit as little as possible.

It is very desirable to admit the feed water either into the steam space or closely below the water level, so as to permit the air to escape into the steam. If there be a large amount of chlorides present in the water, it appears advisable to reject such water entirely, but, if not, it is well to observe the inside of the boiler very carefully, and as soon as signs of corrosion appear, to install zinc plates in metallic connection with the boiler shell, taking care, however, to see that as little as possible of air is allowed to enter, since otherwise the oxygen will in a very short time destroy the zinc. As regards the organic constituents, Reischle, of Munich, discusses particularly the action of various tar, asphalt and graphite paints, and mentions the Brun process, widely used in Switzerland, which consists in the addition to the boiler water of some linseed oil. On the whole, he comes to the following conclusions with respect to the use of means for preventing scale:

They prevent more or less formation of scale, but cannot be considered as a certain method of protection, with the exception, perhaps of the above-mentioned Brun process they produce solution of old scale only occasionally, but usually make it brittle so that it either breaks off itself or can be more easily removed. Sometimes the application may lead to overheating and injurious results to the boiler plates, especially the firebox plates, and finally, they can produce clogging of the water gauge glass and blow-off cocks.—Journal A.S.M.E.

R. A. Ross, consulting engineer of Montreal, has been appointed by the city of Peterborough as their representative on the board of arbitration appointed to settle the question with regard to the taking over of the plant of the Peterborough Light & Power Co. by the city.

PROGRESS IN NEW EQUIPMENT

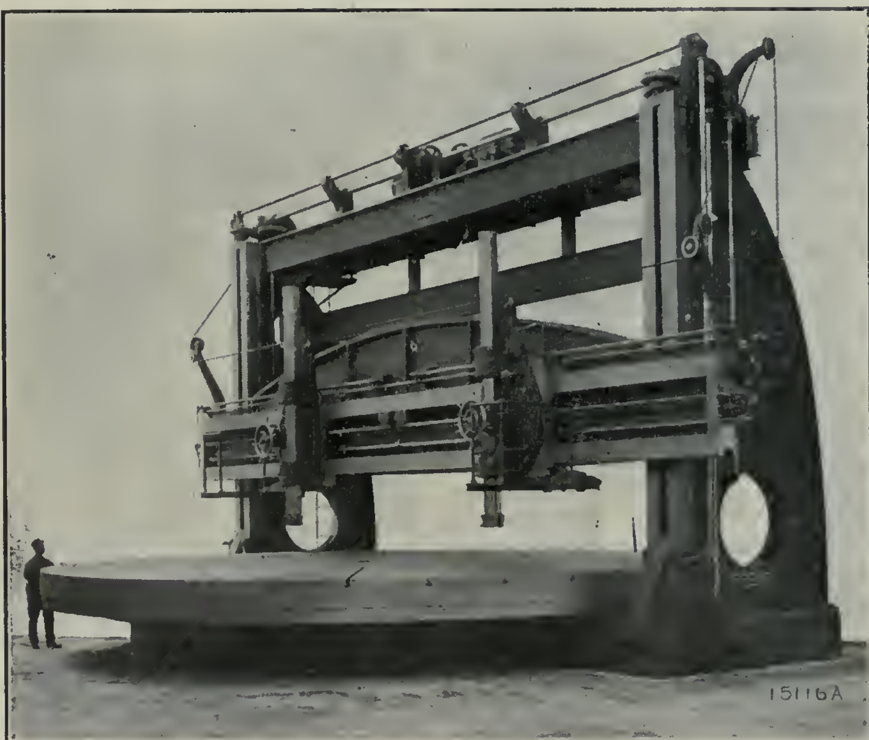
A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

LARGEST BORING MILL YET BUILT IN AMERICA.

AT the Brooklyn Navy Yard, there has recently been completed the installation of the largest boring mill yet built on this continent. This mill was made by the Niles-Bement-Pond Co. at their Niles Works, Hamilton, Ohio. It swings 36 ft. in diameter and has 12 ft. under tools. The great swing of this machine is required for finishing the tracks of the immense turrets carrying the 14 and 16-inch guns of the new battleships. The mill will also be used for boring cylinders and machining castings of the giant steam turbines for war vessels.

The significant feature about the size of this mill is that it is not of the so-called extension type, but it is a regular cross-rail machine with an actual swing of 36 ft. 2 inches, with the housings in a fixed position. An idea of the size and massiveness can be gained from the fact that the total net weight including motors, is 665,000 lbs., or over 330 tons.

The table is designed to carry a weight of over 200,000 lbs., and its extreme size, 34 ft. diameter, made it necessary to cast it in three parts, the three sections weighing 225,000 lbs. The table is supported on conical rollers running in a circular track 24 ft. in diameter, sunk in the bed. Rollers are of high carbon steel and fitted to circular guide frames to insure alignment of the rollers. In addition, the table rests in an annular adjustable bearing ring surrounding the central spindle. The bearing ring is adjusted vertically by steel screws, while the spindle is centered in the bed by an adjustable conical bush. Table tracks and spindle have forced lubrication from a pump operated from the main driving motor. The table is fitted with a spur gear 28 ft. in diameter which is a semi--steel casting, with teeth cut from the solid. It is driven by means of two forged steel pinions, placed on opposite sides of the mill.



LARGEST BORING MILL YET BUILT ON THIS CONTINENT.

The main part of the bed is made in two sections, and there are two bed extensions attached to the main bed. The whole bed weighed 69,000 lbs. in the rough, and the other section 48,600 lbs. The table tracks are rigidly supported by the vertical webs of bed.

The housings are box castings of massive construction, connected at the top by a heavy cross brace. Rigidity is further increased by a steel girder connecting the housings. Each housing weighed in the rough 32,000 lbs.

The cross-rail is about 46 ft. long and weighed 85,000 lbs. in the rough. It is a box casting. Bolted to the top of the cross-rail is a massive camber beam, its function being to stiffen the cross-rail and take up the sag due to the great weight of the cross-rail and the heads. The combined depth of the cross-rail and the camber is 8 ft. The rail is raised and lowered by means of a 30 h.p. motor located on the top cross brace and connected to four elevating screws of large diameter working in bronze nuts. The cross-rail is fitted with two heads for boring and turning. The heads are right and left, so arranged that either can be moved to the centre. They are provided with graduating swivels, with worm gearing for setting them over to any angle on either side of the vertical of 30 degrees or less.

The heads and bars are provided with rapid power traverse, as well as hand movement for close adjustment. The rapid traverse is operated by a 10 h.p. motor located on the top brace. The control of these operations and also the engaging and disengaging of feeds is from a platform attached to each head, upon which the operator stands. The operating levers are interlocking so that the rapid traverse cannot be engaged for one head unless it is disengaged from the other, making it impossible for the operator on one head to accidentally move the opposite one.

Eight reversible power feeds are provided for the bars and are operative in a vertical or angular direction. The feeds for each head are entirely independent and positive. Means are provided by friction clutches to prevent the breakage of feed gearing, should either bar or saddle encounter obstruction.

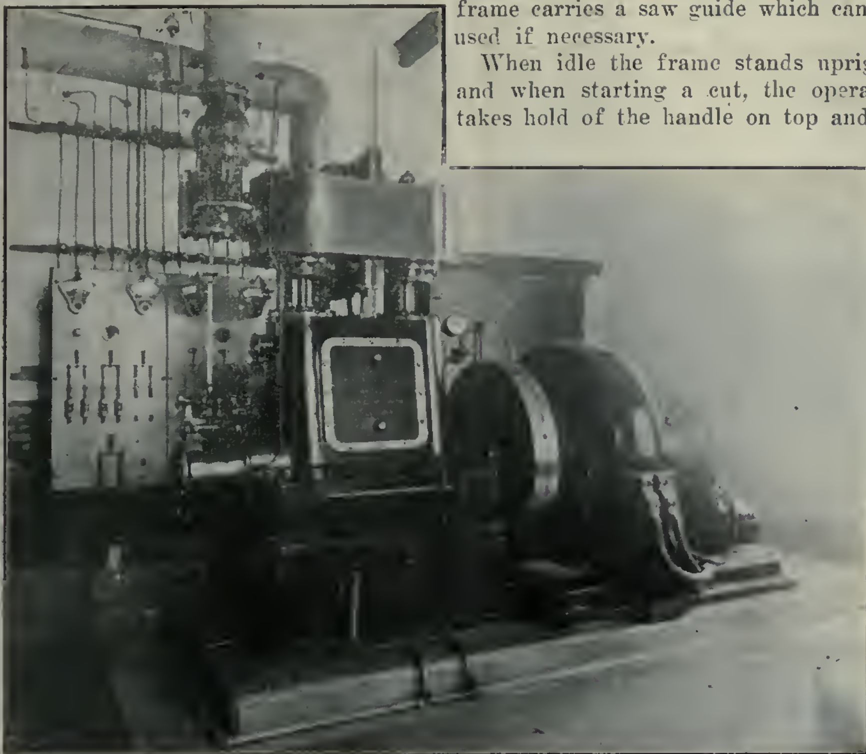
The main drive is by a 75 h.p. motor, and speeds are provided for boring, turning and facing operations.

ENGINE AND GENERATOR INSTALLATION.

THE Imperial Oil Co., of Sarnia, Ont., recently added to their electrical equipment, the following power generation unit. It consists of a direct current generator, 125 k.w., 450 r.p.m., 125 volts, built by the Canadian General Electric Co., Toronto, and driven by a Goldie & McCulloch, Galt, Ont., vertical twin cylinder, non-condensing, forced lubrication engine, taking steam of 80 lbs. pressure at throttle valve and exhausting against 8 pounds back pressure.

This twin engine has been specially

developed to meet cases where considerable power is required, with only a low steam pressure available at the throttle valve, or where the engine is exhausting against very considerable back pressure. Features of this engine are the small floor space required for the horse power developed and the great reduction in cost of engine and generator due to the high speed at which they can be operated.



ENGINE AND GENERATOR INSTALLATION.

The switchboard, also built by the Canadian General Electric Co., consists of Blue Vermont marble panels, arranged so that each panel contains all the necessary equipment for control, consisting of one d.c. generator, and 3 feeder circuits. For each generator there is provided an ammeter and voltmeter, rheostat, main and equalizer switches with fuses, and for each generator circuit one double pole, single throw knife switch with enclosed fuses.

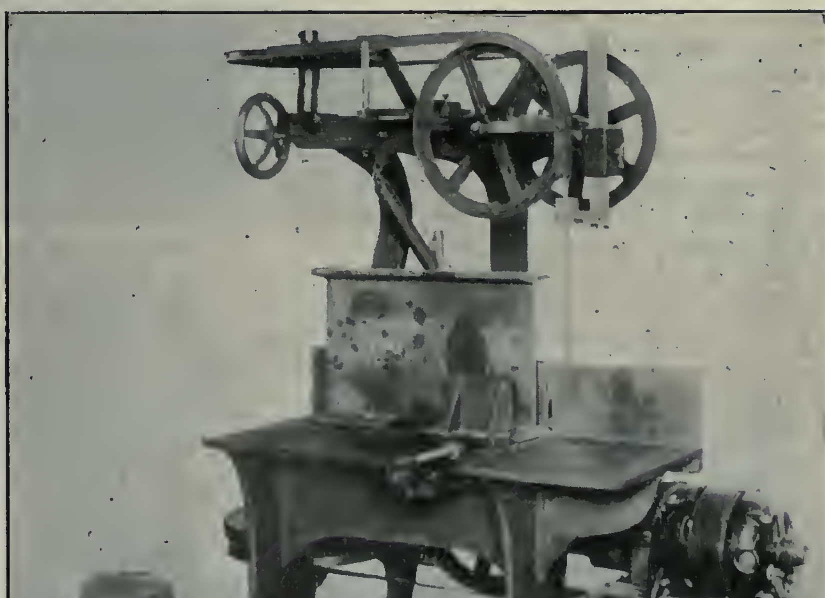
MOTOR-DRIVEN METAL BAND SAW.

THE metal band saw here described and illustrated is a product of the H. C. Williamson Co., Lake Street, Chicago, Ill. Its construction is such that any length of stock can be cut off, as the blade is carried sixteen inches to the rear by the arrangement of the wheels. The swinging frame is rigid in construction, while the bed is substantial and the table has holes drilled and tapped for strapping on special work. Swivel back and vise are furnished on table for cutting at any angle. The drive shaft carries a 24-tooth pinion, meshing into a 96-tooth gear. There is a hand wheel to tighten saw with ample adjustment. The frame carries a saw guide which can be used if necessary.

When idle the frame stands upright, and when starting a cut, the operator takes hold of the handle on top and in front of frame, placing saw to the work; it then feeds by gravity, without further attention. An automatic stop shuts off the power on the belt-driven machine when through cutting, while the spring retards the fall, giving an even pressure all the way down. The pulleys are flanged to prevent the blade running off. By folding the band saw blade, it can readily be seen that the blade runs in its own natural position, a very desirable feature. The saw blade should, of course, be kept tight.

Among the many interesting features of this machine there may be noted the following:—Being continuous cutting, the saw runs faster than on a reciprocating machine; it will cut off any size of I beam up to 12 inches with a perfection almost equal to that of a milling machine; it cuts off tool steel discs, square and eliminates much of the waste due to running allowance; the vise and back can be removed, giving a plain table 14 ins. x 36 ins.; no expensive help is required for its operation, and should a blade break it can be brazed and used again.

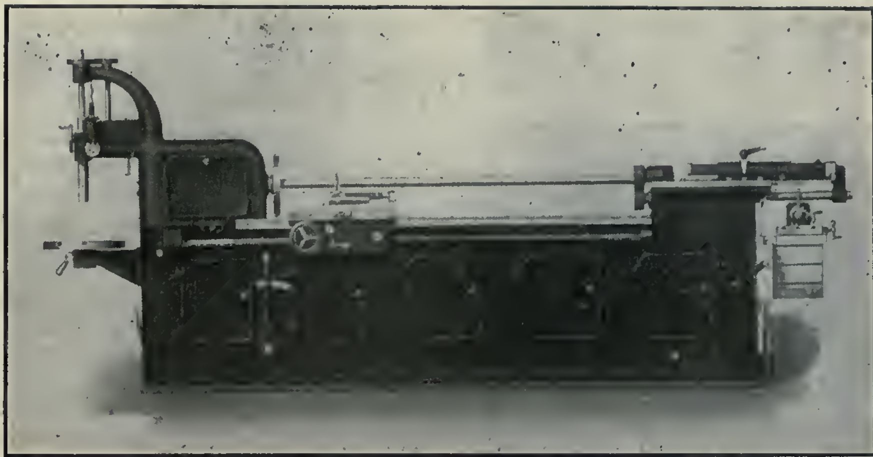
The table is 20 inches high, being, therefore, convenient for handling heavy pieces. The floor space occupied is 36 ins. x 50 ins.; the approximate weight, 900 lbs., and when motor-driven a ½ h.p. motor running 1,200 r.p.m. is employed. For cutting tool steel the pulley speeds are 130 r.p.m., and for mild steel they are 175 r.p.m. The machine will cut off from ⅛ in. to 10 ins. round of any length, and is also highly suitable for pipe and tube cutting.



MOTOR-DRIVEN METAL BAND SAW.

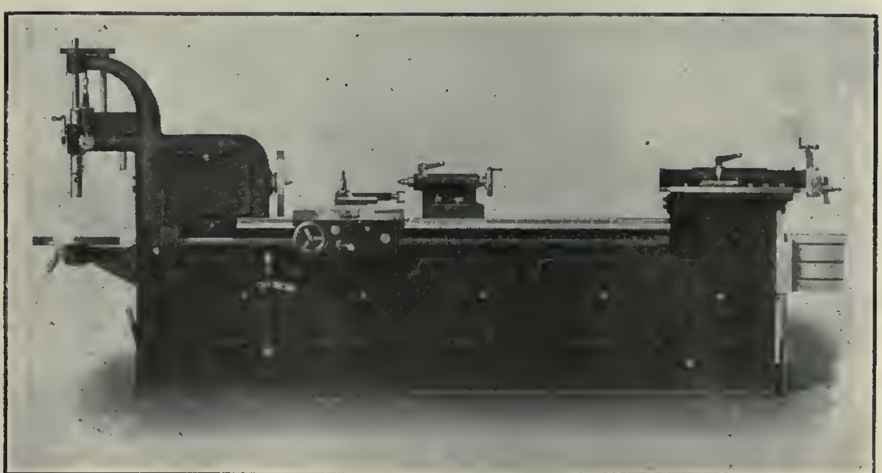
A UNIVERSAL MACHINE TOOL.

SPECIAL construction work and repair bills are costly enough, but it is the lost time required to deliver the material to a machine shop, to explain what is wanted, to await the convenience of one who at best cannot realize what the delay is costing you, that are factors of vital concern to the manager and superintendent of any industry which does not now operate an auxiliary machine shop. Many industries evade this auxiliary machine shop installation for several very logical reasons, viz.: The room required, installation details and expense, the necessity of employing machinists, and other reasons.



DRILL, LATHE AND MILLING MACHINE COMBINATION.

To reduce these objections to a minimum and to offer the benefits derived by quick repairs low costs this combined machine shop tool—a lathe, drill press, milling machine, shaper and keyseater—has been put on the market by the Canadian Linderman Co., Woodstock, Ont. With a floor space of 11 ft. x 22 in., this combination machine can be placed in any convenient spot, tool room, engine room, or at any other point most suitable. Driven by motor, it can be operated at any time when the factory is not in operation. It is also built, when ordered, to drive from line shaft.



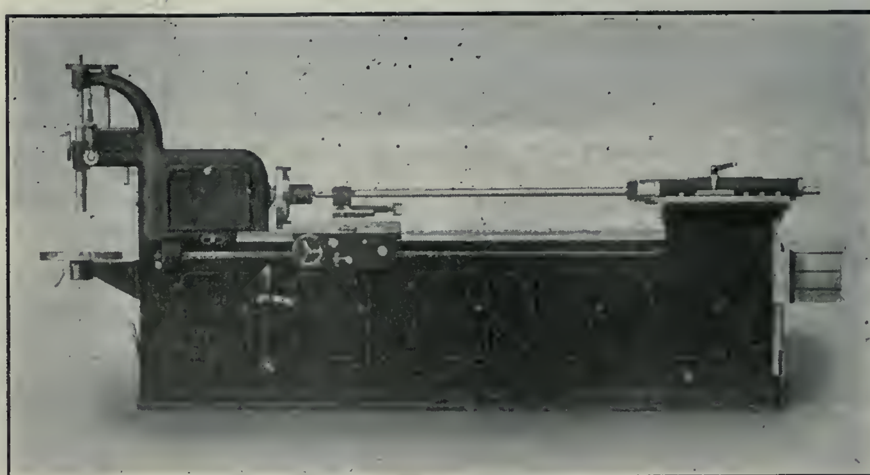
DRILL, LATHE AND SHAPER COMBINATION.

In addition to being used for repairs, jigs or special tools, it can also be used for experimental work; to build special machines; in garages to make immediate repairs; or on board ship in cases of emergency, or to prevent delay in port. Occupying but twenty square feet, it can be placed in any convenient spot. Three men can work at once if necessary, each having separate control over his own machine.

The main frame is 11 ft. long x 22 in. wide, resting its entire length and width on the floor, thereby giving an even strain and having approximately only 25 lbs. pressure to the square foot. The rigidity of this construction assures accuracy for each tool. The following particulars of each purpose equipment will give some idea of the production scope of the combination machine:—

Engine Lathe — Distance between centres, 44 inches; gap bed for 24 in. diameter swings over vees, 16 ins.; swing over carriage, 10 ins.; all geared headstock with enclosed gears; eight speeds, compound rest, set over tailstock; length of carriage, 27⅛ ins.; cuts any standard thread from 3 to 24, including 11½.

Drill Press—Drills holes from ⅛ to 1½ ins. diameter; drills to 20¼ inch centre; spindle feed, 8 ins.; maximum distance, spindle to floor, 40 ins.; and spindle to table, 22 ins.



DRILL LATHE AND KEYSEATER COMBINATION.

Milling Machine—Geared head drive from lathe through 2-inch transmission bar; back geared, two to one; power and vertical feeds, 14 ins.; lateral feed, 4 ins.; distance from table to spindle from 3 ins. to 14 ins. A dividing head can also be furnished, as well as a ram fixture for outboard support.

Shaper—Size of machine, 14 ins.; extreme length of stroke, 14 ins.; cross motion of table, 19 ins.; vertical adjustment, 14 ins.; distance between table and ram, 16 ins.; feed of tool block, 4 ins.; length of top of table, 15 ins.; width of top of table, 11 ins.; keyseating capacity, 2½ ins.; tilting table, zero to 90 degrees.

Key-Seater—Key-seating capacity, 8 ins.; stroke, 14 ins.; work held in lathe chuck; key-seating bar guide held in tool post; shaper head in rear of ram gives taper to key seat; feed for keyseating tool through cross slide.

A few operation facts relative to this machine are that it will turn, bore, face and key seat pulleys or gears up to 24 inches diameter at one chucking; thread nuts and bolts of practically any diameter and thread; cut off and thread pipe and fittings up to 8 inches diameter; cut interior keyways up to 5/8 inch wide by 13 inches long, and with grinding attachment, cylindrical grinding, both interior and exterior, can be done. It will broach irregular-shaped holes, profile an interior or exterior cam, mill a slot lengthwise and shape a slot crosswise on the same chucking, key seat shafting up to 4 inches diameter, drill and pin the teeth in a broken gear and re-cut the teeth accurately, and cut a spur, mitre or bevel gear with dividing head attachment.

CHAIN SOCKET FOR ELECTRIC LAMPS.

THE Monarch Electric Co., of St. Lambert, P.Q., have recently put on the market a new chain socket for electric lamps. The construction of this new socket is very substantial and simple. It consists of a base, pull chain, switch mechanism, lamp holder, brass shell, cap and necessary insulating fibre.

The base consists of two pieces of unglazed porcelain, and between these pieces are located the various links which constitute the switch mechanism. The supports for the top piece of porcelain and the current carrying parts are mounted in grooves on the lower porcelain to prevent turning. There are three brass supports carrying the top piece of porcelain. These struts are about 0.05 inches in thickness. The first is a support for the chain bell, while the other two act as terminals. These latter are provided with upturned lugs for holding the wires under the binding screw heads. The screws used are No. 5, of 40 threads per inch. The spacing points of opposite polarity are everywhere spaced at 3-64 of an inch apart or a greater distance.

The lamp holder is of the standard Edison screw shell design, and is held to the base by two screws. One of these screws is the current carrying conductor to the shell. The other screw is of opposite polarity and extends through the central portion of the base and through a large hole in the holder. Washers of mica capped by a smaller brass washer communicate pressure to the internal flange of the holder. Thus by means of the second screw and a direct pressure, the holder is rigidly attached to the porcelain base. The sealing is done by wax which will not melt at 200° F., and is made in compliance with rule No. 72 of the National Electric Code.

The cap is brass and of the usual fixture type. The method of fastening it to the shell is somewhat unique. On the body of the shell about 3-32 of an inch from the top are two groups of four outpressed lugs. These are pressed out from the body of the shell and the groups are diametrically opposite each other. The cap is provided with an interior brass ring punched with a series of rectangular holes to engage with the outstanding lugs. The holes are so

CHAIN SOCKET FOR ELECTRIC LAMPS.

punched that the cap will fit on the body when simply pushed over it. It is therefore unnecessary to twist the cap until the holes and lugs register against each other. The shell and cap are both lined with heavy fibre approximately 0.035 of an inch thick. The chain is of the universal design, the inner end lying in a channel of white horn fibre.

The switch mechanism is of the single pole, single break type. It is very simply constructed. A flat rectangular piece of porcelain is mounted on a central pin, and one side of this porcelain is faced with a copper conductor connecting with the central pin which is in turn connected with the central terminal screw. This rectangular porcelain is made to go

CHAIN SOCKET FOR ELECTRIC LAMPS.

through one-half a revolution each time the chain is pulled. The motion is accomplished by means of two springs and a cam. Thus every other time the chain is pulled, the flat non-conducting side of the rectangular porcelain piece is pressed against the terminal and the current is broken. Further, every other time the chain is pulled, the copper faced side of the porcelain is in contact with the terminal and the circuit is complete.

This socket has been tested under a voltage of 242 with a current on one ampere. After twenty-nine thousand cycles were completed, the socket was taken apart and examined, and found to be in excellent condition.

LAKE SUPERIOR STEEL OUTLOOK

IN his report to the shareholders of the Lake Superior Corporation, J. Frater Taylor, the president, reviews the position of the subsidiary companies, which include Algoma Steel, Algoma Central and Hudson Bay Railway, Algoma Western Railway, International Transit Co., Trans St. Mary Traction Co., Togona Water & Light Co. Regarding Algoma Steel, which is the foremost of the enterprises, Mr. Taylor says:—

"Pig iron production has been well maintained, and the rail mill output has exceeded that of any previous year. On account of the smaller demand for Merchant Mill material, the output from the Merchant Mills is less than for the previous year.

"The company's mines in the Michipicoten District are operating to full capacity, and are producing ore of a satisfactory grade, part of which is being used in the blast furnaces, the remainder being sold in the open market. As anticipated in the last report Magpie Mine commenced shipments of ore in the month of May."

With respect to the general outlook, Mr. Taylor says:—"Whilst the volume of business has been fully maintained, and the earnings compared favorably with those of the previous year, the outlook is somewhat uncertain. The demand for steel products has fallen off and money stringency, owing to the European situation, is operating as an adverse factor. In view of the continuing necessity for outlay upon the older plants and properties of the Steel Company and its consequent inability to provide the Lake Superior Corporation with sufficient revenue, your directors regret that this year they will be unable to pay any interest on the income bonds.

"Throughout the year, capital expenditure has been curtailed as far as possible. Unforeseen expenditure occurred through the collapse of part of the Ore Dock at the Sault and the consequent loss of the Ore Bridge last winter. The existing battery of open hearth furnaces is being added to by the construction of two additional furnaces, bringing the capacity of this plant up to 20,000 tons of steel ingots per month."

D. Meadows, of St. Thomas, Ont., has been appointed treasurer of the Travelling Engineers' Association.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals, will be found a most useful companion study, and should not be overlooked.

Question.—Making no allowances for losses, in what time will a standpipe be filled by a duplex pump having 30-in. plungers, 34-in. stroke, and making 20 strokes per minute? The standpipe is 125 feet high, and contains 198,804 gallons.

Answer.—One Imperial gallon contains 277,274 cu. in. The volume of the standpipe is $198{,}804 \times 277.274$ cu. in.

Amount of water pumped at each stroke is $15^2 \times 3.1416 \times 34 \times 2$. Amount pumped per minute

$$= 15 \times 15 \times 3.1416 \times 34 \times 2 \times 20$$

Time required to fill the tank is

$$\frac{198804 \times 277{,}274}{15 \times 15 \times 3.1416 \times 34 \times 2 \times 20} = 57.31 \text{ mins.}$$

* * *

Question.—How many yards of concrete would be required for an engine foundation, the sides of which slope up like a frustrum of a pyramid? The base is 31×12 ft., the top is 26×9 ft., and the height is 11 ft.

Answer.—To find the volume of a frustrum of a pyramid or cone, add together the areas of both bases and the square root of their product. Multiply the sum by one-third the height.

Area of base $= 31 \times 12 = 372$ sq. ft.

Area of top surface $= 26 \times 9 = 234$ sq. ft.

$$\sqrt{(372 \times 234)} = 295$$

$$\text{Volume} = \frac{(372 + 234 + 295) \times 11}{3}$$

$$= 3303.66 \text{ cu. ft.}$$

$$= \frac{3303.66}{27} = 122.358 \text{ yards.}$$

* * *

Question.—Approximately how many tons of pea coal would be contained in a conical pile 24 feet high?

Answer—The angle of repose or the angle at which the coal would stand is about 48 deg. The radius of the base would be found by simple trigonometry.

$$\text{The tangent of 48 deg.} = \frac{\text{Radius of base}}{\text{Height}};$$

therefore,

Radius of base $=$ Height $\times$ tangent of 48 deg. $= 24 \times 1.1106 = 26.654$ ft.

Volume of pile $=$ Area of base $\times 1/3$ height.

$$= \frac{26.654^2 \times .7854 \times 24}{3} = 4463.18 \text{ cu. ft.}$$

One ton $= 32.77$ cu. ft. No. of tons then

$$= \frac{4463.18}{32.77} = 136.2 \text{ tons.}$$

Question.—In a hydraulic plunger elevator system with lift 165 feet, and operated by electric-driven centrifugal pumps, will the power consumption for a given travel be greater when the system is operated at 175 than at 160 lb. pressure? Assuming that the consumption is greater in the former case, as seems correct, what becomes of the extra power required when operating at the higher pressure, the travel and ultimate work accomplished in either case being the same?

Answer.—Hydraulic elevators operated by electrically-driven centrifugal or triplex pumps require the use of a storage tank in which the air is the cushioning medium. If the pressure of the system were 160 lb., the pressure of the compressed air in the receiving tank would be 160 lb. Should this be compressed at 175 lb. instead of 160 lb., more heat would be generated in the compression and therefore the radiation of heat would be greater than at 160 lb. pressure. Assuming the efficiency of the pumps at the two pressures to be the same, the only difference in the current consumption would be the extra heat unit lost in compressing to a higher pressure. However, other losses such as efficiency of apparatus, friction, etc., might affect the current consumption, the difference in current consumption depending on the physical design of the apparatus in question.

* * *

Question.—We are making castings that require a minimum tensile strength of 24,000 lbs per square inch, and would like to know of a mixture of ordinary No. 2 foundry iron, cast scrap, and steel scrap that would be suitable. We have two grades of No. 2 iron, one containing 2.50 per cent. silicon and the other 2.25 per cent. silicon.

Answer.—You should have no trouble in getting the strength you require with these irons by adding from 10 to 20 per cent. steel scrap. The addition of 2 oz. of pure aluminum in the ladle to every 100 lbs. of metal will help you get a good sound casting. Put the aluminum in the ladle before the iron is tapped in.

* * *

Question.—We are making rolls that must stand a pressure of 80 lbs. steam and a hydrostatic pressure of 200 lbs. We cannot get our iron sufficiently close grained for this pressure. The rolls are cast on their side.

Answer.—Pour your moulds on end and gate from bottom if possible. Put heavy riser on top so as to carry out all impurities. You might also change your mixture until you have the grain close enough for your purpose.

* * *

Question.—Please give a formula for brass to make plumbers' goods. We would like a good cheap mixture.

Answer.—The following is a mixture that has given good results on high-pressure work: Sheet brass clippings 71½ lbs., copper wire 25 lbs.; lead 2 lbs., tin 1 lb., prosphor-copper (15 per cent.) 8 oz. Charge the copper wire first and when it begins to sink throw in a small shovelful of charcoal. When copper is melted add phosphor-copper. The clippings are next charged, and a ring should be placed on the crucible to increase its height so that a larger quantity can be packed in each time. When the clippings are all fed into the molten copper and are melted, add the tin, and lastly the lead. The metal will be ready to pour when it ceases to boil or to impart vibrations to the skimmer. When pouring the moulds, the metal should be rushed in quickly and with decision, otherwise the castings will be smoky.

* * *

Question.—We are having trouble with pin-holes in our bronze mixture and would be pleased if you could tell us how to overcome this difficulty. We have been using the following mixture: Copper 90 pounds, phosphorus copper 5 lbs., and lead 5 lbs.

Answer.—This is a peculiar alloy and we could advise you more definitely if we knew what your castings were used for, but we would suggest you change your mixture to the following: Copper 90 lbs., phosphorus copper 3 lbs., tin 2 lbs. and lead 5 lbs. We advise this change, as it is difficult to make an alloy of copper and lead alone, and in case an anti-acid alloy is desired, this mixture is equally as good as an all-lead mixture, and is more easily cast. The pin holes, however, are caused by the meal being burned while in the furnace and we advise the use of charcoal as a covering, and greater care in the melting. Use a small handful of salt as a flux on the first metal charged in crucible, and feed your cold metal into your molten mixture slowly.

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PRINCIPAL CONTENTS.

MADE IN CANADA.

WE have noted a commendable and vigorous campaign on the part of the various Canadian Manufacturers' Associations to induce the general public to buy where possible, home-made goods in preference to imported articles. It is true that many millions of dollars go out of the country that, if retained, would largely find their way to the pockets of Canadian workmen.

Like all other questions, this one has two sides, both of which must needs be considered. The wage-earner, or the man receiving a small salary is making a considerable sacrifice in deliberately buying a more expensive article simply because it is made in Canada and, even if he be certain that the extra money paid will come back to another Canadian workman, he has no assurance that the smallest part of it will go to increase his own income. The public to whom the appeal is made should be taught how it is that, with the help of the tariff and if anything lower wages to pay, home products cannot be made more attractive to them.

We feel sure that the public spirit of the great majority of Canadian citizens is such that they will favor home-made goods if the quality and cost compare at all reasonably with others, and this is where manufacturers themselves should take up the responsibility and add to their present educative efforts that of not only personal example but an earnest endeavor to produce goods that will require no patriotic exhortation to take them to the homes of the Canadian people.

OUR OVER-DONE WAR FEVER.

THE past season in its every feature has been a disastrous one so far as Canadian shipping and railroad transportation is concerned. To the European war, of course, must be attributed the disorganized ocean traffic to our shores, the curtailment and premature closing of the passenger and tourist service on our inland waters, and to some extent also the decreased movement of freight on the latter and on our railroads. The advent of the war, coming as it did when the wave of commercial depression had not fully spent itself, gave a renewed impetus and an added strength to that already destructive influence.

It is unfortunate, however, that we should allow ourselves individually and collectively to become so distracted by this war of nations, as to become oblivious to every other interest, personal and communal. Much has recently been written relative to the tendency on the part of employers of labor to sit tight and sip war news, and while the stirring-up which they have received has been intensely seasonable and productive of good, it cannot be denied that employees in their capacity as such, and in the opportunities at their disposal for rational enjoyment, have adopted a like and perhaps more aggravated attitude. The fact is that none of us have been or are attending to our business affairs as we should and, of necessity, where we call the tune we must pay the piper.

The panic with which our business interests were seized in the early days of last month has passed off, only to give place, however, to something more stunning and destructive still—the war fever. We seem to forget that the war in which we are involved has as its object the crushing-out of militarism among the nations of the world, and who shall deny that unless we take immediate steps to again put business on the pedestal, the present temper of our people will contribute to and establish a military regime in Canada, hitherto undreamed of, and in no sense desirable.

We need not, of course, be too rashly optimistic, nor our faith in men and things be so unbounded, as to believe that wars are going to cease when peace is again declared in Europe. This Canada of ours, like every other nation, should be prepared to defend, as it will yet without a doubt have to, both her rights and her very existence, a contingency she is at the present time utterly incapable of doing but, while this is all true, her industrial feature must be safeguarded both in its continuity of application and its progressive development, for by so doing, and only so, will the best interests and welfare of our people be served.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 65	
Lake Superior, charcoal, Chicago	15 75	
Ferro Nickel pig iron (Soo)	25 00	
	Montreal.	Toronto.
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 50	17 85
Victoria, No. 2X.......	18 25	17 60
Victoria, No. 2 Plain ..	18 00	17 35

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b, Montreal.	2.00
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh ...	1.20
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.35
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes..	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$21 00
Open hearth billets, Pittsburgh..	21 00
Forging billets, Pittsburgh.....	26 00
Wire rods, Pittsburgh	26 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 50
Copper, crucible	10 00	10 00
Copper, unch bled, heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	10 75	11 00
No. 1 compos'n turnings	8 50	8 50
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings ...	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload ...	$14 50	$13 50
Electrolytic copper	14 25	14 00
Castings copper	13 75	13 50
Spelter	6 00	6 00
Tin	34 00	40 00
Lead	4 85	5 00
Antimony	16 00	16 00
Aluminum	20 00	25 00

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt, casks, per cwt.	6.40
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine, single bbls.	0.67
Linseed oil, raw, single bbls.	0.63
Linseed oil, boiled, single bbls.	0.66
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.16
Lard Oil, per gal.	0.60

CHAIN.

¼ inch	$5.65
5/16 inch	4.70
⅜ inch	4.00
7/16 inch	3.65
½ inch	3.45
9/16 inch	3 45
⅝ inch	3.35
¾ inch	3.25
⅞ inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2 50	$2 60
Canada plates, ordinary, 52 sheets	3 70	3 85
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (American)	3 90	3 90
Queen's Head, 28 B.W.G.	4 30	4 35
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1½-in	$37.50	$30.00	$17.50
33/64 to ¾-in.	41.25	33.00	19.25
7/16 to ½-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	$1.10 lb.
Leather in sides	$1.00

BELTING RUBBER.

Standard	50%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

¾ inch	$ 4.95
1 inch	8.05
1¼ inch	12.65
1⅜ inch	15.30
1½ inch	16.50
1⅝ inch	19.40
1¾ inch	22.50
1⅞ inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Sept. 21, 1914.—In general the situation has not changed greatly in the last week. Iron and steel prices in the east seem to be holding their own. Certain lines of manufacturing, are, however, benefitting directly from the war, and there are others again whose business does not seem to have suffered materially as a result of it. One example of this is the Consolidated Rubber Co. of this city who have recently declared a quarterly dividend and, at the same meeting, the directors stated that they expected to operate their factory full time all during the winter without any reduction in staff.

The metal market seems to remain fairly firm. Prices have weakened, perhaps a little, but the general aspect is pretty firm. Should the present battle terminate in a decisive victory for the Allies the business situation would immediately become much better.

Steel Market.

Prices in the steel trade remain firm, although, owing to the fact that a great deal of construction work throughout the country has been stopped, the demand for structural steel has not been very great. The general depression of business has also greatly reduced the sale of bars of machinery steel. The quotations that dealers make are all for immediate acceptance and the steel offered is largely of American manufacture. However, there is in Canada a great deal of British steel in stock. The small volume of business has tended to keep the prices from fluctuating. Some mills have made slight advances in certain lines, while others have advanced different lines. Thus quotations on the American product may incline to vary a little.

Pig Iron.

The pig iron market is still dull. The grey iron foundries have been feeling the depression almost more than any other branch of the metal industry and thus the pig iron market has fallen more or less flat. There is still on hand here a considerable quantity of British pig iron but the demand for it is light. Prices have been unchanged for several weeks.

Machine Tools and Supplies.

The machine tool market continues quiet. Frequent sales are reported but they are usually of small units. The supply business is still fairly brisk but orders here are also small.

Metals.

Prices of metals remain fairly steady, although some are a trifle weaker than last week. Tin is steadily falling as the deliveries are of sufficient size to supply the light demand, but at thirty-four cents a pound it is comparatively high.

Toronto, Ont., Sept. 22, 1914.—Business conditions this week indicate a somewhat brighter tendency, although it cannot be said that trade has improved to any material extent; however, a more optimistic spirit prevails. We are steadily recovering from the acute depression following the outbreak of the war, and were money to become easier there would be a distinct revival as the business community is taking a calmer view of the situation, and is therefore more inclined to act along more nearly normal lines. The exchange market is easier than it has been at any time since the war began, and the money market should therefore be less stringent and export trade be benefited.

The recent success of the allied forces in Europe is no doubt responsible for the greater degree of confidence in mercantile circles but it will be some time before normal conditions may be expected. The improvement in trade conditions will be gradual and in the meantime, manufacturers will be able to adapt themselves to the changed situation. There seems to be no doubt but that openings for new business will develop in due course, to a substantial degree. Sir George Foster, Minister of Trade and Commerce, has stated that as a direct result of the war, new business was already coming to Canada, orders having been received from Great Britain that formerly went to German firms. He also stated that Canada, with the other Dominions, would get the first opportunity of filling orders from the Old Country. From this source alone, the possibilities of securing new business are distinctly bright.

The British Empire Industrial League has recently been founded for the purpose of assisting in the establishment of additional industries and factories in the Dominion. Committees are being formed in the different cities to help in the work, and no doubt much good will result. The Department of Trade and Commerce is also devoting all its energy to furnish information to help in the movement to increase the trade of the Dominion. In order to obtain full benefit from the opportunity afforded, manufacturers must lose no time in taking advantage of any business that is offering, and in which they are interested.

Steel Market.

No change of any moment is noticeable in the iron and steel market this week, although the outlook is brighter. A certain amount of new business arising out of the war has been booked, notably by the Dominion Steel Corporation, which has received orders for 2,000 tons of nails and 2,000 tons of wire rods from England. We understand that negotiations are pending in another direction regarding an order for nails. This is an interesting development which may be the forerunner of a considerable amount of new business.

The Grand Trunk Railway has issued an order that all supplies will in future be purchased in Canada or Great Britain. This will have a stimulating effect on certain lines of steel products, seeing that in the past large quantities of steel tires, car wheels, tubes, etc., were obtained from Germany. With sufficient incentive to lay down plants to manufacture new lines, Canadian mills will be able to expand their business, at least in some products, even if they cannot compete in all lines. The Dominion Government has placed a large order for shells which has been distributed among five firms, and there is a possibility of further orders being given out. This is a new line of business, and will keep the companies concerned, busy for a time at least.

There is some building being done, but not enough to create much demand for structural shapes. Prices on steel products are being maintained, notwithstanding the fact that there is little demand. A Government order for 10,000 tons of rails for the Intercolonial Railway is being held as a nucleus pending the development of other business. Consumers appear to be holding off until the outlook improves and the financial stringency moderates.

The war is having a depressing effect on the steel trade in the United States and the dullness which exists is perhaps more pronounced than last week. Prices all round are being maintained, but there is little probability of any advance under the present conditions.

Pig Iron.

The pig iron market is extremely dull and little business is passing. Foundries and steel mills are very slack and consequently are buying very little iron. The Canadian Furnace Co. have blown out their furnace at Port Colborne on account of the dullness in trade.

Machine Tools.

The machine tool market is quiet, a few orders only being placed for single machines. There are a number of inquiries about, which has improved the outlook. We understand that specifications have been sent out for tools for the new dry docks at Owen Sound and Sault Ste. Marie, and the Department of Militia has ordered from a local dealer some machine tools and supplies for motor truck repair plants which are being equipped. The Department has also purchased locally a large number of motor trucks and truck bodies; among the former are included special trucks fitted out as repair shops.

Machinery Supplies.

Slightly improved business is noticeable in machinery supplies. Consumers who had held off during the past few weeks are now buying necessary supplies to satisfy immediate requirements. There has been no further change in prices.

Metals.

The metal markets are all quiet and the demand is comparatively light. Prices are steady, there being no changes from last week. Tin is steady, although it is possible that a further decline may be experienced, as there appears to be little difficulty now in obtaining this metal. The export of tin from England is now permissible. Spelter is steady, with a tendency to weaken. The New York and London metal exchanges are still closed.

St. John, N.B., Sept. 19, 1914.—Although somewhat upset when the first news came of the war troubles, manufacturers and proprietors of industrial plants throughout the province, are now settling themselves to face the outcome with calmness and determination. Many houses have lost some of their best help by the call for volunteers, but in most cases they have generously allowed them to go with an understanding that their position will remain awaiting them, and with a liberal arrangement as to pay. "Thus far," said one big industrial man this week, "we haven't lost such a great deal of business since the war broke out. Collections are not quite up to the standard, and we are shutting off on slow pays, but for the most part affairs with us are moving along as though there were no war. We are impressing upon our travelers the necessity of their refraining from reference to the war when on the road, and should a customer bring the matter up, they are advised to depreciate any thought of poorer business because of it. My belief," said he," is that Canadian manufacturing firms are going to experience an era of progress such as they had never dreamed of because of the crippling of the European industries, but its coming will be regulated by the duration of the war."

General Activities.

J. B. Cudlip, manager of the Cornwall & York Cotton Mills Co., here, said this week that business conditions were very satisfactory. Preparations are now being made by his big plants to handle an immense output of finished material. A slight depression was noticeable in the business at the outbreak of the war, but this was now lessening, and there is already evidence of advancement foreshadowed by the loss of German trade, in the manufacture of finished cottons.

The work of erecting a new main building for the LaTour Corn Mills in Carleton, to replace the plant destroyed by fire some months ago, is well advanced. The intention is to have the machinery soon installed and operations begun in the near future.

The plant of the Canada Wire Nail Works in West St. John is just about ready for output work. Horseshoe nails were cut in it this week. The outlook is for good business.

Some of the lumber mills about the city have been closed because of the war and the difficulties in the way of shipping, but the majority have continued sawing throughout, and anticipate a huge demand for their products later. Crews are being now engaged for the annual winter activities in the woods and many portable mills are being established.

By the 1st of November the steel arch for the new bridge at the reversing falls, St. John will be completed. The Dominion Bridge Co. will soon be able to set the first panel in position on the eastern anchors of this million dollar steel structure.

It is possible that a floating elevator may be built at St. John this fall to replace temporarily the loss sustained by the burning of the I.C.R. elevator recently. The Government has announced, however, its intention of replacing the former building by a larger concrete structure, with modern machinery to be installed.

A fourth high speed clam shell grab for reclamation purposes is expected in the city from a firm in Montreal in a few days for work on the new wharves being built at West St. John. This will greatly increase the efficiency of the larger plant now in operation there.

NEW CANADIAN BUSINESS.

Sir George Foster, Minister of Trade and Commerce, stated that as a direct result of the war, new business was already coming the way of Canada, orders having been received from Great Britain that formerly went to German firms.

Sir George also stated emphatically that nine-tenths of the stories going around to the effect that orders were being placed in the United States which could be filled in Canada, were pure fiction. In fact, he said, in every case the British Dominions are being given the first opportunity by the Motherland to fill orders, but of course, there were some requirements which Canada could not supply.

With regard to the capture of German trade, Sir George said that while already some firms had shown considerable enterprise, and were doing business which used to go to German firms, there were not the efforts being made that might have been expected.

Trade Gossip

The Canada Iron Corporation, Fort William, Ont., has been awarded the contract for cast iron pipe by the city of Winnipeg.

Keith's, Ltd., Toronto, will supply all the refrigerating equipment for the new artificial ice plant of the Montreal Arena Co., Montreal.

Keith's, Ltd., Toronto, have been awarded the contract for the refrigerating equipment of the new Central Technical School, Toronto.

The General Supply Co. of Canada, Ltd., Ottawa, has been awarded the contract for supplying a Trench rammer by the city of Ottawa.

The Northern Electric Co., Toronto, has been awarded the general contract for cable and wire, etc., for complete separate line to Dominion Chain Co., Niagara Falls, Ont., at $4,000.

The A. B. See Electric Elevator Co., of Canada, Ltd., Toronto, has obtained the contract for two elevators for the Merchants Bank of Canada, Montreal.

The Bain Wagon Co, Woodstock, Ont., has received an order for transport wagons from the British Government. The wagons are of special design to suit service conditions.

The Massey-Harris Co. are building at their Toronto plant 135 motor truck bodies for the Department of Militia. The bodies are of exceptionally substantial construction, and are made of oak.

The A. R. Williams Machinery Co., Toronto, have been awarded a contract, by the Militia Department, for three motor car repair outfits. Each outfit consists of a 20-in. drill, band saw, forges, and a number of small tools.

The Canadian Fairbanks-Morse Co., Toronto office, have received an order for the complete transmission equipment for Soren Bros., new factory on King street West, Toronto. Skefko patent double row, self-aligning, ball bearings will be installed throughout.

The Dominion Government has placed a large order for shells, which has been distributed among the following firms: Canadian Allis-Chalmers, Ltd., Toronto; Goldie, McCulloch Co., Galt; Jenckes Machine Co., Sherbrooke; John Bertram & Sons Co., Dundas, and the Chapman Double Ball Bearing Co., Toronto.

To Advertise Canadian Goods.—The Canadian Manufacturers' Association have decided to expend a large sum on a newspaper advertising campaign to place Canadian-made goods before the Canadian public. The publicity is to be displayed in the leading papers across the country and to start in the immediate future.

Suspension of Patents.—An Order-in-Council has been passed under the provisions of the past war session, conferring on the Minister of Agriculture power to suspend or cancel patent rights held in Canada by citizens of an enemy's country. The Minister is empowered to use his discretion in dealing with the patent rights in question, and may award them for a period extending to six months after the close of the war to any bona fide applicant. Similar action has been taken by all the belligerent countries.

Canadian Locomotive Co.—In submitting the annual report of the Canadian Locomotive Company, President Aemilius Jarvis said in part: "The decrease in profits as compared with those of the previous year is accounted for by the smaller output of the works as a result of the curtailment of orders by the Canadian Railways.

"During the whole of last year the trade of Canada has been steadily diminishing, consequently the railways' present equipment is ample for their existing mileage and needs. For this reason, added to the difficulties of obtaining money, many good orders from the railways have been postponed. On the other hand, a large amount of railway mileage in Canada is fast reaching a point of completion, to operate which additional equipment must be required. As our new plant is now practically completed, we will be in an exceedingly advantageous position to take care of new work when it is offered.

"At the present time, however, I have to report that the company is practically out of orders. The directors, foreseeing this situation, have for some time past kept the company in a strong financial position so as not to jeopardize the payment of interest and fixed charges. This is evidenced by the statement of liquid assets shown in the balance sheet, which amounts to $686,782, with quick liabilities of $139,806, or net liquid assets of $546,976."

War Grist

G. T. R. to Give $100,000.—The Grand Trunk employees in Montreal have decided to contribute the sum of $12,000 to the local branch of the Patriotic Fund. This will be but a portion of the contribution made by the men of the big railway system, as smaller gifts are being arranged for at the various traffic centres along the line, the money donated passing through the local patriotic funds. With the Grand Trunk employees' co-operation, the amount contributed by the officers and general staffs will probably reach a total of nearly $100,000.

Steel Shells.—The Nova Scotia Steel Co. are going ahead with preparations to manufacture a large number of steel shells for the British Government. While the shells are not such as will run into heavy tonnage, they will provide a considerable amount of employment, and greatly help out in that direction. It is a matter of congratulation that the company's product of raw steel is so good as to conform in every test with the requirements for these shells, and a success in this branch will no doubt lead to further orders along other lines of military equipment.

F. A. Jacobs has severed his connection with The Mechanical Engineering Co., of McGill St., Montreal, and is succeeded by F. Ditchfield, who is now president and general manager.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Galt, Ont.—The building for the gas purification plant at Glenwood has been completed, and machinery is now being installed.

Guelph, Ont.—The Taylor-Forbes Co. have started their factory working on practically full time, and all their old employees have been notified to get back on the job.

Macleod, Alta.—Friction between City Engineer Altham and the Natural Gas Co., has terminated in the gas being removed from the city power house, and coal furnaces being re-installed.

Port Colborne, Ont.—The Canadian Union Furnace Co. have found it necessary, owing to the scarcity of work and the decrease in demand for their product, to lay off their men for a time at least.

Sidney, N.S—Some activity is being witnessed in connection with the Dominion Iron & Steel Co., according to recent reports. It would appear that the company is getting a share in the business formerly sent to Germany.

Redcliffe, Alta.—Mr. McKellis, of the Imperial Brass Co., Chicago, expects to visit Redcliffe shortly with regard to the consideration of tenders which have already been received for the construction of the company's new plant here.

Manufacture of Shells.—A Canadian commission has been appointed to inquire into the feasibility of the manufacture of shells in Canada for the Canadian and British field artillery guns, and a meeting was held at Valcartier recently. The members are: Thos. Cantley, general manager Nova Scotia Coal & Steel Co.; Col. Bertram, Montreal; Geo. W. Watts, Lieut.-Col Lafergie and A. G. Carnegie, Toronto.

St. Thomas, Ont.—A special meeting of the Board of Water Commissioners, was held at the city hall last Thursday morning to consider tenders for the work of installing boilers at the waterworks. Two tenders were submitted as follows: H. M. Morton, $1,230; J. S. Belbin, $1,343. The tender of H. M. Morton was accepted on the understanding that he give satisfactory security for the completion of the work.

Swastika, Ont.—Shipments for the month of August, outside of the Cobalt silver field, consisted only of gold and nickle. The Tough-Oakes Mine which is producing high grade gold ore at a phenomenal rate, shipped 61,680 pounds to the smelter at the latter end of the month. Over a million pounds of nickel ore came from the Alexo Mine at Iroquois Junction. While the war has seriously crippled the nickel market, the Mond Nickle Co. continues to produce, and as the Alexo ships to the Mond it may be said that this property will still be able to market its product.

Electrical

Bolton, Ont.—The tender for the $9,500 Hydro debentures was awarded to the Bolton Light, Heat & Power Co. at a special meeting of the village council. Their price was $9,215.

Fairbanks, Ont.—A deputation has been appointed to interview R. J. Fleming, of the Toronto Electric Light Co., as to the possibility of obtaining street lighting facilities for the district.

Kingston, Ont.—J. M. Campbell has offered to supply 700 horse-power of electrical energy to the city from Kingston mills at ¾ of a cent per killowatt hour. The offer will be put to a vote of the people.

Simcoe, Ont.—The bonds for Hydro-Electric extension to Simcoe have been sold. Work will commence at once, and the current is promised by November 14. If possible, the circular annex of the old gas plant will be used as a transformer station. The foundation and walls are in excellent condition.

Galt, Ont.—The installation of the ornamental street lighting on Main St. commenced on Sept. 16, when a gang of men was placed at work cutting out a strip of the cement sidewalk along the curb on the north side, where the conduit to carry the wires will be placed. The work will be rushed along as fast as possible.

New Toronto, Ont—At a meeting held on Sept. 14, the Hydro Commission resolved to extend the street lighting service into Etobicoke Township along the Lake Shore road, as far as Brown's line, about one mile from where the present service ends. This will give street lighting a little beyond Long Branch and also supply lighting for domestic purposes to Lake Shore Gardens and several streets running off the main route.

Municipal

Montreal, Que.—All work on the new filtration plant has been suspended until the spring.

Belleville, Ont—The tender of Wm. McGie of $1,975 for installing a new heating plant in the city building was accepted. The tender was the lowest.

Humboldt, Sask.—A by-law will be prepared providing for the raising of the sum of $5,000 to cover capital expenditure for electric light extensions.

Regina, Sask.—The Provincial Government propose spending $500,000 on road work, which will be executed by farmers who are the victims of crop failure, and are in need.

Winnipeg, Man.—The Manitoba Legislature has adjourned after a four days' session, in which the new loan for $2,000,000, to be expended on public buildings, was approved.

Kingston, Ont.—Dr. Amyot and J. A. Dallyn, of the Public Health Department, Toronto, opened the new sewage plant at Rockwood Asylum on Sept. 19. The works are considered to be the most modern now in existence.

Toronto, Ont.—A busy session of the Scarboro' Township Council was held on Sept. 14. Hydro Radial by-law, to be voted on October 19, was given its second reading. Taxpayers will be asked to vote that the township guarantees the bonds of the commission for $567,000 of the total issue of bonds.

Montreal, Que.—By a vote of 29 to 1 the City Council at a special meeting on Saturday rejected the recommendation of Mayor Martin and Controllers Herbert and Cote, to purchase the plant of the Montreal Water & Power Co. at $8,000,000. The only alderman opposing the council vote was Alderman Turcot.

Vancouver, B.C.—H. H. Stevens, M.P., on his return recently from Ottawa, announced that the Government would carry on to completion all public works under way in this city. While new undertakings will be restricted to those absolutely necessary, the Dominion Government will not curtail the public work in any other way.

Peterborough, Ont.—At the meeting of the power committee on Sept. 15, Mr. Robinson, of Toronto, general manager

Grey Iron and Car Wheel Foundries of C.P.R. Angus Shops

Staff Article

It were only natural to expect that the foundry layout and equipment, materials employed, methods adopted, efficiency and economy of production achieved, would be at least commensurate with the other departments of this, the principal new and repair work plant of the Canadian Pacific Railway. That such is the case, a perusal of the accompanying article amply bears out.

THE Angus shops of the Canadian Pacific Railway Co. are among the largest of their kind on the American Continent, and are by far the largest industrial shops in Canada. They are situated in Montreal toward the northern limits of the city, on rising ground, and command an uninterrupted view of the eastern portion of the city and the river beyond.

There are two separate foundries in connection with the works. They are known as the Grey Iron Foundry and the Car Wheel Foundry. The C.P.R. use all steel wheels on their passenger coaches, and cast iron wheels on their freight cars; but as the latter vastly outnumber the passenger coaches, the quantity of wheels required from the car wheel foundry is of necessity large. All of the cast iron that enters into the construction of the locomotives and cars is made in the grey iron foundry. In the days when most cars were constructed of wood, a great deal of cast iron, especially malleable castings, was employed in their construction, but, since the era of the steel car has dawned, less and less cast iron is used in this connection. However, the larger locomotives, and the greater number in use, have tended to equalize matters, and the volume of work has remained about the same. Of course, in the recent dull times a great falling off has been experienced. The freight business of the company, however, has not suffered in the same measure as the passenger traffic, and, as a consequence, the wheel foundry continues to run at nearly full capacity. The Western wheat has to be moved, and this business usually taxes the capacity of the railways, so at present it is desired to have all the rolling stock possible available for use.

Grey Iron Foundry—Sand.

The sand used in this foundry is delivered in cars and shovelled into the sand storage department. There are two kinds of sand used—the Hamilton and South Amboy. The former is shipped direct to the works in cars, while the latter is conveyed by water to the city wharves, and there transhipped into cars and hauled to the foundry. Hamilton sand is used for the lighter classes of castings, including bench and snap flask work, while the larger and heavier work is all done in the South Amboy sand. From the sand storage the new sand is conveyed to the floor in wheelbarrows and introduced as required. Some of the burnt sand is conveyed to the core room, where it is used in the central portions of the larger cores. Burnt sand is also used in the making up of cupola bottoms. Eventually it finds its way to the dump.

Patterns and Core Boxes.

All patterns are stored in a building adjacent to the foundry. No pattern is ever destroyed unless the type of locomotive or car of which it forms a part has become obsolete. Thus the number of patterns which have accumulated is enormous, and the system of caring for these patterns and keeping track of them is a more or less elaborate one. They are often of a more or less irregular construction, and care must be taken to prevent them from becoming warped. Each pattern is numbered and so classified that it can be located on a moment's notice. The foreman pattern maker is responsible for all patterns.

All special core boxes are stored with their patterns. When a pattern is required from the pattern vault an order

GENERAL VIEW OF INTERIOR OF GREY IRON FOUNDRY.

is placed on the foreman pattern maker by the foundry, giving particulars of the pattern required and the store order number to which the casting is to be charged. Thus, when a pattern is issued to the foundry, its core boxes accompany it. The foundry clerks receive their orders from the office, and, after receiving a pattern, attach to it a card giving full instructions to the moulder, who in turn fills out blanks on the card regarding his time and other remarks that may be necessary. While a pattern is in the sand, the cores are being made, and in this way the cores are always ready to be placed in the moulds when these are completed and ready to be closed up.

Nearly all the patterns are made of No. 1 white pine. They are varnished with shellac, cut in alcohol, and colored with lampblack. Other patterns are made of white metal and aluminum. These metal patterns are, however, used largely for brass and malleable castings which are not made in the Angus foundries. There are also some patterns of cast iron, but these are limited in number. When the cast iron patterns are used, it necessitates the use of a crane in drawing, for if of any size they are naturally so heavy that if drawn by hand bad results are almost sure to follow.

Flasks.

The size and construction of locomotives have made such rapid strides in the last quarter of a century that a large variety of patterns has accumulated. To mould many of these special flasks have been constructed. These flasks have all been preserved and are stored in the yards. They are preserved until the patterns for which they were made have become obsolete. The great majority of the flasks are made of cast iron. However, when a pattern will only be used for a few times at most because of its being of special design, a wooden flask with metallic pins and fixtures is constructed. There are many of these wooden flasks. Several carpenters are kept constantly employed changing flasks or putting in special bars in copes and other similar pieces of work.

When special anchoring out of the sand in a cope is required many little ideas are applied to make the anchored part solid. Thus, often there is considerable work entailed in fixing up copes and boxes. This work is of a varied nature, and is under the direct supervision of the foundry foreman. Very little snap flask work is done, and only a small amount of bench work is required. The reason for this is that locomotives are not built in large numbers, and there are relatively few small or light parts of cast iron. There are, however, three moulding machines installed. Many of the larger flasks can be made to take various patterns by making small alterations in the drags and copes of the boxes. In this way it is contrived to reduce the exceedingly large number of flasks that would otherwise accumulate. The flasks are all classified, and under the care of one man, who can at all times locate requirements upon short notice.

EXTERIOR OF GREY IRON FOUNDRY WITH PATTERN STORES ON LEFT.

EXTERIOR OF GREY IRON FOUNDRY SHOWING SCRAP PILE.

Core Room.

Adjoining the core room are seven core ovens, each equipped with a flat car, which rolls into the oven on tracks. The ordinary round cores are made up in a machine and kept in stock. Sizes from three-eighths of an inch to seven inches can be produced in this machine. In preparing the sand for making the cores, no flour is used. Several core compounds are used, experience having shown that some makes are better under certain conditions than others. A Blystone batch mixer, manufactured by the Blystone Mfg. Co. of Cambridge Springs, Pa., prepares the sand used in the larger cores. This machine is belt connected to a 3 h.p. Canadian General Electric Co. motor.

The Iron Feature.

Most of the scrap is obtained from the rolling stock turned in for repairs, and since the advent of the all-steel car there has been, if anything, more of a surplus than a shortage of scrap iron. All scrap is kept out in the yard, although there is always a sufficient quantity for immediate needs kept in the small yard between the foundry and the pattern vault. This yard is equipped with a ten-ton Whiting electric travelling crane. In that portion of the yard served by the crane a considerable quantity of pig iron is also kept. The crane is also used for elevating coke and other materials to the level of the charging floor, and one of the numerous spurs which serve all parts of the yard, conveys all materials to a point where the crane can take charge of it.

There are three standard mixtures of grey iron used. The first is the "cylinder mixture" from which cylinders and other castings required to withstand excessive wear and great heat are made. It is the best grade and closest grained iron of the three. The second is called the "machine mixture." This is used for all castings which have to be finished on machines. The third is known as the "common mixture," and is used wherever a casting need not be finished with a machine or tool.

General Practices and Equipment.

The foundry has been equipped throughout practically by the Whiting Foundry Equipment Co., of Harvey, Ill. The main section has two 10-ton electric travelling cranes installed. One of these is of English manufacture, being a Royce crane; the other is a Whiting. Most of the ramming is done by hand. Air is however available throughout the shop, and is used mainly for blowing out moulds, spraying blackwash, and in the moulding machines and vibrators. There are four pneumatic air rammers used in the cylinder moulds and other large work.

Running along each side of the shop is a small narrow gauge track with turntables and cross tracks laid at various short distances. Ladles mounted on trucks are used to convey metal to the various parts of the shop in quantities up to one thousand pounds. From these truck-ladles, metal is poured into bull ladles and hand ladles. Various other ladles having capacities of 2½ and 5 tons are also used, but they are handled entirely by the overhead electric cranes. It is not often that a ladle of greater capacity than 5 tons is required, because about the heaviest casting produced is the cylinder casting and this, in the case of the larger locomotives weighs rarely over four tons. Some of the larger castings commonly made are superheater headers, cylinders, cylinder bushings, pistons, piston rings, cylinder heads, sand boxes, domes, smokestacks, foot-plates, driving-wheels, etc.

The large ladles are all equipped with a hand wheel and a train of gears for tipping. In the train of gears there is a worm and worm-gear, so that the ladle locks itself at whatever angle it is inclined. The smaller track ladles are tipped by hand. They have, however, a locking device which keeps them in an upright position while being transported about the shop.

Two jib cranes are provided for use in making cylinder moulds and other heavy work. These cranes are designed to lift 10 tons, and are operated by hand. The whole cylinder mould is in reality a dry sand core, and these cranes lift the whole moulds on the core oven trucks, when they are to be put in the ovens to bake. In other large moulds, these cranes are used for lifting the copes, drawing heavy patterns from the sand and such other work as requires a heavy lift applied slowly and for some considerable time. These cranes are made entirely of steel. The length of the radial arm is about 18 feet.

Cupolas.

The foundry is equipped with two cupolas, one having a capacity of 12 tons per hour and the other a capacity of 22 tons per hour. There is also a 5-ton reverbatory air furnace, where more or less work of an experimental nature is carried on. The work is experimental in as far as the various percentages of carbon, silicon and other elements which enter into the composition of the iron are concerned.

The wind blast is supplied by a positive Root's blower driven by a 75 h.p. Canadian General Electric Co. motor. The blower operates at a constant speed and supplies the blast for both cupolas. The air is by-passed and is thus supplied to the cupolas at a constant pressure of 9 inches. Each cupola is fitted with six tuyeres through which the blast is introduced.

Castings.

The castings, after having been shaken out, are taken over to the cleaning room. All pieces up to 350 pounds in weight are put into the tumbling mills. With them are placed smaller castings, iron stars, etc., so that upon removal from the tumblers the castings are perfectly free from sand. Rough fins and burs are removed by emery wheels, of which there are several in the cleaning hoom. When ready to leave the cleaning room the castings are placed on trucks and conveyed to the various parts of the machine shop, where they are to be machined.

INTERIOR OF GREY IRON FOUNDRY SHOWING CORE ROOM.

Employees' Welfare.

In no department has the welfare of the employee been overlooked. Lockers are provided with shower baths. The latter are very attractive and are used daily by all the employees. The plant has several lunch counters situated on its grounds, where the wants of the employees are well looked after at nominal prices. As well as the regular meal at a fixed price, there is also an a-la-carte service, which is often more attractive to some men. Thus in as far as wash rooms and shower baths and the noon lunch arrangements are concerned, the C. P. R. Angus shops are far ahead of the large majority of industrial plants.

C. P. R. WHEEL FOUNDRY.

THE car wheel foundry is an entirely separate establishment from the grey iron foundry. The Hamilton and the South Amboy sands are also used here, but they are mixed; two parts of South Amboy sand to one of Hamilton being about the usual run of the mixture. This has been found to give the best results.

Patterns.

There are three distinct types of wheels which are recognized as standard by the Master Car Builders' Association. These are the 625, the 675, and the 725 pound wheels. Another type is also recognized but it is more or less special—the 880-pound wheel. This type being very heavy, is only used on the largest cars, those with a capacity over 100,000 lbs. It is also used on locomotive tenders. Thus there are but few pattern types, although a large number of patterns of each type. The patterns are constructed of No. 1 white pine and varnished with shellac colored with lampblack.

Flasks.

As the work is of a standard nature and all wheels are chilled, the flasks are practically of the same design and built specially for the work. When the foundry is operating at anything like full capacity, the flasks are nearly all in use and there arises no necessity for storing them outside. As a matter of fact they are nearly always to be found on the foundry floor.

Core Room.

There are in connection with the core room three core ovens all equipped similarly to the ovens in the grey iron foundry. Here, however, no core compounds are to be found, flour being used exclusively. The reason is that the cores are swept up on cast iron shells and baked in the latter. When cores, into whose composition a commercial core compound has entered, are baked in iron shells, it has been invariably found that the core sticks to the iron so tenaciously that its destruction is caused by removal. Trouble of this nature has never been experienced with flour, hence its exclusive use here.

Methods.

Every moulder has a helper, and upon commencing work in the morning they first begin to mould. Between nine and ten in the morning the day's floor, which cosists of twenty or twenty-one wheels for each moulder and his helper is completed and the pouring is started. The moulder and helper pour their own moulds, shake them out while the castings are still red hot, and place them in the annealing pits. As soon as the lot of wheels are in the pits, the day's work is complete.

Cupolas.

There are two cupolas of 22 tons capacity each per hour. Only one cupola is used at a time. Thus each cupola is fired every other day, while its mate is idle. The vein is tapped from the cupola into large 10-ton mixing ladles, which are tipped by electric motors, being mounted on fixed trunnions. In front of them runs a small narrow-gauge track which conveys a train of truck ladles. These ladles are conveyed the length of the shop by means of the tracks, and are carried across the foundry by overhead carriers to the rows of moulds. Each ladle carries about one thousand pounds of metal, or sufficient to pour one of the heaviest wheels.

Iron.

The iron mixture consists largely of old wheels with a little pig iron and malleable scrap thrown in. The principal endeavor is to keep the iron low in silicon. The old wheels are rolled in from the yard and taken to a crusher where they are broken up. The charges are all carefully weighed up and taken to the elevators which convey them to the level of the charging floor. The coke is also unloaded from cars into coke waggons which are elevated to the charging floor by these same elevators. The average melt is about 120 tons per day.

INTERIOR OF GREY IRON FOUNDRY SHOWING CUPOLAS.

Both cupolas were erected by the Whiting Foundry Equipment Co. of Harvey, Ill., and the air blast is furnished by a positive Root's blower, which is driven by a 75 h.p. Canadian General Electric Co. motor. The air is also by-passed into the cupolas. Each cupola has six tuyeres through which the air blast passes. The iron is tapped first into the big mixing ladles, from whence it is poured into the track ladles and thence into the moulds.

General Practices.

Soon after the iron has set in the moulds, the wheels are knocked out of the sand and taken to the annealing pits. There are sixty-six annealing pits and each pit can treat twenty-one wheels. For four days the wheels are left in the pits to allow the annealing process to be completed. When the castings are removed from the pits they pass on to the cleaning room, where the cores are removed and the loose sand brushed off. Next the final inspection takes place and they pass on to the storage platforms in the yards, and from there to the machine shops as required.

Tests.

A test piece is cast from every fifteen ladles. These test pieces are cast in small iron moulds 6 ins. x 2 ins. x 1½ ins., and are tested only for the depth of chill. Other pieces are cast in sand moulds 1¼ inches square by 24 inches long. These pieces are broken between 12-inch centres.

Three wheels from out of every hundred are taken and subjected to various tests. The first test is a thermal test, the wheel being placed in green sand with flange downward. A circle of molten metal, 4½ ins. deep by 1½ ins. wide, is run around the rim of the wheel. When two minutes have elapsed from the time pouring has ceased, the wheel is examined for checks, while another wheel is examined for depth of chill. All these tests are recommended by the Master Car Builders' Association.

Further tests recommended by this association are also applied to the car wheels. The tape test is perhaps applied in a somewhat different manner than by some other institutions. The nominal diameter of a car wheel is 33 inches and, to use the technical phrase, wheels are allowed to vary two sizes either way from their nominal diameter. A size represents about a 1/8 in. variation in circumference. All wheels are measured and their sizes marked; thus when pressing wheels on axles it is always endeavored to place wheels of the same diameter on the same axle. It is quite easily seen that wheels thus mated will wear a great deal longer than if there were an appreciable difference in their diameters. The average life of a wheel is about six years and, during that period it is estimated that it runs about 70,000 miles.

General.

In conclusion there is but little further to add. Both foundries are furnished with the very best of equipment and in regard to the conditions surrounding the employee we can safely say he has been in no way overlooked. The men under whose supervision the foundries have fallen are every one alive and progressive. Thus, with an excellent executive guiding the work, with the best of equipment and materials and a contented body of employees, there can only be one result—a product of high quality.

EXPLOSIONS IN ENGINE CRANK CHAMBERS

AMONG the explosions of various kinds that came under an inspector's notice, it is interesting to note the record of oil explosion in the crank chambers of high-speed engines. The inspector for the N.W. district of England reports three explosions of this nature—two in the crank chamber of gas engines, and one in the crank chamber of a steam engine in an electric generating station. Similar explosions have been reported in recent years, with fatal results, all of which occurred in engines of the enclosed type, with superposed cylinders, in which the engine framing is constructed as a hollow chamber to hold the lubricating oil in which the cranks, crank shaft and eccentric run.

A special oil with a flash point of 400° to 450° F. is generally used, and its constant agitation by the engine cranks not only raises the temperature (records in unventilated chambers show temperatures of 150° to 160° F.), but causes a fine spray or mist of oil to fill the chamber. This mist contains oil particles in such a finely divided state that it requires only a spark or overheated surface to cause ignition.

Explosions in crank chambers of steam engines have been caused by ignition due to defective lubrication and overheating of the slides. In gas engines, ignition may be due either to escape of heated gases round the trunk pistons, or to vaporized oil coming in contact with an overheated piston, or possibly to splashing of oil into the cavity of the trunk piston, where it dries and forms a deposit of carbon, which may become incandescent from an overheated piston, and thus ignite the oil vapour.

Removal of the combustible gases by means of plenum ventilation has proved the solution of the trouble with gas engines, but it is not clear if the same means would equally answer with steam engines, although plenum ventilation would reduce the temperature of the crank chamber. Percentage analyses of gases from the crank chamber of a gas engine, A before and B after plenum ventilation has been installed, are given below:—

ANALYSIS OF GAS ENGINE CRANK GASES.

	CO_2	CO	CH_4	H	O	Combustible Gases.
A	4.4	10.4	Nil	Nil	11.6	10.4
	0.4	Nil	Nil	Nil	19.6	Nil
B	0.2	Nil	Nil	Nil	19.6	Nil

Temperature of oil in crank chamber (B) 131° F.

Previous to the installation of plenum ventilation at the works from which the above results were obtained, both water cooling and natural ventilation (by connecting up the crank chamber to a mill chimney) had been tried, but neither method nor a combination of the two gave satisfactory results, and, after a further explosion, plenum ventilation was installed.

WHEEL AND RAIL FRICTION.

THE coefficient of friction between wheels and rails is a variable quantity, depending on the condition of the rails and the state of the weather. The author of an article in a German paper on this subject deals with the extent to which it is possible to utilize to the best effect any given coefficient of friction according as steam or electric traction is employed. With an ordinary steam engine with two cylinders, the torque is by no means uniform, and the coefficient of friction cannot be taken as being more than 1/6, having regard to the largest value of the torque, whereas with a similar electric locomotive, in which the torque is constant, the coefficient might be taken as 1/5.

The next question is as to whether the electric motor, either direct-current or single-phase or polyphase, can be rightly considered as having a constant torque, and this depends not only on the motor itself, but also on the methods of control and the various stages provided by the controller. Experimental work on the Prussian State Railways with regard to this point is described, and it seems that, generally speaking, the coefficient of friction with electric traction can fairly be taken as being 20 per cent. greater than that with steam traction.

ELECTRICAL PROTECTIVE DEVICES.

WRITING in the Vulcan of September, J Gardner says the protective devices installed in modern generating stations probably represent the highest standard of design and workmanship in the entire installation, and the cost of the switchboard frequently falls not far short of the generating plant it controls. In the old days, however, few or no protective devices were installed. For instance, in a power station still running there are several 2000-volt 300-kilowatt single-phase generators controlled by open single-pole switches of the simplest type and without even a fuse in circuit; one side of the system is earthed. Everything operates quite satisfactorily until a cable goes to earth or someone makes a mistake; then there is a serious accident.

A case of this kind recently occurred. A direct-current generator coupled to a steam engine was being run up in readiness for paralleling with other machines. When the volts were about 100, the attendant closed the main switch by mistake. Although the fault was discovered immediately, the rush of current into the machine pulled the armature winding partly round the core, and some of the commutator segments were nearly forced out of the V rings. The driving pins in the armature were sheared off and the insulation of the core was damaged. The armature had to be entirely re-wound and the commutator rebuilt.

Machine Gun Battery.—The machine gun battery mounted upon automobiles which has been financed mainly by the Hon. Clifford Sifton and was mobilized at Ottawa, has left for Valcartier. It comprises 15 protected high speed automobiles with quick-firing guns, automobile ambulances and machines for reconnoitering. The motor cars have a speed of 50 miles an hour and this unit will be one of the best and most efficient component parts of the Canadian division. The recruiting of the 150 men, all of whom are qualified chauffeurs, or mechanicians, has been attended to personally by Jack Sifton

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

AN INEXPENSIVE BENCH GRINDER

By W. G.

THE small bench grinder herewith described was designed and made with the object of providing a simple and efficient machine, all the

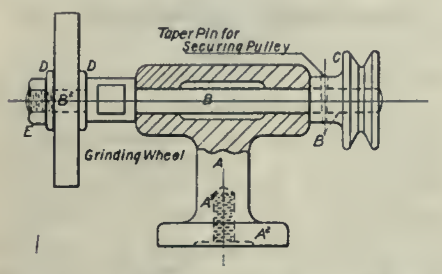


FIG. 1. INEXPENSIVE BENCH GRINDER.

work in connection with which could be done on a 12-inch screw-cutting lathe without the addition of special tools, fixtures, etc. The work for which the machine was made consisted of the grinding of the more delicate cutting tools for which the regular shop grinder was unsuited. The grinder must also be efficient, cheap and so constructed that duplicate parts can be readily made at any time.

Figure 1 is a part longitudinal section showing its general arrangement. Figs. 2 and 3 are detail views of the body casting, spindle, pulley and clamping washer respectively. The head stock, A, consists of a cast iron bracket of circular section as shown, which is bored out to a nice running fit for the spindle B. It will be noticed that the central portion of the said hole is recessed to provide clearance for the spindle and to facilitate boring. The base is also recessed for clearance at A^2, and the hole

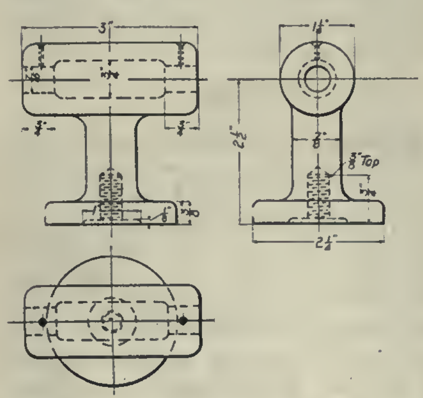


FIG. 2. INEXPENSIVE BENCH GRINDER.

A^3 is drilled and tapped for a stud. A stud has been found more suitable for this purpose than a cap screw as it is much easier to get the nut on.

The spindle part B, is made of mild steel and consists of a bar having at one end a reduced stem part, B^1, and at the other a screw neck, B^2, for the purpose of receiving the grinding wheel. This should be an easy running fit in the bore of the body catsing. The pulley is shown at C, Fig. 1. This is made of cast iron and is machined all over to preserve true running and balance of the spindle. The clamping washers, D, two of which are used, although constituting the simplest parts of the machine, should be made very carefully. These are made from the bar and are bored out and faced before being cut from off. The nut was faced on a mandril after being threaded an easy fit for the screwed part of the spindle.

After arranging for lubrication, either in the hollow of the body casting or by separate oil holes, the machine is ready to be assembled and put into service. Care should be taken to see that the wheel is not too tight on the spindle and

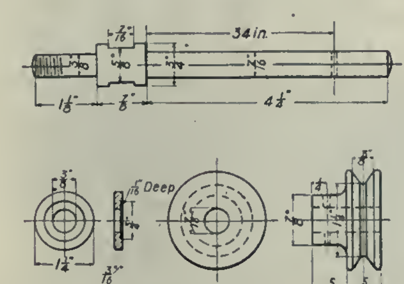


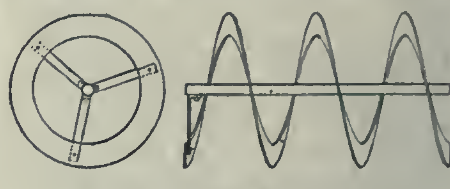
FIG. 3. INEXPENSIVE BENCH GRINDER.

that it is properly trued up. This machine fulfilled the requirement of cheapness, and if required to be made in quantities, would easily lend itself to the operations of automatic machine tools.

SPIRAL CONVEYOR QUERY.

Will you please ask some of your readers through the medium of your journal to suggest the easiest and cheapest way of making the spirals for conveyors, as shown in the accompanying sketch. The spiral is made of wrought iron, 1 x ¼ in., is 18 in. outside diameter and 3 ft. long, having three complete turns in this length.

This is a repetition job, and is made in a large variety of sizes. The only tools at our disposal are the ordinary bending rolls, such as are used by boiler makers. Hitherto this has been largely a rule of thumb job, both in getting the correct diameter of coils and calculating the exact length of strip required for a certain number of turns and a given extension. If the tools mentioned are not applicable, the writer would like to know of the



SPIRAL CONVEYER QUERY.

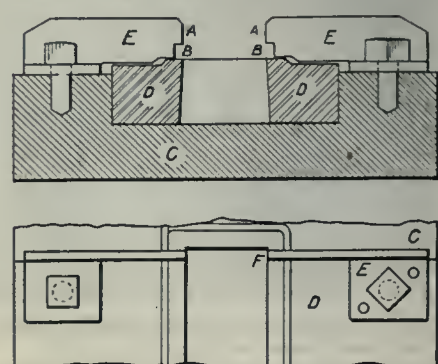
simplest possible device to satisfactorily do the work.—J. Davis.

A CHEAP STRIPPER

By X. Y. Z.

WHEN putting strippers on blanking dies for cutting round or rectangular pieces from a strip, it is usual to employ a plate stripper made of stock generally from ¼ to ⅜ in. thick. This must have a hole worked out to fit the punch, and must clear the strips that guide the stock. When the material to be punched is not too heavy, small pieces E E, as shown in the accompanying illustration, may be used instead of the plate.

The cast iron die shoe C carries the tool steel die ring D. The mild steel pieces E E are cut out and bent, as shown, and are fastened to the shoe by dowels and cap screws. These pieces serve not only as strippers, but guide the stock as well. The points A A just clear the punch, and the stock slides easily between points B B. When the punch rises after cutting a blank, these projections at A A strip the metal from the punch. Four of these are required, two on each side of the die, and, if the die



A CHEAP STRIPPER.

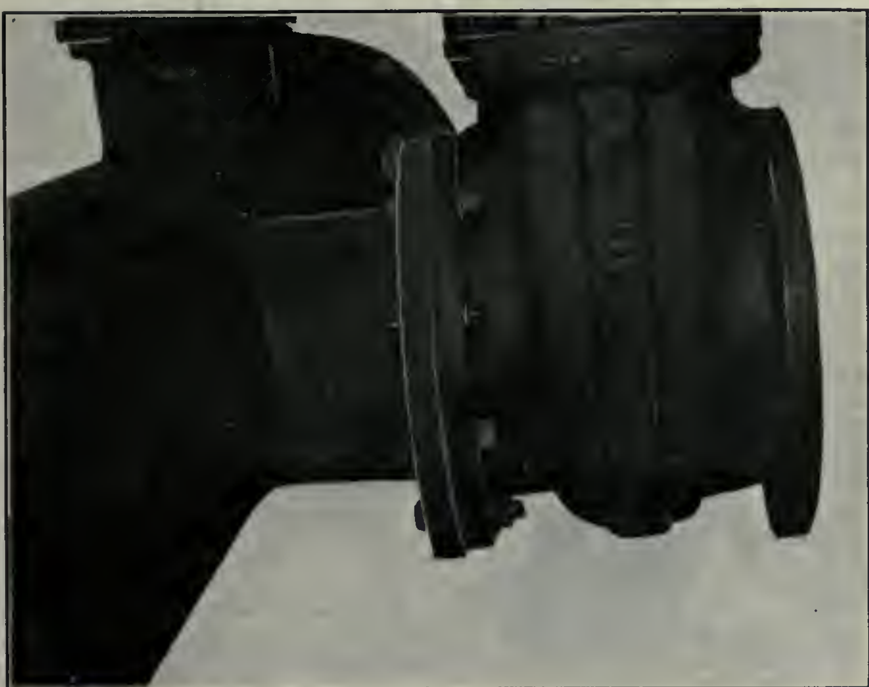
be square or rectangular, they should be located close to the corner, as at F.

The writer has found this method of stripping to work very satisfactorily on round or square blanks, and has also used them on many odd shapes. The stripper also leaves the die and gauges always in sight of the operator, and enables him to turn out more work, as he can, at all times, see just what is going on. Pieces of scrap, which often clog the ordinary stripper, especially when narrow stock is used, can easily be removed, and the cheapness of the device is also a strong recommendation for its adoption.

EXHAUST HEADER WITH WELDED NOZZLES.

By F. K. Blair.

THE illustration shows an 18-in. exhaust header in the plant of the London Electric Co.,London, Ont., to which has been welded a 10-in. and 12-in. nozzle, the former being the exhaust connection from three high-speed engines, and the latter a connection to one of three condensers. In addition to the nozzles shown, which, by the way, came quite close to each other and at right angles according to the layout, numerous other 10-in. and 12-in. connections were made by welding, none of them, of course, being on piping subject to high internal pressure.



EXHAUST HEADER WITH WELDED NOZZLES.

The particular advantage derived from having the nozzles welded was that of getting connections close together where these were desirable, without the complications of crowded-up fittings and a multiplicity of joints. Perfect satisfaction of service is being rendered by the various joints, a circumstance more or less complimentary to Green & Sloan, Bredalbane street, Toronto. who carried out the work.

GAS POISONING.

THE following is an extract from a table made up from cases reported as accidents under Section 4 of the British Notice of Accidents Act, 1906, which serves as some guide of the frequency of cases of poisoning by gases:—

Nature of Gas or Fumes.	1913.	1912.
(1)	(2)	(3)
Carbon monoxide	59^{7}	91^{13}
(a) Blast furnace......	20^{3}	33^{5}
(b) Power (suction producer, Mond, Dowson)	21	19^{4}
(c) Coal	9^{4}	29^{2}
(d) Other	9	10^{3}

The small figures relate to fatal cases, and are included in the principal figures.

Blast Furnace Gas.—Among the 20 cases with three deaths reported from blast furnace gas, eight occurred in charging at the cupola, eight from cleaning operations, mainly of flues, and three in repair work. One of the fatal cases occurred to a tar still man in an iron and chemical works who, towards the end of a double 12 hours' shift, retired to lie down on a bench in a small shelter fitted with a door and heated by means of the furnace gas supplied by a 1 in. pipe. When his father came to relieve him the man was found unconscious. The gas was turned on, but was out either as the result of fluctuation in the pressure or of the deceased's foot touching the tap. The door of the shelter was closed.

Power Gas.—Of the 21 cases, one occurred in starting the plant, two in stoking, twelve in cleaning or repairing, and six by escape of gas from a leak in the purifier. In one case the workman, knowing the danger, entered the scrubber through a manhole. In another, the workman chose to lie down to rest beside the engine.

BLUE PRINT QUERY.

I would much appreciate any information you can give me as to the causes and cure of our blue print trouble. We have a roll of sensitised paper and find that we cannot get clear white lines as we have done before. Upon a short exposure, we get blue lines and a pale blue background and, on washing, the lines disappear. When the print is exposed for ten minutes, a white background with blue lines appears, which also washes out. The paper has been carefully stored in a dark room for some time.—G. Barrett.

Answer.—The first exposure mentioned is a little too short, and the ten minute exposure is certainly too long. About two and a half minutes in the sun should give good results. Many blue prints can be improved by over-exposure and dipping in a solution of bichromate of potash before washing.

The paper is probably too old. In winter time blue print paper will keep for two months if properly stored, but during the warm weather of summer, one month of usefulness is all that could be expected of the unexposed paper, and, if used after this, its behavior is liable to be erratic.

OXIDIZED FINISH FOR SHEETS.

IN the ordinary oxidation of iron or steel sheets by air, a deeply oxidized, hard light blue finish is secured which is said to be not always uniform throughout the surface, while ordinary oxidation by steam results in a superficially oxidized soft and dark blue finish. A patent (1,105,251, July 28, 1914), granted to John E. Carnahan, Canton, Ohio, has as its object the giving of such sheets a deeply oxidized hard and uniform dark blue finish. The new process consists in heating the sheets in an annealing box to an annealing heat and then separately exposing the heated sheets to the air. They are then again heated in an annealing box to a dark red temperature not sufficiently high to decompose the air-formed oxidation on them, after which they are permitted to cool while in the annealing box, steam being introduced into the box while they are both being heated and cooled. It is claimed that this further oxidation by the steam not only darkens the blue color, but renders it uniform, and that it serves to soften any excessive hardness from the previous oxidation.

OVERHAULING A DAMAGED THRUST BEARING.

IN a recent number of the Journal of the American Society of Naval Engineers there appeared the following paper covering the Overhaul of a Damaged Thrust Bearing, by Lieut.-Commander H. C. Duigen, U.S.N.

In the four-shaft Parsons turbine installation where a h.p. and i.p. cruising turbine are employed, the two cruising turbines being on the inboard shafts, there is considerable excess propeller thrust on the l.p. thrust collars, whose shaft also carries the i.p. cruising turbine, when going up to speeds near the limit of this combination. Under these conditions, with the propeller thrust taken on the lower shaft rings, the l.p. thrusts of the shafts that carry the i.p. cruising turbine are quite susceptible to heating, and this thrust has been burned out on several vessels. There is usually sufficient surface in the l.p. thrust collars, and the thrust will operate quite satisfactorily provided the bearing of a sufficient number of the collars on their surface is true.

On one vessel this thrust operated without trouble for a long period, until one day, when it was desired to speed up to 19 knots quickly, the thrust heated rapidly and could not be cooled till the combination was shifted so as to release the excess thrust and allow the rotor to move out. Previous to this, speeds as high as 20 knots had been run on this combination for long periods with thrust quite cool. In connection with this matter it has been noted that the rotor comes in harder, and there is considerably more propeller thrust when in shoal water. The worst condition for heating is therefore in speeding-up quickly on the i.p. combination in shoal water. When the vessel is by herself this condition can be avoided to some extent, but when in formation any speed called must be quickly given.

Revealing the Trouble.

On anchoring, the heated thrust was examined, and about six of the collars and rings were cut and roughened. The surfaces were cleaned and stoned; but as there were only a few hours available to do this work, a thorough job could not be made of it. On trying this thrust again on the i.p. combination, it again heated up at about 17 knots. During an overhaul week, a few days later, the thrust was carefully examined. The clearance on bottom rings and go-ahead side of collars was measured by feeler gauges, with shaft in position, at intervals of 90 deg. The readings conclusively showed that the surfaces of the collars did not run true. The heated collars also showed that the most intense heat was at one part of the circumference, and this was the same part of the circumference on all the collars. Squares and straight-edges placed on the surfaces of the collars also showed that the collars were far from being true, and that they were not parallel to each other or normal to the axis of the shaft.

Spotting the shaft collars with red lead and bringing the thrust wings up to bear, and then revolving the shaft also clearly showed that the collars ran out, and the collars that bore touched only in spots on one side. The flange of the thrust shaft was trained to see whether the shaft ran out. The differences for different points of the circumference were so slight that it was apparent that the shaft itself was not bent. From the measurements taken it appeared that the surfaces of collars had not been machined true, but that there had been sufficient bearing surface to allow the thrust to run cool till, on account of some special circumstances, due perhaps to speeding-up quickly, an excessive load was produced and the heating resulted.

Remedying the Trouble.

To remedy the defective conditions, the following procedure was adopted:—The lower thrust-block shell carrying the rings taking the go-ahead propeller thrust was carefully cleaned up and put in place. The surface of the collars was carefully covered with red lead, the thrust brought up to touch, and then the shaft revolved. The first spotting showed number 6 collar to bear hard in two spots, and about five other collars bearing slightly in streaks for about 40 deg. on one side. The spots were then filed and the spotting process repeated. The second spotting showed about eight collars bearing in streaks part of the way around. The third spotting showed about ten collars bearing in rather heavy streaks about half-way around. Filing was then stopped, as it was feared to take off too much metal, and time was also limited.

Grinding-in Process Adopted.

A novel grinding-in process was then tried. The lower thrust block was put in place. A dummy adjustment jig which permits of rotors being moved in or out with a ratchet gear was rigged over the thrust collars to keep rotor in place. A mixture of bathbrick and oil was put on the thrust bearing and the turbine rotated at about 25 revs. with steam. The collars were brought to bear by means of the jig, and were moved up slightly tighter as the grinding proceeded. The supply of powdered bathbrick and oil was continually replenished while the grinding was going on. The brickdust and oil ground the surfaces in contact and tended to smooth them up. As the collars are of hard steel and the thrust rings of composition, most of the grinding would be done on the rings, however, some grinding and smoothing-up of steel surfaces would also result. This grinding was continued for about 2½ hours. The thrust block was then taken out and all parts of rings and collars carefully cleaned and replaced. After these adjustments were made, the thrust, though regarded with suspicion, ran satisfactorily up to nearly 18 knots on the combination for nearly three months, but on another occasion when necessary to speed up quickly in shoal water, it again heated badly.

The vessel arrived at the navy yard shortly after for a two weeks stay, and thus an opportunity for more carefully overhauling the thrust presented itself. The shell containing the rings was taken to the shop, and the edges of countersinks and all oil grooves were carefully milled out and the surfaces carefully smoothed up. The surfaces of collars were carefully dressed up with file and scrapers by two navy yard mechanics especially expert at this work. Then the process of spotting the collars with red lead and filing down high spots was repeated, but this was done more often than on first attempt. The work took two machinists six days.

When this spotting and filing had progressed so far that a fair bearing was obtained on most of the collars, and all the collars touched at some points, the surfaces were again ground in a bath of oil and brickdust for about three hours, running the turbine with steam at about 30 revs. per min. Everything was again carefully cleaned out. The process of cleaning out, spotting, and filing, and finally grinding-in, ensured surfaces being smooth. When the thrust was tried soon after this to the practical limit of the I.P. combination, it operated satisfactorily. This method of grinding-in a bearing is perhaps somewhat novel, but it appears to be quite effective, and accomplishes what might otherwise require a large amount of labor.

The Electric Vehicle.—Dr. Charles P. Steinmetz, of the General Electric Co., than whom there is no one who can speak more authoritatively upon the subject, predicts that within ten years there will be in operation not fewer than one million moderate priced electric vehicles whose approximate price will not exceed $500 with a speed certain to average 20 miles per hour. Against the gasoline cars he claims the disadvantages of fuel and oil costs, the concentration necessary in driving a high-powered machine and the need of constant attention to its engine. "Within a decade," he says, "the gasoline car will be relegated to the limbo of things outlived."

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

DONT'S FOR CUPOLA USERS.

By "Melter."

DON'T use a straight clay with fire-brick for cupola, but mix one part of clay with two parts of moulding sand which is more refractory than clay alone and possesses sufficient bond.

Don't skimp on the workman's tools; there should be two brick hammers, one 3-pound hammer, two small chisels, two steel bars, three water pails, one moulder's shovel, one straight-edge, two soft daubing brushes, two trowels, one slag hole pin, one tapping hole pin, two torches, two cupola picks, three bars for freeze-ups, one hoe, four hole stoppers, six tapping bars, one rammer, one ladder, and one broom.

Don't have the ends on hole stoppers of greater diameter than the bod or difficulty will be experienced in making the bod stay on the stick when cutting into the top of metal stream.

Don't leave the metal in the wind box exposed. Line it with silica sand and fireclay to a depth of one-half inch which will save the material and facilitate the removal of any iron which may be spilled into the box.

Don't use gangway sand for the cupola bottom for, if there be a large heat, the iron will cut. Use a mixture of new molding sand two parts, old molding sand two parts, core and gangway sand one part.

Don't put in too big a tapping hole; $1\frac{1}{2}$ ins. diameter and 6 ins. long is large enough for any cupola. If brest is over 6 ins. long, cup it out on the inside. For a brest mixture use moulding sand, white sand and fire clay in equal parts.

Don't let freeze-ups bother you, put a bod on the inside of tapping hole when putting in the bottom.

Don't be afraid of using too much wood when lighting up or, the iron will be cold. Make a frame box 4 ft x 4 ft. x 8 ft. for a 72 ins. diameter cupola to hold each day's requirements, and see that it is all thoroughly dried. Wood should be from 8 to 18 inches above top of tuyers and uniformly laid flat around cupola.

Don't put on all the remaining bed coke after the first has burned through but, as soon as cupola gases are ignited fill up places where bed has burned, and wait until the whole is cherry red and then charge evenly.

Don't throw in charges any old way, but put large pieces in first, then pack smaller pieces in holes and around lining, particularly well over tuyeres. Steel should be charged on the coke because it is there in closer contact with the carbon which it absorbs—after red heat—about 1,500 degs. F., until the melting point of cast iron is reached.

Don't use too heavy a first charge of iron. It should weigh not more than $3\frac{1}{2}$ times the weight of the bed coke.

Don't skimp on the bed coke, but rather cut the coke charges down after the first three. Sometimes a ratio of as much as 11 to 1 can be maintained.

Don't be afraid to increase coke if cupola is oxidizing excessively which will be noted by the condition of slag. If cupola be running right, the color of the slag will be brown, and if it is oxidizing in excess the color will be black, due to the excessive pressure of iron and manganese oxide. This oxidation can also be noted by an examination at the tuyeres and charging doors, and the conditions carefully noted.

Don't slag when you feel like it, but do it with consistent uniformity, and the iron will be of more uniform temperature and analysis, also freer from dirt.

Don't stick on the blast because it gives hot iron. Melt no hotter than is actually required, because the hotter one melts the greater the size of graphite flakes and the weaker the iron. Too hot iron possibly means more oxidation than is necessary; silicon and manganese cost money. Putting on blast will increase temperature to a certain point, after which there will be no further increase, but meanwhile the lining is being cut excessively.

TURBINE VS. GAS ENGINE FOR STEEL PLANTS.

SPEAKING before the Chicago Section of the American Institute of Electrical Engineers on "Power Problems in Steel Mills," F. G. Gasche made pointed reference to the shortcomings of the gas engine as an exclusive prime mover for steel mill service. Mr. Gasche's remarks were directed particularly to the four-cycle twin tandem type of large capacity, driving alternating-current generators. The unsuitability of this type of prime mover for exclusive use, granting that under steady load conditions the gas engine has enough advantages to warrant its supplying a part of the power required, was based in part upon the following facts:

A VOYAGE OF DISCOVERY.

Being an artist's idea of what an eminent German gentleman saw during his recent visit to British shipbuilding yards.—*Journal of Commerce.*

Investigation has not yet given sufficient data for determining accurately the extent of the loads thrown suddenly upon the prime movers in steel mills, particularly motor-driven mills. Supplying sufficient space capacity in gas engine units to carry these peak loads is accordingly a matter of guesswork, and especially so because the regulation of the gas engine of the type under discussion is hopelessly inadequate to the instantaneous character of the mill load variations. The weight that is required to be put into fly-wheel and rotor parts to equalize the load is entirely out of proportion to the effective capacity of the units, and the drag resulting from the inertia of these moving parts makes the question of adequate regulation impossible of satisfactory solution. The variation in torque inherent in the gas engine of this type as a prime mover, even under ideal conditions of constant load, is another essential handicap to its harmonious adaptation. The addition of the storage battery for the absorption of the peak loads, to the gas engine plant at some of the steel plants, does not provide a sufficiently flexible nor economical regulator of the load to offer a solution of the difficulties.

Mr. Gasche ventured the suggestion that a design of prime movers for a steel mill might provide 70 per cent. of the capacity in gas engines and 30 per cent. in steam turbines, in which proportion the probability of the power plant adapting itself to the load conditions would be improved in every respect. Against the future development promised in the field of the gas engine, the possibilities to be realized in the use of superheated steam, in the range of temperatures above 700° F., were regarded as even more attractive.

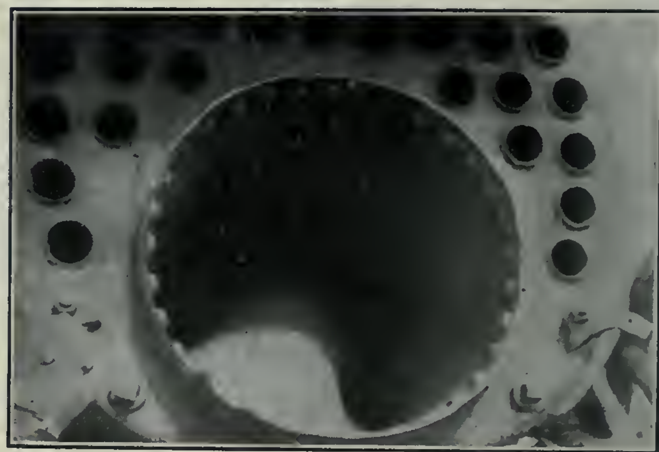
REPORT ON BOILER EXPLOSION.

THE Department of Public Works, Province of Ontario, has issued through its Steam Boiler Inspection office, the following report covering the explosion of a portable agricultural type boiler at Kincardine, Ont., on September 11 of this year.

Description of Boiler.

The boiler, as already stated, was of the portable agricultural type, with internal furnace, and rated at 10 or 12 horsepower. The shell, constructed in one course, was 39 ins. in diameter by 6 ft. 6 ins. long, of 5-16 in. plate with longitudinal seam, double riveted lap; the rivets being 5-8 in. diameter by $2\frac{3}{4}$ in. pitch. The heads were 5-16 in. thick, and the circumferential seams had $\frac{5}{8}$ in. diameter rivets of $2\frac{1}{8}$ in. pitch. The rear head was stayed to the combustion chamber head by $\frac{3}{4}$-in. screw stays pitched at 6 ins. by 6 ins. maximum. The furnace consisted of one course 21 ins. diameter, 60 ins. long. $\frac{1}{4}$ in. plate with longitudinal seam single riveted lap, and $\frac{5}{8}$ in. rivets, $2\frac{1}{4}$ in. pitch. The tubes were $2\frac{1}{2}$ in. diameter and numbered twenty-three. The segments above tubes were stayed by two 1-in. through stays. The boiler mountings were of the usual type, the safety valve diameter being $1\frac{1}{2}$ ins. This was manufactured by the Consolidated Valve Co., Connecticut. A single-cylinder horizontal engine was mounted on top of the shell and the outfit was manufactured by L. D. Sawyer & Co., Hamilton. The date of manufacture was not obtainable.

ASSEMBLY VIEW OF PORTABLE ENGINE AND BOILER



VIEW OF RUPTURED FURNACE.

Condition of Boiler After Explosion.

The furnace had ruptured and collapsed about three feet from the front end, tearing circumferentially. The longitudinal seam was on the bottom of the furnace and the rupture passed through the centre of a rivet-hole. The bottom half of the furnace at the point of failure was forced up to the crown and was torn about half way around the circumference. The plate was wasted around the mouth of the furnace to a knife edge in many places and pitted and corroded generally to a material depth which could not be gauged owing to the condition of the furnace at the time of inspection. The engine and mountings were all smashed more or less, with the exception of the safety valve, which was intact. The steam gauge dial was missing, but the movement, which was of the double tube type, was not damaged, and appeared to be in sound working condition.

Remarks and Conclusions.

The explosion was undoubtedly due to the failure of a furnace weak in construction and weakened and impaired by age and corrosion, and altogether totally inadequate to withstand the working pressure of 100 pounds per square inch carried at the time of the accident. Owing to the nature of the collapse, the thickness and condition of the metal at the ruptured part could not be ascertained without the furnace being removed. The safety valve was tested after the accident and a report of this test from Hergott Bros., Mildmay, shows that it released at 110 pounds per square inch.

The boiler was blown by the reaction of the explosion about 100 feet from its original location through the woodwork of a barn, causing considerable damage to property and the loss of the owner's life, Samuel Lindsay, besides inflicting very serious injuries to the deceased man's father and another victim, a farmer, who was assisting to run the threshing machine at the time of the disaster.

It is obvious that this fatal explosion could have been avoided had the boiler been examined by a competent man and the working pressure fixed in accordance with the strength and condition of the boiler structure. The boiler had only been in operation at the already mentioned farm for a very short period and had been previously purchased in a second-hand condition from some person in this line of business.

We are indebted to D. M. Medcalf, chief of Boiler Inspectors' Department, Province of Ontario, for the report and photographs.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals, will be found a most useful companion

Question.—The pressure on the piston of a steam engine is 30,000 pounds; the length of the stroke is 30 inches, and the distance from the centre line of the connecting rod to the centre of the main bearing is 16 inches. What sized shaft should be used?

Answer.—In this case it is necessary to determine the combined effect of twisting and bending, and reduce both to either bending or twisting moment.

Equivalent bending moment $= Mb + \sqrt{\frac{Mb^2 + Mt^2}{2}}$ where $Mb =$ bending moment and $Mt =$ twisting moment.

$Mb = 30{,}000 \times 16 = 480{,}000$; $Mt = \frac{30{,}000 \times 30}{2} = 450{,}000$ equivalent bending moment.

$$= 480{,}000 + \sqrt{\frac{480{,}000^2 + 450{,}000^2}{2}}$$

$$= 480{,}000 + 328{,}975 = 808{,}975$$

Formula $= \frac{M}{S} = \frac{I}{c}$, $M = 808{,}975$, $S = 10{,}000$

$I = .049d^4$; $c = \frac{d}{2}$; $\frac{I}{c} = \frac{.049d^4 \times 2}{d}$ $= .098d^3$

Formula becomes $\frac{M}{S} = .098d^3$ or $d^3 = \frac{M}{.098S}$.

$$d^3 = \frac{808{,}975}{.098 \times 10000} = 825.48;\ d = 9.38 \text{ in.}$$

Use in this case 9⅜-inch shaft.

* * *

Question.—Will a pump lift hot water? If not, why?

Answer. — No. Theoretically cold water can be lifted about 34 feet. As the temperature is raised this height is decreased until at or near the boiling point it cannot be lifted at all. The reason is that the hot water easily changes to steam at the lower pressure of the suction and this steam instead of solid water fills the cylinder of the pump.

* * *

Question.—What is the method of procedure in setting the valves of a duplex pump?

Answer.—First take off steam chest covers and set both rocker arms exactly plumb. Measure carefully the width of steam ports and place both valves centrally over ports. Set up jam nuts to within half the width of the ports from the valves and lock them in this position. Valves should move in opposite directions to open ports. Replace covers and pump is ready to start.

* * *

Question.—A hydraulic wheel press is driven by two eccentrics directly connected to a 20-in. pulley. The diameter of one plunger is ¾ in., and of the other 2 in., and the common stroke is 2 in. If the effective pull on the belt be 90 lbs what pressures could be obtained on the ram with either eccentric?

Answer.—The possible pressure on the plungers is the same as 90 lbs. on a 10 to 2 leverage or

$$\frac{90 \times 10}{2} = 450 \text{ lbs.}$$

Area of ram $= 10^2 \times .7854 = 78.54$ sq. in

Area of small plunger $= 15^2 \times .7854 = .4418$ sq. in.

If pressure on plunger were 1 lb., pressure on ram would be

$$\frac{78.54}{.4418} = 177.8$$

Therefore, with belt pull of 40 lbs, pressure on ram is $177.8 \times 450 = 80{,}010$ lb. or approximately 40 tons.

Area of large plunger is $2^2 \times .7854 = 3.1416$ sq. in. 1 lb. pressure on large plunger would give

$$\frac{78.54}{3.1416} = 25 \text{ lb.}$$

With belt pull of 90 lbs. or 450 lbs. on plunger pressure on ram is $25 \times 450 = 11{,}250$ lbs. or 5.6 tons.

* * *

Question.—If the speed of the driving pulley be 200 r.p.m., what would be the speed of the ram (a) using small plunger only, (b) using both plungers?

Answer.—Speed of small plunger is

$$\frac{200 \times 2}{12} = 33.33 \text{ ft. per minute.}$$

$$\text{Speed of ram} = \frac{\text{area of plunger}}{\text{area of ram}} \times 33.33$$

$$= \frac{.4418}{78.54} \times 33.33 = .187 \text{ ft. per min}\ldots(a)$$

With both plungers working at 33.33 ft. per min. speed of ram is

$$\frac{\text{combined area of plungers}}{\text{area of ram}} \times 33.33$$

$$= \frac{3.5834}{78.54} \times 33.33 = 1.52 \text{ ft per min}\ldots(b)$$

or 8 times as fast.

* * *

Question.—A smoke stack is 96 feet high to the point where the guy wires are attached and the ground ends of the wires are fastened 100 ft. from the base. The strain on one cable is 30,000 pounds. What are its horizontal and vertical components?

Answer.—The hypotenuse of a triangle whose sides are 96 and 100 is $\sqrt{(100^2 + 96^2)} = 158.24$ ft. The length 158.24 represents the pull of the cable. The vertical component is represented by 96 and the horizontal component by 100.

The horizontal component is then, 30,000 : 158.24 : x : 100 or x

$$= \frac{30000 \times 100}{158.24} = 18958.5 \text{ pounds.}$$

The vertical component is,

$$\frac{30000 \times 96}{158.24} = 18200.2 \text{ pounds.}$$

* * *

Question.—Taking the diameter of the earth as 8000 miles, and that it rotates once in 24 hours, what is the speed in miles per minute of a point at the equator? What would be the speed of a point half way between the equator and the pole?

Answer.—Circumference of earth $= 8000 \times 3.14165 = 25{,}133.2$ miles. No. of miles per minute

$$= \frac{25133.2}{24 \times 60} = 17.453 \text{ miles.}$$

The radius of a circle halfway between the equator and the pole = 4000 × the sign of 45 degrees = 4000 × 70711 = 2828.44 miles. Circumference $= 2828.44 \times 3.1416 = 8885.827$ miles.

Speed per minute

$$= \frac{8885.827}{24 \times 60} = 6.1707 \text{ miles.}$$

* * *

Question.—What is the rim speed of a 96-in. pulley when running at 180 r.p.m.?

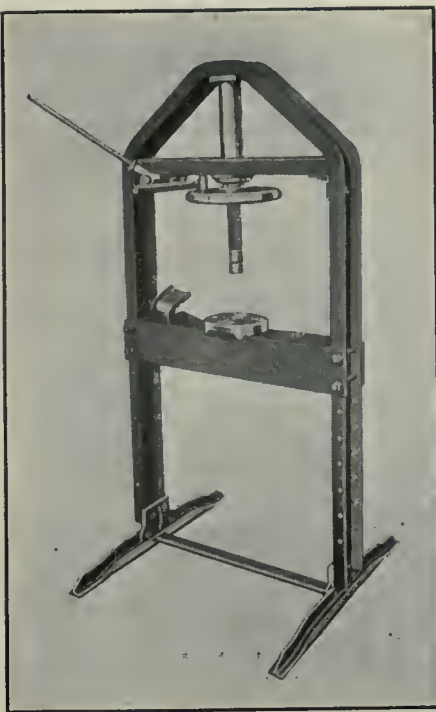
Answer.—Circumference of pulley $= 8 \times 3.1416 = 25.133$ ft. Rim speed $= \frac{25.133 \times 180}{60} = 75.4$ feet per second.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

GARAGE PRESS.

WHILE this press is capable of handling practically all classes of machine shop work it has been designed especially to meet the demands peculiar to the auto repair shop and garage.



20-TON GARAGE PRESS.

The frame is in one piece of 5-inch by 2-inch channel steel, there are as a consequence no joints or connections to weaken the construction. A heavy hand wheel, 15 inches in diameter provides quick action for ordinary light jobs, and for securing the maximum pressure, the lever construction, shown in the accompanying cut is employed; providing a leverage of 1,500 to 1 and enabling the maximum pressure of 20 tons to be accomplished with ease.

The bolster which carries the plate is readily adjustable for height upon the uprights of the frame. The maximum adjustment is 48 inches between plate and bottom of screw. The screw is two inches in diameter with 3 pitch Acme thread. The weight of the screw rests upon bronze thrust bearings which enable the wheel to spin the screw up or down quickly. The screw has a range of movement of 12 inches. The distance between the uprights of the frame is 32 inches, which permits the press to accept the largest automobile wheels. A vice attachment for holding round or irregular pieces is provided which permits of a great variety of application. A varied equipment of blocks is also furnished with each press.

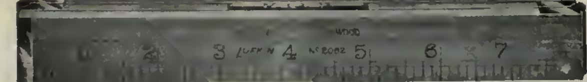
The following are among the number of applications to which the press is adaptable:—Straightening shafts and axles; pressing wheels on and off shafts; compressing leaf springs for assembling; pressing bushings on and off; straightening frames and rear systems; broaching holes; pressing ball races on and off shafts; cutting key-ways in pulleys; bending and shaping angles, bars, etc.

The Weaver Mfg. Co., Springville, have put this tool on the market, and in its strong, compact and powerful features gives every indication of amply fulfilling the purpose of its design.

COMBINATION POCKET RULE AND LEVEL.

THIS product is a 2-ft. folding boxwood rule fitted with a spirit level. The three 8-inch rule sections are each 1 in. wide, 3-16 in. thick and are united by substantial brass joints. The rule is fully graduated its entire length both sides, one side inches to eighths, and the level is neatly set into and flush with the upper edge of the middle section of the rule where most convenient for use and is securely protected by the two outer sections of the rule, which fold against it on either side when closed for carrying in the pocket. The combination rule and level being light and but 8 in. long when folded, is conveniently carried in the pocket. Closing pins especially designed for the purpose hold the sections of the rule in proper alignment insuring a perfect bearing surface. The accuracy of both rule and level is guaranteed.

The Lufkin Rule Co. of Canada, Ltd., Windsor, Ont., are its manufacturers and patents are pending.



COMBINATION POCKET RULE AND LEVEL.

COMBINATION POCKET RULE AND LEVEL.

HEAVY PATTERN DOUBLE CRANK POWER PRESS.

THE heavy pattern double crank power press shown here is a recent product of the Cleveland Machine & Mfg. Co., Cleveland, Ohio. Several sizes have been developed, each of which is made in various widths between housings. The frame is "four piece," held together with heavy steel tie rods, while the length of the housings can be varied to suit

HEAVY PATTERN DOUBLE CRANK PRESS.

individual requirements, giving die space from bed to slide, up to 72 inches. Where these extreme dimensions are necessary from crown fender and similar high dies, a special connection is furnished which permits adjustment of the slide through the whole die space and eliminates the necessity of using the auxiliary bed plates, ring bolsters, etc., for dies of normal sheet height. The slide-ways are also extended so that the slide never overhangs its bearings.

The machine is equipped with a powerful multiple disc friction clutch, with the operating links fully enclosed so that there are no revolving parts exposed. The adjustment is universal on all levers. The brake arms are operated by a pair of toggle links and the clutch is controlled by a hand lever in convenient position for the operator.

The machine shown is 72 ins. between housings, has 3 ins. stroke of slide, and weighs about 35,000 lbs.

SAFETY WATER COLUMN AND STEAM SEPARATOR.

FIGURE 1 shows the operating mechanism of the Anderson safety water column with high and low water alarm. All of the working parts are assembled in the removable hanger frame A, which is secured in the body of the column by means of the pins G. When the water rises in the boiler to the high point, the float D strikes the top lever B, which draws the whistle valve M from the valve seat. At the low water point, the float strikes lever C, which opens the whistle valve through the link E.

These columns are made in different sizes, suitable for different sizes and types of boilers, and Figure 2 shows a section through column, the large sediment chamber in the bottom being noteworthy.

The Anderson steam separator is shown in Figure 3. This separator consists of the body with the outlet extending up about half-way through it. The head, which screws to the body, is fitted with a bell-shaped cone, to which is fastened a set of spiral baffles. The steam enters through the head, strikes the cone, and is given a spiral or whirling motion by the baffles which throws the moisture against the body, the steam passing out under the cone. The moisture is prevented from following the steam by the deflector at the top of the discharge opening, and is drained off through the globe valve at the separator bottom to a steam trap. They are made in all sizes from 1½ ins. to 12 ins., in both vertical and horizontal types, by the V. D. Anderson Co., Cleveland, Ohio., who are also manufacturers of the safety water column.

FIG. 1. OPERATING MECHANISM OF WATER COLUMN.

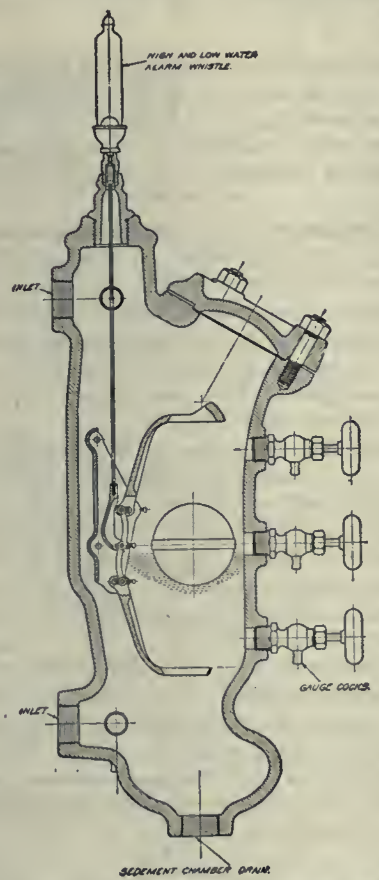


FIG. 2. SECTION THROUGH WATER COLUMN.

WORKMEN'S COMPENSATION ACT.

THE Workmen's Compensation Act comes into operation on January 1. The formal proclamation to that effect has been published, and sets at rest any doubts there may have been on that score. Every workman injured after the first of the year will be entitled to compensation as provided under the new Act.

In order to give employers ample time in which to prepare their statements as to pay rolls, etc., the board has decided to extend for a month the time for presenting these. The statements, which must show the total pay roll for the twelve months ending September 30, and give an estimate of the total pay roll for the calendar year 1915, can be submitted any time before the end of October. Forms can be obtained from the board after October 15.

Among the matters with which the board will have to deal are the questions whether the assessment on employers will be made on the actual pay roll for 1914 or the estimated pay roll for 1915; whether employers having only a very few workmen shall be excluded from the Act except where they choose to come under it; what rearrangements, if any, of classification of industries shall be made; and what rates shall be fixed for each class, and what method of sub-classification or grading of different hazards shall be adopted.

In announcing their plans, the board intimate that because of the prevailing depression, employers will be dealt with as easily as possible. The chairman of the board intimates that, subject to the conditions that safe provision must be made for the payment to the workmen and their dependents of the compensation to which they are entitled, the board will endeavor to meet the wishes of employers as far as it feels it can properly do so in regard to arrangements for the collection of the funds and other details. It is quite realized that the industrial conditions of the province are far from being normal at the present time, and this fact will be carefully borne in mind.

FIG. 3. PHANTOM VIEW OF STEAM SEPARATOR.

Question and Answer Series for Foundrymen

Foundrymen having difficulties in connection with their work are invited to forward particulars of them to this department for solution. The greatest possible care will be taken to give only reliable and tried-out advice on all questions submitted.

Question.—Will you kindly give us a good formula for hot rolling mill bearings?

Answer.—The following formula has given very good results: Copper 90 pounds, tin 10 pounds, or try copper 85½ pounds, phosphor-copper (15 per cent.) 3½ pounds, tin 8 pounds, zinc 3 pounds.

* * *

Question.—We are anxious to secure a mixture for bushings required on a machine operated at a very high speed. These bushings vary from 2½ to 4½ inches in diameter, and are from 6 to 8 inches long.

Answer.—An alloy that can be recommended for this work is as follows: Copper 82 pounds, tin 10 pounds, phosphor tin (5 per cent.) 2 pounds, lead 6 pounds. This is an expensive alloy and will probably be too costly for your work. If so, you might try the following: Copper 66 pounds, lead 14 pounds, zinc 10 pounds, tin 4 pounds.

* * *

Question.—We are making steel castings and have considerable trouble in removing the cores from them, especially the small cores in the heavy sections. The cores seem to change into a mixture of silica and steel, and require considerable more time to be spent on their removal than should be necessary. We have changed the mixture of our core sand several times, with very little success. Analysis of the cores after such formation show about equal parts of silica and steel. We thought that probably the moisture in the cores was the cause of the crystallization, and used every precaution to keep them dry, but this did not overcome the difficulty. We would like to have a core mixture for small and medium cores that can be removed from the castings with the least amount of work.

Answer.—All steel foundries have more or less trouble in removing small cores from the castings when the cores are in the heavy sections, and if it were possible to make cores of silica sand about 98 per cent. pure, there would be very little difficulty. The foreign matter in the sand which is used for binding purpose fuses and causes the trouble. The idea should be to prepare a core with the least possible percentage of binding material, and have the skin of the core as free as possible from porosity. A mixture that has given excellent results for small and medium cores is as follows:—Silica flour tempered with molasses or glutrin. When the cores are dry, it is advisable to wash them with a mixture of silica flour and molasses or glutrin diluted with water.

* * *

Question.—We deliver the iron around to the smaller ladles on the different floors with a 1,000-lb. bull ladle, and experience considerable trouble with the daubing as it invariably falls off after it has been filled with the metal three or four times. Can you suggest anyway to overcome this difficulty.

Answer.—The cause of your trouble is due to the fact that the daubing on your ladle is not thoroughly dried before the ladle is used and steam is generated between the lining and the shell of the ladle which forces the daubing away from the shell. Clean your ladle and clay wash with a brush and use only enough clay water to hold your lining material together. A mixture for lining that has given good results is:—New moulding sand 2 parts; sharpsand, 1 part; fireclay 1 part. Too much fireclay in lining material will cause it to shrink and crack when drying.

* * *

Question.—Can you give us a first class formula for making modeling wax.

Answer.—Wax for modeling purpose can be made from the following mixture: —White wax 6 lbs., lard 1 lb., and zinc white 1 lb. Melt the wax at a low temperature, add the lard and stir in the zinc white and color with vermillion. Another good formula is:—White wax 20 parts, oil of turpentine 4 parts, sesame oil 1 part, and vermillion 2 parts, Melt the wax and stir in the turpentine gradually, add the other ingredients, then pour on to a slab or plate to cool; remelt and pour into tepid water and knead until plastic.

* * *

Question.—We would like a good mixture for red metal for making bond lugs. The metal must be soft, as the lugs are riveted to the rail.

Answer.—The following alloy is suitable for this purpose:—Copper 88 pounds, tin 3 pounds, zinc 6 pounds, and lead 3 pounds.

U. S. IMPORT AND EXPORT TRADE.

TREMENDOUS decreases in American export trade during August, resulting from war in Europe, are shown in detail by comparisons of the Department of Commerce with the business of one year ago. Export trade to Germany practically came to a standstill, while that to France and Great Britain, where shipping has not been so seriously interrupted, showed only a comparatively small decrease. Trade to Belgium, and that to Argentina, which depends largely on foreign shipping, suffered heavily.

The decrease in the August export trade to Europe as a whole amounted to \$58,320,619. That represented in a large measure the decrease in credit abroad as employed to offset American obligations. The falling off in exports reached more than \$77,000,000. One year ago in August the total was \$187,909,200, compared with \$110,369,240 last month.

The effect of war upon American import trade was not so great. Last month it amounted to \$129,767,890, compared with \$137,651,553 in August, 1913. The imports from Germany and Great Britain did not show as large a decrease as those from France. The decrease from Europe as a whole was about \$17,000,000.

Manufactures showed the largest decrease in exports among the various groups. Foodstuffs almost maintained their level of one year ago.

TRADE WITH GREAT BRITAIN.

THE following are official figures of trade between Canada and Great Britain in the undermentioned articles during August:

Imports From Canada.

	Aug. 1914	Aug. 1913
Wheat	£1.506.011	£868,255
Wheatmeal and oatmeal	147,889	144,539
Oats	85.797	37,578
Barley	97,395	75,999
Bacon	129,404	65,893
Hams	21,380	24,857
Cheese	739,930	649,590
Canned salmon	2,948	22,202
Canned lobster	53,622	45,176

Exports to Canada.

Spirits	54.359	43,885
Wool	16.767	6,743
Pig iron	869	6,975
Wrought bars	911	5,286
Galvanized sheets	18.241	33,875
Tinned plates	5,402	11,262
Steel bars	7,143	23,309
Cutlery	6,037	8,944
Hardware	10,596	10,159

Charles E. Mackenzie, manager of the Winnipeg office of the Canadian General Electric Co., and Canadian Allis-Chalmers, Ltd., died on Sept. 21, at his residence in Winnipeg, ager 42. Mr. Mackenzie was a nephew of Sir William Mackenzie, president of the C.N.R.

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Vol. XII. OCTOBER 1, 1914 No. 14

PRINCIPAL CONTENTS.

BUSINESS AS USUAL?

ONE of the most popular slogans arising out of the European War, at least in the commercial and industrial sphere, is that of "Business as Usual." Just why the interests concerned have appropriated the phrase is not at all clear, neither is it reassuring, for may it not actually be the outcome of a desire to simply put a "face" on conditions that more or less demand it. In one sense, "Business is as Usual," and in another sense it is otherwise, and our relative position to one or the other determines whether we are in earnest or bluffing.

In prosperous or boom times little effort, comparatively speaking, may be expended to keep the factory wheels and a myriad of employees taxed to the limit to serve the demand, and this condition may be to a large extent existent in quite normal times. Is it not possible, however, that in spite of the tremendous upsetting events of the past two months, we still are disposed to "take" what is offering and let what needs "getting" go by; in other words, we are conducting our business as "usual" and there is no bluff about it.

Having said this much on behalf of what is undoubtedly a minority of commercial and industrial enterprises, it may be safely inferred that the majority are quite insincere in the use of the "Business as Usual" slogan. They have in many cases withdrawn themselves completely from the public eye, and what is perhaps more condemnatory still, because absolutely without reason or justification, they have decided that the particular sphere to which they had the privilege of catering needs meantime no attention.

The great trouble to-day is that we are all too pessimistic. We act, however otherwise we may talk and write, as though the European Anti-Burglar Alliance was unequal to the task it has set itself. In grasping hold of the bee, we seem somehow to get the sting instead of the honey. In trying to pluck the rose, our portion seems to be the thorn, and our upward look sees nothing but the dark cloud, although the silver lining is there.

Business, notwithstanding, is as "Usual," by which is meant that there is business to be got, but the amount of our share will be entirely dependent on the enterprise and energy we put forth to get it. This is neither a normal time nor yet is it a boom time, to the latter of which unfortunately we have become too accustomed. It is an abnormal time and the very antithesis of a boom period. Conditions are just such now that our industries should have every searchlight of publicity focussed on the path to their factory doors, but in how few instances is this being given effect to. It is insufficiently realized, and generally not at all, that the peculiar circumstances in which we find ourselves make it necessary for us to go after business more insistently and more strenuously than ever before. Our own and the needs of others still demand supply, and the wherewithal to produce and to purchase is just every whit as available as formerly if we go about our business affairs in the proper spirit and in a determined manner.

Declarations otherwise, notwithstanding, we have not got beyond the panic stage. Canadian business enterprise is simply seething with pessimism, born of a craven fear that the European Burglar may after all prevail. The adoption of such an attitude is contrary to both right and reason. No subject of the British Empire, if he be truly loyal, should have the slightest misgiving as to the ultimate outcome of this European struggle, for he who assumes the role of a coward is perchance not far removed from being a traitor. Again, and on the highest plane of approach to the ultimate issue, none of us worthy the name of Christain dare be pessimistic.

Let us get rid of all this pretence therefore of "Business as Usual," and turn it into reality by getting after and embracing the opportunities everywhere offering. Let us get into the firing line and throw out again our scouting forces, and where in normal times these consisted of a few scattered units, let us be strategic enough to see that such means are multiplied and increased in effectiveness.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh	.....	$13 65
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron	25 00	.....
Victoria, No. 1	18 50	17 85
Victoria, No. 2X	18 25	17 60
Victoria, No. 2 Plain	18 00	17 35

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.00
Steel bars, f.o.b., Toronto	2.00
Common bar iron, f.o.b, Montreal	2.00
Steel bars, f.o.b., Montreal	2.00
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.25
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.25
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs.	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in.	75%
Finished Nuts over 1 in.	72%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$8 50	$8 50
Copper, crucible	10 00	10 00
Copper, unch bled, heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	10 75	9 25
No. 1 compos'n turnings	8 50	8 50
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	72	62
7, 8, 10 in.	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload	$14 50	$13 50
Electrolytic copper	14 25	14 00
Castings copper	13 75	13 50
Spelter	6 00	6 00
Tin	34 00	35 00
Lead	4 85	5 00
Antimony	16 00	16 00
Aluminum	20 00	25 00

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt, casks, per cwt.	6.40
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine, single bbls.	0.67
Linseed oil, raw, single bbls.	0.63
Linseed oil, boiled, single bbls.	0.66
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.16
Lard Oil, per gal.	0.60

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3 45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2 50	$2 60
Canada plates, ordinary, 52 sheets	3 70	3 85
Canada plates, all bright	3 90	3 95
Apollo brand, 10 3/4 oz. (American)	3 90	3 90
Queen's Head, 28 B.W.G.	4 30	4 35
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1 1/2-in	$37.50	$30.00	$17.50
33/64 to 3/4-in.	41.25	33.00	19.25
7/16 to 1/2-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	$1.10 lb.
Leather in sides	$1.00

BELTING RUBBER.

Standard	50%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4.95
1 inch	8.05
1 1/4 inch	12.65
1 3/8 inch	15.30
1 1/2 inch	16.50
1 5/8 inch	19.40
1 3/4 inch	22.50
1 7/8 inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Sept. 28, 1914.—Very little business has been transacted in the steel trade during the last week, yet when compared with that of the previous few weeks, the volume of business is about the same. The Government has stopped all new construction work throughout the country, although many jobs are still being pushed through; these, however, cover contracts let before the commencement of the war. This tends to keep things moving somewhat.

The railway shops are, of course, all running. Traffic has fallen off a little, but not to such an extent that drastic measures of retrenchment would seem necessary. There is, of course, little work being done in the way of building new rolling stock, as the present number of cars is quite sufficient to take care of the volume of trade that this present winter will bring forth.

Foundries whose output consists of stoves and furnaces are doing considerable business, the demand in the rural districts for these lines of goods appearing to be quite up to normal. However, city demands have fallen off largely.

Certain industries are enjoying an enormous volume of trade as a direct result of the war; these being largely textile mills, boot and shoe factories, and some pulp and paper mills. The whole industrial situation is in far better shape than some of our alarmist friends would have us believe to be possible. The British Isles industrial situation is really remarkable, and our position in Canada, although good, can hardly be compared with that of the Mother Country.

The Steel Market.

In rolled sections for construction purposes the demand has fallen away considerably, and prices have advanced somewhat, but quotations seem to be a little varied. The summing up of the market shows them to be generally stronger. Business in machinery sections being done is all of the small variety, while the demand for sheets has also fallen off considerably. Prices, however, are a little firmer.

Pig Iron

Foundries have been forced to curtail operations very materially, and the demand for pig iron has thus correspondingly dropped off. British iron in Canada is sufficient to supply the limited demand for some time to come, and as a consequence prices rather tend to be firm.

Machine Tools and Supplies.

From time to time small sales are reported, but this business is practically at a standstill. The supply end of the business, however, keeps up well.

Metals.

The prices of metals have not changed, and business seems to be at a standstill. The last week has been quieter than any since the beginning of the war. There is, however, quite a supply of most metals on hand, and no shortage is anticipated. It was at first expected that the supply of tin would be more or less limited, but all danger of such an emergency seems to have passed.

Toronto, Ont., Sept. 29, 1914.—The general business situation shows no particular change over last week, and with due consideration of the present conditions in Europe, it cannot be said that conditions here are really unfavorable; in other words, they might be a good deal worse. The prospect for ultimate prosperity in Canada is having a reassuring effect, and that, combined with the untiring efforts of the majority of our manufacturers to keep things going, is helping considerably to relieve the present industrial depression.

In some sections of the country, trade is very good, many factories being engaged on Government contracts. Pulp and paper, and flour mills are also extremely busy. The British Government has been placing large orders for various lines of goods, and this, too, is having a stimulating effect. Orders for war supplies will be of considerable assistance to the industries involved, and will help them over the period of depression until trade becomes normal again, or at least approximately so.

There are definite indications of returning confidence in business circles, because of the general feeling that conditions are fundamentally sound. This is a state of affairs that might be expected, providing a little consideration is given to the position in which Canada actually stands with regard to the present and prospective possibilities for trade. Except for the financial stringency, the war has not interfered to any great extent with the transaction of business in Canada, nor has it in any way reduced the value of stable products; in fact, the reverse is more likely to be the case, for the demand is bound to increase.

The nervousness occasioned by the war has been largely responsible for present conditions. This feeling will pass away as soon as it is realized that it is not justified by actual facts. We understand that there are more travelers on the road now than previous to the war, a fact that speaks well for the enterprise of our manufacturers.

Steel Market.

It cannot be said that the steel trade has shown any marked improvement during the past week. In a few isolated cases new business has been booked, but this has not affected trade generally. The future, however, is full of large possibilities, and Canadian manufacturers of iron and steel are making every effort to capture at least a portion of the trade that formerly went to Germany from this country. Lack of manufacturing facilities has in the past been largely responsible for much business going out of the country. This to a large extent will, no doubt, be corrected in the future, and it is to be hoped that, given sufficient time to install the necessary plants, Canadian manufacturers will secure a considerable part of that business. This does not, however, include the rolling of structural shapes, as far as the immediate future is concerned, but eventually this will come. German competition does not, under the average market conditions, enter into this field to any great extent. The problems surrounding the installation of a plant for rolling structural shapes are far too great to be settled in a few months. In other lines there is a big field, and now is the time to make a bid for the business.

The iron and steel markets are quiet, and prices rule about the same. A slight increase is to be noted in steel bars and beams, in which business is being done at 1.25c. f.o.b., Pittsburg. The building trade is dull and manufacturing consumers of iron and steel are operating at reduced capacity, although in some districts a slight improvement has been shown. The Nova Scotia Steel & Coal Co. and some other steel plants are busy experimenting on the manufacture of shells. This is a new industry, and one which may possibly be established permanently as a direct outcome of the war.

Pig Iron.

The pig iron market is almost stagnant, and no change in last week's conditions is noticeable. Prices are the same, but there is not sufficient business to really test these.

Machine Tools.

There is little business being done in machine tools, although the outlook is more promising. An interesting specification has been issued by the British Canadian Dry Dock Co. for equipment for the dry dock and shipbuilding plant at the Soo, a detailed list being given in our industrial section. A specification has also been issued for tools for the new dry dock at Owen Sound, while a large amount of machinery and tools will be required for the projected dry dock and shipbuilding plant at Vancouver. Specifications for this work have not yet been issued.

Old Material.

Prices on old material are lower than those obtaining before the war, and business is quiet. For about three weeks after the opening of hostilities prices went away up, then dropped to ante-war prices, and still further to the present level.

Metals.

The metal markets are quiet, and not much business is passing. Prices are the same as last week. The tin situation is much the same, prices holding firm. There is a near possibility of lower prices in lead, while spelter may also weaken.

CONTINUE PUBLIC WORKS.

THE Government is preparing for the exigencies of the coming winter by making arrangements for the continuance of all the big public undertakings now under way. At the present time thousands of men are employed on these works from coast to coast and in so far as weather conditions will permit operations will be maintained all winter.

At Halifax, extensive terminals of the Intercolonial Railway and a new entrance of that road are being built. At St. John the extensive harbor improvements at Courtenay Bay are going ahead, and Quebec, Montreal and Toronto have similar big jobs in progress.

Then there is the Welland Canal works, the Port Arthur and Fort William works and new docks and harbor works at Vancouver and Victoria, along with the Hudson Bay Railway and a long list of minor works. Some of these will necessarily be affected to a certain degree anyway by the cold weather, but the general intent is to keep large staffs at work thus ensuring employment and the circulation of public money.

The general outlook here is viewed most optimistically at Ottawa. The bank statements just issued and covering the first month of the war when there might be a disposition towards panicky conditions is regarded as favorable indeed, and the statement for the current month will show the greater extent to which circulation has increased for the maintenance of the country's industry and commerce.

Money for all legitimate undertakings is assured and, while some industries may slacken up, this will be compensated for by the stimulus to other lines owing to the war and its demands. The official view at Ottawa is that the outlook is most hopeful.

RELATIVE TO PATENTS.

THE question has often been asked as to what is the position of an applicant for a patent or a patentee who has volunteered for active service, and thus is unable to attend to the prosecution of his case. It is generally known that in all patent offices certain rules are laid down restricting the length of time in which certain documents may be filed, renewal fees paid, and so on.

In Great Britain we are advised that an Act has now been passed under which the Comptroller of Patents has the authority to grant extensions of time for the filing of such documents, the duration of such extensions being governed by the particular conditions of the case. This provision is made for the benefit of applicants or patentees who are absent from their country on active service or for any other justifiable reason are prevented from attending to their cases by circumstances arising from the present state of war. The extension may be also granted when it is shown that the documents could have been filed, but under the circumstances arising from the state of war this would be prejudicial to the rights or interests of the applicant or patentee. The provisions apply only to patents in Great Britain, and it remains yet to be seen whether a similar Act will be passed in Canada and other British possessions.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

NO NEW CONTRACTS LET.

NOT a single contract has been let by the Railways and Canals Department since the war began. Every effort is being made, however, as is also the case with the Department of Public Works, to carry on work already started.

Operations have been continued without cessation on the Welland Canal, the Hudson Bay Railway, the work at Port Nelson and the Halifax harbor scheme. Provided that money conditions remain reasonably easy, this work will be prosecuted steadily throughout the war, but nothing new will be undertaken.

The Georgian Bay Canal Investigating Commission, it is understood, has practically ceased work. There is no doubt that this great proposed public work will be held in abeyance on account of the war with its large military and naval expenditures requiring to be financed in addition to the unavoidable expenditures of internal government. The commission will continue in existence, although its work will experience a temporary cessation.

ENGINE AND BOILER PACKING MARKET.

THE following statement from the British Board of Trade shows for a recent year the value of engine and boiler packing exported from Germany, Austria-Hungary, and the United Kingdom, respectively, to the principal colonial and neutral markets to which the two first-named countries send such goods:—

Country to which Exported	From Germany 1912.	From Austria 1913.	From U.K. 1913.
	£	£	£
British India	1,800	650	30,600
Norway	6,350	140	6,500
Sweden	6,850	20	6,100
Denmark	5,200	290	4,100
Netherlands	17,150	4,560	7,600
Belgium	17,100	2,430	10,600
France	11,100	7,760	12,400
Switzerland	8,700	1,530	300
Spain	6,350	430	3,700
Italy	12,900	1,880	2,200
Servia	500	280	—
Roumania	2,800	930	900
Russia-European	12,300	12,080	5,700
Turkey-European	900	1,150	2,400
Turkey-Asiatic		150	2,400
Egypt	1,300	410	4,800
Dutch East Indies	2,150	50	[illegible]
Japan	3,000	10	5,600
Argentine	10,700	270	[illegible]
Chile	2,900	160	9,400
United States	11,250	2,300	[illegible]
Total	£141,300	£38,480	£134,800

The foregoing figures show that while the United Kingdom holds a strong position in the Indian, Egyptian, Chilean and United States markets, the position is less strong in the remainder. In Norway and Sweden the trade is about equally divided between the United Kingdom and Germany, but in the remaining European markets specified, and in the Dutch East Indies, there is room for considerable expansion in the sales of British made engine and boiler packing.

Principal German Markets.

The following additional information is available as to the principal markets to which piston packing, stuffing-box packing, luting cords, and Klingerit boiler jackets, calking slabs, calking rings, etc., of asbestos, of asbestos paper or asbestos tissues were exported from Germany in 1912, and the value of the exports sent to each:—

Countries to which exported.	Piston packing, stuffing-box packing, luting cords.	Klingerit boiler jackets, calking slabs, calking rings, etc., of asbestos, of asbestos paper or asbestos tissues.
	£	£
British India	1,500	300
Norway	3,300	3,050
Sweden	4,350	2,500
Denmark	3,150	2,050
Netherlands	10,850	6,300
Belgium	6,100	11,000
France	4,600	6,500
Switzerland	5,050	3,650
Spain	3,650	2,700
Italy	4,500	8,400
Servia	400	100
Roumania	1,600	1,200
Russia (European)	5,500	6,800
Turkey (European and and Asiatic)	650	250
Egypt	1,000	300
Dutch East Indies	1,7500	400
Japan	2,700	300
Argentine	6,700	4,000
Chile	2,100	800
United States	1,750	9,500
Total to above markets	£71,200	£70,100

The aggregate value of German exports of engine and boiler packing to the above markets amounted to £141,300, or 70 per cent. of Germany's exports of such goods to all destinations.

Summary.

The aggregate value of the German and Austrian export trade in engine and boiler packing which might be recovered by British and colonial manufacturers may be summed up as follows:—

(a)—In the United Kingdom market:—

	£
German Trade (1912):	
Piston packing, stuffing-box packing, luting cords	12,450
Klingerit, boiler jackets; calking slabs, calking rings, etc., of asbestos, etc.	14,150
Austrian Trade (1913):	
Engine packing of rubber	16,780
Total	£43,380*

(b) In Colonial and Neutral Markets:—

	£
German Trade (1912):	
Piston, packing, stuffing-box packluting cords	71,200
Klingerit boiler-jackets, calking rings, etc., of asbestos, etc.	70,100
Austrian Trade (1913):	
Engine packing of rubber	38,480
Total	£179,780*

or a grand total of £223,160.

The following further particulars are available as to the imports into the South African and Australian markets:

Australia.

The value of the imports of asbestos and other packings into the Commonwealth of Australia during 1912 according to countries of origin was:—

	U.K.	Austria-Hungary.	Germany.	All Countries.
	£	£	£	£
Asbestos and other packings (except in rope form) including asbestos cloth (with or without wire), proofed with rubber; asbestos cord; boiler covering; asbestos mattresses for boilers.	21,469	3,469	4,985	42,724
Engine packing in rope form, other than asbestos.	1,951	80	104	3,374
Totals	£23,420	3,549	5,089	46,098

It will be observed that although the United Kingdom contributed over one-half of the total imports, Germany and Austria-Hungary secured between them a not inconsiderable share of the total trade, which British and Colonial manufacturers have the opportunity of capturing.

South Africa.

The following are the particulars of the value of the imports of engine packing into the Union of South Africa during 1911, 1912 and 1913:—

Countries of origin.	1911.	1912.	1913.
	£	£	£
United Kingdom	18,399	19,143	17,308
Austria-Hungary	482	504	395
Germany	5,171	3,846	4,899
All Countries	42,938	38,726	36,386

It will be observed that the total imports showed a decline in 1912 and 1913. Imports from Germany were, however, over 27 per cent. greater in 1913 than in 1912, whereas those from the United Kingdom showed a decrease of 10 per cent.

*The German figures for 1912 and the Austro-Hungarian figures for 1913 have been added so as to give an idea of the trade in a year.

MOTORS FOR NEWFOUNDLAND FISHERMEN.

CANADIAN firms in a position to supply motor engines and motor fuel will find a valuable market is Newfoundland. The fishing fleet within the past two years has been installing motors in its boats, with the result that not only is there a brisk demand for engines but there is also a steadily increasing consumption of gasoline. Last year, according to statistical returns, motor engines valued at $140,000 were imported into the colony, and this year it is estimated that imports will approximate $500,000. The representatives of two United States concerns have spent the entire summer in and around St. Johns, and up to the end of July they had been able to place 275 orders. Engines of five, seven and nine horse-power composed the bulk of these orders, but in some instances higher powered engines were purchased. The prices for the smaller powered engines ranged from $180 to $225. So far as could be learned, no Canadian firm is actively engaged in soliciting this market. A few years ago a Nova Scotia concern, now in liquidation, sold a considerable number of motors. The two United States companies referred to seem to have largely gained control of the market. The fact that there is a rebate on the duty for engines for fishermen's use provides a stimulus for this trade.

In the matter of motor fuel, Canadian firms should be at a great advantage. Oil from the United States sells at 50 cents a gallon which is only 4-5 of an Imperial gallon. Gasoline in Canada can be purchased at 25 cents per gallon. As indicative of the demand, one fisherman requested one of the motor engine representatives from the United States to secure for him 50 drums of gasoline as an initial order. Inquiries for supplies of oil are also constantly noted in St. Johns.

Canadian firms in a position to supply either engines or fuel would do well to investigate the conditions in Newfoundland, for while the market for engines may not be an expanding one, that for motor fuel will steadily increase, and with the advantage of price in favor of Canadian concerns, a profitable business might be built up. Oil for the use of fishermen is also subject to a rebate of duty.

AGRICULTURAL MACHINERY IN RUSSIA.

SOMEWHAT more fully than heretofore the British Vice-Consul at Berdianisk thus reports on the Russian agricultural machinery industry and trade:—

Russian factories produce ploughs and seeders of the highest quality which to a great extent have supplanted the foreign article. Native makers were the first in the market in the manufacture of hand delivery reapers, and never gave a chance to foreign competitors, who after trying to get a share of the trade had to give it up. The enormous sales of the last-mentioned machine have latterly somewhat fallen off in consequence of unfavorable weather conditions during the harvest time. Owing to its simplicity it is a peasant's machine, but there are signs that the demand for it has reached its limit or perhaps is falling off, and the demand for the more perfect self-raking and self-binding reapers is gradually increasing. All this goes to prove that the cultivation of the soil by small farmers is making rapid progress. Horse gears and threshers found ready buyers in 1913, most of the makers being sold out. Multiple ploughs with seeders combined were largely in demand towards the end of the year; these are for use in spring.

The selling prices at the works for some of the principal machines of Russian make were:—

Ploughs, Russian type, with fore carriage, according to size, 15 to 30 roubles.

Multiple ploughs combined with seeders, Russian type:—

3-share, 60 roubles.

4-share, 73 roubles.

5-share, 80 roubles.

Hand delivery reaper, Russian type, 135 to 140 roubles.

Self-rake reapers, 5-foot, 165 roubles.

Note.—A rouble is equivalent to our half dollar.

Government Subsidy.

The Russian Government, in order to give native makers a chance to compete in the production of certain machines which are extensively imported, now gives a subsidy to those making them in the country. Harvesters of the self-raking and self-binding class and also steam threshers enter the country duty free, and now each of these of native manufacture receives a premium from the Government of 1 rouble per poud (40 pounds). This measure took effect from January 1, 1913, and the production of self-raking reapers reached 18,000, for which the makers received 500,000 roubles as subsidy. No self-binding reapers were made as no works were properly laid out for their production, but 1914 will see a number of these machines upon the market, and there can be no doubt that in a few years the importation of havesters will nearly cease, unless the increase in the price of raw material should counteract the advantage of the premiums. Portable engines, when imported along with threshing machinery or steam ploughs, pay a duty of 75 copecks (a copeck is approximately ½ cent) per poud, the same as other agricultural machinery, but if imported alone, the duty is 3 roubles 20 copecks per poud, for they are then considered to be industrial machines. There is a subsidy also for portable engines of 1 rouble 25 copecks per poud. In order to receive the premiums on any of these machines, they must be made in the country, of Russian material and, in the case of portable engines, proof is required that they are sold by the makers for agricultural purposes only.

Siberia takes a considerable part of the production of the Russian works in ploughs, seeders, hand delivery reapers and horse-threshers, while the demand there for improved harvesting and dairy machinery is mostly met by foreign productions. The works which were started for making manila twine for self-binding reapers have had to close down; they found it impossible to compete with foreign duty-free twine.

The trade in agricultural machinery cannot be said to be in a healthy state, even though the demand for such is increasing. Machines are sold on long credit; even small implements costing 20 roubles are very seldom bought for cash, the payment often being arranged on the installment system like sewing machines. However, this may answer in the latter case where failure to meet payment may risk the forfeiture of the machine, it cannot be called a success in the sale of agricultural machinery in Russia. There comes a bad harvest, no installment is paid; a second failure of the crops and the chances of the dealer getting in his outstanding debts diminish. The majority of the dealers are men of small means and often of smaller honesty; seeing that they have little or nothing to lose either of the one of the other. They run heavy risks, hoping for the big profits, but when losses come they promptly transfer them to the shoulders of the manufacturer or his agent. At the present moment there are many millions of roubles figuring in the books of manufacturers and agents which will in all probability never come in. The system seems radically wrong; it cannot endure, and has already ruined several firms whose assets according to their books far exceeded their debts. It is demoralizing the peasant, who is now beginning to feel that he may pay up how and when he likes, and in fact there is practically no way of enforcing prompt payment. A few years ago the Russian peasant was fairly punctual in settling up his accounts in the autumn, but the installment system has given him the idea that, if the seller can wait one season for his money, he can wait a second, and a third, and before thinking of paying for his plough bought on credit he will go and buy a gramophone.

Market In Poland.

The British consul at Warsaw contributes the following information in regard to Poland:—The following machinery is sold to farmers in Poland:—Ploughs (locally made and of German origin), cultivators (German and American), seeders, horse-drills (American, German, Austro-Hungarian; British makes are considered to be too expensive), harvesters (American and British) and food-preparing machinery. A large amount of garden implements are imported from America. Steam threshing sets are of British, German and Austro-Hungarian origin. British dairy farming machinery has been driven out by Finnish, Swedish, Dutch and German makes owing to the high price of British makes.

Demand for Power Ploughs.

In regard to the possibilities of Russia as a country for motor or steam ploughs, the British Export Gazette has the following remarks to make:—Russia, and particularly Siberia, with their rich agricultural potentialities, are necessarily countries where the power plough should be widely adopted, yet few markets offer so many obstacles to the successful introduction of this class of equipment. Motor ploughs driven by petrol, for instance, are handicapped by the high price of the fuel, though the substitution of crude oil types ought to be possible. It is, of course, also an admitted fact that the motor plough is not always sufficiently powerful to deal with the heavy soil and to withstand the consequent rough treatment it suffers.

It would, therefore, appear that the solution of the difficulty lies with the steam plough, but here again is the disadvantage that water is not in too plentiful supply in many districts. There can be no doubt, however, that the steam plough is increasingly finding favor in the Russian and Siberian markets, and it is so far satisfactory to know that British models are in considerable favor.

GERMAN ELECTRICAL ACCESSORIES.

WITH that extraordinary persistence which is characteristic of the Teuton, the production of vast quantities of lampholders, ceiling roses, tumbler switches and wall plugs, not to mention bell pushes, bells and small telephones, has continued for many years in the hands of German firms, states the Ironmonger. The British manufacturer has, almost without exception, despised this class of competition, and until recent years made no attempt to meet it. Unlike many other German products, electrical accessories have been both cheap and nasty, and this fact probably explains the reluctance of English makers to enter the market.

The wireman and electrical contractor, on the other hand, have, under pressure from the jerry-builder and keen intercompetition, encouraged the trade in cheap accessories, unpatriotically giving the business to foreign concerns. When present stocks are exhausted the supply of such accessories will, for a time, cease. There is little or no competition from the United States, except in special lines; and it will be instructive to observe what steps the erstwhile lax British manufacturer will take to seize his present opportunity to increase his production facilities. Should he do so, it will be the duty of the trade to support him.

CANADIAN TIMBER PIT PROPS IN DEMAND.

BECOMING anxious concerning the supply of timber props for coal mines, hitherto largely supplied from Baltic ports, from which the traffic has been interrupted by the war, British colliery owners, in co-operation with the Board of Trade, are sending special commissioners to confer with Hamilton Wickes,

CORPS OF ENGINEERS RAISED AND MAINTAINED BY THE CANADIAN GENERAL ELECTRIC CO. FOR SERVICE DURING THE WAR.—FROM LEFT TO RIGHT:

Back row, standing: H. S. Elliott, Charles Stewart, C. Pink, W. J. Swanger, F. G. Jackson, H. Williams, E. S. Shill.

Front row, standing: Capt. Ritchie, A. T. McLean, W. S. Johnson, J. S. Dunlop, G. Hillier, C. Henry. George Monaghan, A. Hardie, J. C. Munro, C. C. Rous.

Front row, seated: P. Foster, E. Crockford, H. S. McKean, A. J. Palmer, R. W. Nurse, H. Galvin, R. Bethune, H. Bestard.

British Trade Commissioner at Montreal, as to the possibility of securing a supply from Canada.

The value of the trade, according to Harrison Watson, Canadian Trade Commissioner, is $20,000,000 annually, but Mr. Watson fears lest Canadian exporters should make their prices prohibitive, thinking that Britain is wholly dependent on Canada during the war, whereas suitable timber is also procurable from the South of France and from Portugal. Moreover, Russian Baltic ports have been supplying about half the imports of props hitherto, and Russia, being an ally, the trade would probably revert to these ports after the war unless Canadian prices are made attractive. Mr. Watson also points out that another reason why the Canadian quotations should be kept at a moderate figure is that the Atlantic freight rates are considerably higher than those from the Baltic ports, and, therefore, the Canadian dealers should make this a consideration if they wish to obtain and retain the trade. Another important question which the commissioners will be called upon to decide is whether the Canadian timber is suitable from the standpoint of breaking strength.

The five commissioners who sailed on the Royal Edward on Saturday, Sept. 19, are: W. Windham, representing the Board of Trade; N. Cummings and D. B. Harrower, of the Timber Trade Federation of the United Kingdom; E. B. Whalley, of the Mining Association of Great Britain, and R. Gomme, secretary of the Board of Trade. They will be met at Quebec by Hamilton Wickes. The commissioners may visit Newfoundland before their return, but they will not decide definitely on all their movements until their arrival in Canada.

Mr. Watson reports also that British timber merchants and creosoting works are enquiring for Canadian wood sleepers suitable for railway construction. Large orders have already been placed in British Columbia, and he thinks that a good share of the trade is procurable for Eastern Canada if the prices and other conditions are made attractive.

Winnipeg, Man.—It is officially announced by the administration board of the Greater Winnipeg Water District that half of the Falcon river dyke at the Shoal Lake end of the aqueduct has been completed. This is being constructed at a cost of $120,700 by Tomlinson & Flemming, who have already received $14,037.60 on account. It is for the diversion of the Falcon river, and is an immense undertaking requiring an embankment of 5,070 feet long and a channel 3,300 feet long, 35 feet wide, and 7 feet deep.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Newcastle, N.B.—The Imperial Oil Co. is endeavoring to obtain permission to erect a large oil storage tank here.

North Vancouver, B.C.—The Dominion Shipbuilding & Drydock Co., has secured a site of 140 acres. It will establish a plant estimated to cost about $5.-000,000. Machine shops will be built first.

North Sidney, C.B.—The installation of a new 275 k.w., steam generator has just been completed by the Cape Breton Electric Co. at the sub station as a safeguard against possible damage and interruptions on the Sydney to North Sydney power transmission line.

Electrical

Brigden, Ont.—The installation of the new electric light plant by H. W. Smith, of Petrolea, and A. T. Patterson, of Toronto, has been completed, and the current turned on. There are about thirty street lights, which make a decided improvement in the appearance of the village. The total value of plant is $4,000.

Toronto, Ont.—P. W. Ellis, chairman of the Toronto Hydro-Electric Commission, stated recently that it would not be long before an official announcement regarding the reduction of rates would be made. The managing engineers of the Toronto and the Provincial Commissions are working on the problem, and it is reported, are nearing a settlement.

Peterboro, Ont.—The distributing system of the Peterboro' Light & Power Co. passed into possession of the city on Sept. 24, and the Utilities Commission at once took charge. The right to expropriate the plant was given to the city by special Act of Legislation and throughout the entire proceedings the city has had the staunch support of the Hydro-Electric Commission.

Woodbridge, Ont.—Extension work of the Hydro Electric system is being constructed to Woodbridge from Weston. Reeve Wallace expects that the village will be lighted with municipally owned power by Christmas. Everything is being put in readiness for the current when the power line is completed. This line will be continued towards Bolton, where the citizens are preparing to use hydro energy.

Municipal

Sarnia, Ont.—It is probable that the capacity of the new filtration plant may have to be increased.

Brantford, Ont.—The council have a proposal on foot for the construction of a road to Hamilton.

Oakville, Ont.—It is proposed to build a fire hall. A by-law is being prepared and will be voted on in due course.

Galt, Ont.—A bylaw to grant $55,000 for extensions to the waterworks system at Galt will be submitted to ratepayers on October 23.

St. John, N.B.—The city is in the market for three 3-inch meters, three 2-inch, six 1-inch, three 1½-inch, and six ¾-inch meters at an estimated cost of $1,000.

Cornwall, Ont.—A by-law will be submitted to the ratepayers on October 14, regarding the granting of a franchise to the Cornwall Street Railway, Light and Power Co.

West Vancouver, B.C.—It has been decided to draw up a by-law for the approval of the people for the proposed water system which is estimated will cost $150,000.

Chatham, Ont.—In the annual report of the Fire Underwriters' Association on conditions in Chatham a number of important recommendations for the general improvement of the system have been made.

Calgary, Alta.—Water Superintendent A. E. Ellison Fawkes, has been released from the service of the city. The aldermen adopted the recommendation of the city commissioners dismissing Mr. Fawkes.

Peterboro, Ont.—After nearly four years of legal proceedings and special legislation, Peterboro comes under Hydro Electric jurisdiction. The city officials formally took over the plant and stock of the Peterboro Light & Power Co., and turned it over to the Utilities Commission (Water and Power), which will administrate it. The city comes into possession of a well-equipped and adequate light and power plant. The bulk of the late employees of the company will be retained in the city's service.

Saanish, B.C.—The by-law was passed on Sept. 19 to authorize an expenditure of $375,000 on the waterworks system.

Winnipeg, Man.—The Administration Board of the Greater Winnipeg Water district has awarded contracts on construction amounting to over $6,000,000. The successful tenderers are all Winnipeg firms. James H. Tremblay's award is for $945,945: Thomas Kelly & Sons, $1,301,485, and the Northern Construction Co. allied with Carter, Halls & Aldinger, for $3,895,210. The engineers announced that while the original estimates for the big scheme totalled $13,-045,000, the outlay would be $1,200,000 less than that amount.

Victoria, B.C.—A meeting of the industrial committee of the Victoria and Island Development Association was held recently for the purpose of discussing the situation in the matter of new industries for the city. In addition to the bringing of new concerns to the city, the committee is taking up the question of greater development of those which are already in existence, and the extension of the use of home manufactures in and about Victoria.

Oshawa, Ont.—A movement was launched here last Friday for the promotion of a concrete road from Toronto to Oshawa, similar to that from Toronto to Hamilton. At a special meeting of the Oshawa Board of Trade, to which Whitby representatives were invited, a resolution was unanimously passed asking the Whitby deputation to call a meeting of representatives of municipalities between Toronto and Oshawa, probably next Thursday. A delegate from the Good Roads Commission will be asked to attend to help work out details of the proposition. The Whitby deputation who will handle the meeting are Mayor Willis, Dr. Bascom and F. R. Annes. At present there are fourteen miles of improved roadways from Toronto to Oshawa, leaving twenty miles to be paved.

General Industrial

Calgary, Alta.—Tenders for the erection and equipment of the Western Canadian Cartage Co. premises at Manchester closed on Monday, September 21.

Sault Ste. Marie, Ont—It is announced that the Standard Chemical Co. will re-

The Lighting Feature of a Prominent Railroad Shop

Data concerning the lighting of factories and workshops are perhaps rather more in demand at this season of the year than at any other; the accompanying article may therefore be reckoned opportune in that it deals with highly satisfactory results obtained from the installation and arrangement of a specific type lamp.

THE manifold advantage of having adequate illumination in an industrial plant is being realized by no class of operators more readily than by railroad men. Not only does the proper illumination of a shop mean a better and more efficient class of work turned out, but exhaustive tests recently made in a large industrial plant proved conclusively that a workman actually made a gain of several minutes per day in the production of a given piece of work, owing entirely to the better illumination with which he was supplied. These few minutes when multiplied by a large number of workmen amount to a considerable item.

There are shown herewith some views of an excellently lighted boiler shop and erection shop of a prominent eastern railroad. As will be noted from a glance at the reproduced photographs of same, which were taken at night, the illumination is abundant but entirely without glare or shadows, reaching every part of the shop. The buildings are 528 feet long and 58 feet wide, giving an area of 30,624 square feet in each building.

The illumination for these buildings is furnished by type Z Cooper-Hewitt quartz lamps operating on a 220-volt direct current circuit. These lamps are a modification of the well-known Cooper-Hewitt lamp, based on the same fundamental principles, but possessing some essential differences. The details of construction have been previously described in our columns. The lamp uses the mercury vapor and a short tube of pure fused quartz instead of the long tube of lead glass used in the older types.

LOCOMOTIVE BOILER SHOP ARTIFICIALLY LIGHTED.

LOCOMOTIVE ERECTING SHOP ARTIFICIALLY LIGHTED.

Ten lamps are installed in the boiler shop, being placed at regular intervals of 52 feet down the middle of the building, each lamp lighting an average of 3,062 feet.

In the erecting shop there are twelve lamps regularly spaced down the middle of the building at intervals of 44 feet, giving an average space lighted by each lamp of 2,552 feet.

All the lamps are hung at a height of 50 feet above the floor, and are rated at 2,400 candle power with an energy consumption of 725 watts, or a total for the installation of approximately 16 kilowatts. The light afforded is entirely sufficient for all purposes, even the locomotive pit being well illuminated, the only other form of artificial light required being a portable hand lamp needed by the workman when he goes inside the boiler. The total lumens per lamp from these units is 14,603, with a total available in a zone of 0 to 60 degrees of 10,800 lumens per lamp which, with a wattage of 725 gives a value of 20.2 total lumens per watt, and 14.9 available lumens per watt.

The efficiency of the system as installed is made evident from the low wattage consumption obtained per square foot, these being .28 for the erecting shop, and .24 for the boiler shop. The average candle feet obtained is 4.24 for the erecting shop and 3.53 for the boiler shop.

No better evidence of the success of the installation from a practical viewpoint can be secured than the universal commendation of the employees who are working under the light. It is interesting to note, however, that when a trial installation of four lamps was first made, there was a certain antipathy to the light on the part of the employees, because of the difference in color value, but this speedily disappeared after having been given a thorough trial. This trial resulted in the adoption of the complete installation of these units.

The lamps have been installed at various times but the entire installation averages practically 16 months, and the maintenance charges for the period totals $134.54 of $4.58 per lamp per year.

LOCOMOTIVE BOILER SHOP ARTIFICIALLY LIGHTED.

THE MAN IN CHARGE.

By C. D.

THE successful administration of the every-day affairs of a large machine shop requires of the person in charge, either superintendent or general foreman, a degree of skill and intelligence coupled with executive ability that is not often understood and very often underestimated by the uninitiated.

In the first place he must be a man that can and does command the respect of the men under him. If he be an expert mechanic so much the better. He must have the observing eye so that he may walk through his department and see at a glance just what is going on and notice feeds and speeds, and the way work is chucked for turning or clamped for planing, etc. He must also learn to think quickly and be able to give a decision without beating around the question any unnecessary time. He must also be familiar with the best and latest methods of production, as the production part is the heart of the position. Anyone can run a machine shop if the parties who finance it are satisfied to run without profits, but now with competition so keen, the art of producing in large quantities and at low cost has become a science very few as yet understand.

Competitive Cost Comparisons.

In some cases, as, I am glad to say, is the case with the writer, we are blessed with having the privilege of a comparison of costs with another large shop, I may say, one of the largest in America, doing the same work and under almost identical conditions. The trouble with most machine shop heads who have not the benefit of this comparison is that they are too often satisfied with the production they are getting, and begin to let things go along without constantly trying to invent new ways and means of doing the work quicker and better. As eternal vigilance is the price of liberty, so eternal watchfulness on the part of the production men is the price of success in the machine shop. Never be satisfied with the amount or the quality of the work performed, as there is always something better to be brought to light by the continued persistent effort in looking into every little detail of the work and eliminating all unnecessary moves and handling of output.

Increasing Production.

I have seen shops that have increased their production from 20 to 40 per cent. simply by the men in charge going thoroughly through each foreman's department with a stop watch and timing each operation, showing the men how to move to advantage, giving the operators the reason for their suggestions, and encouraging them and stimulating them by telling them how much easier it is for them to dispense with these useless movements and still retain, or even better the quality of the work. Of course, a great deal depends on the grouping of the machines so that the operations follow in rotation, and involves in the case of heavier castings having slides or runways made of gas pipe, so that the work can be slid along from one operator to the next without having to be lifted from the floor each time.

Selecting Competent Men.

One of the hardest propositions a man in charge of a large machine shop has to face is the selection of competent men, either from the tool department or the various manufacturing departments under his charge, to place in charge of new departments constantly opening up in order to take care of new work about to be undertaken. Sometimes we can pick a man from one of the departments who shows marked ability in both the quality and quantity of his work and place him in a sub-foreman's position and he makes the best kind of boss. Then again, where the work about to be undertaken is of a finer quality, we go to the tool room and have a talk with the tool room foreman and look over the men in his department and pick one that seems to have the push in him necessary for manufacturing work. How often, however, in going into the tool room do we see men there perched up on stools looking very wise but with their machines taking little light cuts with the finest feeds they can possibly get. This kind of work certainly keeps toolmakers from advancing to positions of trust, yet how few of them seem to realize this point.

Selection of Tools.

The man in charge must also be careful in the selection of the various tools used in the work he undertakes to perform. He must know what make of drills is the best for the particular kinds of steel being machined, also what make of high speed steel to use in the tool blocks of lathes and the proper design of cutters for milling operations, and why these things are the best, and not be led into buying anything the many salesmen constantly calling would like to sell him. **Furthermore, he should be a regular reader of all the mechanical publications he can get his hands on, and pick out all the good things in them and see where he can apply them to his own work.**

He must also be a man broadminded and willing to take a suggestion from any of the men in his employ, and develop it for its good and bad points; a man easy to approach by those under him, and yet one they know will not tolerate any familiarity, while they feel sure he is always their friend and can be depended on to see that they get a square deal at all times. Of course, he will be called on to be severe in cases, but what man can control 500 or 600 men without being severe at times?

Synopsis of Papers Read at the Foundrymen's Convention

While, in subsequent issues of Canadian Foundryman, publication will be made more or less in full of those papers, the subject matter of which may more directly appeal to our readers, we believe that a condensed preliminary reference will serve to not only awaken a larger interest generally, but at the same time draw attention to data that might otherwise be overlooked when sandwiched among contributory detail.

EVILS EMBODIED IN SPECIALIZATION.

By Thos. B. West.

THE two main influences that are supporting the modern trend toward specialization are first, the necessity for cheapness and improving the quality of commodities and second, the desire to open avenues that will permit persons to engage in industry who have little and often no practical experience in their work. Embodied in the latter tendency are evils that are undermining the very foundations of successful industrial and professional life. These evils can be remedied and the benefits of specialization preserved. Among other corrective measures, the author urges that agencies be created to develop and foster the conviction that the skilled and efficient workers in the mechanical trades are justly entitled to wages far in excess of those paid to clerks and others engaged in work that involves very little sacrifice of time in the apprenticeship period.

SELECTION OF FOUNDRY GRINDING WHEELS.

By C. F. Dietz.

THE development of the modern grinding wheel has been simultaneous with the development of the modern foundry. It would be quite impossible to conceive of a foundry with the melt running into hundreds of tons daily, removing the fins and spurs of its castings by means of a chisel and file. A grinding wheel is both a chisel and file in one instrument, a massive aggregation of little cutting tools bonded together in such a manner that their high speed of rotation provides an opportunity for the rapid and economical removal of large quantities of metal. To get the best results out of grinding wheels great care must be used in selecting a wheel of the proper hardness and with a suitable grain size for the work at hand. The life and productivity of a wheel of a given abrasive material is directly measured both by the grain size and the strength with which the grains are held together. This paper includes many suggestions for selecting the proper type of abrasive and the correct grain size and kind of binding for different classes of work. The bond to be used for any given operation depends upon several factors, including the wheel and work speeds, the condition of the grinding machine, the area of the casting in contact with the wheel, the ability of the operator, the character of material being ground and the finish desired. Similar considerations govern the selection of the proper grain size.

MELTING CHARACTERISTICS OF ACID STEEL.

By A. F. S. Blackwood.

THE manufacture of steel for casting purposes is discussed at length, the acid process receiving special attention. The crucible, converter, open-hearth and electric processes are described, and details of furnace construction and manipulation are given. Many practical suggestions are included covering the lining of furnaces, while charging, tapping and the making of alloy additions also receive considerable consideration. The production of manganese steel is described and various types of side-blow converters are discussed. The paper concludes with a discussion of the various types of electric furnaces, and their adaptability to the manufacture of steel for casting purposes is pointed out.

ANNEALING PROCESS RESEARCHES FOR MALLEABLE CASTINGS.

By O. W. Storey.

FROM the results obtained by E. L. Leasman and reported at the 1913 meeting of the American Foundrymen's Association, in a paper entitled "A Study of the Annealing Process for Malleable Castings," the auther has been able to make a more extended investigation of the exact nature of the reactions occurring in the annealing of white iron. The results of this investigation are presented in this paper. In his work Mr. Leasman investigated the influence of the following variables upon the structure of malleable iron:—

1.—Packing materials.
2.—Temperature of annealing.
3.—Time of annealing.
4.—Rate of cooling.

FOUNDRY AND MACHINE EXHIBITION, CHICAGO. VIEW FROM WEST END OF ARENA, SHOWING FOUNDRY EXHIBITS IN FOREGROUND AND ALONG EACH SIDE.

The results of the more extended investigation made are as follows:—

1.—The critical range of cooling malleable iron is between 700 and 775 degrees Cent.

2.—Below 700 degrees Cent. no decomposition of iron carbide occurs.

3.—All malleable iron must be cooled slowly to 700 degrees Cent. to insure a complete breakdown of the iron carbide.

4.—Increasing the percentage of silicon will increase the upper limit, while increasing the manganese, will decrease it.

In addition to the experiments upon malleable iron, similar experiments were made upon scrap cast iron. Similar results were obtained, though the upper temperature limits were higher, probably due to a higher silicon content.

SELECTION AND USE OF REFRACTORIES.

By. W. H. Kelley.

AS its title indicates, this paper covers the general subject of refractories for foundry work. The author first describes the principal kinds of refractory brick available, covers the methods of manufacture and gives typical analyses of fire clay brick, silica brick, bauxite brick, chrome brick and magnesia brick. A perfect fire clay should analyze 53.27 per cent. alumina and 46.73 per cent. silica. Fire brick containing from 59 to 73 per cent. silica will usually give trouble. Analysis, however, is not the only criterion in judging refractories. Physical structure also must be given consideration, for often the brick is called upon to resist severe abrasion and the scouring action of hot gases moving at high rates of speed. The paper concludes by giving details regarding the selection of refractories for different purposes in the foundry, including brick for lining air furnaces, annealing furnaces, brass melting furnaces, steel converters, core ovens, crucible furnaces, cupolas, electric furnaces, malleable furnaces, and acid and basic open-hearth furnaces.

LOCATING A FOUNDRY IN NEW TERRITORY.

By L. L. Anthes.

THE many problems that must be considered by a manufacturer before locating a plant in a new territory are discussed and difficulties that will confront him in the operation of his shop are pointed out. The question of selecting the site with its possible market, bonus propositions, railroad facilities and contiguous markets are given careful consideration. The plant referred to is located in Winnipeg, Man., where extremes of temperature prevail in summer and winter. This necessitates the construction of a plant that will protect the employees regardless of climatic conditions, and the cost of building is a factor that should receive more than ordinary attention. Other factors that must not be overlooked are the labor market, basis of wage payment, relations with other manufacturers, cost of living, etc. The author states that the pioneer in manufacturing, like any other pioneer, must have youth, optimism and determination, as well as a certain amount of cash in hand.

THE TWO STOREY FOUNDRY.

By C. K. Hooder.

THE two storey foundry is the natural result of the development of the full possibilities of the moulding machine. Aside from the greatly increased output per square foot of floor space resulting from the two storey design, additional production is obtained because the moulding and pouring operations are simultaneous and continuous. Little advantage is gained in placing the foundry on the upper floors of a 4 or 5-storey building, using the lower floors for machine shop or other finishing operations of a highly complex character. The most economical two storey foundries are those in which the lower floor is on a level with the yard. This construction permits the handling of materials with a minimum of effort and expense.

SAFETY FIRST.

By F. W. Reidenbach.

THIS paper deals with the causes of accidents and suggests preventive measures and remedies. After making a thorough examination of a large number of casualties, the author concludes that the most vital causes of industrial injuries are lack of proper education and the use of intoxicating liquors. He, therefore, suggests that steps be taken so that all men employed in shops and foundries will have at least a common school education and that total abstinence be insisted upon.

BRASS FOUNDRY SAFETY AND SANITATION.

By F. Moerl.

THIS paper treats of safety and sanitation in the brass foundry, with particular reference to the measures adopted by the Pullman Co., of Chicago, in order to comply with the Illinois Occupational Disease Act. At first this law was received with disfavor generally throughout the State both by employers and employees, but now it is recognized that such regulations are necessary for the protection of the health and comfort of

FOUNDRY AND MACHINE EXHIBITION, CHICAGO. VIEW FROM NORTH END OF NORTH BUILDING, SHOWING FOUNDRY EQUIPMENT.

workingmen, and the Pullman company was one of the first corporations in the state to more than fully comply with the provisions of the Act. At the Pullman works, the men in the brass foundry are subjected to a medical examination once a month, the object being to keep them in good health and prevent rather than cure occupational diseases. Each man in the brass department is furnished with a suit of white overalls and a jumper, individual towels, a nail brush, and if necessary, goggles, respirators, rubber gloves and a rubber apron. The men are also provided with individual lockers. In the shops themselves, particular attention has been given to ventilation and the gases generated during the pouring can be cleared from the room in 30 seconds.

ELIMINATING WASTE MOTION IN BENCH MOULDING.

By. R. E. Kennedy and J. C. Pendleton.

EVERY shop has almost an unlimited number of opportunities for reducing time and cost at only a very small expenditure of money. The necessary changes can be brought about by following out the suggested improvements shown by careful time and motion studies. In order to show in a concrete way what can be done along this line, the authors made a study of bench moulding and found that there were three principal causes for delay. In many cases, the tools were not in the most convenient positions for handling: in others the workman did not have the necessary tools nor were those he did have in good shape; while in still other cases the moulder did too much unnecessary work. These three causes for decreased production are analyzed in considerable detail and an improved design for a moulder's bench is presented.

GRINDING WHEEL SAFETY.

By R. G. Williams.

A LARGE number of valuable suggestions showing how to avoid grinding wheel accidents are included in this paper. The speed of the wheels should be rigidly controlled and under no circumstances should the limit set by the manufacturer be exceeded. Washers of some compressible material should be used between the wheel and the flanges. All flanges, either straight or safety shape, should be relieved. Wherever operating conditions will permit, a well-designed substantial protection hood should be used. In such situations a tapered wheel and flanges of a corresponding taper are not necessary. Where protection hoods cannot be used, tapered wheels with safety flanges are the next best thing. Exhaustive tests, however, indicate that safety flanges alone do not afford complete protection.

SAFETY MOVEMENT PROGRESS.

By A. T. Morley.

THE public as regards factories, railroads and powder plants, still considers abnormal conditions as the causes of accidents, instead of realizing that they are the result of common habits of carelessness. The big accidents, like the Titanic disaster, are not sporadic happenings under unusual circumstances, but come largely from racial habits of careless thought, and the man who causes a great catastrophe is anathematized for manifesting a racial characteristic. Through thorough organization and the enlistment of the co-operation of its employees, the accident record of the Commonwealth Steel Co. shows a reduction in compensation loss of 73 per cent. This paper describes the safety organization of the Commonwealth Company and also refers to the work of the National Council for Industrial Safety.

DEFECTS IN STEEL CASTINGS AND THEIR REMEDIES.

By John H. Hall.

DEFECTS in steel castings may be divided into four classes:—(1)—Pipes and other cavities due to contraction of the steel and formed chiefly during solidification. (2)—Stresses set up and cracks formed by contraction of the steel in the solid or semi-solid state. (3)—Internal blow holes. (4)—Surface blow holes, sand holes and other exterior imperfections. In this paper, the remedies for the four classes of defects mentioned above are discussed in detail. Special attention is given to methods which will produce sound castings with a minimum loss of metal scrapped in the form of shrink heads, gates and runners. The causes of pipe defects are thoroughly discussed and methods of preventing them by the use of chills, shrink heads and proper molding are pointed out. Chills in many cases are preferable to shrink heads. Many shrink heads are unnecessarily large and improperly located. A head should be placed and proportioned with due reference to the laws of fluid pressure. The design of the neck is also important. The paper also discusses the proper proportioning of gates and runners; the advantages of gates at several levels in deep molds; the making of shrink head necks in cores; the causes of cracks and the proper remedies for them, and the best methods of eliminating blow holes from steel castings.

STRENGTH AND DUCTILITY OF MALLEABLE CAST IRON.

By E. Touceda.

THE aim of the author in writing this paper is to demonstrate that the metal under the skin of malleable castings is ductile and of good quality, contradicting statements which are frequently made to the contrary. The author first briefly describes the process of manufacturing malleable cast iron and wrought iron. The paper then goes on to describe some tests made on malleable castings as they were received from the foundry and also on castings which had been machined so that all of the outer skin was removed. These tests indicated that the metal in the core of properly made malleable castings is of superior quality and sufficiently ductile for all ordinary purposes.

COMMITTEE REPORT ON INDUSTRIAL EDUCATION.

By P. Kreuzpointner.

PROGRESS has been made during the past year in the introduction of industrial education. Six States thus far have inaugurated definite systems for the organization and supervision of industrial schools, including Pennsylvania, Wisconsin, Indiana, Massachusetts, New York and New Jersey. The most decided progress that has been made is in the establishment of numerous corporation schools. The report discusses corporation schools at length, taking up their functions, the subject matter taught and their relation to the public school system. Continuation schools are also dealt with in detail. The proper course of study for continuation schools is outlined and the attitude of the schoolmen toward them is discussed.

CALCULATING MALLEABLE CAST IRON MIXTURES.

By H. Hemenway.

THIS paper treats briefly of the elements entering into the manufacture of malleable castings and explains fully a system of calculating mixtures. There are five elements that enter into the composition of malleable iron, two of which are classed as negative and three as positive. The negative elements are sulphur and phosphorus, and the positive elements are silicon, carbon and manganese. Of the latter silicon is the one on which the greatest dependence is placed. The method of calculating mixtures which the author explains in considerable detail is simple and easily understood and is applicable to a wide range of conditions. The silicon contents may be easily manipulated and the method is adapted to heats of any size.

SAFETY IN CRUCIBLE PRACTICE.

THE graphite crucible is simply a piece of pottery, not strong even when new; it naturally weakens under the severe treatment which it must endure in service. Nevertheless, care and skill in its use makes the graphite crucible a comparatively safe vessel in which to melt and handle molten metals.

The care of crucibles should begin when they are received. They should be inspected carefully for cracks and other superficial flaws, and only those crucibles which seem to be in sound condition should be put into service. It is especially important to examine crucibles for dampness; and if the condition of the packages or of the car in which they have been shipped indicates that they have been wet in transit, the crucibles should be put aside, either to be returned to the maker or to be specially treated.

Moisture in the crucible is a great source of danger when the crucible is exposed to high temperatures, for the heat rapidly converts the moisture into steam, and the latter, unable to escape quickly, causes slight explosions in the crucible walls, which weaken or fracture them. The remedy is gradually to drive out all moisture before charging the crucible, and to prevent further absorption of moisture.

Storage of Crucibles.

When received, crucibles should be stored in a warm dry place, preferably in an oven on the roof of a continuously operating core oven, and shut off from moist air as much as possible. The best results are obtained when the temperature in the storage oven is maintained at about 250 degrees Fehrenheit, at which temperature crucibles will not absorb moisture. Waste gases from furnaces or from ovens may be advantageously used for this purpose; when these gases are moist, however, they should not come in contact with the crucibles, but should be conducted through the furnace walls. The use of damp high sulphur coke or coal or fuel oil containing excessive moisture should be avoided, both in the storage oven and in the melting furnace.

Sometimes the heating space available will not allow storage of all of the crucibles in stock. In that case, the maker's date stamped upon the crucible will assist the man in charge to heat the oldest and best seasoned crucibles first; otherwise it is advisable to mark the date of receipt on each crucible, and use that date as a guide. When the date of entry into the storage ovens is also marked on the crucibles, it indicates which ones are best prepared for annealing.

Crucible Annealing.

No crucible is ready for annealing until it has been heated to a temperature of 212 degrees Fahrenheit or more. Annealing consists in slowly and uniformly heating the crucible from this temperature to a dull red heat. This may be readily accomplished in the usual coke furnace by steady, slow firing, eight or ten hours being the proper time allowance for annealing, or waste gases from oil-fired furnaces may be utilized by carrying them to an annealing pit, where crucibles are annealed continuously. Each crucible must be properly annealed before metal is placed in it for the first time. After annealing, the crucible should not be allowed to cool before it is charged, else moisture may again be absorbed by it.

At usual melting temperatures, crucibles become soft and pliable and are easily deformed by concentrated pressure. Indentations sometimes cause immediate fractures, while slight deformations frequently develop cracks when the crucible cools. Crucible bottoms should therefore be kept free of clinker or other projections, and should be set upon well prepared fuel beds or upon level fire bricks or graphite pedestals when in the furnace, so that, when full, the heavy weight of the metal will be distributed as evenly as possible over the entire crucible base. Care should also be taken to charge the metal loosely, and to prevent jamming or wedging of the metal, else its expansion will strain or damage the crucible walls.

If the crucible is not to be immediately recharged after pouring, it is important that no metal be allowed to remain in it; such "buttons" contract and strain the crucible when cold and induce early cracking. In any case, it is advisable carefully to scrape out slag or dirty scrap after each heat, to avoid scoring of the crucible, and to secure maximum capacity.

Tools.

Crucibles are often damaged by the use of badly fitting tongs and shanks. Tools should be so constructed that the crucible can be lifted and poured with least amount of "pinching." Tongs should grasp the crucible below the bilge and should close in such manner as to avoid crushing of the lip. Plain ring shanks are safest because they pinch crucibles least. The ring should be deep, and kept smooth to secure maximum bearing upon the crucibles, and where practicable rings should be thick enough to retain their shape indefinitely. A full set of cast iron crucible forms and their frequent use to restore deformed shanks and tongs to their proper shape will help to insure good fit and safest contact of these tools with the crucibles. Tongs and shanks should also be frequently inspected for flaws, wear of pins or rivets, or any other weaknesses which may cause or allow a crucible to spill its contents prematurely.

It is advisable, under some conditions, to keep extra sets of tools to replace others while they are being repaired, and to prevent delay in repairing tools which often occurs because the faulty tools cannot be spared. It is also good practice to provide an extra set of tongs and shanks of suitable shape for use on crucibles that have become small in diameter.

Protective Clothing.

Notwithstanding every precaution which may be taken to prevent it, crucibles sometimes break or leak in service, when molten metal is apt to spill and burn workmen. Runouts and careless handling of crucibles often cause similar injuries. As molten non-ferrous metals, which are usually handled in crucibles, inflict even more serious burns than molten iron or steel, it is therefore all the more important that suitable protective clothing be worn when handling molten metals in crucibles.

The proper care of crucibles reduces accidental injuries to workmen. It also extends the life of crucibles and prevents loss of metal which would otherwise occur through more frequent crucible breakage.

CONCERNING CUPOLA PRACTICE.

By R. Micks.

ONE of the most essential points in successfully operating a foundry is good cupola practice. No concern can turn out good, clean castings unless their cupola is handled by a competent and reliable man, for the best of iron can easily be ruined by carelessness in the melting. A lot of foundrymen seem to have the idea that there is some mystery or secret about getting good heats, but in my experience, operating both large and small cupolas, I have found that by using a little judgment and watching the cupola closely until you find out its pecularities, you will have little difficulty in getting good, hot, clean metal and also in keeping the cupola in good working order.

Good material should be used for daubing, as common clay or moulding sand or other cheap daubing only scales off with the heat and comes down in the iron as slag, causing trouble in the cupola and giving dirty catsings. The writer has found that a mixture of fireclay, 3 parts, and good sharpstone, 1 part, makes an excellent daubing, as the addition of good sharp sand keeps the latter from cracking. It should be applied to the lining at about ¾ in. thick, but never more than 1 in. thick, and used as dry as possible. Badly burned spots in the lining should always be repaired with split brick and not be filled in with clay, as the clay will remain in place only for one heat or probably not that long.

The diameter of a cupola should be kept as near uniform as possible, except in the melting zone, where it can stand to be 4 or 5 inches larger. The sand for the bottom should be tempered about the same as moulding sand, and care should be taken not to ram sand in too hard, as this will cause the molten metal to boil and cut or scab the sand on the bottom. The coke bed in every cupola should be 22 to 24 inches above the tuyeres. The cupola bottom should have a gradual slope from all edges to the tapping hole.

Always use enough coke until certain of the actual amount required to bring out satisfactory heats, for many dollars' worth of castings are often lost for the sake of a few cents' worth of coke. Keep the coke beds level and charge the iron close to the sides of the furnace, so that the blast cannot circulate between the charge and the lining, as this will chill the fuel and iron and cause the cupola to bung up and bridge. After a third charge in a large cupola, it is advisable to use as a flux about 60 lbs. good limestone per 1 ton of iron.

These suggestions will work out in any standard cupola with the tuyeres in the proper place and the right amount of blast.

PORTABLE DRILL FOR BLAST FURNACE TAP HOLES.

A special portable electric drill for opening the tap holes of blast furnaces is being used in the United States. It is intended to take the place of the hand drill. These tools have sufficient power to drill 2½-in. holes without danger of stalling. When in operation, the drill is supported by a long handle. The operating switch is placed in the end of the handle and is so designed that the power is automatically cut off as soon as the operator lets go the handle. It is said that a furnace can be tapped with this machine in less than five minutes, the actual drilling time not exceeding two minutes. The electric drill is withdrawn when within an inch or so of the iron, the final tap being made as usual with a long bar of steel. Drills of this type are being used by the Carnegie Steel Co., Pittsburgh, at its various blast furnaces. The drill shanks are about 10 feet in length, about 3 feet of which is twisted. The drill is 2½ in. in diameter. At the Edgar Thompson plant at Pittsburgh, the drill is hung on a special crane, which is so arranged that danger of accidents to the operator is obviated.

The Gilson Manufacturing Co., Guelph, Ont., reports business brisk. Their factory has been running overtime for some weeks.

The Method and Manner of Laying-out Plates

By Joseph W. Ross

The laying-out of plates to form the various shapes for which sheet metal parts are used involves difficulties that are only discovered when such a job is undertaken. It is well known to superintendents and foremen that some men require much more time than others to do this work in which system and right methods are the great economizers.

CYLINDRICAL SURFACES.

THE general formula for obtaining the stretchout of cylindrical forms is 3 1-7 times the diameter. This is not strictly correct but many mechanics prefer to use it, as it is near enough for ordinary calculation. The correct formula, and one which the writer uses and advises is 3.1416 times the diameter; this gives the circumference of the circle, or as it is termed in plate work, the "stretch-out." By stretch-out is meant that length of plate on the flat, which, when rolled to shape will conform to and make up the required diameter.

Take, for instance, the cylinder of No. 22 gauge iron (about 1-32 in. thick), shown in the perspective drawing Fig. 1. In gauges lighter than No. 20, it is not usual to consider the thickness. To calculate by the fractional formula, the stretch-out will be 3 1-7 × dia. = 3 1-7 × 21 = 66 inches. The decimal formula gives 3.1416 × 21 = 65.97 inches. The first formula gives the length of plate 3-100 or 1-32 part of an inch too long. In this case, however, it is practically an infinitesimal quantity, but in the heavier gauges the thickness of the plate must be considered.

FIG. 1. NO. 22 GAUGE SHEET IRON CYLINDER.

Effect of Plate Thickness.

During the operation of rolling, the outside circumference of the plate stretches, while the inner circumference compresses. These factors which are generally termed the "take up" or "loss in the rolls" have to be considered in calculating the stretch-out. They are usually overcome by working from the neutral line. For instance, in the plan view of the cylinder shown in Fig 2, the inside diameter is 20 inches and its inside circumference 20 × 3.1416 equals 62.83 inches. The outside diameter equals 20 in. plus 2 plate thicknesses, making 20 + (2 × ½) = 21 in. The outside circumference, therefore, is 3.1416 × 21 = 65.97 inches. As the inside circumference has been compressed and the outside stretched, it will readily be seen that the true circumference must be the mean of these values, or in other words the neutral circumference, which is (62.83 + 65.97) ÷ 2 = 128.8 ÷ 2 = 64.4, or 64 13-32 inches.

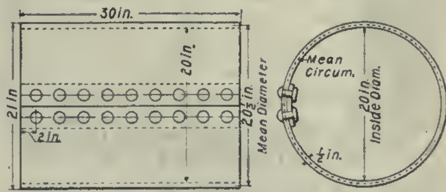


FIG. 2. PLAIN CYLINDER WITH BUTT JOINT.

As the plan in Fig. 2 shows a butt joint, the length of plate required on the flat is 64.4 in., or 64 13-32 in. Fig. 3 shows a lap joint, therefore to the calculated length must be added the laps. A much quicker method than the above to obtain the stretch-out in heavy plate is by calculating directly from the neutral diameter. The neutral diameter in Figs. 2 and 3 is 20½ in., therefore the neutral circumference is 20½ × 3.1416, which equals 64.4 in., or 64 13-32 in. This is the same desult as given by the longer method.

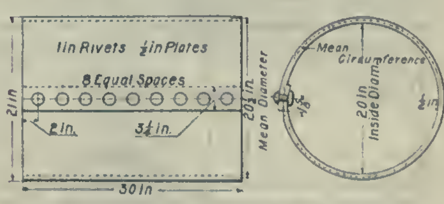


FIG. 3. PLAIN CYLINDER WITH LAP JOINT.

A summary of the foregoing paragraphs shows that the stretch-out of light plate less than gauge No. 20 (1-32 in.) equals diameter multiplied by 3.1416, whilst the heavy plate is calculated by 3.1416 times the neutral diameter. In most operations, therefore, where thickness, bending, flanging and rolling are contended with, work from the neutral line.

The length of plate required for Fig. 2 is 64 13-32 in. Measure as on Fig. 4, this distance on the plate, bisect and

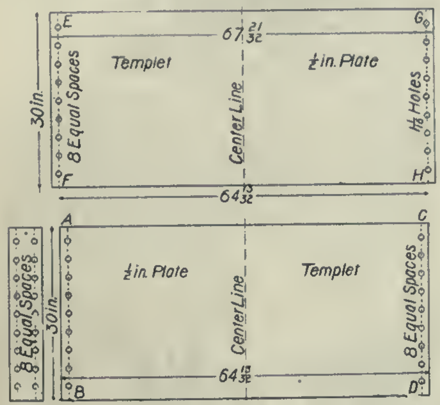


FIG. 4. COMPLETED TEMPLET OF CYLINDER IN FIG. 3.

square up as explained in previous article re squaring up*. Measure the line of rivet holes 1⅝ in. from the butt edges and on this line A-B, mark off the two end rivets 2 in. from the top and bottom edges respectively.

Bisect this distance and, at each side of centre, mark off four equal spaces. Transfer all these hole centres to a lath and place lath on the opposite rivet line C-D, with rivet centre to centre of line C-D. Now mark off all the holes from the lath and use the same centres for marking off the butt strap. Fig. 4 shows the complete pattern with butt strap. The length of plate between the rivet line centres of cylinder shown in Fig. 4 is 64.4 or 64 13-32 inches. To this is added the laps or twice 1⅝ inches, and the total length of plate required becomes $64.4 + 3\frac{1}{4} = 67$ 21-32 in.

As shown in Fig. 4. measure off 64.4

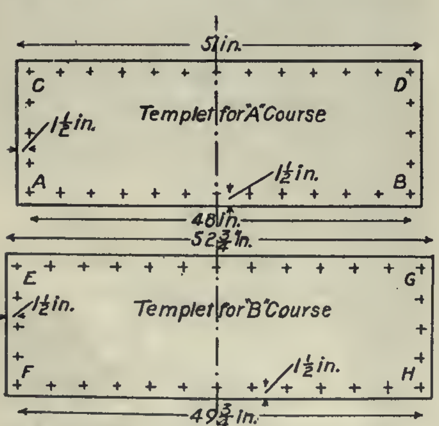


FIG. 6. TEMPLET FGOR A COURSE OF CYLINDRICAL PLATING.

in., the distance between rivet lines; bisect and square up the plate, and add 1⅝ in. for laps to each end, thus making the total length 67 21-32 in. Bisect the rivet line E F and mark off the two end rivets 2 in. from top and bottom plate edge. Between the centre and one of the end rivets on line E F, mark off four equal spaces and transfer these by the lath method to the other side of the centre. Next transfer all hole centres to line G H, always bearing in mind that centre of lath must be kept to centre of rivet line. Fig. 4 represents the completed templet of the drawing shown in Fig. 3.

Where there are a great number of holes, the lath method of marking is a splendid time saver, and although this may not seem apparent when there are but a few holes to mark off, it still has the advantage of accuracy, interchangeability and uniformity, which are great factors in repetition work and even in odd jobs.

In Fig. 5 is shown the plan and elevation of a number of plates connected together by the in-and-out system of cylindrical plating. That is to say, one series of plate courses fits inside, whilst the other series fits over or encircles the inner courses. With some modifications in laps, butts and riveting, the drawing shown may be utilized for such work as

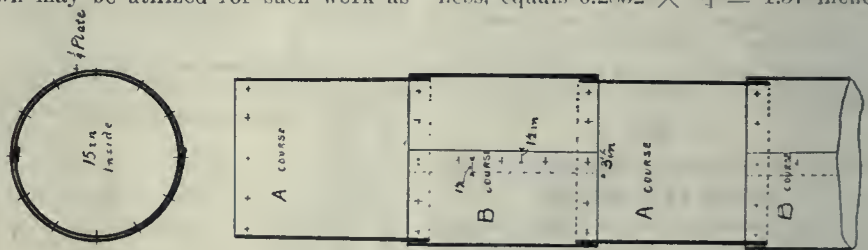


FIG. 5. IN-AND-OUT SYSTEM OF CYLINDRICAL PLATING.

tanks, standpipes, air receivers, horizontal and vertical boilers, etc.

The inside diameter of course A equals 15 in. and the neutral diameter will equal 15 + one plate thickness, making 15¼ inches. The neutral circumference (which is the length of plate required, ignoring laps) equals $15\frac{1}{4} \times 3.1416 = 48$ in. As the laps at each end of plate are 1½ in. from the rivet line centre, the total length of plate for course A will be $48 + 1\frac{1}{2} + 1\frac{1}{2} = 51$ inches.

Measure off, as shown in Fig. 6, 48 inches (which is the distance between the lap rivet centres), and mark off the rivet line A B, 1½ inches from, and parellel to, this line. Bisect rivet line A B, and square up the plate, thus obtaining all the rivet lines. Mark off twelve equal spaces on the top and bottom rivet lines A B and C D; also divide the rivet lap lines A C and D B into four equal spaces, using the lath method as before. Centre-punch all the rivet hole centres and from these line centres mark off 1½ inch laps. Strike in the lines with a chalk line or straight edge, and a few suitably placed centre punch marks will locate the shearing edge in case of the chalk lines being obliterated. This completes the templet for course A, and is as shown in Fig. 6.

As course B fits over or encircles course A, it will be obvious that it will require a longer plate. The difference in length depends upon whether a tight, easy or slack fit is desired, according to the nature of the work. In boiler and tank work it is essential to have tight fits; that is, the metal should be brought together as closely as it is possible to be drawn. Smokestacks and similar work is generally easy fitting, and thus permits easy, economical assembling.

The inside diameter of course A is 15 inches and its outside diameter will be 15½ in., while the inside diameter of course B will be the same as the outside of course A, which is 15½ inches. The outside diameter of course B will then be 16 inches and its neutral diameter 15¾ inches, or two thicknesses more than the neutral diameter of course A. The neutral circumference of course B will be $3.1416 \times$ two plate thicknesses more than course A. This is more generally calculated, 6.2832 times one plate thickness, equals $6.2832 \times \frac{1}{4} = 1.57$ inches. Course A circumference = 48 in., therefore course B will equal $48 + 1.57 = 49.57$ in., or 49 17-32. This calculation gives a good tight fit for boiler and tank work, and permits the plates to be well drawn together, thus ensuring good riveting and calking.

As will be seen, the method of calculating the outer course is to obtain the neutral circumference of the inner course and add to this 6.28 times the plate thickness, which gives the stretchout of the outer course. This calculation is for a tight snug fit. If a tight fit is not essential, the formula 6½ times the plate thickness is added, and again, in the case of quick and easy assembling of the courses, the formula generally used is 7 times the plate thickness.

To sum up the foregoing, the result is that 6.28 times plate thickness for good steam or watertight work, 6½ times plate thickness for easy fit, and for slack fit, 7 times the plate thickness have to be added to the neutral circumference of the inner course.

It is required to make course B a slack fit, therefore the length of plate between the line of rivet hole centres will

*Page 3, Vol. 12, July 2, 1914.

be length of course A plus 7 times plate thickness. This equals $48 + (7 \times \frac{1}{4}) = 49\frac{3}{4}$ inches, to which must be added the laps. Therefore, the overall length of course B equals $49\frac{3}{4} + 1\frac{1}{2} + 1\frac{1}{2} = 52\frac{3}{4}$ inches, including laps.

Measure off on the plate, as in Fig. 6, a distance of $49\frac{3}{4}$ inches and parallel to this, mark off the rivet line $1\frac{1}{2}$ inches distant. Bisect this rivet line F H and square up the plate. At each side of centre of F H rivet line, mark off four equal spaces and transfer all holes to line E G. Mark off lines E F and G H in a similar manner.

It will be noticed that as course B is longer than course A, the rivet spacings on E G and F H, Fig. 6, are slightly further apart than on C D and A B, although the holes are spaced equally in their respective courses. As in Fig. 6, mark off the shearing lines $1\frac{1}{2}$ inches from the rivet centres. These templets may be used for marking any number of plates required.

After the necessary operations have been performed on the plate, and it is ready for assembling, care should be exercised to keep the laps looking in alternate ways as shown in elevation and plan view in Fig. 5.

THE WAR AND CANADIAN TRADE.

"THE Effect of the War Upon Canadian Trade" was the subject of an address on October 5 by Professor Adam Shortt of Ottawa to the Toronto Canadian Club, which assembled in large numbers to listen to the well-known economist. He spoke, however, rather upon business conditions as they existed in Canada before the war.

"The present depression," said Professor Shortt at the beginning, "is not altogether due to the war. The war has aggravated a condition which existed before war was declared. We all must have realized before the war," continued the speaker, "that Canada had been overdoing speculative investments. There was an overdevelopment of cities and towns in the West which stimulated industries in the East." Immense investments had been made in the country which are incapable of giving immediate returns, and it was inevitable that areas thus affected should remain idle until the Dominion as a whole had a chance to catch up. "That condition," declared Professor Shortt, "cannot be blamed on the war."

Our "Imaginary Wealth."

After dealing with the excessive development in the urban communities of Western Canada and distinguishing between "actual produced wealth" and "prospective, imaginary, psychological wealth," Professor Shortt showed how a great quantity of the latter class of wealth vanished at a time like this, due to the falling-off in the supply of borrowed capital. "While capital was being imported in such large amounts, the imports of goods were always from two hundred to three hundred million dollars in excess of our exports, and now when the slowing-down comes, we give our production a chance to catch up."

The speaker then quoted Dominion trade returns to show that Canada's imports during July had fallen off by $16,000,000, and for the year by $123,000,000. During the same period of twelve months, Canadian exports, however, had increased in value to the extent of $66,000,000.

Not the Duty of Banks.

Professor Shortt discouraged any notion of asking the banks to come to the rescue just now and provide money to maintain the city and railway construction which had been going on and had been supported by British capital. "That would be perverting the function of the banks," said he, "which was simply the facilitating of exchange. You cannot," he continued, "by adjusting the banking system create one more mouthful of food." The money lenders abroad must be paid by bills of exchange or counter goods, and not by Dominion notes.

Capturing German Trade.

Touching upon the agitation to capture German Trade, Professor Shortt was doubtful about the soundness of such an enterprise. "Certain articles which have been produced in Germany and which have been essential to manufacturing in Britain and other countries would take years to establish by rival peoples. "After the war," continued the speaker, "Germany will return to her industries and will be obliged to endure all sorts of self-sacrifice, including lower wages and lower standards of living. We will not be willing to compete with Germany then."

Canada's Present Duties.

In conclusion, Professor Shortt advised Canada first to go on increasing its national production, and secondly, to reorganize the system of national credit so that it might be conserved, and so that after the war was over, with its consequent scarcity of capital, Canada might be in a position to demand her share, supported by a business-like statement pertaining to the affairs of our railways, manufacturing and other interests

C. M. A. AND WORKMEN'S COMPENSATION ACT.

THE Canadian Manufacturers' Association has issued a circular to its members regarding the Ontario Workmen's Compensation Act. The circular states: "As we have already advised you, considerable portions of the Act will have to be abandoned to make it workable, but we believe that we may confidently expect that the administering board will make every effort to work out a fair and reasonable system, and we should like to urge upon our members that, notwithstanding the unsatisfactory conditions attendant upon the passing of the measure, nothing in the way of co-operation and sympathy on the part of employers should be wanting to assist the board in its difficult task." The communication is signed by P. W. Ellis, Chairman; F. W. Wegenast, Legal Secretary, and G. M. Murray, General Secretary.

AMERICAN FOUNDRYMEN'S ASSOCIATION OFFICERS.

PRESIDENT—R. A. Bull, Commonwealth Steel Co., Granite City, Ill.

Senior Vice-President—H. E. Field, Wheeling Mold and Foundry Co., Wheeling, W. Va.

Secretary-Treasurer—A. O. Backert, The Foundry, Cleveland, Ohio.

District Vice-Presidents—Henry A. Carpenter, General Fire Extinguisher Co., Providence, R.I.; Walter Wood, R. D. Wood & Co., Philadelphia; S. B. Chadsey, Massey-Harris Co., Toronto, Ont.; T. W. Sheriffs, Sheriffs Mfg. Co., Milwaukee; J. P. Pero, Missouri Malleable Iron Co., East St. Louis, Ill.; Alexander T. Drysdale, Sheffield Cast Iron Pipe & Foundry Co., Sheffield, Ala.; J. J. Wilson, Cadillac Motor Car Co., Detroit; A. H. Thomas, Buckeye Steel Castings Co., Columbus; and Ben D. Fuller, Westinghouse Electric & Mfg. Co., Cleveland, O.

Manganese, to alloy well with brass, bronze, or other similar alloys, should first be alloyed with copper. It would be necessary to overheat pure manganese to unite with brass or bronze. The melting point of pure manganese is as high as steel. Manganese may now be bought alloyed with copper at a slight increase in price but the difficulty that is avoided surely makes up this extra cost.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

HOLDING IRREGULAR WORK.

THE holding of irregularly shaped pieces in fixtures for first operation work is often a more or less aggravating problem with the tool maker, particularly where there are not a great many pieces to be machined. Some plants are fortunate enough to be favored with a designer who is possessed of foresight enough to look out for the machining of the details, as well as the successful accomplishment of their purpose but, as most mechanics know, the efforts of a great many draughtsmen are not calculated to save the thought and energy of those who come after them. The following method while not new to many, has some particular advantages in certain classes of work. It has been used successfully in milling flats on balls and other peculiar shapes, and for drilling and many other operations upon castings connected with implement manufacture.

In the case of the job described, it was required to bore out and tap enough rail fittings for eight flights of stairs. To work these one at a time in a lathe seemed ridiculous, and yet that was the method being adopted until the drill press method was suggested. The fittings were made of a cheap brass and are shown in Fig. 1. They consisted of crosses, tees, and acute and obtuse-angled elbows, some of which were to be tapped left-handed, and all were of the common angle of 38 degrees.

The job is set up on an angle-plate as shown in Fig. 2. Two crosses are set up side by side, but with reversed angles as outlined in dot and dash sketch by Fig. 3. Four small steel blocks, B, are placed under the projecting parts of each cross and both are clamped down by the clamp C, which is drilled and countersunk somewhat so as to fit over the ball sections of the fittings. The three bolts, L, are placed in the positions shown, with their heads raised somewhat from the surface of the angle-plate. The ends of the crosses are filled with wood plugs and the whole is framed up with wood blocks, as at W, Fig. 2.

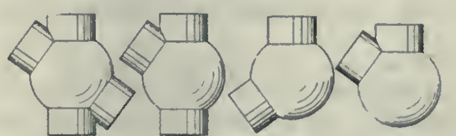


FIG. 1. SPECIAL RAIL FITTINGS.

Metal is now poured in around the fittings and bolt heads approximately up to the line a.b. The best and cheapest metal for this purpose has been found to be old type metal mixed with the metal parts of old copper half-tones, with enough lead added to give the proper consistency of toughness. The crosses are now removed and clearance scraped in the ball parts, and a little on the sides as well, to allow for inequalities in the castings.

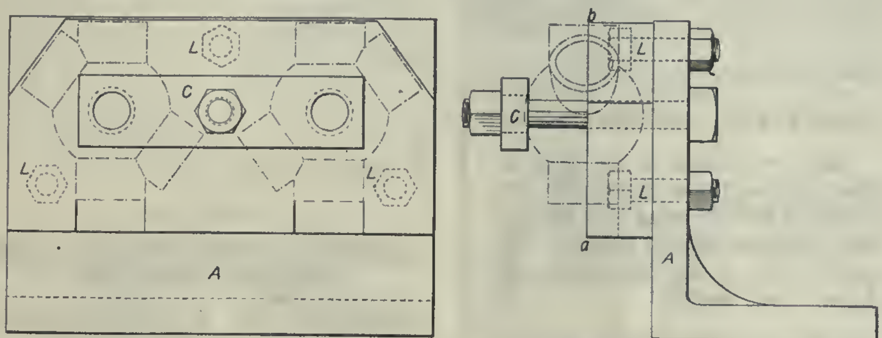


FIG. 3. FIXTURE FOR BORING AND TAPPING RAIL FITTINGS.

All that is now required is to tighten up the three bolts, L, and set-up the angle-plate on the drill press table, as in Fig. 3. It will be found that two impressions thus made will look after all the fittings. The tools used were simply a straight fluted drill and a square tap socket, a drill press with a reversible spindle being used.

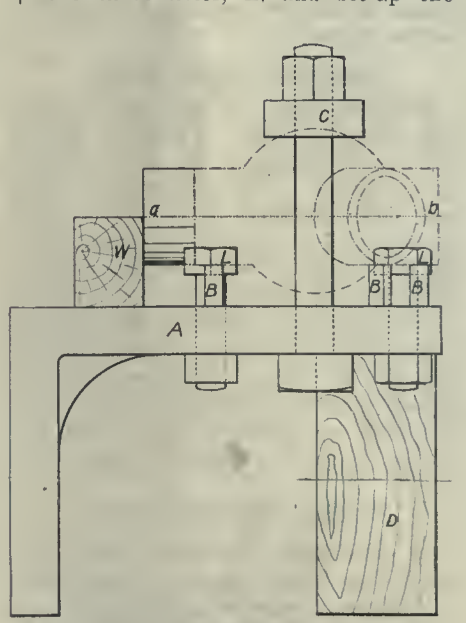


FIG. 2. FIXTURE SET UP READY TO POUR.

The advantages of the principle involved in this method are obvious. As many pieces as desired can be set up at once and at infinitely less cost than the method of three point support as adopted for work where greater accuracy is required. The angle-plate is in no way injured. If there are holes in which the metal can anchor so much the better, and the metal can be melted up and used for another job. If care be exercised a much greater degree of refinement and lasting qualities is possessed by the fixture than would be supposed, and the whole can be made in the time usually required to set up one or two pieces in the lathe chuck.

ANCHOR BOLT FOR CONCRETE.

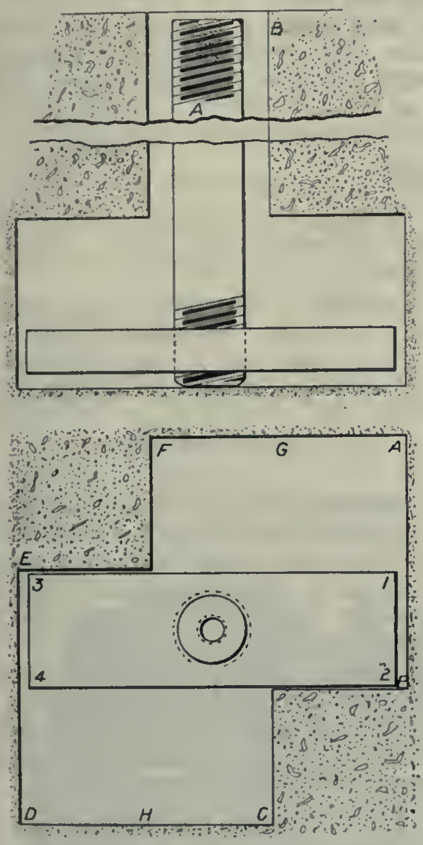
By James Ellethorn.

THE anchor bolt for concrete shown on page 251 of the July 30 number of **Canadian Machinery** has brought to mind a somewhat similar arrangement which came to the writer's attention some time ago. The forms or moulds are made of galvanized iron or other suitable class of sheet metal without top or bottom, and the concrete is run around them. These moulds, of course, cannot be removed when the concrete is set, and must be left in place.

Referring to the sketch, A, B, C, D, E, F, show the shape of the mould for the bolt head, while G, C, H, F outline the shape of the hole extending to the surface of the concrete. The bolt head may either be forged solid with the shank or many be in the form of a nut. When lowered into the hole, it is simply necessary to give it a quarter turn to the position 1, 2, 3, 4, when, upon being raised, it comes into contact with a full area of concrete. The bolt is made short enough to remain entirely below the surface of the concrete when let fall to the bottom. This allows machinery to be readily moved about over it.

For the purpose of fishing the bolt up through the hole in the machine bed, it can be drilled with a small hole and tapped as at A for the purpose of screwing in a small threaded rod, or a special pair of pliers can be made to accomplish the same thing. If it be desired that the bolts protrude above the concrete, they can be cut of suitable lengths and, by screwing them into the heads until these are clamped tightly against the upper side of the chamber, each bolt is held solidly in place.

A great many advantages of this arrangement are evident. The bolts can be readily removed, replaced or exchanged for different sizes. Again, if the machine be removed, it is an easy matter to fill the hole with a piece of



ANCHOR BOLT FOR CONCRETE.

wood until such time as it will be again required.

FUEL WASTE ON RAILWAY ENGINES.

INVESTIGATION, says the Railway Gazette, shows that from 15 to 25 per cent. of the coal used by locomotives is consumed in running sheds and elsewhere, while the engines are not actually performing service. Tests have shown that from 20 to 35 per cent. of all feel used on locomotives is burnt while the engines are stationary or not actually engaged in hauling trains. In a few cases, the absolute waste of fuel is as high as 50 per cent., and examination of the ash pits has proved that from 35 to 50 per cent. of fixed carbon exists in the ash deposited there.

This matter was discussed at some length at a recent meeting of an engineering society, which was attended by a number of railway locomotive men. In the course of the discussion, it was pointed out that, if the necessity for cleaning fires so frequently were removed, the result would e a saving in fuel. An instance was given in which a saving of £205 had been effected by running the same engine through, over a distance of 240 miles, instead of changing en route.

The question of firing-up was also discussed, and special attention was called to the necessity of leaving ashpans open when fires were being built up, so that the coal dropping through the grate would fall into the pit and not clinker up the ashpan opening.

AN EXCELLENT EXAMPLE OF SLACK BELT.

THAT real slack belts on short centres are quite practical is conclusively proved by the accompanying cut, which shows a 5-inch single leather belt transmitting power from a 15-in to a 33-in. pulley. The distance, centre to centre of shafts, is only 5 feet, and the speed of the driving pulley is 500 r.p.m. This belt, operating in the engine room of the Lambeth Public Baths, Kennington Road, S.E., England, drives two 36-in. towel washing machines, one 36-in. fan, one 36-in. rolled mangle, and one 38-in. hydro-extractor.

Before treatment great difficulty was experienced in keeping the belt on the pulleys even with much tension, and the latter caused the bearings to overheat, a trouble that was enhanced by the high temperature in the engine room—100 deg. F. at the time the photograph was taken. The exceptional slack now made possible has permiteed the removal of all initial tension except that due to the weight of the belt and has been the means, we are assured, of a 25 per cent. increase in the pulley contact areas.

We are indebted to the Cling-Surface Co., Buffalo, N.Y., for the foregoing data and illustration.

AN EXCELLENT EXAMPL EOF A SLACK BELT.

Personal

Captain Samuel H. Burnham, one of the best known marine men on the Great Lakes, died in Port Huron, Mich., on Oct. 2, in his 77th year.

Capt. J A. Vibert, a former deputy port warden at Montreal, died in that city on October 1, aged 87. He retired from service 14 years ago.

Walter B. Snow, publicity engineer, has removed to a new suite of offices, rooms 511-516 in the Federal Street Building, 136 Federal street, Boston.

James Frater Taylor, president of the Lake Superior Corporation, Sault Ste. Marie, Ont., is among the newly-elected members of the American Iron and Steel Institute.

W. P. Hinton, assistant passenger traffic manager of the Grand Trunk Pacific Railway, at Winnipeg, has been appointed assistant passenger traffic manager of the entire Grand Trunk System, with headquarters in Montreal. The appointment is effective October 1.

James Wallace, chief engineer of the C. P. R. steamer Princess Victoria, has left for Dumbarton, Scotland, where he will watch the installation of the machinery aboard the new C. P. R. steamship Princess Irene. Mr. Wallace will remain on the Clyde until the Princess Irene is completed, when he will come out with her as chief engineer.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals, will be found a most useful companion

Question.—A ball thrown horizontally by the hand has a velocity of 1,000 ft. per second. If the ground is level and the distance from the ground to the hand at the instant the ball leaves it is 5 ft. 6 in., how far will the ball go before striking the ground?

Answer.—The time required by the ball to fall 5.5 feet would be

$$t = \sqrt{\frac{2h}{g}}$$

where t=time in seconds, h=height in feet, and g=a constant for force of gravity = 32.16.

$$t = \frac{2 \times 5.5}{32.16} = \sqrt{.3424} = .585 \text{ sec.}$$

At the rate of 1000 ft. per sec., in .585 second the ball will travel .585 × 1000 = 585 feet.

* * *

Question.—How much would 8 long tons of coal weigh before being dug out of a mine a mile deep?

Answer.—Weight decreases as the distance to the centre of the earth. Radius of the earth = 3960 miles. Weight at 3959 miles from centre $= \frac{8 \times 2240 \times 3959}{3960}$ = 7 tons 2235.47 lbs.

* * *

Question.—If eight long tons of coal were carried to a point one mile above the surface of the earth, how much would it weigh?

Answer.—If a body be lifted above the earth's surface, its weight decreases as the square of the distance from the centre of the earth increases. Taking the radius of the earth as 4,000 miles, we have for weight on the mountain

$$\frac{8 \times 2240 \times 4000^2}{4001^2} = 17911.04 \text{ pounds}$$

= 7 tons 2231.04 pounds.

* * *

Question.—The crank arm of an engine is 13 inches long and the length of the connecting rod is 65 inches. If the engine be running under, and the pressure on the piston be $2\frac{1}{4}$ tons, what will be the greatest thrust of the crosshead against the upper guide?

Answer.—The forces acting on the piston in this case may be resolved into a vertical component and a horizontal component.

The vertical component is represented by 13 and the component in line with the connecting rod is 65. The horizontal component is $\sqrt{(65^2 - 13^2)} = 63.6$. This horizontal component actually is $2\frac{1}{4}$ tons, therefore the vertical component which acts against the guide is

$$4250 : 63.6 :: x : 13$$

$$x = \frac{4250 \times 13}{63.6} = 868{,}707 \text{ lbs.}$$

* * *

Question.—What is the greatest range of a bullet fired from a level surface at a speed of 4,000 ft. per sec.

Answer.—Theoretically the greatest range is obtained by firing the projectile at an angle of 45 degrees with the horizontal. Practically this angle becomes 40° on account of the resistance of the air. The vertical velocity is 4000 × the sign of 40° = 4000 × .64279 = 2571.16 feet per sec. The horizontal velocity = 4000 × the cosine of 40° = 4000 × 76604 = 3064.16 ft. per sec.

The height to which the bullet will rise is got from formula,

$$h = \frac{v^2}{2g} \text{ or height} = \frac{2571 \times 2571}{32.16}$$

= 2056.61 ft. The time required to rise to this height is

$$t = \sqrt{\frac{2h}{g}} = \frac{2056.61 \times 2}{32.16} = 3.53 \text{ sec.}$$

Time to rise and come down again is 3.53 × 2 = 7.06 seconds.

At a velocity of 3064.16 feet per sec. The range of the cannon ball is 3064.16 × 7.06 = 21632.97 feet or about 4.097 miles.

* * *

Question.—If the projectile were fired from the top of a hill 5,000 ft. high what would the range be?

Answer.—Total height from which the projectile has to fall is 2056.61+5000 =7056.61 ft. Time required to fall from this height $= t = \sqrt{\frac{2h}{g}}$

$$= \sqrt{\frac{14113.22}{32.16}} = 20.9 \text{ seconds.}$$

Total time required for the projectile to go up and come down is 3.53+20.9=24.43 sec.

Range is therefore 3064.16×24.43 =74,857.4 feet, or about 14.17 miles. The range increased about 10 miles by raising the gun.

* * *

Question.—The nut on a piston rod is tightened by a wrench, whose handle is 36 in. long. If the pitch of the screw is ¼ inch and the efficiency of the combination 40 per cent., what would be the initial stress on the rod when 100 lbs. is applied to the wrench handle?

Answer. — Circumference of circle whose radius is 36 in. is 226.195 in., or the velocity ratio is 226.195÷¼=904.780.

With efficiency of 100 per cent., stress in rod is 904.780×100 = 90,478 pounds. With 40 per cent. efficiency this becomes $\frac{40}{100}$ of 90478=36,191.2 pounds.

* * *

Question.—The specific gravity of tin is 7.35. What is its weight per cubic foot?

Answer.—A cubic foot of water weighs 62.355 pounds. By specific gravity of 7.35 is meant that it weighs 7.35 times an equal bulk of water. Weight of a cubic foot of tin then is 7.35×62.355 =458.309 pounds.

* * *

Question.—The specific gravity of the wood of which a pattern is made is 0.45. If the pattern weighs 23½ pounds, and contains a core, the size of which is 7×4×14 inches, what will be the weight of the casting?

Answer.—The volume of the core is 7×4×14=392 cu. in. The weight of a cubic foot of the wood is 62.355×0.45 =28.059 lbs. The volume of pattern then is $\frac{1728 \times 23.5}{28.059} = 1447.2$ cu. in.

Net volume of pattern is 1447.2—392 =1055.2 cu. in. Cast iron weighs 0.26 lb. per cu. in.; therefore, the weight of the casting will be 1055.2 × .26 =274.352 pounds.

* * *

Question—At a cutting speed of 54 ft. per minute and a 32 feed, how long would be required to turn a roll 19 inches in diameter and 5 ft. 2 in. long, removing ¼ inch of metal?

Answer.—Circumference of uncut roll =19.5×3.1416=61.261 in.

Number of revolutions required is 62×32=1984.

Time required would be $\frac{1984 \times 61.261}{54 \times 12}$ =187.5 minutes.

$$= \frac{187.5}{60} = 3 \text{ hours } 7\frac{1}{2} \text{ minutes.}$$

* * *

Question.—Which would be the more expensive pattern—brass at 21 cents, or aluminum at 37 cents per pound? The specific gravity of brass is 8.4 and of aluminum 2.67.

Answer.—The relative cost of brass and aluminum would be 21×8.4 and 37×2.67, or 176.4 for the brass and 98.79 for the aluminum, for the same bulk of each. The saving accomplished by the use of aluminum would be

$$\frac{77.61}{176.4} \times 100 = 44 \text{ per cent.}$$

* * *

Question.—If a man raises a weight of 900 lbs. 150 feet in fifteen minutes, by means of a winch, how much work has he done, and what part of a horse-power would this be equivalent to?

Answer.—Foot pounds per minute

$$= \frac{150 \times 900}{15} = 9000 \text{ foot pounds of work.}$$

$$\text{No. of horse-power} = \frac{9000}{33000} = \frac{3}{11}$$

horse-power.

* * *

Question.—In the above problem, what horse-power was actually expended assuming friction to be 40 per cent. of the load?

$$\textbf{Answer.}—\frac{40}{100} \times 9000 = 3600 \text{ foot lbs.}$$

Total work done is, therefore $9000 + 3600 = 12,600$ foot pounds.

$$\text{This is } \frac{12,600}{33,000} = .3818, \text{ or } \frac{4.2}{11} \text{ horse-}$$

power.

NEW G.T.R. SUBURBAN LOCOMOTIVES.

SOME few months ago, the Grand Trunk Railroad decided to have some locomotives built which would be particularly adapted to the handling of the increasing suburban trade in the vicinity of Montreal. The Montreal Locomotive Works was given the contract to build six of these, four of which have already been delivered, while the fifth and sixth are expected to be handed over early in the present month.

These locomotives are each equipped with six drivers of 63 inches diameter and all wheels are flanged. There is also a leading and trailing truck, the wheels of each of which are 31 inches diameter. The trailing truck is of a special patented design, giving exceptionally easy riding qualities to the cab and, affecting favorably the whole locomotive frame.

The locomotive frame extends right on to the trailing truck over which is mounted the tender as part of the loco. unit. The driving wheel base is 15 feet 8 inches, while the over-all wheel base is 39 feet $4\frac{1}{2}$ inches. The main driving journals are $9\frac{1}{2}$ inches by 20 inches, and the front and rear driving journals are $9\frac{1}{2}$ inches by 12 inches. The tender tanks hold 3,500 gallons of water, and the coal capacity is 5 tons. The frame is of steel and exceptionally heavy, being well stayed with heavy steel cross members.

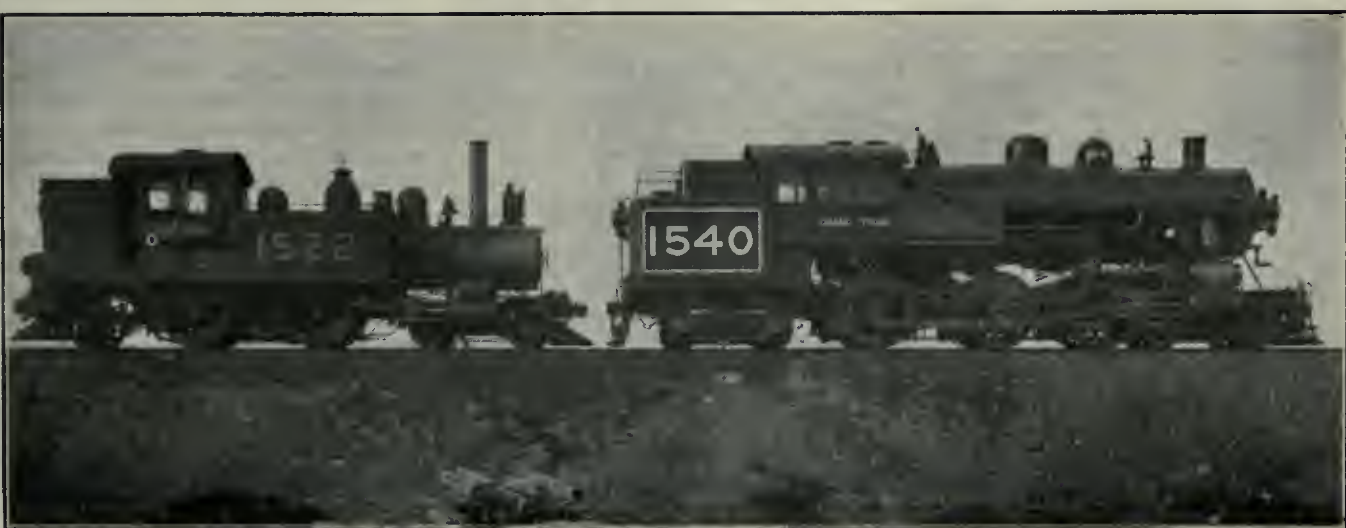
Boiler.

The boiler is of the straight top type, and is constructed for a working 200 lbs. per square inch. There are 191 two-inch tubes, 11 feet 10 inches long, and the heating surface totals 1,808 square feet. There are 26 $5\frac{3}{8}$-inch flues, 11 feet 10 inches long, for the super-heater, which is of the latest Schmidt type. A Gaines combustion chamber is fitted, while the arch is of the security fire brick type. Franklin grate shakers and fire doors also form part of the equipment. The fire-box space is $129\frac{1}{8}$ inches by $75\frac{1}{4}$ inches, and the grate area is 47 square feet.

Walschaert link motion is fitted to the valves, which are of the piston type, 11 inches diameter. The longest valve travel is 6 inches. The cylinders are 21 inches bore by 26 inches stroke. The piston rods are extended through the cylinder head, and work in a tail guide bearing. The pistons are of cast iron. A No. 5 Detroit lubricator and Westinghouse air brake form items of the accessory equipment. The total weight of the locomotives in working order is 250,000 lbs., the weight on the drivers being 139,500 lbs., and the tractive power 30,940 lbs.

These locomotives express the last word in the suburban type design, and are expected to give a good account of themselves in their particular service. The tender being all of a piece with the locomotive proper, contributes to facility of handling at terminal points.

We understand that some interesting developments in suburban traffic around Montreal are projected for next season, there being every likelihood of the service of whole new trains composed of steel passenger coaches and the above described locomotives.



OLD AND NEW TYPES OF SUBURBAN LOCOMOTIVES, THE GRAND TRUNK RAILWAY SYSTEM.

AMERICAN INSTITUTE OF METALS OFFICERS.

President—G. H. Clamer, Ajax Metal Co., Philadelphia, re-elected.

Vice-Presidents—R. B. Wallace, National Cash Register Co., Dayton; Robert Job, Milton-Hersey Co., Montreal.; W. G. Harris, Canada Metals Co.; Jesse L. Jones, Westinghouse Electric and Mfg. Co., Pittsburgh; George C. Stone, New Jersey Zinc Co., New York; W. H. Bassett, American Brass Co.; Fred Moerl, Pullman Co., Chicago; J. G. Kasjens, Brass Foundry Co., Peoria, Ill.; H. W. Gillett, Bureau of Mines, Ithaca, N.Y.; E. B. Horne, Packard Motor Car Co., Detroit.

Secretary-Treasurer—W. M. Corse, Titanium Alloys Co., Niagara Falls, N.Y., re-elected.

How Can Engineers Best Utilize Technical Journals?*

By J. W. Alvord**

As stated by the author in his concluding sentences, technical journals, together with the proceedings of technical societies form the repository of the professions, they are the interchange mediums of experience, and a common store from which all can draw. Without them we would be strangely helpless.

IN 1880, when the writer first commenced to take some interest in technical journals, such publications were relatively few. Since 1880 we have added to civilization the electric light, the electric railway, the telephone, the phonograph, wireless telegraphy, the X-ray, high steel buildings, reinforced concrete, the explosion motor, steam turbines, high-duty pumping engines, central power stations, hydro-electric plants, automobiles, flying machines, bacteriology, filtration, modern sewage disposal and scientific sanitation, and the engineering world has been practically made over in about 35 years.

Engineering literature has had to specialize, divide, concentrate and keep pace with this rapid movement. Of necessity it has grown voluminous, and the problem of the engineer in 1880, which was to treasure and index almost every scrap of printed matter on any engineering subject whatever that came his way, is to-day to sort out, discard, and eliminate that which he can no longer use, and limit himself to the inspection and reading of that which bears principally on his selected professional specialty. Many do not succeed even in doing as much as this with the technical journals that flood in upon us in these busy days.

That we cannot keep abreast of the times without reading the engineering journals is obvious. That if we carefully read all the engineering journals in our chosen specialty we would have no time left to earn a living is easily capable of demonstration. What, then, is the proper attitude to adopt toward this ever-increasing flood of information that pours in upon us so relentlessly, week after week, month after month, and year after year?

If we look about us to see how our fellow-engineers solve this matter, we shall find a great variety of attitudes toward the problem. Some engineers simply do not take engineering journals, reading one occasionally here and there as opportunity offers. Others take all they can afford to take, and let them pile up around the office, often unopened and unused. Others still limit themselves to a select few, which they carefully bind and shelve. Still others read journals when they can, and throw them away when they move on. As a rule, however, the engineer prizes his technical paper, and endeavors in some ill-defined and formless sort of fashion to preserve its information for future use. Generally he fails to find any practicable scheme which makes his rapidly accumulating material of much value to him after it has once passed under his eye and, for a large number of engineers, technical journals are only professional newspapers with which to idle away an hour or so and to satisfy their curiosity. That their value is something much more than this, or should be more than this, is so apparent as to need no denial.

The Personality Feature.

The problem of the engineer with his technical paper is much affected by his age, station and aim in life. To the man who is in engineering only to get money and more money, the engineering journal is a newspaper in which he may notice mainly where there are better jobs than his own that may be sought after and perhaps obtained. To the man who is anxious to fit himself every year of his life for something better, it is an opportunity, quite unequaled many years ago, for a great variety of study. To the young engineer, the engineering journal, properly read and noted, is part of a post-graduate course in engineering. To the middle-aged man, it is a mine of data, bearing in all sorts of ways on his work, and to the mature specialist only does it begin to become burdensome by its repetition of experience and its volume of matter on subjects which have already, to him at least, been well digested. Let us see if we can outline how each of these classes can get more profit out of the matter contained in the engineering journals than do the careless or indifferent, who, after their journal is once looked over, let it go to waste or idleness.

Relative to the Young Engineer.

The young engineer and the college graduate need, most of all, practical experience. It is safe to say that engineering literature will never have any proper perspective for him until he has been connected in some capacity with engineering work himself, be it in ever so modest a capacity. With the actual doing of engineering work, however, should come contemporaneously the reading of technical journals, particularly along the lines in which he is working. Nothing can be more instructive, broadening and enlightening to a man doing a particular kind of work than reading about similar work at the same time. It follows, therefore, that the young engineer should, as early as possible, take at least one good, first-class engineering journal, and own it himself; bind it, if he can afford to, but lay it away in an orderly manner, in any event. If he can afford two journals, so much the better, especially if they are selected so as to widen his outlook.

Laborious Reading to be Avoided.

Many young engineers are omnivorous readers by instinct and curiosity. Some cram on technical literature, largely because their professors at college and others have given them the good advice to read engineering journals as a habit. Others cannot bring themselves to read much "shop talk" out of hours, because they naturally prefer recreation and mental relaxation. There is, however, a happy medium. It is to be doubted if laborious reading of all kinds of engineering articles all the time is advisable for anyone. Mere quantity of reading is mentally detrimental. If one might advise, it would be to suggest enforced systematic reading of all articles particularly bearing on the line of work the reader is immediately engaged upon, and the optional reading only of such other articles as interest him. This ought not to be much of a task. In course of time, as his experience broadens, engineering reading will become less burdensome and more interesting because its relation to practical matters will be more and more appreciated and the discriminating use of engineering literature better understood. Of course, all this applies to engineering societies as well, but that is another story.

Indexing Data.

In the matter of indexing for the young engineer, much must be left to the judgment and taste of the individual. The engineering indexes are very complete and useful in these modern days. The mind itself is a wonderful indexer. It is safe to say the average intelligent man reading an article which impresses him as useful and valuable can, without effort, remember, for many years after, the name of the journal and the approximate year in which the article appeared.

It is probably not wise for the young engineer to indulge extensively in card indexes, filing systems and the like for topically arranging his available en-

*From paper read at the Federation of Trade Press Associations' Convention.
**Consulting Engineer, Chicago.

gineering journal articles. Few men know very early in life where fate and interest will land their future attention, and filing systems and special indexes are expensive and time consuming, and when indulged in without definite aim nearly always quickly become too voluminous and thereby useless. Many a young engineer has spent many weary hours filing and indexing, only to abandon his system later on in despair at the quantity of material he early collects and the difficulties of making it quickly available.

If any suggestions are made along this line, it would be to start a loose leaf letter size (8½-in. x 11-in. page) notebook, and note in it (separate pages for separate subjects) only what appears to be extremely useful, either in exceedingly brief abstracts from engineering articles or diagrams, costs, etc. These notes will be most useful if they are confined to that kind of work in which the compiler is immediately engaged and has on his mind at the time, or, at the most, work very similar to his own which has perhaps had his personal inspection.

If any such book is started, it is highly desirable that it be of letter size, because that is nowadays the working size to which all sorts of documents, engineering reports and estimate work are approximating. Pocket note-books, card indexes and odd sizes of note-books should be avoided, if possible, as likely to be finally abandoned. The letter size fitting the stock office furniture and ordinary typewriter is much more likely to endure with the average man as a permanent system.

The young engineer is tempted to read much about large enterprises—the Panama Canal, big bridges, astonishing tunnels, great dams. This does no harm and probably holds his interest for the time being. Gradually he learns that, for him at least, the chief value of the technical journal does not lie in its dramatic side, necessary as that may be for our general information, interest and pleasure, but its chief value lies in a fund of small things which make up routine work of the ordinary everyday job. These are to be watched for and noted as practically useful to the average man.

Relative to the Man in Full Harness.

We next come to the man in early middle life, actively engaged in his profession, and note at once that his problem with the technical journal is the absence of "time." Absorbed in a multitude of responsibilities, harassed with unexpected difficulties, worn out at night with the long day of strain, how shall he derive any useful good from the multitude of journals which his more ample income can readily afford, but which pile high on his table after every brief absence from the office and constantly aggravate him with their temptation to neglect other duties? Whether or no such an engineer shall make any effort systematically to assimilate, file and study current technical journals depends in part upon the nature of his routine.

If he is largely engaged in administrative work, or is a salaried officer in a large enterprise with a comparatively limited range of problems, or a limited call for miscellaneous data, he may generally be content with a cursory examination of the engineering journal such as will keep him qualified on his undertaking, and the preservation of such journals in bound form, with the standard published indexes. If, however, he is entering upon novel work, or work presenting a great variety of problems, overlapping into a great variety of fields, ambition will compel him to do more than this, and some form of special indexing will appeal to him more or less strongly as he feels the need more often for research in up-to-date material.

The Editorial Method of Rating Articles.

The average editor can judge of a technical article with only a brief inspection—a sentence here and there, a headline and a moment's reading of the summary and conclusion. Long familiarity with matter of a similar character gives him the assurance that he can detect in this rapid review anything novel, new or original, and can fairly pass judgment upon it in a general way. The working engineer who has had some experience with technical literature can form the same habit and save much time. It is really wonderful how much repetition there is in engineering writing and in the producection of engineering papers. Each new generation needs the same drill in its reading as did its predecessors, but it wants the old form in new dress, and each year a vast number of engineers have arrived at that degree of maturity that they will be interested to read matter that suddenly impresses them and which seems to them new, but which in reality has already been largely well written long ago. It thus happens that we are under the necessity of seeing much the same facts and principles repeatedly published in varying form, for some one is always attracted to really read them, with consequent benefit to himself, under the belief that they are new and novel.

Again, the mature engineer notes that a large amount of engineering literature is of the purely descriptive order, merely giving outlines of work that has been accomplished without going into reasons or principles. All this kind of writing is valuable and useful, and has its proper place, but all of this class of literature has its limitations. One of the most severe of its limitations is that it rarely describes mistakes, errors of judgment or failures, and in these lie the most valuable lessons to the seeker after truth. One is obliged to read between the lines or read with reservation, much as one does in reading accounts of battles in the daily press. It is always wise to look back and note the origin of the despatches in such cases.

Personal Knowledge of Article Writers.

Much light is thrown upon engineering literature by personal or general acquaintance with the author. One can more fully appreciate what an author says when he knows fairly well what the author's experience has been. All men have their high, strong ground, their less trodden side slopes and their twilight zone of knowledge, and they should not be blindly accepted as authority in all of the fields in which they sometimes venture an opinion. A tremendous lot of engineering literature is written which is of little permanent value. Often it represents the writer's struggles to understand a subject. Often it is compiled largely from a desire for publicity. Fortunately, the editors of the technical papers can limit this kind of reading by care in selection.

Amid all these drawbacks, however, a discriminating mind will always find a great deal of wheat amid the chaff, and the wheat that will be gleaned will be of a differing kind and amount, depending upon the type of mind of the reader, his present problem and his desire to systematize his information. What, therefore, shall he do with his special selection when once he thinks he has separated it from the floor of raw material? Several courses are open to him:

Systematizing the Information

First—He may rely on his memory and the published index to his bound volumes. It is safe to say, however, that few engineers really make much practical use of this method. The intervening index and the bother of a search following prove to be discouraging to that degree that a proposed reference search is abandoned in about one-half the suggested attempts. The ideal filing system is the one in which, with the least amount of effort, one can put his hand immediately and accurately on the thing itself, be it a book, a pamphlet or a data sheet.

Second—He may keep a special card index of important data and reference to valuable articles. This at once involves labor and attention which few busy men can give, and which, if done by assistants or librarians, largely loses its personal value to the one who needs it. The same objection as to the discouraging effect of intervening indexes holds good here, too, and it is further safe to say that, of all the contrivances for indexing, the most difficult to readily handle and rapidly examine is the card index system.

Third—He may abstract important data in a limited way on loose leaf transparent paper, standard letter size, and he may remove or detach articles of special value from out his journals, to be filed in the regular office filing system, like correspondence.

The writer has tried all of the above methods at considerable cost in time and patience,, and has for many years settled upon the third method above outlined. With all its admitted limitations it seems to be the best for an office which is expected to find out information on a great variety of subjects in a limited time and with the least amount of effort. Some description of its practical workings may be of interest here.

Method Three Operation.

All the technical papers of the office pass on to the desk of the head of the office, and are at least looked over (not read) by him. Articles important to his particular specialty are checked with pencil and articles of especial interest are looked over with care and double-checked. Once in a long while data important enough to go to the data file is noted. This is either especially abstracted by the stenographer, or if a diagram or cost data, perhaps traced in the drafting room—all on transparent paper for copying purposes. Special data of these kind on $8\frac{1}{2}$-in. x 11-in. sheets are filed in the office data file (a separate but common standard correspondence file). From the data file loose leaf working note-books are made up from the blue prints for office or travel purposes. They are altered, refilled, amended and sorted back from time to time as needed to keep them of usable volume and usefully up to date.

The technical journals, with checked articles, go to the office clerk or the stenographer at odd hours, or the librarian if one can be afforded, and the useful articles are removed by tearing them out with a ruler. They are folded, usually once ,to standard size, with one edge lap left for binding, and are then filed in a subject index file, like current correspondence. The Dewey decimal system, especially arranged for the office, is used, but only as a general subject plan. When the file is full, portions of its contents, especially that which is most useful, is simply bound in plain pasteboard covers and placed in the library shelves, with titles. Such a book (or many books) would contain all the recent articles thought to be of special value on a given single subject. The remaining portions of the technical paper are thrown away; but in a large office, warranting the expense, duplicate bound copies can be kept as well, with the general published index as their key. The objections to this system are as follows:

Objections to and Advantages of System Three.

(1)—It is too expensive for any but the most important offices doing specialized work.

(2)—Data accumulates almost too fast unless rigidly kept down to a minimum.

(3)—It requires some personal attention of the head of the office, a competent assistant or the employment of a regular librarian. The advantages are:

(1)—It compels the office head to know all the time what is being published in current engineering literature, if only by inspection.

(2)—It removes all intervening indexes between the searcher and the final repository in bound volume.

(3)—It keeps one's library usefully up to date on all lines in which one should be especially interested.

(4)—It is economical for final shelf room and binding cost.

Some System a Prime Requisite.

Obviously, one should not start so elaborate a system as this unless he is fairly sure of the special line of engineering to which his life will be devoted. Otherwise, waste effort and discouragement will be certain. It is not to be recommended to the young man, but only to the mature man of early middle life when his work clearly indicates the necessity for it. It is, however, the prime requisite of the engineering specialist. To him some such system is invaluable. Of course, modifications can be made in it which will lessen its expense, and if the amount of material which is filed is rigidly kept down to a minimum the resulting accumulations will not be embarrassing or so expensive. Not a few consulting engineers use this standardized system interchangeably, particularly the data file, thereby greatly increasing its usefulness to each other as a joint export.

Relative to the Engineer Advanced in Years.

We come finally to the mature and experienced engineer of advancing years. How can he make engineering and technical literature of use? It is safe to say that when an engineer has much passed fifty or sixty years of age, and has led an active life, in constant touch with affairs, his need for engineering literature lessens. Out of the mass of detail which seemed to him so overwhelming and endless in his youth and early manhood, fundamental principles emerge like peaks out of the clouds, and upon these as foundations all detail classifies itself simply and naturally, and, therefore, he feels less need for accumulated data or particular description. Probably no one enjoys engineering reading as does the mature engineer, for he can read between the lines and find much to instruct as well as interest, and yet while he is probably the most interested and intelligent reader of engineering litrature that the journals have, his ambition as a collector is gone, and filing systems no longer appeal to him.

Filing Does Not Appear.

If his acquaintance is wide, he reads with interest the accomplishments of his friends, and the addresses of engineering society presidents, and articles on the ethics of the profession. Of failures he is the keen student. The personal column appeals to him, and if he is of right-mindedness he is conscious of more pleasure than formerly in the accomplishments of those who have succeeded and succeeded well in dire and burdensome responsibility. More often than the young man, he will turn back for his satisfaction to papers that served him well in times past, and perhaps smile at the lack of improvement that later attempts to deal with their subject often show.

Again His Technical Newspaper

Like aged men who relapse into second childhood, the engineering journal again becomes for him a technical newspaper of great personal interest and deep satisfaction, for no longer is he keen for jobs, or eager for data, but the human, personal, and etchical side of the life work of the engineer are uppermost in his mind, and he realizes that though he may have seemed to others, and even may have seemed to himself to have been striving all these years for emolument, as a matter of fact, the deep and abiding motive of his life work has been the pleasure of being "needed" and the joy of being useful.

In conclusion, I would remark that technical papers, along with the technical societies and their proceedings, form the repository of the professions; they are the interchange of experience, the common store upon which we all draw. Without them we would be strangely helpless. We are indebted to every one more or less who records his experience for the common use, and that debt we should endeavor to helpfully repay in kind, but wisely, concisely, and thoughtfully.

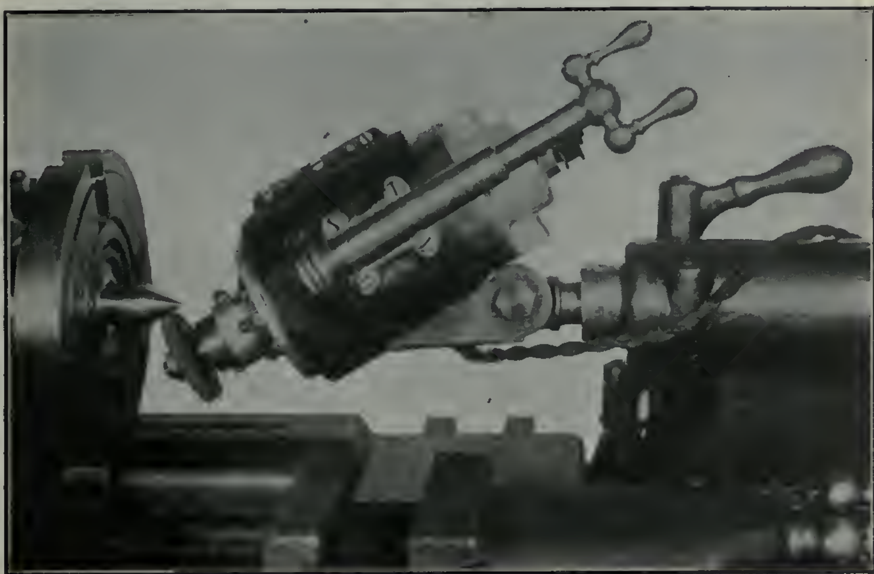
The Hare Engineering Co., manufacturers of the Fulton water-cooled mechanical stoker and other appliances, have moved their general offices from 78 Duchess Street to 115 King Street East, Toronto, where larger and more commodious premises have been secured.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

NEW PORTABLE ELECTRIC CENTRE GRINDER.

THE tendency in modern manufacturing processes is towards the elimination of all cut and try methods and the standardizing of not only the products, but the plant equipment. In the grinding of lathe centers, the practice heretofore has been, either to grind them in a separate machine or to grind them in place with a tool post grinder. The former method has its obvious disadvantages. In the latter case, the grinder is often made to grind other work as well as lathe centers, and must be adjusted in every direction. A correct angle of the centre is only obtained after several adjustments and trials by means of a centre gauge.



PORTABLE ELECTRIC CENTER GRINDER.

After this is obtained it will probably be found that the angle is concave, which means that the grinding spindle is not parallel to the plane of the lathe spindle, and after this is corrected the angular adjustments must be made over again. As each man has his own personal ideas as to what centres should be and is also liable to loose patience with many adjustments, it is quite natural that the different lathe centres in the plant should be of as many different angles.

The advantage or having a machine for grinding lathe centres and nothing else; that would do the work with no adjustments whatever and that would grind all centres exactly alike to an angle of 60 degrees, will be easily realized. This has been accomplished in the Ideal Portable Electric Centre Grinder, just put on the market by the Neil & Smith Electric Tool Co. of Cincinnati, Ohio. The illustration shows the tool in position. It is fitted with a socket into which a tapered shank to suit the lathe tail stock is fitted. The angle between this shank and the grinder spindle is fixed, so that all that is required is to press the shank firmly into the tail stock of the machine in place of the tail centre, and proceed with grinding the centre which requires no gauging after being cleaned off. A separate shank will be required for each different type of tail stock taper.

The machine presents an attractive appearance and is as light and compact as is consistent with adequate power. By its use throughout the plant, the operation of grinding a pair of centres consumes but a few minutes and absolute uniformity of centre angles is obtained. This permits the use of standard centre drills and arbors for all machines and, as arbors will be interchangeable, a very much smaller number is required with a consequent saving in outlay and storage space.

TOOL AND STORAGE ROOM EQUIPMENT.

ALONG with the application of science to the management and office end of manufacturing institutions, have come great improvements in tool-room and storage departments. These, being classed as nonproductive branches, have long been begrudged the additional capital required to make them efficient. Moden tool-rooms and storage systems are becoming more and more impertant features of successful industrial establishments. A number of articles dealing with cost, storage and stock-keeping systems have recently appeared in these pages and have evoked much interest.

This week we are showing several il-

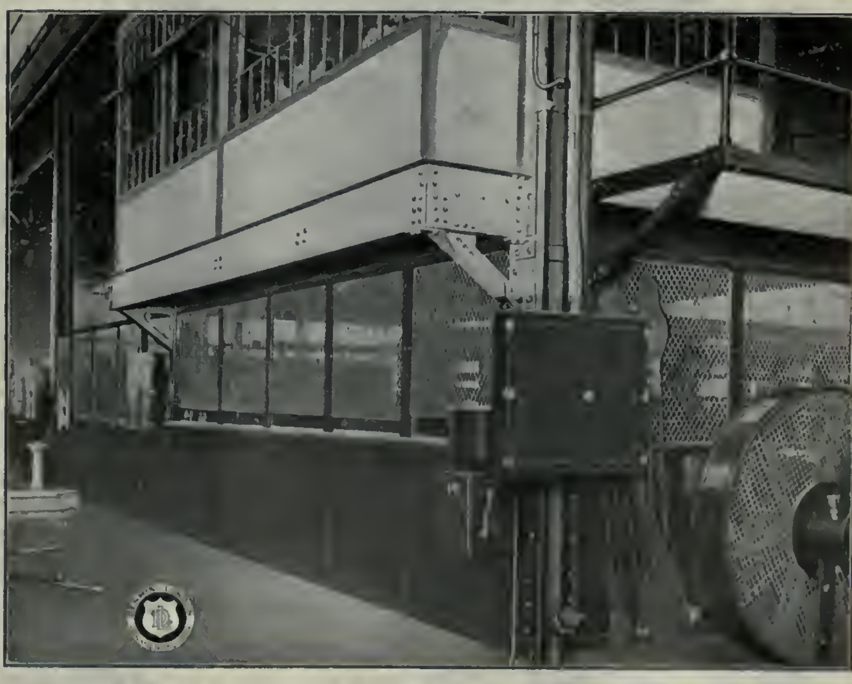


FIG. 1. FOREMAN'S AND TIMEKEEPER'S OFFICE, NEW LOCOMOTIVE SHOPS,

lustrations of the tool-room and office equipment which has recently been installed by the Michigan Central Railroad in their new locomotive shops at St. Thomas, Ont. These shops have only been lately completed and are among the most modern in Canada as regards layout, construction and equipment.

In Fig. 1 is shown the foremen's and timekeeper's office above, and the storage rooms below. The former is reached by a steel stairs, and its walls are composed almost entirely of glass, so that from it a clear view of the entire shop can be obtained. The lower part of the walks are made of cement plaster over reinforced metal lath. The tool and storage room below is walled with sheet steel and wire mesh. Faintly through the wire mesh can be seen the storage bins and shelving. These storage arrangements are shown more closely in Figs. 2 and 3, and show clearly the methods adopted. Parts of different kinds are provided with a separate and fixed shelf, bin or cupboard, and each compartment is labelled as to its contents. The cupboards are made of such size that they can be used also for the storage of tote-boxes for carrying material and tools from job to job.

All of the partitions and storage equipment are made of metal and are absolutely fire proof, and were supplied by the Dennis Wire and Iron Works Co., of London, Ont.

FIG. 3. STORAGE BINS, SHELVING, ETC., NEW LOCOMOTIVE SHOPS, M.C.R., ST. THOMAS, ONT.

FIG. 2. STORAGE BINS, SHELVING, ETC., M.C.R., ST. THOMAS, ONT.

NON-FERROUS CASTINGS.

IN a discussion on the influence of the casting process following a paper on "Wrought Non-ferrous Materials," before the American Society for Testing Materials, it was pointed out that the surface of molten brass becomes instantly covered with a thick film of oxide on exposure to the air, and this oxide must be prevented from becoming incorporated in the solidified metal. Two instances will illustrate the importance of proper casting.

Ingot copper of the finest character, as received from the refining furnace, is neither very ductile nor malleable when cold, but when properly melted and cast from a crucible it becomes highly so. A properly cast billet should show no pipe at the upper end, and when improperly cast a considerable pipe may occur. The casting process, when properly performed, leaves the bar, billet, or ingot free from blowholes, gas cavities, or dirt, and from surface imperfections.

The Electric Vehicle.—Dr. Charles P. Steinmetz, of the General Electric Co., than whom there is no one who can speak more authoritatively upon the subject, predicts that within ten years there will be in operation not fewer than one million moderate priced electric vehicles whose approximate price will not exceed $500 with a speed certain to average 20 miles per hour. Against the gasoline cars he claims the disadvantages of fuel and oil costs, the concentration necessary in driving a high-powered machine and the need of constant attention to its engine. "Within a decade," he says, "the gasoline car will be relegated to the limbo of things outlived."

J. A. Heritage, formerly chief engineer of the Princess Charlotte, is now at Dumbarton, Scotland, standing by the steamer Princess Margaret, which is nearing the steam trial stage.

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PRINCIPAL CONTENTS.

THE STATUS OF UNIVERSITY TRAINING.

A FEW days ago, our great educational mills again engaged in the task of grinding technical grist into an army of raw, but ambitious young men. Some of these youths have a definite and clear conception of what is to be their aim in life and how it can be promoted by a college education. The vast majority, however, have a hazy notion of the requirements of high and responsible mercantile positions, the enhanced social standing being more generally uppermost with them. The facts that these latter are not particularly sought by manufacturers upon graduation, and that hard struggles and bitter disappointments result in consequence, disclose a weakness in the system of training which, though it cannot be accurately diagnosed, can, at least, be mitigated to a great extent.

A number of the more progressive universities are making much of the practical side of their curriculum in the hope that this will, in conjunction with the technical education provided, turn out the practical technical man which the industrial world is demanding to-day.

The acquiring of a trade involves many disagreeable features and indignities which can be best overcome when the student is young, and having once risen above them, he is more or less rounded and lacks the petty varieties of the one-sided technical man. As a tradesman, his capacity of earning money is so increased that, with a judicious use of his vacations, he can meet a large part of his college expenses as they come.

Most important of the advantages of this training is the acquired ability to associate with and handle men. This is the qualification that manufacturers are seeking, that financiers will pay for and that our industries need.

THE COST OF LIVING PROBLEM.

THE present year has earned the distinction in the business world at least as one of depression, that is, a period of money scarcity. A peculiar difference is noticeable, however, between this period of stringency and the one which we had about twenty years ago in that, on this occasion the cost of the necessities of life has shown no marked tendency to come down. In fact these have advanced in price if anything.

For a number of years attention has been called to the rate at which our rural population has been flocking to the cities. These wholesale desertions from the land have been real and are prompted by causes which influence the growth and comparative prosperity of this whole Dominion. The farm life of our country has not kept pace with its mercantile and manufacturing achievements. People seem to find more pleasant occupation more agreeable surroundings and better wages in our cities and factories.

If the cost of living is to be lowered, rural life and pursuits must be shorn of a large part of their drudgery and be made more attractive, and the most important step in this direction is, of course, education. Next to this comes the manufacturer's ability to place city comforts in a larger degree within the reach of the people who till the soil. Outside of the general line of farm implements, Canadian manufacturers have not done all they might in this respect. The kerosene lamp is still supreme, the farmer still carries his water while his wife does the milking, washing and cooking in the same old way.

What is evidently wanted among other things is a line of plumbing fittings at a moderate price that can be set up by the farmer himself; compact systems of heating and lighting, and devices for the production and utilization of power, etc. We have applied efficiency principles to our industries until they have become automatic and their operatives more or less automatons, but the source of our subsistence is still being run in a hap-hazard, wasteful way, and while we often hear of one man replacing many in the factory by the aid of improved appliances, the farmer's son still supplants only his father who has gone before him, and in not a few instances doesn't even seek to accomplish this, but hies himself citywards.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 65
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 50	17 25
Victoria, No. 2X	18 25	17 00
Victoria, No. 2 Plain	18 25	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.00
Steel bars, f.o.b., Toronto	2.00
Common bar iron, f.o.b, Montreal	2.00
Steel bars, f.o.b., Montreal	2.00
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.25
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.25
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs.	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in.	75%
Finished Nuts over 1 in.	72%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws	75 & 5
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 50
Copper, crucible	10 00	10 00
Copper, unch bled. heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	10 75	9 25
No. 1 compos'n turnings	8 50	8 50
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong. Sizes Ins.	Extra Strong. Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	72	62
7, 8, 10 in.	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload	$14 50	$13 50
Electrolytic copper	14 25	14 00
Castings copper	13 75	13 50
Spelter	6 00	6 00
Tin	34 00	35 00
Lead	4 85	5 00
Antimony	16 00	16 00
Aluminum	20 00	23 00

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt, casks, per cwt.	6.40
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine, single bbls.	0.67
Linseed oil, raw, single bbls.	0.63
Linseed oil, boiled, single bbls.	0.66
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.16
Lard Oil, per gal.	0.60

CHAIN.

¼ inch	$5.65
5/16 inch	4.70
⅜ inch	4.00
7/16 inch	3.65
½ inch	3.45
9/16 inch	3 45
⅝ inch	3.35
¾ inch	3.25
⅞ inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b., Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2 50	$2 60
Canada plates, ordinary, 52 sheets	3 70	3 85
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (American)	3 90	3 90
Queen's Head, 28 B.W.G.	4 30	4 35
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

CAST IRON PIPE.

6 inches and upwards	$32.00
4 inch	33.00
Specials per 100 lbs.	3.00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1½-in	$37.50	$30.00	$17.50
33/64 to ¾-in.	41.25	33.00	19.25
7/16 to ½-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	$1.10 lb.
Leather in sides	$1.00

BELTING RUBBER.

Standard	50%
Best grades	30%

COLD DRAWN STEEL SHAFTING.

¾ inch	$ 4.95
1 inch	8.05
1¼ inch	12.65
1⅜ inch	15.30
1½ inch	16.50
1⅝ inch	19.40
1¾ inch	22.50
1⅞ inch	25.80
2 inch	29.30

Prices quoted are cents per foot.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Oct. 5, 1914.—While it cannot be said that any very material improvement has developed during the past week in the business outlook, there is evidence in all directions that those responsible for our business administrations are, by keeping their organizations intact and generally conserving their resources so far as plant additions and extensions are concerned, preparing themselves for the inevitable influx of trade which is bound to come just as soon as the war is over or even earlier.

The Steel Market.

The situation has not changed much in the steel market. The same small volume of trade, which is merely nominal, seems to keep coming in, and prices in consequence fluctuate little. With the approach of the fall season, business in structural sections and shapes continues to drop off further, although machine sections in small lots are moving to a fair extent.

Pig Iron.

According to reports received from United States centres, the present dullness in this market is the quietest period seen in the last twenty years, and a practically similar situation exists in Canada. Little or no pig iron is moving.

Machine Tools and Supplies.

The machine tool market continues dull. Most shops are able to handle the limited orders they receive with their present equipment, and thus no new tools are meantime required. In the supply end of the business, small hand-to-mouth orders compose about 90 per cent. of the trade that is passing.

Metals.

Another very quiet week in metals falls to be reported. Sales have been very limited and prices have not changed, the small amount of business not being sufficient to test prices.

Toronto, Ont., Oct. 6, 1914.—Business conditions remain unchanged, but the outlook, generally speaking, is brighter. There is a probability that trade will keep at about the present level for some time to come, as the war promises to be protracted and financial conditions will not improve materially until the allies have assumed a more decided supremacy over the hostile forces. The outlook is far from being discouraging, and conditions are a great deal better than might have been expected under the circumstances. Many firms are taking a distinctly optimistic view of the situation, and are not at all cast down because of the present temporary depression. It is generally conceded that Canada stands to benefit by the war, and it is only a question of time before this is realized. Those who display confidence and courage will be the first to reap the benefit of the stand they have taken. The stimulus which has been given to the farming industry by the war will be of the greatest benefit to the country and, of course, indirectly to the manufacturer.

The "Made-in-Canada" movement will no doubt result in a greater proportion of new industries being established in this country than in previous years, although the success of the movement will depend to some extent on the ability of Canadian manufacturers to compete with British and foreign concerns. If our manufacturers can keep down the cost of production to a point where, with the assistance of the tariff, competition can be met, then the number of factories established will be greatly increased. Some industries, for example, pulp and paper, are specially adapted to Canadian conditions, but others not so favorably situated, require considerably more effort to allow of operation at a profit.

Conditions affecting the export and

import trade have not changed to any noticeable extent, except that more ships have been requisitioned for military purposes. A number of these, however, will soon be back in service, so trade will not suffer any serious dislocation. The ocean is clear, but marine insurance is still slightly above the normal figure and freights are somewhat higher than usual. Importers are not experiencing much difficulty in obtaining delivery of shipments, except for occasional delays. The lake trade has suffered from the war, and a number of boats are already laid up in the various ports. Grain is moving freely, and this is having a stimulating effect on railway traffic returns.

Steel Markets

The iron and steel trade is dull, and shows no material improvement over last week. Prices are unchanged, and are keeping firm. Orders for steel shells are being widely distributed, and the firms favored with the business are busy in certain departments. It is announced that the International Harvester Co., Hamilton, have started operations in their foundry with other departments to follow suit. This is encouraging, even though operations for the present may not be on a large scale. The building trade, although not particularly active, is showing more signs of life, and operations are being continued on the majority of buildings upon which work was started before the war.

Municipal work has been considerably reduced on account of the difficulty in financing, consequently the demand for steel products from this source has fallen off. A few orders for cast iron pipe have been placed recently, some to Canadian foundries, and a few orders have gone to United States' concerns. There is, however, a strong tendency to buy as much as possible from Canadian firms, regardless of price. The railroads are buying as little as possible, and street railway work has been cut down considerably.

Prices on steel products in the United States have not changed, the tendency being, however, towards firmness. Conditions in the steel trade in that country are not altogether favorable, but the expectation of increased foreign business is having a beneficial effect. The domestic demand, however, has fallen off. The Canadian demand for plates, bars and other material from United States' mills has materially increased and a fair volume of trade is passing.

Pig Iron.

The pig iron market is very dull, and prices are unchanged, except for a slight adjustment that has been made in prices of "Victoria" iron. We are advised that stocks of this brand on hand are sufficient to take care of business for some time, notwithstanding the fact that the furnace was blown out recently.

Old Material.

The demand for scrap has declined, and little business is being done. Merchants have considerable stocks on hand, but prices are unchanged.

Machine Tools and Supplies

Business is quiet in machine tools. Two local dealers report having sold some lathes and other tools to the Electric Steel & Metals Co., of Welland, Ont., for machining shells. There are no inquiries of any importance about, with the exception of those referred to last week. Supplies are quiet, and there has been no change in prices.

Metals.

The metal markets generally are stagnant, with no change in prices. There is not much business passing, and the tendency is towards a weaker market. London and New York markets are still closed.

St. John, N.B., Oct. 3, 1914.—"Business as Usual" has been accepted as the slogan for New Brunswick manufacturers and industrial houses. They are adhering to it as closely as possible. Though depression and pessimism prevail in some quarters, it is not so to any very noticeable extent about the various industrial centres here.

At a meeting of the St. John Board of Trade this week, various industrial matters were discussed, and it was decided to recommend the Government at Ottawa that the proposed new I. C. R. elevator to replace that which was burned be increased in capacity to 1,500,000 bushels. The harbor committee reported upon an inspection of the new west side wharves nearing completion. These it is expected will be ready very soon, and all work will be completed by December 1. The Maritime Dredging & Construction Co., which has had the task in hand, has worked night and day crews throughout the summer, and much progress has been made. The new pier will accommodate two extra steamers this winter, and when all has been finished there will be accommodation for four 400-foot boats.

The Lumber Situation.

Several of the big lumber companies have started their crews to work in the North Shore woods. With the supply of lumber from the Baltic cut off, New Brunswick operators feel that there will be a brisk demand for stock, and they believe that more attention will be given to the supply of pulpwood. The new pulp mill at Bathurst is rapidly nearing completion and will likely be operated before next year. The request for pit props from the Old Country has been of interest to local lumbermen, who are endeavoring to place orders. A pleasing indication of a restoration of confidence was seen this week when several St. John lumber mills resumed operations after having been closed since the outbreak of the war.

Rail Expansion.

The St. John Street Railway Co. has decided to continue at once with its work of constructing the new line to Coldbrook and Glen Falls, temporarily abandoned at the commencement of the war. The company is advertising for about 100 men to rush the job which may be completed this winter.

S. B. Wass, chief engineer for the St. John and Quebec Railway Co., said this week that they expected to have the stretch of the Valley Railway from Gagetown to Centreville, N.B., ready for operation about the last of the month, when it will be taken over by the I.C.R.

New Company.

The Globe Educator Syndicate Co. has been formed in this city for the manufacture and sale of an interesting educational device for which the patent is held by a St. John man, S. C. Matthews. It had been at first intended to have the article manufactured in Germany, but the war has changed these plans, and it is now possible that the industry may be established here.

Trade Gossip

Welland, Ont—The Canada Forge Co. and Canadian Billings and Spencer have been awarded contracts for large quantities of 15 and 18-pound shells by the Department of Militia.

The Empire Mfg. Co., London, Ont., has been awarded a contract for brass goods by the City of Winnipeg for the water service system.

Mr. J. Smith, structural steel engineer, has been appointed by the Toronto Board of Control clerk of works on the new registry office at a salary of $150 a month.

Keep Factories Running—Addressing the members of the Windsor Board of Trade at their weekly luncheon on October 1, Major J. C. Tolmie, M.P.P., urged local manufacturers to keep their factories running, "even if you only break even." E. G. Henderson, president of the Canadian Manufacturers' Association, and head of the Canada Salt Co., declared there was a limit to the capacity of the warehouses and the credit of manufacturers. "The best way to help out in the present crisis is for Canadians to buy goods made in Canada," he said.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

EUROPEAN EXPORT OF MACHINERY BELTING.

THE value of machinery belting of leather, wool or cotton, and of other materials exported from Germany and Austria-Hungary in a recent year was as follows:—

From Germany—1912.

Of leather	£ 317,000
Of cotton, wool, or other coarse animal hair	233,000
Of textile materials combined with rubber	185,000
Total	£ 735,000

From Austria-Hungary—1913.

Of leather	£ 20,400
Of cotton or wool	700
Of other materials	2,100
Total	£ 23,200

From Great Britain—1913.

The United Kingdom exports of machinery belting to all destinations in 1913 were as follows:—

Of leather	£ 683,000
Of woven hair or cotton	542,000
Of other materials	394,000
Total	£1,619,000

Leather Belting.

The following statement shows for a recent year the principal markets for German and Austro-Hungarian machinery belting of leather and the amounts sent to each. Figures for the United Kingdom have been added for comparison.

EXPORTS OF MACHINERY BELTING AND LEATHER.

Country to which Exported.	From Germany (1912)	From Austria-Hungary (1913)	From United Kingdom (1913)
	£	£	£
Colonial and neutral markets—	1,300	....	189,400
British India	500	....	10,800
Australia	2,300	....	2,900
Norway	22,950	....	6,500
Sweden	6,500	....	1,900
Denmark	4,350	120	7,400
Netherlands	2,350	230	16,300
France	1,450	....	2,400
Spain	1,100	....	7,100
Portugal	23,750	690	5,800
Italy	2,100	4,130	1,200
Bulgaria	13,000	4,330	11,700
Roumania	131,700	4,820	176,000
Russia	3,250	1,150	9,200
Turkey	1,000	....	12,400
Egypt	16,800	80	1,700
Switzerland	3,950	90	1,500
Dutch East Indies	700	....	17,200
China	......	....	3,700
Japan	1,400	....	10,000
Mexico	2,200	....	200
Cuba	6,200	....	33,100
Brazil	2,450	....	2,300
Urugay	8,700	30	25,800
Argentina	3,350	....	9,100
Chile			
Total to above destinations	£263,350	£15,670	£565,000
Exports to United Kingdom	£5,800	£60	

The foregoing statement shows that the United Kingdom holds the bulk of the trade in leather belting in France, Portugal, Egypt, British India, China, Mexico, Brazil, and Australasia, while Germany leads in the Swedish, Danish, Italian, and Swiss markets. German competition is severe in Roumania, Russia, and Uruguay. Austria has a fair share of the trade in Bulgaria and Roumania, but is hopelessly out-distanced by Germany and the United Kingdom in the remaining markets.

CANADIAN PATENT ORDERS AND REGULATIONS

THE following is a copy of a Special Act respecting patents of invention made under the "The War Measures Act, 1914," which has been passed to govern conditions due to the present trouble:—

1.—"Commissioner" means Commissioner of Patents, and includes the Deputy Commissioner of Patents.

2.—The Commissioner may, on the application of any person, and subject to such terms and conditions, if any, as he may think fit, order the avoidance or suspension, in whole or in part, of any patent or license, the person entitled to the benefit of which is the subject of any State at war with his Majesty, and the Commissioner, before granting any such application, may require to be satisfied on the following heads:—

(a)—That the person entitled to the benefit of such patent or license is the subject of a State at war with his Majesty.

(b)—That the person applying intends to manufacture or cause to be manufactured the patented article, or to carry on, or cause to be carried on, the patented process within the Dominion of Canada.

(c)—That it is in the general interests of the country or of a section of the community, or of a trade, that such article should be manufactured or such process carried on as aforesaid.

The fee payable on such application shall be ten dollars.

The Commissioner may at any time, in his absolute discretion, revoke any avoidance or suspension of any patent or license ordered by him, but if any person during the period of such avoidance or suspension begins to manufacture, use or sell in Canada the invention covered by said patent, such person may continue to manufacture, use or sell such invention in as full and ample a manner as if such revocation had not been made.

Provided always that the Commissioner may at any time, if in his absolute discretion he deem it expedient in the public interest, order the avoidance or suspension in whole or in part of any such patent or license upon such terms and conditions, if any, as he may think fit.

3.—The Commissioner may, at any time during the continuance of these orders and regulations, avoid or suspend any proceedings on any application made under the Patent Act by a subject of any State at war with his Majesty.

4.—The Commissioner may also, at any time, during the continuance of these orders and regulations, extend the time prescribed by the Patent Act or any rules made thereunder, for doing any act or filing any document, upon such terms and subject to such condition as he may think fit in the following cases, namely:

(a)—Where it is shown to his satisfaction that the applicant, patentee, or proprietor, as the case may be, was prevented from doing the said act, or filing the said document, by reason of active service or enforced absence from this country, or any other circumstances arising from the present state of war, which, in the opinion of the Commissioner, would justify such extension.

(b)—Where the doing of any act would, by reason of the circumstances arising from the present state of war, be prejudicial or injurious to the rights or interests of any applicant, patentee or proprietor as aforesaid.

Such extension of any prescribed time, if granted after its expiration, shall have the same effect as if granted prior thereto, provided such expiration occurred on or after the 4th day of August, 1914.

5.—The Commissioner may refuse to register the assignment of any patent made by a subject of any State at war with his Majesty, and filed in the Patent Office on or after the 4th day of August, 1914, unless satisfied that such assignment was made in good faith and not for the purpose of evading any of the provisions of the foregoing orders and regulations.

6.—The term "person" used in these orders and regulations shall, in addition to the meaning given thereto by par. (20) of Section 34 of "The Interpretation Act," include any Government department.

7.—These orders and regulations shall come into operation as and from the 4th day of August, 1914.

Contributed by Marion & Marion, Patent Attorneys, Montreal.

OPPORTUNITIES FOR CANADIAN MANUFACTURERS.

THE Department of Trade and Commerce, Ottawa, advises that enquiries have been received regarding goods which could be secured from Canada to take the place of those formerly obtained from sources of supply now cut off. The opportunity is presented to Canadian manufacturers to supply at least a proportion of these goods, and thereby open up the way for a large and increased business. Amongst the articles enquired for, the following list may be of interest:—

Gimlet-pointed cotch screws; iron screws (flat); iron screws (round heads); brass screws (flat heads); brass screws (round heads); cut tacks; bolts and nuts (cup, square, square); bolts and nuts (square round square); spout bolts and nuts; crucible cast steel files (flat, half-round, round, square); mill saw (one or two square edges); horse rasps; wood files and rasps; air guns; augurs; axes; bits; braces; brackets; carpet sweepers; sash cord; chisels; choppers; clippers; clothes pegs; manure forks; potato forks; back saws; hammers; handles (hammer); hatchets; lawn mowers; padlock hasps and staples; pliers; scissors; saws; stones (hones and slips); tin openers; vices; wrenches.

CANADIAN TRADE.

FOR the month of August which was the first month of the European war, the total Canadian trade reached an aggregate of $100,374,000 compared with $97,832,000 for the corresponding month of 1913, according to a trade statement issued on October 5 by Hon. J. D. Reid, Minister of Customs.

While there has been a falling-off in imports, the statement declares that a healthy condition exists in the trade of the Dominion. During August last, Canada exported $8,780,000 worth of animals and their produce, as against $4,817,000 for August, 1913. For the five months of the present fiscal year ending August 31 last, the total exports under this head were $26,063,000, as against $17,901,000 for the corresponding five months of the previous year.

There is also an increase in the value of manufactured articles exported. For August last, these amounted to $5,049,000, as against $4,911,000 for August, 1913. For the five months, the exports of manufactured articles were $26,728,000, compared with $20,963,000 for the corresponding period of 1913.

Coin and bullion imported into Canada during August reached the total of $11,452,000 as against $572,000 for August, 1913. During August $7,425,000 worth of domestic agricultural products were exported, and $10,924,000 worth of foreign agricultural products.

Trade for the Year.

This summary of the trade of Canada for the twelve months ending with July, with comparative figures for the corresponding periods of the three preceding years, are the last trade figures that will appear covering a period unaffected by the war.

Imports in merchandise, which in 1913 advanced more than $100,000,000 worth, show a decline exceeding that amount in the last year of record, and are about ten and a half millions under the total for 1912. Duty collected in 1914 is down about twenty and a half million.

Exports Greatly Increased.

Exports, however, continue to grow, that side of the sheet exhibiting an advance of almost $66,000,000 worth in the outgo of the country's produce, as compared with a $47,000,000 increase in 1913, and $46,000,000 in 1912, over the preceding year in each case. The decline in aggregate trade is thus correspondingly reduced.

Trade With Germany.

An interesting portion of the statement relates to the trade of Canada with the various countries of the world, showing that our imports from Germany in the twelve months ending July 31 amounted in value to $13,557,621, and our exports there to $4,511,153, a trade now totally wiped out by the war.

Summary for Year.

The total trade summary for the last year is:

Imports—Dutiable goods, $366,858,417; free goods, $196,320,267; total merchandise, $563,178,684; coin and bullion, $14,757,635; total imports, $575,936,319; duty collected, $97,094,410.

Exports—Canadian produce, $431,974,001; foreign produce, $29,841,099; total merchandise, $461,815,100; coin and bullion, $21,614,085; total exports, $483,429,185.

Aggregate trade, $1,061,365,504.

Trade Gossip

The Port Arthur Wagon Co., Port Arthur, Ont., have commenced delivery of part of the wagon order for the Militia Department.

The A. R. Williams Machinery Co., Toronto, has recently sold a number of lathes to the Electric Steel & Metals Co., Welland, Ont.

The Galt Brass Mfg. Co., of Galt, Ont., has been authorized to increase the capital stock of the company to $100,000, and change the name to that of the Galt Brass Co., Ltd.

Welland, Ont.—The Canada Forge Co. and Canadian Billings & Spencer have been awarded contracts for large quantities of 15 and 18-pound shells by the Department of Militia.

The Canadian Fairbanks-Morse Co, Toronto, has received an order from the Electric Steel & Metals Co., Welland, for three 18-inch McDougall (Galt) lathes and a drill press.

The Robert W. Hunt Co. has removed its Vancouver, B.C., office and cement and physical testing laboratories from the Bank of Ottawa Building to the Standard Bank Building, 508 Hastings Street West.

The Canadian Fairbanks-Morse Co., Toronto, has received an order from the corporation of Englehart, Ont., for a 70 h.p. Fairbanks-Morse gas engine for driving a Morris 3-stage turbine pump. The town has also placed an order with the company for a 15 h.p. Fairbanks-Morse gas engine to drive a Goulds' triplex pump.

Soo Canal Traffic Decrease.—With a decrease of half a million tons from August, 1914, the statistical report of the September traffic through the St. Mary's Falls canals, issued on October 4, shows a decrease as compared with the corresponding month last year of two and one-half millions. For the month of September, 1913, the figures show a total tonnage of 10,910,363 and, for this year, 8,417,716. Increases are shown in flour, wheat and salt, while grain, coal and iron ore show decreases. There were nearly six hundred fewer vessels passages through this year. The Canadian canal carried through 920,454 tons more than the American side, with 996 less vessel passages. The number of passages show a decrease of 2,850.

Specific Industrial Opportunities for Manufacturers

By a Staff Reporter

No individual, however generally superior in the eyes of his fellows, has a monopoly of gifts or is a perfection in personality, and we esteem it well that it is so. In like manner no one location in our Dominion has a monopoly in the matter of attracting industries. With the almost endless variety of the latter there is fortunately an equivalent personal condition existent; manufacturers have therefore a wide choice and can shrewdly estimate the value to themselves of the different facilities offered.

WELLAND, ONT.

THE town of Welland was incorporated in 1878, and grew steadily until about five years ago, when the population was 4,000. Since then the population has increased to 8,000, and the town has developed into an important manufacturing centre. Welland is favored with excellent transportation facilities. The Welland Canal runs through the town, affording direct water communication between the St. Lawrence River and the Great Lakes. The canal is of inestimable value, and will be to a greater degree when the enlargement is completed. Raw materials come in at low rates, which is an important factor for such industries as are located at Welland.

The railroad service includes seven systems—the Grand Trunk, Michigan Central, Toronto, Hamilton and Buffalo, Canadian Northern, Canadian Pacific, Wabash and Pere Marquette. The electric railways comprising the Niagara, St. Catharines and Toronto Railway and the Niagara, Welland and Lake Erie, afford an excellent suburban service. On account of the close proximity to the border, Welland is in the Buffalo switching group, and takes the Buffalo rate from the United States. The roads all centre at Welland and so create competition, which secures efficient service for the manufacturers.

Another important factor for an industrial centre is cheap power. Two companies—the Ontario Power Co. of Niagara Falls, twelve miles east of Welland, and the Dominion Power Co., Decew Falls plant, about twelve miles to the north, supply the town with current at low rates, varying according to the quantity of power used and the load factor, an average being about ¾c per k.w.h. Natural gas forms another important factor; Welland being situated in one of the biggest natural gas belts in Canada, and gas is sold for 25c to 30c per thousand feet for domestic purposes, with a special rate to manufacturers. On account of the comparatively low freight rate on coal, this material can be obtained at low cost. For the same reason crude oil only costs 3½c a gallon delivered in tank cars.

With the above mentioned inducements, prospective manufacturers could hardly expect concessions from the town; as a matter of fact, the majority of the concerns which have located have done so only for the commercial advantages obtainable. Free sites, however, can be secured from private individuals, and the town offers a fixed rate of taxation for ten years and water for manufacturing purposes at cost of pumping. Welland does not sit down and trust to Providence to obtain new industries for them. The Board of Trade, fully alive to the situation, has an Industrial Commissioner, who has been exceedingly active, and, what is more important, successful, in his efforts to develop the industrial possibilities of the district. It goes without saying that a town may have any number of attractions, but unless they are presented to prospective manufacturers in a proper manner, the results will not be satisfactory, and the town, to all intents and purposes, will hardly be on the map.

Welland has been particularly fortunate in the type of industry which it has secured. It is generally conceded that foundries and steel plants form an attraction for the establishing of other industries not necessarily directly connected with the iron and steel trade. In this particular case we have the Canadian Steel Foundries, Ltd.; Electro-Metals, Ltd.; Page-Hersey Iron Tube & Lead Co., and the Canada Forge Co., all doing a big business. Other large concerns established in Welland include the John Deere Plow Co., Plymouth Cordage Co., Billings & Spencer Co., Standard Steel Construction Co., Hamilton Tube Co., and several other smaller factories.

The greater number of the above concerns are branches of prominent firms, with headquarters in the United States. The location of Welland is particularly good for Canadian branches of United States concerns, being within easy access of many of the principal manufacturing centres of that country. Manufacturers in the United States often prefer to have a branch established in Canada as near headquarters as possible, and when this can be obtained with other valuable considerations, towns such as Welland usually benefit.

SAULT STE. MARIE, ONT.

THE town of Sault Ste. Marie is situated on the "Soo" Canal, which connects Lakes Huron and Superior, and through which all the shipping passes from Duluth and Port Arthur to points on the lakes east of the canal. During the season of navigation, the tonnage passing through the canal is enormous, being estimated at about 70,000,000 tons; these figures being for both the Canadian and American locks.

Sault Ste. Marie has a population of over 13,000, and is perhaps best known as being the headquarters of the Lake Superior Corporation, one of the largest concerns in Canada and comprising as subsidiaries the Algoma Steel Co., Algoma Eastern Railway, and Algoma Central Railway; while the Lake Superior Paper Co. is closely associated. The surrounding country is rich in iron, making it a logical location for iron and steel industries, while coal brought via the lakes can be obtained at comparatively low cost.

Large timber limits are within easy reach of the "Soo," an important factor in the development of this district by the establishing of pulp and paper mills and saw mills. The district is rich in copper and nickel, which are being mined at considerable profit, although large prospects are still untouched. It will thus be seen that the prospects for extensive industrial development are excellent, there being so many features in favor of expansion.

The Lake Superior Corporation is the most important concern. Here are operating a Bessemer steel plant and rolling mills, also blast furnaces, while open hearth furnaces have been built and a large quantity of steel rails are turned out every year. The Lake Superior Paper Co. has both paper and sulphite mills. The Algoma Central Railway makes connections with the Canadian Northern Ontario Railway, and the Grand Trunk Pacific will soon be linked up, making, with the water route, excellent transportation facilities.

Sault Ste. Marie has been an important shipping centre for several years, but has developed considerably in this respect latterly on account of the canal. In 1797 the first lock on the American Continent was built here, but was destroyed by fire in 1812. During the years 1888-1895, the Dominion Government built a lock 900 feet long and 60 feet wide at a cost of nearly $4,000,000, the result being that the "Soo" enjoys the distinction of having one of the largest locks in the world.

THREE RIVERS, QUE.

THE city of Three Rivers, the second oldest city in Canada, founded in the year 1634, is located at the confluence of the St. Maurice and the St. Lawrence Rivers, the former emptying into the St. Lawrence at this point through three channels; thus giving the city its name. The advantages of its location on a promontory overlooking the rivers made it a natural meeting place for the early traders, and, as the country grew in population and the rich lumbering, agricultural and mineral resources became more and more developed, the importance of the city as a manufacturing centre began to be fully realized.

The excellent natural harbor advantages have been supplemented by over two miles of docks, which are being constantly extended so as to accommodate the largest ships. An abundant supply of hydro-electric power is developed within twenty miles of the city at Shawinigan Falls, and at other points, and is both cheap and reliable. A large portion of the raw materials required by many different manufacturers are available from the surrounding districts. These advantages along with good labor conditions and efficient railway service has made this city an attractive location for a large number of industries.

Manufacturing.

The Wabasso Cotton Co. and the St. Maurice Valley Cotton Mills, Ltd., each capitalized at over $1,250,000, employ about 2,000 hands and turn out the highest class of product. The Canadian Pacific Railway at this point connects up with the St. Maurice Valley Railway and maintains large shops and yards. At Shawinigan Falls and Grand Mere, a short distance away, are located the Laurentide Pulp & Paper Co., the Northern Aluminum Co., Shawinigan Water & Power Co., The Belgo-Canadian Pulp & Paper Co., and the Canadian Carbide Co.

Within the confines of the city itself one of the oldest industries is the coffin trimmings and casket factory of Girard & Godin, and one of the largest is the plant of the Wayagamack Pulp & Paper Co., which has an annual pay roll of over $500,000. Among other institutions are the plants of the Tebutt Shoe & Leather Co., the Balcer Glove Mfg. Co., the Robert Ryan Co., the Canada Iron Corporation and the Diamond Whitewear Co. The Grand Trunk, Intercolonial and Delaware & Hudson railways also have connection with the city.

Lumber Industry.

It is estimated that about 200,000,000 feet of timber come down the St. Maurice annually to be converted into lumber, pulpwood and paper by the mills in and around the city. Of this amount the Gres Falls Co. uses about 50,000,000 feet annually, and the St. Maurice Lumber Co. manufacturers about the same amount into lumber and pulpwood. The latter concern employs in all about 3,000 men and 650 horses in its various branches. The rest of the timber industry is divided among a number of smaller plants.

Three Rivers is an old city with modern ideas, as is evidenced by the order and lack of an excess of unsightly poles in the streets. There is an abundance of schools, churches, hospitals, parks and other public institutions. The population has more than doubled in the last 20 years, the customs receipts have increased 150 per cent. in five years, and the city is rapidly taking its place among the most popular cities in Canada.

GERMAN TRADE.

IN the concluding article of the series on German trade which have been appearing in recent issues of the Department of Trade and Commerce Weekly Report it is stated that it does not appear possible for Germany to recover her abandoned trade, for as a general proposition it may be laid down that the building up of export trade is a slow business, and if interrupted for a year or more, its recapture presents a most difficult problem. For the time being the opportunity for Canada is patent, and we should so make our plans and develop our methods that we may capture as much as possible and retain all that we capture.

It will not be forgotten in Canada that in 1903 Germany declared a small economic war by contesting the right of Canada to grant a preference to the Mother Country, and imposed maximum duties as a penalty, thereby bringing into operation the Canadian surtax and cutting down German trade by one-half, during a period of Canadian expansion; but in 1910 Germany admitted defeat by withdrawing from the arbitrary position she had taken up in 1903. During the seven years of economic hostilities, the fact was demonstrated that Canadian trade was far more valuable to Germany than German trade to Canada, because the former consisted of manufactured goods and the latter was largely composed of foodstuffs which the world must have. The industrial development of Germany compelled purchase of wheat, and it did not matter to Canada to whom she sold it, for wheat, like water, finds its level.

Trade Gossip

Montreal, Que.—The new officers of the Montreal Publicity Association elected on September 29, are as follows:—Hon. president, Theodore Morgan; president, Fred. A. Scroggie; first vice-president, H. A. Robert; second vice-president, Charles Fee; secretary-treasurer, W. H. Mercheson; directors, Messrs. F. A. Covert, E. M. Emery, L. R. Greene, E. H. Lawson and R. S. Muller.

Dominion Steel Dividend.—Directors of the Dominion Steel Corporation met in Montreal on October 5 and declared the regular quarterly dividend of 1½ per cent., payable November 1 next. J. H. Plummer, president of the Corporation, stated after the meeting that there was little appreciable change in the steel situation, but that the directors were hopeful of the future, and had several important lines out for new business.

Pit Props Wanted.—A delegation of representatives of the British Board of Trade has been in Ottawa interviewing the Minister of Trade and Commerce with reference to securing in Canada supplies of timber for pit props in British collieries. The supplies heretofore were secured in Russia or Norway, but the war has interfered with importation from that source. The delegation has learned that the timber can readily enough be had in this country, but the prices will be very considerably in excess of what has usually been paid. They are now en route to Newfoundland to make similar inquiries there.

Victoria, B.C.—Plans for an energetic campaign, which has for its object the development of local industries, were discussed at a meeting held a few days ago by the committee of the Victoria and Island Development Association recently appointed for the purpose. The increased prosperity of those industries now located in the city and the attraction of others of a nature capable of developing the immense natural resources of Vancouver Island is the aim of the movement. Harry Bullen occupied the chair, and among those present at the meeting were Messrs. H. B. Thomson, M.P.P.; F. A. Pauline, J. L. Beckwith, R. W. Douglas, C. Pendray, H. W. R. Moore, G. Williams, E. Billinghurst, J. L. Hunter, Aldermen Okell and Todd, and Commissioner Cuthbert. Mr. Bullen was appointed permanent chairman of the committee.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Smith's Falls, Ont—The by-law was carried last Monday to loan $25,000 to the Aluminum Castings Co., of Ottawa.

Edmonton, Alta.—North Alberta Lumber Co. contemplates installing a 1,000 h.p. generator for power and lighting in their sawmill.

Joliette, Que.—A hydro-electric plant will be installed here. The contract has been let to Arseneault & Plamondon, of Montreal, for the construction of a dam and power house.

Duncan, B.C.—The completion of the municipal power plant has been delayed on account of the prohibition placed on shipment of the engines from Glasgow, Scotland, by the British Government.

Fraserville, Que.—Tenders will be called later in the year for additions to the power house, including penstock, waterwheel, dynamos and motors, at an estimated cost of $25,000. E. Tallis is the clerk.

Toronto, Ont.—Prospects for a new machinery hall at the Exhibition in time for next year's annual show are not very bright, but a by-law may be sent to the people on New Year's Day. Plans and specifications have been made, but the Controllers have refused to take any action until the cost is known.

Electrical

Beaverton, Ont.—The new Provincial Hydro power development plant at Wasdell's Falls will be formally opened on October 7 by Sir Adam Beck.

Beaverton, Ont.—The first generating plant to be constructed by the Ontario Hydro-Electric Commission has been completed. This is at Wasdell's Falls, and as a result the Beaverton district will be supplied with power and light. Another Hydro enterprise, known as the Eugenia Falls development, is in course of construction.

Municipal

Port Hope, Ont.—The intake pipe for the waterworks system will be extended on the advice of the Provincial Board of Health.

Bedford, Que.—The waterworks by-law has been carried, but tenders will not be called until next year. The estimated cost is $35,000.

Calgary, Alta.—The municipal electric light department controlled by the city, shows a net profit for the year of over $21,000.

Regina, Sask.—The City Council is contemplating an extension to the pump house and sewage disposal works, estimated to cost $5,000. F. McArthur is Engineer.

St. Thomas, Ont.—The City Council has borrowed $18,000 from the surplus funds of the local Hydro-Electric Department for the purpose of continuing local improvements.

Weston, Ont.—Application has been made to incorporate Weston as a town. The population of the municipality is about 2,200. Should the application be favorably received by the Railway Board a town will be created on January 1st.

London, Ont.—This will be a record year for expenditure on civic works in London, the total now in sight for storm sewers and other street improvements being $700,000. The Engineering Department has 472 men at work, which is the largest force in years.

Calgary, Alta.—A dozen members of the Board of Trade gathered on September 24 at the meeting devoted to the discussion of the important subjects of how to stimulate manufactures and take advantage of the new market which has been opened with the tying up of German commerce during the war.

Sault Ste. Marie, Ont.—The twenty-year franchise of the Tagona Water & Light Co., which has been the only source of supply in water and electricity energy in this city, expired on October 1. The system has now been taken over by the city, and will be operated along the lines of the Hydro-Electric system, with a appreciable reduction in rates.

Regina, Sask.—In view of the fact that a much larger number of settlers are in need of assistance in drought-stricken parts of south-eastern Saskatchewan than was at first supposed, the Provincial Government has decided to spend $750,000 in road and bridge construction in these parts. The original intention was to expend $500,000. In all. 150 crews are now at work, averaging twenty-five men to a crew.

St. Thomas, Ont.—It was reported at the meeting of No. 5 Committee last Thursday evening, that the sum of $36,000 would be required to carry out the authorized permanent improvements to the gas plant. Of this the extensions and enlargement will cost about $12,500, the benches and other improvements about $22,000, while the remainder is for contingencies.

Whitby, Ont.—At a largely attended meeting held in the Town Hall here on October 1 of representatives of the various municipalities in the counties of York and Ontario between Oshawa and Toronto, the plans for a permanent highway, to be undertaken partly with a view to providing employment, were further advanced, and a committee was formed to go into details and report to the different councils interested.

New Toronto, Ont.—Work is progressing rapidly in connection with the new water undertaking. The pump and filter building is nearing completion, and long sections of the mains have been laid. Work is to be started on the intake pipe this week. It is expected that the whole system will be in operation by the end of November. The village council has passed a by-law for an issue of debentures amounting to $25,000 to cover the cost of waterworks construction.

General Industrial

Hawkesbury, Ont.—Construction of the new mill for the Hawkesbury Board and Paper Mills will probably start shortly.

Ingersoll, Ont.—It is reported that C. C. Morrison has a number of men at work making repairs at the City Mills with a view to recommencing the manufacture of flour about the middle of October.

St. Stephen, N.B.—The new shoe factory of Clark Brothers in King Street here was destroyed by fire on September 29. The loss in building and stock is placed at about $35,000, with $28,000 insurance.

New Westminster, B.C.—Work has already commenced on alterations to Columbia Cold Storage Co. building, which will be occupied by the Brackman-Ker Milling Co., and used as a warehouse during the construction of the company's elevator and warehouse which will begin shortly. The elevator will have a capacity of 51,000 bushels.

Brampton, Ont.—Representatives of a United States firm, which manufactures furniture decorations, electric light fixtures, etc., have been visiting this town looking for a suitable building in which to establish a factory.

Calgary, Ont.—The local leather factory has received an order to supply saddles to the British Government, and it is intimated that if the first shipment is satisfactory a big order will follow. The same company has just completed a large order of saddles for the Canadian Mounted Police.

Hamilton, Ont.—It is announced that the Proctor & Gamble Co., who are proposing to build a soap factory here, will erect a larger plant than was originally contemplated. The main building, 200 x 60 feet, will have four storeys instead of two, and another building will be increased to three storeys.

St. Thomas , Ont.—Owing to the money stringency, the big plant and stock of Thomas Brothers, Ltd., now insolvent, valued at $250,000, which was offered for sale by the liquidator, G. T. Clarkson, of Toronto, was not sold, as not a single bid was made for the plant or for an equity in real estate valued at $30,000, which was also held by this company. As this industry, which employed about 250 men, has been shut down for the last six weeks, a movement is on foot to raise local capital to reorganize and start the business again.

Railways--Bridges

New Westminster, B.C.—Mayor Gray has reported to the council that the agreement with regard to the Great Northern dépot site has been executed and signed by the Government.

Brockville, Ont.—The ratepayers of the Township of Kitley have voted down by a large majority a by-law to bonus the proposed Gananoque, Arnprior and Ottawa Railway to the amount of $25,000.

Toronto, Ont.—The Toronto Board of Harbor Commissioners are making preparations for the construction of a steel lift bridge at Cherry Street over the Don River. The bridge will cost $95,000. It will be 80 feet wide and 120 feet long, built on concrete piers resting on the solid rock. The lift will be operated by electricity, and will permit the entrance of small vessels into the river.

London, Ont.—Chief Engineer Gaby of the Provincial Hydro-electric Commission, is in touch with prominent New York engineers and passenger car designers, with a view to obtaining the most up-to-date model of passenger car for the London & Port Stanley Railroad, now in process of electrification, the car to be made the standard for all Hydro-electric railways to be constructed throughout the Province.

Victoria, B.C.—A meeting of the various parties interested in the construction of the bridge across Selkirk water by the Canadian Northern Pacific railway will be held shortly. All those who have interests as public authorities or as private individuals are being invited to attend. A representative of the railway company, probably the divisional engineers, will be present to represent the railway's side of the case.

Weston, Ont. — The council expect to receive judgment shortly from the Dominion Railway Board in regard to the Grand Trunk subway on Main street. The municipality has submitted a traffic census and also evidence regarding the life of the present structure. E. A. James, engineer for Weston, has submitted a plan for a steel subway at an estimated cost of $18,000. The car tracks would be in the centre and the vehicular traffic would be on the outside. Two steel piers would support the structure.

Goderich, Ont.—Contractor Campbell, of Strathroy, and Mr. Butler, of London, have been here to get some information regarding the present status and future possibilities of the West Shore Railway. These gentlement are owners of a good railway building plant, and being desirous of keeping it busy, are prepared to consider any proposition for the completion of the West Shore line. They would expect to make a contract for the work with the municipalities up to the point of finishing the road ready for operating.

London, Ont.—The Port Stanley Railway Commission has been notified that steel for the rebuilding of the railway will be delivered this month. This steel includes a purchase of about $100,000 worth of material and comprises rails, tie plates and angle bars. The shipment will be made by the Algoma Steel Co., the successful tenderers. The relaying of the tracks, with the grading and other work necessary in this connection, will be proceeded with as soon as the steel is delivered, and it is anticipated that the work will be completed before the end of September.

Montreal, Que.—At the annual meeting of the Sherbrooke Railway & Power Co., held on September 29, the old board of directors was re-elected. S. L. Spafford, of Lennoxville, Que., was added to the board. In his address to the shareholders, C. J. McCuaig, the president, in referring to the outlook of the company, said in part:—"The company has contracted for the greater part of the power available from its present development, and earnings should show a satisfactory increase as soon as normal conditions again prevail. The company's power plant and lighting systems have been kept in a high state of efficiency, and a considerable amount has been expended in the upkeep of the street railway."

Guelph, Ont.—J. N. Stanley, district superintendent of the Hydro-Electric Survey, accompanied by G. F. Hanning and a gang of seven men have arrived in the city, and will remain here for perhaps a week and a half. Mr. Stanley stated that they were here to make a survey for another Hydro-Electric Railway from Guelph to Toronto. He said this line would be a sort of a main line through Western Ontario and might be continued even past Guelph. It would be built to connect with the proposed line to run north of Guelph and also with the one from Hamilton to Guelph, making this city a central point for Western Ontario. Mr. Stanley was not positive of the route which this main line would take, but he was of the opinion that it would go as direct as possible to Toronto, passing through Milton and avoiding Acton and Georgetown. It would probably run in some places close to the new line of the Toronto Suburban Railway. He stated that the estimates for the other lines north and south of Guelph were almost completed and would be published in a very short time. He refused to divulge any of the figures, although admitting that he knew what they are.

Contracts Awarded

Regina, Sask.—North Western Electric, Ltd., Kerr Block, has obtained the contract for lighting system in new wing of general hospital.

Athabasca, Alta.—A contract has been awarded to the Jamieson Construction Co., of Edmonton, for the construction of a reservoir and filter.

Harwick, Ont.—Park Bros., of Chatham have been awarded a contract for the construction of a pump house, and for supplying pumps, etc.

Winnipeg, Man.—A contract has been awarded to the J. F. Justice Co., Winnipeg, at $1,087, for labor and materials required for the erection of the civic gas testing laboratory.

Richibucto, N.B.—The contract for extension to the breakwater has been awarded by the Dominion Government Department of Public Works, to En-

The Vacuum System of Heating for Industrial Plants

By W. H. Baldwin *

The necessity for heating factory, office, and public buildings during the major portion of each year on this continent, has called forth both engineering ingenuity and enterprise, and the economic aspect of the subject naturally appeals to those who manage and direct such institutions, affecting as it does the three-fold feature of employees' welfare, production, and fuel expenditure.

DURING the last ten years, manufacturing plants in Canada and the United States have made wonderful strides in their development. Improved methods and better machinery have gone a long way towards cheapening production and improving the quality of the product, and were, of course, the first to receive the attention of the up-to-date manufacturer.

At the present time it is not an unusual thing to see large quantities of practically new equipment being scrapped to make room for improved machines which will increase the production of the plant and do it at a lower cost. Large sums of money are also being spent annually by wide-awake manufacturers in order to maintain cost-keeping departments which have for their aim the efficiency determination of each individual unit.

Another thing receiving more attention now than formerly, is the care being given employees in the matter of comfort while on duty. Manufacturers have found that it pays to have men comfortable, and in many of the factories being built to-day, particular attention is being given to the features of ventilation, heat and light.

Exhaust steam Waste.

However, in a relatively large percentage of our plants, there occurs a leak that is two-fold in its effect, and I know of no better way to get an idea of its enormous extent than to go to the top of some tall building, overlooking the manufacturing section of our cities, on a cold day and see the volume of exhaust steam being poured out. This exhaust steam represents thousands of dollars annually in coal bills.

In order to see the other result—go down to one of these factories from which the cloud of steam is rising and look at the workmen. It is more than probable that you will find them bundled up in heavy clothing trying to keep warm. You will see, perhaps, a workman trying to make a difficult adjustment on a machine. He is a good mechanic—he has to be to do the work required of him, and is receiving good wages; still, as you watch him, you think it takes a long time to make the adjustment and start the machine. You are right in thinking so too, for it has probably taken him twice as long as it would, had the building been comfortably warm. To put his thoughts in words, "his hands are so cold that his fingers are all thumbs."

Sometimes conditions are worse than above noted. I have in mind a small plant manufacturing a commodity that required practically the whole factory force to be skilled mechanics and well-paid men. During an extra severe winter, this factory lost thirty-two hours each day in one of its departments due to the fact that it was so cold for the first hour or so in the morning that the men could not work; still at the time, there was enough exhaust steam being wasted to have heated all the buildings comfortably. Not only did they lose the wages of the men during this time, but the output of the factory was cut down an equivalent amount at a time when it should have been running at full capacity. The saving occasioned by the use of a vacuum system of heating in each instance would alone have been sufficient to warrant its use. Another advantage, which applies particularly to Canadian factories, is that it may be extended to care for future additions without increasing the back pressure on the engines to any great degree, and still get the water of condensation back to the boilers at a very high temperature.

Applicable to Heating System Extension.

I have an instance in mind in which the back pressure on the engines was decreased by making an extension of the heating system. The plant in which this occurred had originally a surplus of exhaust steam over that necessary to heat its buildings and the back pressure valve was set to maintain a pressure of about one pound on the heating mains and allow the surplus steam to escape to the atmosphere. A new warehouse was added later and the radiation in it was sufficient to raise the total amount of radiation to an amount which was slightly in excess of that which could be supplied by the engines in severe weather. The effect was, that the radiation, acting as a condenser, condensed the steam faster than the engine supplied it and instead of the gauge showing a pressure on the exhaust main, it showed a vacuum of from two or three inches. The vacuum pump maintained the circulation of steam through the radiators and heated the buildings satisfactorily.

The value of such a condition as this may not at first become apparent to the reader. This vacuum condition means more horse-power from the engines with the same consumption of steam, or the same horse-power, with a smaller consumption of steam, yet at the same time the smaller amount of steam available from the engines was sufficient to heat all the radiating surface because of the positive circulation due to the vacuum pump.

Thermostatic Trap Feature.

What has been stated would of course, have been impossible without the use of a thermostatic trap on the radiators, as the thermostatic trap remains wide open until the steam comes in contact with its disc, thus allowing an unobstructed passage through which the suction from the pump can act upon the air in the radiator, pulling it out and filling the radiator with steam, even though it may be at a pressure lower than that of the atmosphere. Then, as soon as the radiator is filled with steam, the trap closes so that only the water condensing in the radiator is allowed to pass out. This prevents the steam from entering only part of the radiators and insures an even distribution of steam all over the system.

The hollow disc thermostatic type of trap has a hollow collapsible disc in which is a mixture of volatile fluids which vaporize and condense in direct proportion to the changes in temperature. Since temperature is the most potent and positive factor in heating, it is the most reliable of nature's forces to govern the opening and closing of a radiator steam trap. Of course, exhaust steam is used for heating purposes without employing the vacuum system. It has the disadvantage however, that it is necessary to carry a considerable back pressure in order to get circulation, also, there is more or less difficulty in getting the air out of the radiator and in getting the water back to the boiler-room, unless there be a considerable grade down to the boiler room.

In a gravity system there is almost sure to be a part of your radiation in-

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active and this is especially true in extremely cold weather. During very cold weather when the radiators are condensing their maximum amount, the fall in pressure through a radiator is so great that the steam is short circuited through the return pipe and flows to the radiator through both supply and return connections. The result is that the air and water are held up in the radiator and its efficiency is reduced. The vacuum system is also more efficient than a gravity system in saving and using the heat in the steam for heating purposes. This is illustrated very clearly by the following case:—

A Vacuum System Record.

Two years ago a large mining company in the West installed a vacuum system to take the place of a two-pipe gravity system then in use for heating their buildings. As the mines were located at a very high elevation and in a very mountainous district, the cost of transportation made the price of coal very high, and a close account of the coal used was kept the year round. After the vacuum system was installed, the record of coal consumption was compared, and it was found that a net saving of 23 per cent. had been effected. As there was a total of about 35,000 square feet of heating surface on this job and the heating season was practically twelve months of the year, and as their coal cost around $10 a ton, this meant some saving.

Of course, this was an extreme case, caused by extreme conditions, but on the average the saving effected by a vacuum system is well worth considering by the manufacturer who expects to cut his cost of production down to where he can compete successfully with foreign manufacturers.

LOCOMOTIVE MECHANICAL STOKERS

THE report of the Committee on Mechanical Stokers read at the forty-seventh annual convention of the American Railway Master Mechanics' Association was in part as follows:—

The development of the locomotive stoker continues, though nothing notable has been observed during the past year. In the committee's last report allusion was made to the apparently accepted utility of the device, and its adaptability to locomotive service. References were also made to the higher average steam pressures maintained, and especially toward the latter part of a division run, simplicity of operation, work performed, etc. The belief was expressed that most of the statements appearing in their last report have been borne out in practice, according to such observations as the additional year has permitted. In last year's report it was pointed out that the several types were, in the main, divided into two general classes—namely, the underfeed and the scatter or overfeed types, but, up till last year, no opinion was advanced as to which type will, in the end, prevail.

The committee again made reference to the difficulties surrounding the design of a machine to suit present locomotive construction; not so much an account of the work to be performed, but the absence of choice as to arrangement, the absolute limitations of space, and the conditions under which such a machine must operate. It is believed that as time goes on, greater latitude will be given designers, and consequently more will be accomplished, where it is preconceded that the stoker is to be a part of the locomotive.

Fuel Consumption.

Commenting generally upon their report, the committee state, inter alia, that the fuel consumption seems to vary almost in proportion to the physical fineness of the coal used in stoker firing with the scatter-type machines, a percentage of the lighter material being evidently drawn through the tubes by the heavy action of the draft. Using Pocahontas nut stoker-fired, and run-of-mine hand fired, the consumption figures are not far apart. From this it would appear that with the higher volatile coals containing a smaller amount of fine product, the consumption of fuel as between hand-fired and stoker-fired should be very close. It also seems evident that, though the consumption increases as the coal becomes finer in character, the stoker is better able to maintain steam with it than might be secured on an average hand-fired.

With reference to the emission of smoke, it was mentioned in the last year's committee report in substance that, as combustion is improving in stoker firing, as against irregular hand firing, there should be some diminution in smoke. Some observers have reported that with a thin fire and conditions otherwise favorable, stoker firing as with hand firing well executed, little objectionable smoke is emitted, but as the difference in the range of operating conditions and character of fuel are usually so large, a liberal view must be taken of what might be expected. The committee intimated that they had not the opportunity to make extensive investigations, but received reports that when the feeds are not forced beyond the limits of complete combustion, the reduction in smoke is longer maintained with the underfeed than with the scatter types, on account of the fuel being delivered up through the bed of the fire as combustion progresses, when under conditions of service and character of fuel suitable to their present stage of development.

Pulverised Fuel.

Following the presentation of last year's report on this subject, some interesting remarks were made with reference to contemplated experiments with pulverised fuel on locomotives. It is understood that the New York Central has made some investigations in connection with the use of such fuel on switching locomotives, and that the Pennsylvania Railroad has also given it some consideration, but in neither case have they meantime anything of interest to offer.

In the discussion which followed the reading of the report, many instances of the ability of stoker fired engines to handle heavy tonnage under extremely adverse conditions were freely cited.

HONEYCOMB AND CLINKER FORMATION IN FURNACES.

PROFESSOR S. W. PARR, of the University of Illinois, in a paper on "Honeycomb and Clinker Formation in Furnaces," read before the Convention of the International Railway Fuel Association, came to the following conclusions:

1.—The chemical condition which seems to be most conducive to formation of honeycomb is that in which the percentage of iron pyrites is high.

2.—Any conditions in the combustion chamber which by reason of the time interval for complete oxidation, or temperature stages, or deficiency in oxygen, which would promote the formation for any brief length of time of the iron pyrites in the ferrous sulphite or "halfway" stage, is a condition likely to promote clinkering.

3.—The physical condition most active in promoting the formation of clinkering of particles in the fire-box above the grates is found in the finely divided material—coming from the floor of the mine—which is both high in ash and high in iron pyrites.

4.—At least one practical suggestion is indicated, namely, that so far as is possible the fine stuff be eliminated from the material as fired. Material of this sort may be much more readily handled in fires which are not conducted under such forced conditions as to draught and speed of combustion, it being only necessary to allow ample access of oxygen until the time of complete burning out of the sulphur, after which the tendency to fuse is reduced to the minimum.

The Phoenix Foundry Co., St. John, N.B., has been awarded the contract for installing fire-escapes at the new hospital in that city.

Pumps and Injectors for Feeding Locomotive Boilers

By A. Woolford

Attention is drawn in this article to the watchfulness, care and skill required of the operator, and the mechanical features of ancient and modern locomotive boiler feed apparatus relative to efficiency and reliability of performance. Reference is made to the Weir locomotive boiler feed pump, concerning which we hope in a subsequent issue to furnish an illustrated description together with test data bearing thereon.

IN his paper read at a recent meeting of the Institution of Locomotive Engineers, the author said that the locomotive boiler is a very small one in comparison with its power of producing steam, and the quantity of water that has to be evaporated while the engine is working a heavy train is very large; consequently the problem of introducing water to the boiler to replenish that withdrawn as steam is always present, and must be attended to promptly, or there is risk of the firebox crown being quickly overheated. In the large boilers now in vogue on most railways the difficulty of feeding them is relatively less than with the small boilers that were the rule some few years ago, when the boilers were not only much smaller than they are now, but were also more out of proportion to their evaporating requirements.

The Manner of Feeding.

Introducing cold or even cool water into a boiler, from which the hot steam is also at the same time being withdrawn is likely to cause a fall in the temperature of the water in the boiler, and with it, necessarily, a reduction in the steam pressure, unless the firing and the introduction of the feed-water are, more or less, skilfully carried out. The water level in the boiler should be kept as nearly as possible to a uniform height when the engine is running, as great variations in the water levels are liable to impose temperature stresses upon the boiler. It is, however, well known that with heavy and fast trains it is sometimes very difficult to keep to this ideal, and it will be necessary in some extreme cases to shut off the water supply for short periods in order that the steam pressure may not be reduced too much, and then to fill up with water when the boiler has again recovered itself somewhat. This dodging of water into the boiler should not often be required with the large boilers now so usual.

Engine Connected Pumps.

It is of the utmost importance that the instrument by means of which the water is forced into the boiler should be simple, easy to manipulate, and, at the same time, very reliable in operation. In the early days of locomotive working, the only way of introducing water into the boiler was by means of a pump, driven from some moving part of the engine. This seems at first sight an ideal way of keeping a steady water level in the boiler, as it is possible to set the water supply to the pump to the exact quantity that will replace that used as steam, so that the boiler is automatically fed. Unfortunately, the boiler would not always be able to produce steam when the calls upon it were very severe, and the feed would have to be shut off for a time; then, when the engine stopped, and with it the pump, there would be difficulties in filling up the boiler. If the engine were a single-wheeled one, it was the custom to place it against buffer stops or scotches, grease the rails below the driving wheels, open the regulator, and let the engine slip on the rails until the boiler was full. If the engine were a coupled one, it had to be uncoupled from the train and run up and down on the rails to pump the water into the boiler.

One of two kinds of pumps was usually employed. A long-stroke pump, with a long plunger driven from the crosshead of the engine, or a short-stroke one, with a plunger of a proportionately larger diameter, operated from one of the eccentrics of the link motion. It is still the custom to use these types of pump on those engines in which the exhaust steam is led into the water tanks, to cool it down and prevent its emission in tunnels, as in these engines the water soon gets too hot for injectors to take it with certainty. It may not be out of place, however, to mention that pumps of this kind will not satisfactorily work with very hot water, although they will take it of a higher temperature than ordinary injectors will. In some cases, when the water in the tank is too hot even for the pump to take, it may be possible to get the pump to work if the tank lids are opened so that air can freely enter the tank and thus save the situation. It was, however, the limitations of the pumps driven from the engine itself, and their tendency to fly off when the engine jolted over point crossings, etc., in the rails, that led to their practical abandonment for ordinary use when a more satisfactory method of introducing feed water was invented in the injector. Pumps, but independent steam-driven ones, have been again introduced of late years to enable the great advantage of hot feed-water to the boiler to be made use of, the best-known being that made by G. & J. Weir, of Glasgow, Scotland, who are represented in Canada by Peacock Bros., Montreal.

Injector Feed.

The most usual method of introducing feed-water to the locomotive boiler is by means of injectors, these being the most simple and compact instruments that have ever been devised for the purpose. They have the great advantage over pumps that practically all the heat in the steam used to operate them is returned to the boiler with the feed-water. They can also be operated whether the engine is running or standing still, but have the disadvantage that they will not work with very hot water. In the endeavor and hope of adding somewhat to the knowledge of the reasons for the injector's action, and for its limitations in working water into the boiler, a few notes on some of the more well-known makes are gathered together in this paper. First, it may be mentioned that there are several different types in common use:—

(1)—Ordinary fixed cone injectors, which may be intended to lift water, or to force it only.

(2)—Automatic re-starting injectors, lifting or forcing.

(3)—Compound injectors or inspirators.

(4)—Hot water injectors.

(5)—Exhaust-steam injectors, which may be worked by exhaust steam alone, or with the assistance of a jet of live steam.

The essential features of every injector are an outer case, which contains three tapering tubes or cones, arranged in line and concentrically with each other. The first cone has steam led into it, and it projects, more or less, into the mouth of the second, or water cone, into which the cool water is allowed to enter, and in which the steam and water condense together; hence it is usually called the combining cone. If the steam and water are allowed to meet with each other at the proper temperatures and in a suitable way, an immediate amalgamation of the two will result by their condensing together in the combining cone, and a solid jet of water will issue from the small end of the cone and pass into the smaller end of the third or receiving cone, which is fixed with its small end facing the small end of the combining cone. A small space or gap is allowed between these two cones to enable any surplus steam or water to escape freely from the inside of the cones. When the cones are in proper relationship to each other, and the amount of steam and water is correctly regulated, the resultant jet of water will travel at such a speed that it can meet and overcome the pressure within the boiler.

The curvatures and shapes of the cones are very important factors, and they will vary, theoretically at any rate, with every variation in steam pressure and degree of temperature of the water fed to them. In practice it is not possible to vary the shapes at all, so all injectors made with fixed cones are intended to be most suitable for a pressure about 10 lbs. to 20 lbs. per sq. in. less than the maximum pressure they are required for, and then their range of good working in practice will be well within their limits.

In all injectors that are used with cold water it will be seen that the first or steam cone is largest in internal diameter, the combining cone next in size, and the receiving cone is usually smallest of all. At first sight this would appear wrong, but on examination of the operations that each is called upon to perform, it will be realized that it is quite in accordance with natural laws. Giffard's original injector was arranged vertically, and had adjustable steam and water cones—that is, they could be moved laterally in the body—and so the injector could be used either to lift or to force water at will by suitably moving the cones. There can be no doubt that this adjusting power, which allows of the same injector being used under various conditions, is one of the prime reasons why this form of injector has persisted so long in general use, as, owing to this power of adjustment, the capacity of the injector remains the same under very varying conditions of steam pressure and height of lift. It is rarely that one is used on a locomotive nowadays, as the adjustment of the positions of the cones takes time and a certain amount of skill to carry out properly, and then, if the injector flew off, both steam and water valves had to be shut off, and the whole operation had to be again gone through to start it working again, causing continual anxiety to the engineer.

Automatic Re-starting Injectors.

So far the simple injector has to be considered and, owing to its liability to fly off when any great variation in its supply of steam or water was made—as, for instance, the movements of the water in the boiler in stopping and starting the train, or the surging of the water in the tanks, especially when the water level in them had fallen low, or by the jolting of the engine running over points or crossings—some remedy was long sought after, and was found in the automatic re-starting arrangement.

The action of all re-starting injectors depends upon the automatic restoration of a state of affairs in the cones so that a vacuum can again be formed in the combining cone after a pressure there which has caused the injector to fly off has gone. There are several ways in which this release of pressure can be carried out. In those known as the flap nozzle type the combining cone is split longitudinally, and part of it hinged at one end. When the injector is working properly and a vacuum is existing in the cone, the flap is held tightly closed by it, and the cone is to all intents and purposes a solid one. The flap automatically opens the instant that a pressure is caused in the cone, and the pressure is released, the flap again closing the cone as the vacuum is again formed, when the injector once more starts to work. In the sliding cone type, the combining cone is formed of two parts, and constructed so that the smaller end of the cone can move forward, and thus open a space between it and the fixed part of the cone out of which pressure can escape, the movable part again closing when the vacuum is reformed.

A need in some cases for an adjustable injector which can be easily modified to suit varying conditions of steam and water has led to the introduction of the one-movement injectors, in which the steam cone and combining cone are connected together by means of mechanism, so that by one movement of the starting handle the steam and water inlets are simultaneously opened to the suitable amount that the conditions may require. Such injectors may be either simple or automatic. Injectors will deliver more water to a boiler with high steam pressure than with low pressure but, the amount of water delivered per pound of steam will be greatest with the lowest pressures; in other words, the injector is more efficient with lower than with higher steam pressures. The maximum delivery is obtained by reducing the amount of steam passed to the injector, and so increasing the vacuum in the combining cone, or by increasing the area of water entry to compensate for its lower vacuum.—Pages Weekly.

EUROPEAN WAR ISSUE.

Make no mistake about it. Whatever other great issues are involved, the issue is the life, the mission and continued world service of the British Empire.

OILS FOR STEAM TURBINE LUBRICATION.

GENERALLY speaking, the oils most suitable for steam turbine lubrication are pure mineral oils free from acidity and soaps, and incapable of emulsifying when shaken with warm water, and even with a well-designed bearing good results can only be attained when proper mechanical provision has been made for lubricating it efficiently and with a lubricant suitable for its particular purpose. Assuming that facilities are given for the oil to spread over the whole of the bearing surfaces, the best results are obtained by the use of a lubricant that will just keep the moving surfaces apart, under the maximum pressure to be expected, even when the turbine is stationary and at the highest temperature which the bearings may be expected to reach for if the oil has not sufficient body to resist the pressure when the machine is at rest there will be metallic contact between the shaft and the bearings and abrasion will occur on starting, and although the oil "gets round" the bearings after a few revolutions the damage will have been done. The more viscous a lubricant and the stronger the adhesion between it and the bearings, the greater the pressure it will sustain, but a too viscous oil creates unnecessary friction, and power is wasted in overcoming it.

GERMAN TRADE CONSERVATION.

A German trade circular distributed broadcast by the million during the past three or four years contains the following advice:—

1.—In all expenses keep in mind the interests of your compatriots.

2.—Never forget that when you buy a foreign article your own country is the poorer.

3.—Your money should profit no one but Germans.

4.—Never profane German factories by using foreign machinery.

5.—Never allow foreign eatables to be served at your table.

6.—Write on German paper with a German pen and use German blotting paper.

7.—German flour, German fruit, and German beer can alone give your body the true German energy.

8.—If you do not like German malt coffee, drink coffee from German colonies.

9.—Use only German clothes for your dress and German hats for your head.

10.—Let not foreign flattery distract you from these precepts; and be firmly convinced, whatever others say, that German products are the only ones worthy of citizens of the German Fatherland.

PRODUCTION METHODS AND DEVICES

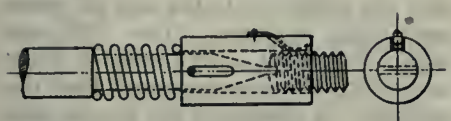
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

SCREW-HOLDER AND SCREW-HOLDER.

By C. E. Wyllys.

A CONVENIENT screw-driver, used for inserting screws in assembly work where a long or low reach is required to be made and in which the screw often falls and becomes lost in the process of placing it in the holes, is described here.

In the sketch is shown part of a screw-driver, having one end turned up on



SCREW HOLDER AND SCREW DRIVER.

which is placed a tension-spring and a round steel sleeve that serves for a screw-holder. The holder is held in place with pin fastened in the screw-driver, and which fits in the slot in the holder. The method of using the screw-driver is to place a screw in the holder, fit the end of the driver in the screw slot, then place the screw in the tapped hole and turn the driver. When the holder is brought up against a machine surface it backs away. A small tempered-spring fastened to the top of the screw-holder prevents the screw from falling out of the holder.

PORTABLE RADIAL REAMING MACHINE.

By J. A. Bradley.

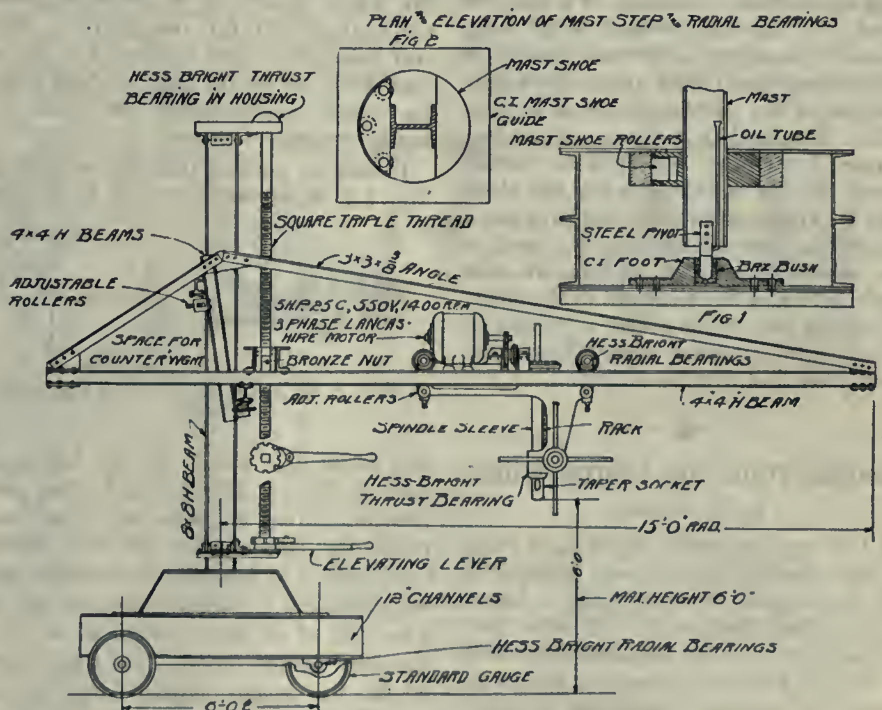
THE accompanying sketch illustrates a special machine designed for reaming holes during the fabrication of bridge and other structural steel work.

The machine consists of a truck, a steel mast, and an elevating arm, upon which a carriage containing a motor and the reaming spindle mechanism travels. The truck is built for standard gauge track and its wheels spaced at six-foot centers are mounted on axles which are held in cast iron journals fitted with ball bearings. The frame of the truck is made up of 12-inch channels in two sections, one on top of the other, while across the bottom of the lower section and extending its full length is riveted a plate which is stiffened by diagonal angles. In the lower section, and on the bottom plate, rests the mast step bearing, while the upper section contains the mast radial bearing.

The mast step bearing shown in Fig. 1 consists of a cast iron foot bolted to the bottom plate of the truck, into which is fitted a bronze bushing. A pivot made of square cold rolled steel has one end turned to fit into the bronze bushing, while the other end is slotted to fit over and bolt to the web of an 8 in. x 8 in. steel H beam forming the mast. An oil hole is drilled through the center of this pivot, for about half its length. Into this is fitted, and carried up to a convenient height for oiling, a copper tube.

The mast radial bearing shown in Figs. 1 and 2 consists of a square casting bolted to the sides and ends of the upper section of the truck with, a round machine-finished hole in its center. To each flange of the mast are bolted crescent-shaped castings of the same thickness as the depth of the hole in the square casting. That on the front side of the mast is cored out to receive three steel rollers, as shown in Figs. 1 and 2, while the one at the rear is left solid. These castings or shoes thus fitted to the mast are an easy fit in the round hole which forms a guide.

The arm, composed of two 4-in. x 4-in. steel H beams, one on each side of the mast, is braced with two 3-in. x 3-in x ⅜-in. angles which connect the 4-in. x 4-in. beams at their front end, and are



PORTABLE RADIAL REAMING MACHINE.

carried up to a point 30 inches above the latter at the mast. The 4-in. x 4-in. beams are also extended to the rear of the mast to allow space for a counter-weight. A maximum height of six feet above the floor is obtained when the arm is elevated to its highest position, and two rollers spaced about 30 inches apart, one on the front and the other on the rear of the mast and connected to the arm, permit of easy operation in raising and lowering. These rollers are adjustable, their axles extending through slotted bearings on each side, which can be moved in or out by means of set screws. This obviates the otherwise necessity of machining the flanges of the mast. An adjustment to take up any deflection in the arm, caused by the weight of the reaming mechanism when in its extreme outward position is also provided.

The elevating screw has a square triple thread and is suspended on a ball thrust bearing at the top of the mast. It carries the arm and all its mechanism by means of a square bronze nut held in a pocket formed of angles and channels riveted to the arm. A lever and ratchet arrangement supported on a bracket placed just above the truck on the mast is used to rotate the screw, thus raising or lowering the arm.

The reaming mechanism is all self-contained on a casting mounted on ball-bearing wheels, while a 5-horse-power Lancashire motor transmits power to the spindle by means of reduction gears. The spindle rotates in a sleeve to which is fixed a rack, engaging a pinion. Thus the reamer has a vertical movement of 15 inches, obtainable without adjusting the arm. A standard taper socket fitted with a thrust bearing is screwed to the lower end of the spindle. The variety in size of holes requiring reaming being limited, change gears were unnecessary.

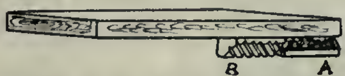
This machine was designed by the Toronto Structural Steel Co. for use in their Weston plant and was built by the Gray Mfg. & Machine Co., Toronto.

PENCIL-POINTER AND ERASER CLEANER.

James E. Cooley.

TWO things a draftsman has to do frequently—sharpen the lead in his drawing-pencil and clean the end of the eraser. A rubber has to be cleaned after a few erasures or the drawing becomes soiled. The lead is usually pointed on a file or emery-cloth tacked to a stick, and the eraser is cleaned on the rough end of a wood-block or on sand-paper tacked on the block. Whatever means are used, much handling is required.

An interesting suggestion for a pencil-pointer and an eraser-cleaner that do not require handling is shown in the accompanying sketch.



PENCIL POINTER AND ERASER CLEANER.

It consists of a block of wood, 1¼ in. square—and 8 in. long, planed diagonally and then sawed in half. These two pieces are nailed under one end of the drawing-board in reverse order. The block A is the pencil-pointer, having a strip of emery-cloth tacked across the top as shown, while the block B is the eraser-cleaner. A new idea for a cleaner is here illustrated. As seen in the sketch, a number of angular slits made with a hacksaw are cut in the block. When the end of the eraser is rubbed in a horizontal direction across these slits they shear the dirt off.

SHAPER TOOL FOR INSIDE WORK.

By G. Barrett.

IN the great majority of machine shops in this country, the trade to be supplied and the capital invested make it necessary to limit the number of tools, particularly of the more expensive kinds, to as small a number as possible, and to arrange the available machines to serve as wide a range of work as possible. The work of the slotter and the keyseater is more or less tedious and difficult to do on the shaper with the regular equipment of that machine. Nevertheless, with a few extra home-made attachments, inside work can be much facilitated on the shaper and the lack of the orthodox tool for this purpose will be much less keenly felt.

The illustration, Fig. 1, shows a shaper fixture for the purpose of machining the inside of the brick die in the right-hand part of Fig. 2. This consists of a special iron casting which is fastened to the front end of the ram in place of the

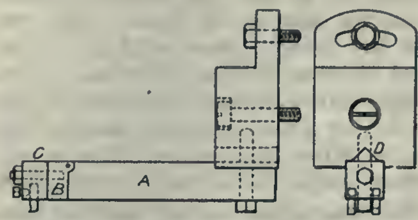


FIG. 1. SHAPER TOOL FOR INSIDE WORK.

clapper block by means of the two screws shown. To the bottom part of this casting, a 1½-inch square bar of machine steel is let in and fastened by means of the cap screw as in the illustration. To the front end of this bar A is hinged a machine steel block B, and to this again is fastened another machine steel block C by means of a ½-in. stud.

The block C can be swiveled to any desired angle with the bar to suit the work and the combination of B and C swings on a taper pin in the same way as the ordinary clapper block. The top hole in the casting is slotted so as to allow the whole fixture to be swiveled about the central bolt for side cutting. Several holes are drilled through the bar so that it can be set for long or short work, the excess length simply extending inwards beneath the ram.

It will be noticed that the casting in Fig. 1 is fitted with a V at D to take

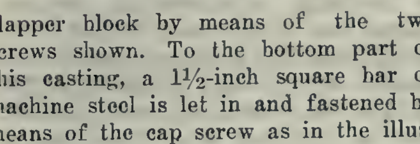


FIG. 2. SHAPER TOOL FOR INSIDE WORK.

the round bar shown in the left-hand part of Fig. 2. This bar is for the purpose of cutting keyways and is self explanatory. At the front end, it is slotted right across to take the key-seating tool which is free to swing about the pin E. This pin is of large area and is of a standard Morse taper. The shank part of the bar is left a little large and is planed off on the bottom to take the head of the fastening bolt. These arrangements secure a rigid cutting bar with all the advantages of the tool relief on the return stroke with the result that heavy cuts can be taken and, if the tools be carefully made, a high degree of accuracy can be obtained in the work.

STATISTICS OF FOUNDRIES.

STATISTICS compiled by The Foundry, Cleveland, Ohio, show that on August 1 a total of 6,507 foundries were engaged in the United States and Canada in the production of gray iron, steel, malleable, brass and aluminum castings, as compared with 6,538 on July 1, 1912; 6,594 on April 1, 1910, and 6,366 in 1908. In the past two years a decrease of but 31 shops is shown, despite unsatisfactory trade conditions and the tendency to establish larger manufacturing units. An interesting disclosure of the compilation is that fully 25 per cent. of the companies that were listed in 1912 do not appear among the plants operating in 1914, at least under the same firm names. Many of the failures among foundrymen are attributed to the lack of proper accounting systems. Over 500 new plants were built in the last two years and many old ones increased their capacities. In compiling the figures, each plant was considered as a unit regardless of the number of casting departments it contained. Considering each department as a unit there were 9,421 casting plants in the United States and Canada on August 1, 1914, as compared with 9,158 in 1912, a gain of 263. In 1910 the total of casting units totaled 9,158.

The following table shows the totals of the various kinds of foundries in the United States and Canada:

	1914	1912	Inc.
Total foundries, U.S.	5,942	5,996	*54
Total foundries, Canada..	565	542	23
Gray iron, U.S.	4,574	4,475	99
Gray iron, Canada	483	468	15
Malleable, U.S.	196	468	15
Malleable, Canada	18	15	3
Steel, U.S.	299	299	..
Steel, Canada	19	19	..

An analysis by States shows that Ohio continues to lead as a malleable castings producer, with 29 shops as compared with 27 two years ago. Illinois is second with 26, and then follow Pennsylvania with 24 and New York with 22. Illinois has supplanted Pennsylvania as the second State. Wisconsin made no gain on the 20 operated in 1912, but Michigan shows an increase from 8 to 11.

In steel foundries, Pennsylvania leads with 78, after which comes Ohio with 29 against 34 two years ago, Illinois with 20 against 24 in 1912, and Wisconsin with 20, a loss of two. The new plants have been offset by the dismantling of old ones.

The four leading foundry centres of the United States are Chicago with 170 plants, Philadelphia with 121, New York City with 116, and Cleveland with 104. The brass casting trade shows a healthy growth, as seen from the following table:

	1914	1912	Inc.
Total brass foundries, U.S.	3,498	3,389	109
Total brass foundries, Can.	334	291	43
Exclusively brass, U.S.....	1,202	1,197	5
Exclusively brass, Canada	64	61	3
Brass deparments, U.S....	2,296	2,178	118
Brass departments, Canada	270	230	40
Aluminum foundries, U.S..	1,850	1,881	31
Aluminum foundries, Can.	176	138	38

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

It will be found by those who have followed the previous lessons and profited by them that the various practical applications can now be easily observed, applied and appreciated.

SPEEDS.

IN the two preceding articles of this series—August 13 and September 3 issues of Canadian Machinery—the subject of feeds was discussed, and in the present instance that of speeds is dealt with at some length.

Successful manufacturing output is largely governed by the proper relation of feeds and speeds, and, to insure satisfactory results in the operation of almost any piece of mechanism, the movement of one part must be in a certain relation to the movement of the other parts. The resistance offered due to the removal of the stock must not be greater than the power applied, and the power applied is largely controlled by the speed of the various parts, coupled with their strength and construction. As the strength and construction of machine details is a subject for the machine designer, their general discussion will not be dealt with here, we as far as possible confining our problems to those most likely to be met with by the average mechanic in his daily shop work.

To obtain definite results from a machine, certain facts and figures must be known or calculated, while, to obtain the necessary speed for a cutting tool, certain sizes of gears or pulleys are required. In the group drive (which is the usual one for the average machine shop) the main shaft nearly always revolves at a fixed speed; therefore, knowing the speed of the line shaft and the required speed, the question becomes one of calculation for the intermediate gearing.

In Chart 35 is shown an arrangement of machine drive commonly used; that is, the machine is driven from a counter-shaft, which in turn is driven from the main or line shaft. A driving pulley A, 20 ins. in diameter, is secured to the main shaft, which has a speed of 120 revolutions per minute. What is the belt speed in feet per minute?

The belt speed is the surface speed of the pulley, then

$$\frac{\text{dia.} \times 3.1416 \times \text{rev.}}{12} = \frac{20 \times 3.1416 \times 120}{12} = 628.3 \text{ ft. per min.}$$

On a line shaft, the revolutions of the driving pulleys remain the same, but the surface speeds vary directly as their diameters. If the driving pulley A were 30 ins. in diameter, what would be the surface speed?

$$20 : 30 = 628.3 : x$$

$$x = \text{required speed} = \frac{30 \times 628.3}{20} = 942.6 \text{ ft. per min.}$$

To find the speed of the counter-shaft, the driven pulley being 15 ins. in diameter. The surface speed of a driven pulley remains the same, but the revolutions vary inversely as their diameters. Referring to the Chart, what is the speed of the counter-shaft?

$$\text{By surface speed:} \frac{628.3}{20} : \frac{628.3}{15} = 120 : x$$

$$x = \frac{\frac{628.3}{15} \times 120}{\frac{628.3}{20}} = \frac{628.3 \times 120 \times 20}{628.3 \times 15} = 160 \text{ revs. per min.}$$

By diameters:—$120 : x = 15 : 20$, or

$$x = \frac{120 \times 20}{15} = 160 \text{ revs. per min.}$$

Secured to the counter-shaft alongside the driven pulley C is the driving pulley B. What is its belt or surface speed?

$$\frac{\text{dia.} \times 3.1416 \times \text{rev.}}{12} = \frac{18 \times 3.1416 \times 160}{12} = 754 \text{ ft. per min.}$$

From the above it is clear that the surface or belt speed of the pulleys B, D, E and F will all be the same, but their revolutions will vary inversely as their diameters. Thus, for D:—

$$D : B = 160 : x, \text{ or}$$

$$x = \frac{18 \times 160}{22} = 131 \text{ revs. per min.}$$

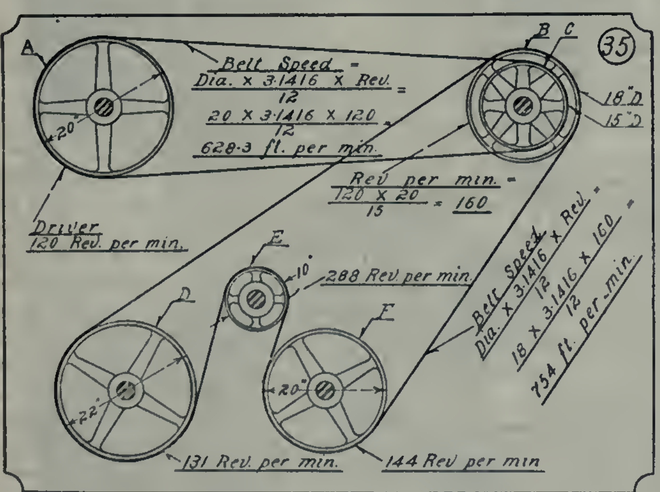
The speed of E and F can be found in the same manner, or the speed of the driving pulley multiplied by the diameters of all the driving pulleys must equal the speed of the last driven pulley multiplied by the diameters of all the driven pulleys. This formula holds good for any train of gears or pulleys.

In the pulley train, shown in Chart 35, the shaft and pulley E are required to make 432 revs. per min. What will be the diameter of the driving pulley on the line shaft, speed of line shaft, and diameters of pulleys being same as in the Chart? By formula:—

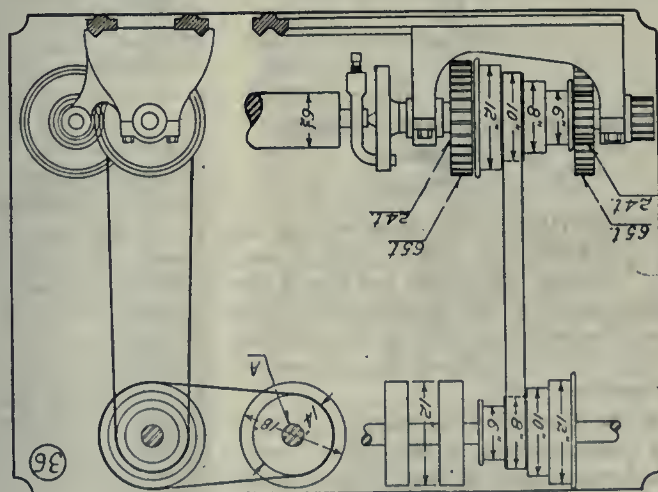
$$120 \times x \times 18 = 15 \times 10 \times 432, \text{ or}$$

$$x = \frac{15 \times 10 \times 432}{120 \times 18} = 30 \text{ inches diameter.}$$

Wherever possible, cancellation as above should be adopted when solving these or similar problems to eliminate



ARITHMETIC CHART 35.



ARITHMETIC CHART 36.

unnecessary multiplication and division.

In the sketch of the lathe on Chart 36, the main shaft A revolves at a speed of 180 revs. per min. What is the speed of the lathe spindle, with and without the back gear, and the cutting speed upon the 6½ ins. shaft? x=spindle speed.

Direct drive:— $x = \dfrac{180 \times 14 \times 8}{12 \times 10} = 168$ revs. per min.

With back gear:—

$$x = \frac{180 \times 14 \times 8 \times 24 \times 24}{12 \times 10 \times 65 \times 65} = 22.9 \text{ or } 23$$

revs. per min.

Cutting speed:—

$$\frac{\text{rev.} \times \text{dia.} \times 3.1416}{12} = \frac{23 \times 6.5 \times 3.1416}{12}$$

$= 40.3$ ft. per min.

If the line shaft runs at the above speed, and the pulley dimensions are the same as in the sketch, what are the different speeds of the lathe spindle? By calculation we have

420 : 262.5 : 168 : 105 : 57.2 : 35.8 : 22.9 : 14.3.

What would be the cutting speed turning on a 1½ ins. shaft? Spindle running 105 revs. per min.

$$\frac{\text{dia.} \times 3.1416 \times \text{rev.}}{12} = \frac{1.5 \times 3.1416}{12} \times \frac{105}{12}$$

$= 41 \times$ ft. per min.

COMMUTATOR AND OTHER TROUBLES.—I.

By H. C. Thomas.

CONSIDERABLE experience in the operation of direct current generators and motors has taught the writer some of the troubles which this type of machine is heir to, and the following hints are offered as a means of overcoming them.

Without question the feature demanding most attention in this class of electrical machinery is that of the brush contact with the commutator. The nicety of adjustment of the brushes which is required in most cases, especially when working at or near full load, and the occasional attention which is needed as the brushes wear, are among the most important details. The introduction of the interpole type in which an intermediate pole is placed between each pair of main poles has reduced the tendency to sparking very considerably. There are, however, many machines in use without interpoles.

Sparking.

Sparking is an evil which must be stopped at all costs, for even though it be only slight, and taking place under the surface of the brushes, the latter will rapidly burn away, and the surface of the commutator become more or less roughened. The evil will gradually become worse, and the heating and sparking that ensue will, if not attended to, rapidly ruin the commutator surface. When the commutator is in good order it should present a dark (not black) burnished appearance, and this is impossible to obtain when sparking is taking place.

If the mica insulation of the commutator has not been chosen with sufficient care by the manufacturer, and proves in operation to be harder than the copper, the latter wears away the faster of the two, leaving the mica projecting above the commutator surface, a condition which effectually prevents good contact with the brushes and consequent sparking. Harder brushes will not always meet the case and the best way to deal with it short of rebuilding the commutator with softer mica is to remove the projecting mica periodically. This may be done with the armature placed stationary between the centres of a lathe, a miniature circular saw driven by a small motor being attached to the slide rest, and the saw worked up and down over the mica between the copper segments.

Removing the Projecting Mica.

The high mica may, however, be removed satisfactorily without taking the armature from its bearings by using a thin file on edge or a narrow scraper the same width as the mica. A guide of some kind will be necessary for the scraper and can be made in the following way:—After the brushes have been lifted, take two wooden wedges of such a thickness that they can be jammed between the commutator and the brush holder with the fingers; fasten a strip of wood across the ends of the two wedges, so that altogether they form the three sides of a square; the strip will then lie parallel with the segments and act as a guide for the scraper or file when trimming down the mica. It is not advisable to go very deep; from 1-64 inch to 1-32 inch being usually sufficient. As each groove is completed move the armature, or rock the brush-holder around to the next. This method will of course be a slow job with a large commutator and may be done a part at a time as the machine can be spared from the load.

Brush Spacing.

The exact spacing of the brushes around the commutator is, of course, one of the most important points to receive attention. The usual method of counting the number of segments between the brushes can be improved upon, particularly in multipolar machines, and when as is sometimes the case in the older machines, some segments are thicker than others, the results are not the best obtainable. A better method is to measure the distance between the brushes in the following manner: Place strips of strong white paper one or two inches wide under the brushes so that they bridge over the part of the commutator lying between each adjacent pair of brushes, the point where the brush touches the paper being marked with a sharp pointed pencil. Number the strips to show their positions on the commutator, then put them together and compare them, when the necessary alterations can be made to bring the brushes all the same distance apart. For example, suppose we are working on a machine having four brush-holders, the true brush centres being 6¼ inches apart, measured along the arc of a commutator about 8 inches diameter. We will designate the brush-holders top and bottom right, and top and bottom left, and the spacing top and bottom, right and left.

If, on measuring, we found the spacing as follows, top 6 inches, right 6¼ inches, bottom 6½ inches, left 6¼ inches, we would move the top right brush-holder, and bottom right brush-holder ¼ inch in a clockwise direction, and make them all equal. Try again with the paper strips and check results.

Bedding the Brushes.

When the spacing is correct, bed the brushes to the commutator by pulling a piece of sandpaper to and fro over the commutator surface with the rough side outwards, examining the brushes from time to time until you can see they are properly bedding along their whole surface. The brushes should have freedom in the brush holders, but no play; this point is of special importance when the armature has to run in either direction. If they are loose in the brush holders they will change their position with each revolution of the sandpaper, making it necessary to hold the brushes in position while being bedded, or to draw the sandpaper in one direction only; say, by securing a band of it to the commutator and revolving the armature by hand. When the bedding of the brushes is complete, clean off all carbon dust and start up, rocking the brushes into the best position for sparkless commutation. If you find this varies with the load, set the brushes at the best point for average load. Violent sparking which cannot be traced to any other cause may be due to one or more burnt out coils, which must be removed and replaced by new ones.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

THE AUTO-SYCHRONOUS MOTOR.

By C. T. R.

THE importance of obtaining a high power factor for electric power transmission systems is being realized more and more by the managers of power companies, and this is accounted for by the fact that so many water power sites within easy reach of industrial activity have been developed to their full capacity as far as the prime movers are concerned. There is only one possible method remaining of obtaining a greater output from these plants, that is, to raise the power factor on the various circuits of the system and in this way reduce the amount of power wasted in the various electrical apparatus. This result is usually accomplished by means of synchronous motors connected at different points in the distributing system, the power factor being raised by overexciting the fields of the motors.

The Synchronous Motor.

The synchronous motor, however, has great disadvantages and cannot be used with good results in some cases; for instance, it is not suitable for starting up under heavy loads on account of the very heavy starting current required to obtain full load starting torque, another serious objection being that, should the voltage drop suddenly due to a temporary short circuit or other disturbance on the line, the motor will drop out of synchronism and drop dead, and considerable time will be wasted in starting the machine up again. There is also the great disadvantage that, should the source of excitement fail, the motor is rendered useless until it is again restored.

Slip Ring Induction Motor.

The use of the slip-ring type induction motor overcomes all of the troubles mentioned above, but at the same time does not possess the great advantage of the synchronous motor, namely, constant speed at all loads provided the frequency is kept constant, and the possibility of power factor correction by means of over exciting the field.

Auto-Synchronous Motor Features.

In order to combine the advantages of the synchronous and induction type motors and eliminate their disadvantages, the auto-sychnronous motor was designed in 1902 by E. Danielson, a member of the staff of the Swedish General Electric Co., Vesteras, Sweden, who now hold the patents for it. The machine is very similar in design to the ordinary slip-ring type induction motor, the chief difference being in the design of the rotor, in which the cross sectional area of the copper in one phase of the winding is equal to the combined area of the copper in the other two phases. When the machine is operating as a synchronous motor, the two phases of small area are connected in parallel by means of a three-pole, double-throw switch. A diagram of connections is shown in Fig. 2.

There is usually a special direct connected exciter supplied of the series-wound type. The voltage varies from 16 to 40 volts according to the design of the machine. On account of the low voltage of the exciter, it is almost impossible to have a breakdown, and if one should occur, the machine can still be run as explained later.

Method of Operation.

The method of operation is as follows: The motor is started in a similar manner to an ordinary slip-ring type induction motor, that is to say, by connecting a resistance unit across the slip-rings and gradually cutting out sections until the motor has reachesd its maximum speed, when the slip-rings will be short circuited. The exciter is then connected to the slip-rings by means of a double-throw switch, the starter at the same instant being disconnected, and the voltage on the exciter being brought up to normal. The motor will then synchronize itself automatically and operate with the same characteristics as the ordinary synchronous motor, while the amount of power factor correction required can be obtained simply by varying the voltage on the exciter.

Should a heavy overload now be suddenly thrown on the motor, or the voltage suddenly drop due to a short circuit or other disturbance on the line, the motor will not stop as would be the case with the synchronous motor, but will drop out of synchronism and run as an induction motor until the line or load have resumed their normal conditions. The motor will then automatically drop back into synchronism and run as before the trouble occurred. If now the exciter becomes damaged through any cause, the machine can be run continuously as an induction motor and will carry its usual load.

The auto-synchronous motor is particularly adapted for conditions where synchronous characteristics and heavy starting torque are required. They can be used to great advantage for driving paper mill machinery, air compressors,

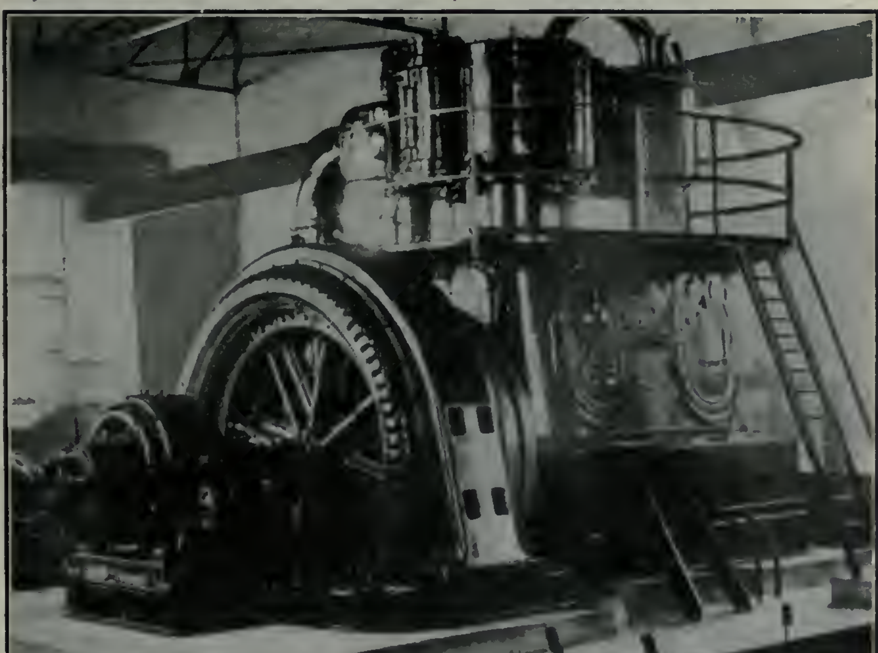


FIG. 1. AUTO-SYNCHRONOUS MOTOR, 940 K.V.A., 2200-VOLT, 25-CYCLE, 187½ R.P.M., DIRECT CONNECTED TO BELLIS & MORCOM AIR COMPRESSOR.

pumps and all other classes of heavy work.

Fig. 1 shows a 940 kva. 2200 volt, 3 phase 25 cycle, 187½ r.p.m. motor of this type, direct connected to a Belliss & Morcom tion at the plant of the Canadian Copper Company, at Frood Mine, Ont., and is giving entire satisfaction. A large number of machines of this type are operating successfully throughout the Dominion, these varying from 100 to 1500 h.p. in output.

The writer is indebted to the Swedish General Electric Co., Toronto, for the illustrations accompanying this article.

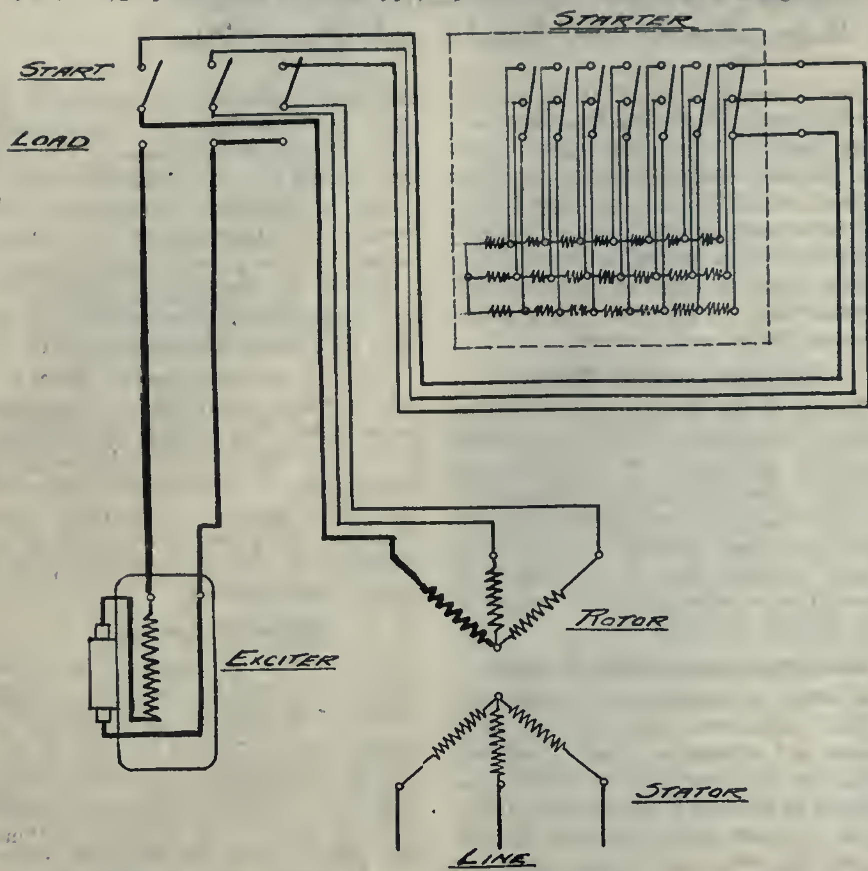


FIG. 2. DIAGRAM OF CONNECTIONS FOR AUTO-SYNCHRONOUS MOTOR.

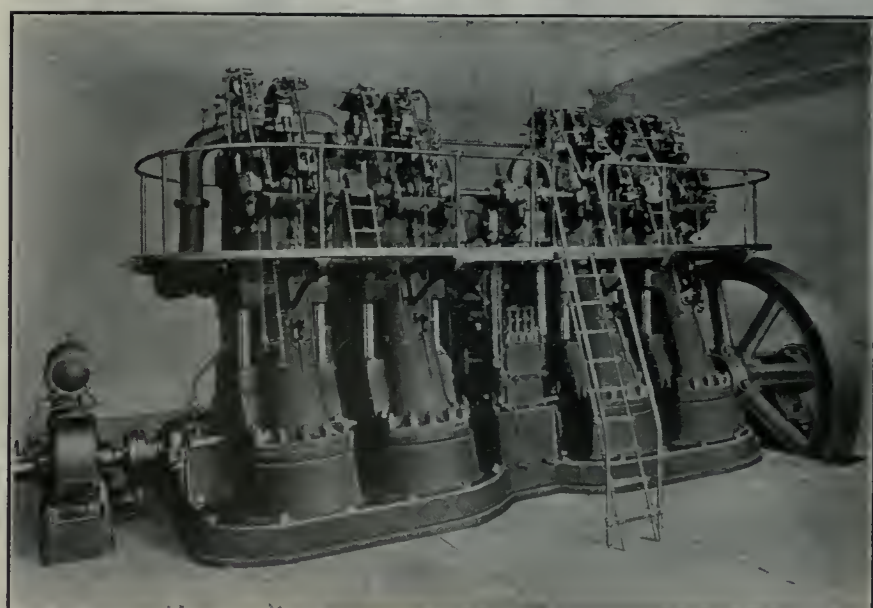
LARGEST AMERICAN-BUILT DIESEL ENGINE.

THE largest Diesel engine constructed to date in America, and the first piece of heavy machinery of this type taken through the Panama Canal, has come recently from the plant of the Lyons Atlas Co., Indianapolis, Indiana.

The engine is of the vertical, four-cycle type, with four cylinders, each of 21 in. bore by 30 in. stroke, and capable of developing 690 brake horse power. It has been sold to the Hawaiian Commercial & Sugar Co. through their New York agents, Alexander & Baldwin, Ltd., 82 Wall street, and is intended to supersede one of their steam plants for irrigation purposes in the Hawaiian Islands, where it will be direct connected to a two-stage turbine pump of 15 million gallons capacity. The conditions covering the acceptance of the engine were severe. The purchaser insisted that the engine should operate continuously 700 hours out of each 720 hours per month at rated load, using the ordinary 14° to 18° asphaltum base California fuel oil, similar to that used in the purchaser's steam plant, and which is the only grade available on the Islands.

Test Data.

The test was conducted by the chief engineer of the Hawaiian Commercial & Sugar Co., and the engine was given a preliminary continuous run of 48 hours with Eastern paraffin base fuel, after which all parts connected with the combustion chambers were inspected in order to determine a basis for comparison between the effect of the two fuels. It was then subjected to a 144-hour continuous run at full load with fuel shipped by the purchaser from California to the manufacturer's works. On completion of this run, the combustion chambers were again examined, and as there was no evidence of deposit on the heads, valves or pistons, the engine was accepted and is now being erected by the purchaser's engineers without assistance from the manufacturer. The actual fuel oil consumption of this engine at any average load between one-half and full rating is a trifle under one-tenth of a gallon per kilowatt hour delivered on the switchboard, or one-fifteenth of a gallon per brake horse power hour. This means that when paying 3 cents per gallon for fuel oil, the fuel cost is less than three-tenths of a cent per kilowatt hour, or a trifle under one-fifth cent per brake horsepower hour. The cost of attendance is considerably less than in a first-class steam plant, because all firing room expense is eliminated, and one engineer, it is claimed, can take care of 1,000 to 1,500 b.h.p. of Diesel engines. Furthermore, there are no stand-by losses, as the engine is available for full load service within one minute at any time, even if started up from a cold stand-still.



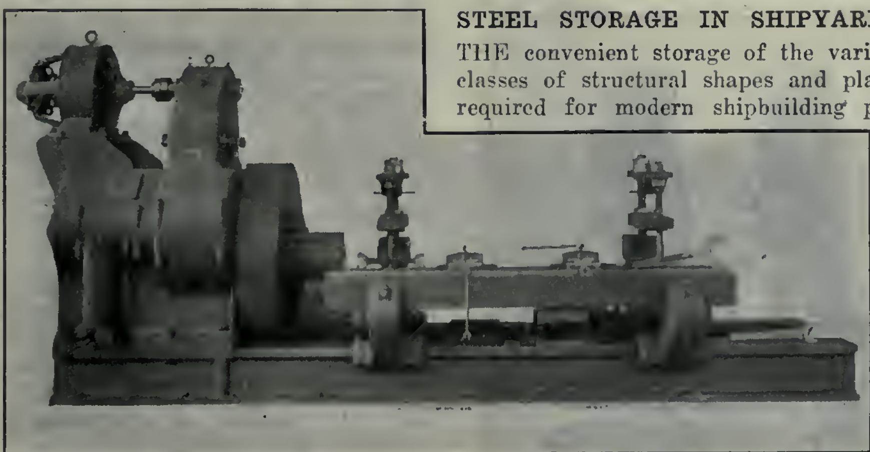
LYONS ATLAS CO. LARGEST AMERICAN BUILT DIESEL ENGINE.

In the design of this engine there are no carburetors, magnetos, or other mixing or ignition devices; it is strictly a combustion engine of uniform motion, and does not operate on a series of explosions. The indicator diagram is like to that from a steam engine. Regulation is within 2 per cent. from no-load to full-load and vice versa. The angular variation is a minimum, and the manufacturers guarantee successful parallel operation in direct-connected electrical service, either a.c. or d.c., 25 or 60 cycle.

The engine contains no radical departures, but represents a harmonious combination of the best features of international Diesel engine practice, without being limited to a reproduction of any single contemporary design.

HEAVY DUTY ROLL TURNING LATHE.

THE description and illustration refers to a heavy-duty roll turning lathe designed and built by the United Engineering & Foundry Co., Pittsburg, Pa., in 18, 26, 34, 42, and 50-inch sizes for motor drive, with speed adjustments of 4 to 1 or of 8 to 1. Belt drive is also furnished.



HEAVY DUTY ROLL TURNING LATHE.

The lathes are of very heavy construction, and designed to give great power, while at the same time eliminating vibration and chatter. All parts are easily accessible, and as the bearings and wearing parts are extra large, the cost of upkeep is reduced to a minimum. The bed plates are massive castings, the two sides being of bow section, thereby securing great stiffness.

The headstocks are of the enclosed type and, while made oil-tight, are so arranged that any of the shafts with their gears can be readily taken out. All gears are of steel with cut teeth, and run in an oil bath, which not only prolongs the life of the gears but reduces noise and vibration to a minimum. The internal gear of the face plate and its pinion also have cut teeth, and are provided with a shield into which grease may be packed for lubrication. All of the shaft bearings are bushed with removable babbitt shells, and are continually flooded with oil by splash lubrication, as in automobile transmission.

The driving motor is mounted directly on top of the headstock, the enclosed type of the latter forming a rigid support for it. It should be noted in this design that the placing of the motor on top of the head-stock does not interfere with the accessibility to the interior of the headstock. In this type of lathe it is possible, due to constructional stability and smooth operation to turn two rolls at once—rough turning one and finishing another.

These lathes are furnished with several types of housings, suitable for handling the various classes of rolls, and they can be equipped with top bearings for matching or crossing rolls, if so desired. As in the cases of the bed and headstock, of the housings, piano rest, tailstock and necking rests are all of heavy construction and convenient design.

STEEL STORAGE IN SHIPYARDS.

THE convenient storage of the various classes of structural shapes and plates required for modern shipbuilding presents an unusual problem in efficient handling and transportation. In a large shipyard the storage must necessarily involve a large and constantly changing tonnage and cover a considerable area, and the material must be stocked in such a manner as to be readily accessible, this latter being a prime requisite.

The accompanying illustration shows a double-cantilever electric traveling gantry crane located in the yards of the Union Iron Works Co. at San Francisco, Cal. At the time the photograph was taken the racks were not all completed, but the general plan of storage is shown, and it will be apparent that each classification is readily accessible and without disturbing other material. The storage yard is approximately 750 feet long and 175 feet wide and is served both by railroad tracks and by the industrial tracks communicating with the adjoining fabricating shops.

This crane was built by the Shaw Electric Crane Co., of Muskegon, Mich., (Manning, Maxwell & Moore, Inc.) and the following brief description may be of interest:

Normal capacity, 3½ tons.

Lift or hooktravel, 27 ft. 6 ins.

Span, center to center of rails, 33 ft.

Cantilever extension on either side, 67 ft. 6ins.

Overall length of bridge, 168 ft.

Effective cross travel of hook, 160 ft.

Hoisting speed at full load, 60 ft. per min.

Trolley speed at full load, 300 ft. per min.

Bridge speed at full load, 400 ft. per min.

The gantry structure is carried on eight wheels with four equalizing trucks, and the clear opening between the gantry legs is 30 feet, so that large plates can be handled without swiveling or interference. All three motions are controlled from the cage, located near the center of the trolley travel where the operator has an unobstructed view of the entire storage. The plates are handled by grip-tongs and bundles of shapes by chain slings. It is reported that this crane effects a saving of eight men, but it is obvious that this statement is by no means the final measure of the economy as the saving in time is probably fully as important a factor.

DOUBLE CANTILEVER ELECTRIC TRAVELLING GANTRY CRANE.

ALL-GEARED GANG DRILL AND TAPPER.

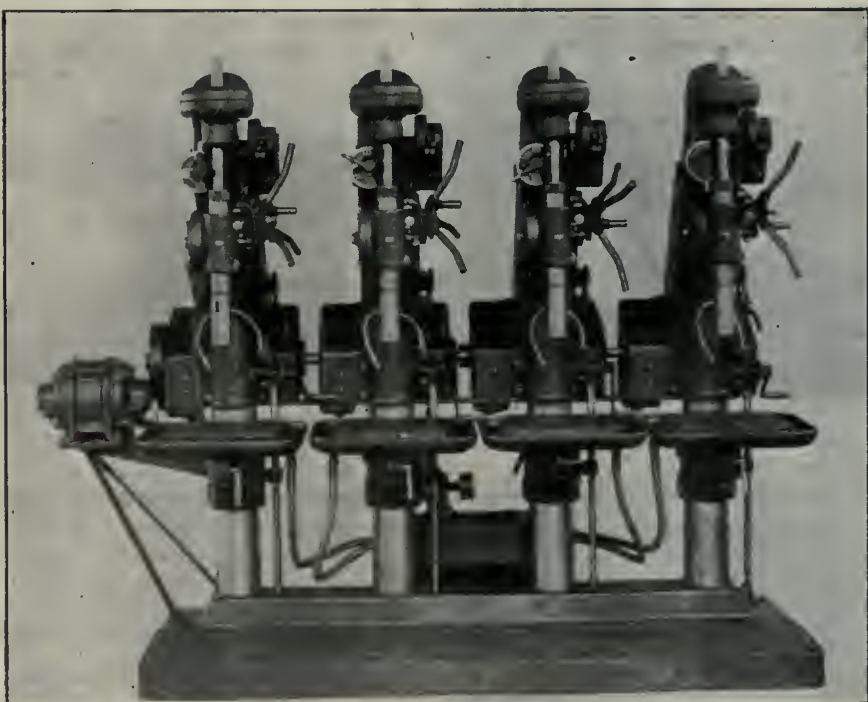
THE all-geared drill from its inception has been built heavier, stronger and much more powerful than an ordinary drill of the same swing, and with the addition of a self-oiling system, there is embodied another contributory element towards high degree mechanical efficiency.

In the 20-inch, self-oiling, all-geared, independent column gang drill and tapper manufactured by the Barnes Drill Co., Rockford, Ill., every bearing, aside from the spindle sleeve and cross spindles, is self-oiled. There are eight changes of geared speeds and a like number of geared feeds for each spindle, all being under the immediate control of the operator from the front of the machine. All gears are fully enclosed.

The frame of this drill is of entirely new design, and is unusually heavy and drills. A star wheel hand feed lever operating through a pinion running into an internal gear in the ratio of 4 to 1, also acts as a quick return lever and eliminates the use of a ball handle for the purpose.

The table is raised and lowered by a crank operating through mitre gears and screw, and can be swung round and clamped in any position. A 5 h.p. motor with speed of about 1,200 r.p.m. is recommended for the four-spindle gang drill, the capacity of which is high speed twist drills from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. at suitable speeds and feeds.

The general design and specifications are the same for self oiling all geared tapping machines, except that there is usually a quarter turn single pulley for driving and reversing. The friction clutch gears give reverse speed of $1\frac{3}{4}$ to 1, and these gears are on the driving end of the machine—not on the spindle



4-SPINDLE SELF-OILING 20-IN. ALL-GEARED INDEPENDENT COLUMN GANG WITH SQUARE TABLES, OUTSIDE OIL PUMP, AND GEARED MOTOR DRIVE.

strong, being provided with a back brace to ensure complete rigidity. The spindle is made of best quality machinery steel, double spliced, ground to size and fitted with a special ball thrust bearing, while the transmission gears located on the diagonal shaft are cut from special chrome nickel steel bar stock.

The back gears are operated by a small lever accessible from the front of the drill, and may be instantly engaged or disengaged while the machine is running. An automatic stop giving full spindle travel is furnished, while a safety device prevents overloading and thereby reduces the breakage of twist thus eliminating wear and tear of clutches placed directly on the spindle.

Any spindle may have automatic reversing mechanism — a very desirable feature particularly for depth tapping, and trip can be set so that the instant the tap reaches depth desired, spindle will automatically reverse, backing out at increased speed. Again, the shifting lever can be set so that when tripped automatically (or by hand), it will return to neutral position, thus stopping the spindle instantly instead of reversing same. The small hand trip lever is always ready for instant use if desired to reverse or stop spindle at any point in the operation. If automatic reverse is not required, it can be furnished with plain hand reversing lever instead.

There are no cone belts to slip and give trouble, while four direct geared speeds and four back geared speeds make eight changes of geared speeds available. This 20-inch machine drives a $1\frac{1}{4}$ U.S. standard tap in cast iron without back guards.

Butterfield & Co., Inc., Derby Lane, Vt., manufacturers of screw plates, are placing on the market their Combined Automobile Screw Plate. These screw plates contain taps and dies, cutting the S. A. E. standard, and also the regular V thread, or the U. S. standard, as may be wanted, all complete with stocks for holding the dies, and high grade tap wrench, in hardwood case.. The claim made for this plate is that heretofore the repair and garage man wanting both forms of threads, was obliged to buy two distinct screw plates, whereas now he gets both styles in one box, and at a reasonable price. These plates are put out in all the various assortments, cutting from $\frac{1}{4}$ in. to 1 in.. and are made in the well-known and popular Derby style.

Moisture In Crucibles.—Although crucibles are free from moisture when removed from the kiln, they rapidly absorb it, and many take up 5 per cent. of moisture during shipment from maker to user. If, instead of eliminating the moisture by a gradual annealing, the damp crucible is put directly into a hot furnace, or into a cold one and heated too rapidly, the moisture will be changed into steam so rapidly that the steam generated will blow pieces of the crucible off bodily; that is, the crucible will "scalp." To prevent this the crucible must be raised from room temperature to a temperature somewhat above the boiling point of water very gradually, so that the moisture may be driven off gradually without "scalping" the crucible.

Canadian Iron-ore Mining.—Pursuant to a request made to the Government for the granting of some measure of assistance toward the development of iron-ore mining in Canada, and in accordance with the statement of the Minister of Finance in his budget speech during the 1913-14 session of Parliament that the iron-mining industry would be investigated, a committee has been appointed to inquire into the situation and to report the facts to the Government. Every owner or operator of an iron-ore property in Canada should be interested in facilitating this inquiry.

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Vol. XII. OCTOBER 15, 1914 No. 16

PRINCIPAL CONTENTS.

WHOSE BUSINESS IS IT?

SINCE the outbreak of the European War, considerable effort has been expended upon and attention given to the broadcasting of trade data compiled from the immediately past records of the different belligerents, the assumption being that these latter were more or less hors de combat industrially and commercially. It was generally conceded that an opportunity presented itself, to nations not directly and those in large measure only indirectly involved, to step into the breach and secure and develop to their immediate and future profit the business that had perforce come to a standstill. As the days and weeks have sped on, it has, however, become clearly evident that the glittering opportunities have lost much of their lustre and that it is getting to be a question of long odds and a strengthening disposition against display of effort to take action thitherward.

On paper, shall we say, Canada and the United States are having the greatest business opportunities in their history presented to them, and we doubt not but all of that enterprise of which they are justly proud and for which they have been rewarded in the competitive markets of the world has been martialled to embrace and partake of each and every offering. This notwithstanding, a spirit of hesitancy to embark is evident. Little headway if any has been made in the matter of capturing trade, for although certain industries in Canada and the United States are experiencing a boom time, the condition is war contributory and not war resultant.

The overwhelming nature of this awful European Conflict has laid claim to first place in the hearts and minds of individuals, the world over, whether they be neutrals or otherwise. Men of all classes and conditions are being disposed to take stock of themselves; in a word, they feel impelled to put first things first. The tragedy of Europe is coming so close home to them as to take the snap out of their business enterprise. The happenings of the past few weeks have raised in everybody's mind the query, "Whose Business is it?" and the unanimous because only reasonable answer forthcoming is that it is the world's, individually and collectively. What has transpired and is transpiring in the war area and beyond brings the lump to the throat of every civilized and freedom-loving human being, and no artifice however skilfully originated and applied will down it.

Never before in the history of this old world has there been so general an ascription to a foundation principle of national and individual being and well-being as that brought to light since this European War began. Never before has honor been so truly enthroned because never before has such an individual appeal been made by it. This whole round earth is suffering in its every relationship because, first of all that war has been consummated and, in the second place, will suffer still more aggravatingly because of its unnecessary prolongation. This European War can and will only have one end—the world-wide overthrow of militarism and in the ups and downs which will intervene, trade and commerce will see-saw and continue to wear the garments of depression.

There is now every appearance of its being a long war, and as all of us know, although little Belgium knows more, it is already a cruel war. The end is meantime nowhere near in sight, although the nature of that end has been determined. Don't then let us swerve from the path of duty and heap adoration on ourselves by subscribing to any such play of words as give expression to the sentiment that the year 1914 will stand out in history as that in which were recorded the North American Continent's Greatest Achievement—to wit the 100 years of Peace, and Europe's Colossal Failure. No, and while giving due credit and honor to the statesmanship and good sense of the citizens of this continent, let us not forget that there is now in progress a movement which in near future years will give total eclipse to our 100 years of localized peace by the establishment of a world's peace, and that to share in this larger achievement it must now be realized of this European War that it is a world's business.

As indicated in a previous writing, we dare not be pessimists, at the same time we need not remain impotent or indifferent. This war is everybody's business in that it be prosecuted vigorously to its one and only logical conclusion, and in that the dislocation of industry, commerce, research and scientific investigation be speedily adjusted. "Whose Business is it?"

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 65
Lake Superior, charcoal, Chicago	15 75
Ferro Nickel pig iron (Soo)	25 00

	Montreal.	Toronto.
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 50	17 25
Victoria, No. 2X......	18 25	17 00
Victoria, No. 2 Plain..	18 25	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
take in 6t pt line	
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b.. Toronto	2.00
Common bar iron, f.o.b., Montreal.	2.00
Steel bars, f.o.b., Montreal	2.00
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.25
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.25
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates. 3-16 in.	2 50	2 50
Tubes, per 100 ft.. 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & Bnt. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails. base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws....	75 & 5
Stove bolts	80 & 7½
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....4½c per lb. off	
Nuts, Hexagon, all sizes.4¾c per lb. off	
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright ......85, 10, 7½, 10, 5 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off	

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh ...	$21 00
Open hearth billets. Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh..........	26 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$8 50	$8 50
Copper, crucible	10 00	10 00
Copper, unch-bled, heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	10 75	9 25
No. 1 compos'n turnings	8 50	8 50
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings ...	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	.1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect. April 21, 1913:

	Buttweld		Lapweld	
Sandard	Black	Gal.	Black	Gal.
¼. ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼. ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in...	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ..	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
¼ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b. Toronto.

METALS.

	Montreal.	Toronto.
Lake copper, carload ..	$14 50	$13 50
Electrolytic copper....	14 25	14 00
Castings copper	13 75	13 50
Spelter	6 00	6 00
Tin	33 00	34 00
Lead	4 75	5 00
Antimony	16 00	16 00
Aluminum	20 00	23 00

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	6.40
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll ..	0.95
Motor gasoline, single bbls., gal..	0.21
Benzine, per gal.	0.20
Pure turpentine, single bbls.	0.67
Linseed oil, raw, single bbls.	0.63
Linseed oil, boiled, single bbls. ..	0.66
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs. ..	3.25
Pure Manila rope	0.16
Lard Oil, per gal.	0.60

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double...	60%
Standard	60 & 10%
Cut leather lacing, No. 1	$1.10 lb.
Leather in sides	$1.00

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3.45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4 95
1 inch	8 05
1 1/4 inch	12 65
1 3/8 inch	15 30
1 1/2 inch	16 50
1 5/8 inch	19 40
1 3/4 inch	22 50
1 7/8 inch	25 80
2 inch	29 30

Prices quoted are cents per foot.

CAST IRON PIPE.

6 inches and upwards	$32 00
4 inch	33 00
Specials per 100 lbs.	3 00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1 1/2-in..	$37.50	$30.00	$17.50
33/64 to 3/4-in. ..	41.25	33.00	19.25
7/16 to 1/2-in. ..	45.00	36.00	21.00
0.178 to 0.4218 ..	56.25	45.00	26.25
0.125 to 0.175...	62.25	49.80	29.05
0.101 to 0.120...	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

SHEETS.

	Montreal	Toronto
take in 6 pt line		
Sheets, black, No. 28	$2 50	$2 60
Canada plates, ordinary, 52 sheets	3 70	3 85
Canada plates, all bright..	3 90	3 95
Appollo brand, 10 3/4 oz. (American)	3 90	3 90
Queen's Head, 28 B.W..G.	4 30	4 35
Fleur-de-Lis, 28 B.W.G....	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4 00	4 20

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Oct. 10, 1914.—The week just passed has been one of general quietness. There does not seem to be any appreciable change in the general conditions existing. The business created by the manufacture of shells in Canada has, however, had a very stimulating effect, on account of its being widely distributed among the various plants whose equipment permits them to undertake the work. In all lines of business there exists an underlying current of optimism, the situation being everywhere viewed calmly. There is a cheerful submission to financial losses of varied magnitudes, these being everywhere regarded as the portion of our toll toward the nation's great expenditures. Trade with Britain seems to be going on as well as can be expected under the circumstances, particularly in view of the present small number of ships engaged in the merchant service.

The Steel Market.

Although steel prices have remained quite firm for some time, it looks as if at present there was an inclination to weaken, especially so if there be any prospect of a sale of any dimension hanging in the balance. The manufacture of steel shells has been commenced in Canada and this has given new life to many factories who previously had difficulty in keeping their employees. Structural steel has suffered most, as there is little or no activity in building circles, and although work on buildings commenced earlier in the year has been for the most part continued, these operations call for little new steel requirements. Machinery sections seem to be in fair demand. A great many shops are still running on reduced time; their needs are, therefore, much below normal.

Pig Iron.

Foundries generally have been hard pressed for work since the war started, and unfortunately many of them have been forced to close down. This has left pig iron markets in a very weak condition. Supplies of British iron have been maintained and there has been no evidences of a shortage. Prices have not varied to any extent, the tendency being rather toward firmness.

Machine Tools and Supplies.

The demand for machine tools disappeared with the advent of the war and the outlook seems to indicate that this condition will continue to exist for some time. The supply end of the business keeps up, however. Small sales are the order of the day.

Metals.

In the metal markets a general quietness prevails. There is little change in prices, although the supplies on hand are large. The general business depression is also reflected in this market. The New York and London market exchanges remain closed.

Toronto, Ont., October 13, 1914.—Industrial conditions generally are unchanged and business appears to be marking time preparatory to a forward movement when conditions at the front are of a more favorable and decisive nature. In the meantime, the outlook remains as satisfactory as can be expected under the circumstances. Orders for war material continue to be placed with Canadian factories, keeping them very busy. This offsets to some extent the loss in business which is being experienced by others not so favorably situated. Large quantities of foodstuffs are being shipped to Great Britain, with a corresponding benefit to this country. Flour mills are busy, as are also pulp and paper mills, all of which help to benefit the country generally.

Work on clearing the site for the new Union Station is not making much progress, although we understand that the financing has been satisfactorily arranged for. The city has several public works projected, involving an expenditure of nearly two million dollars, and by-laws will be voted on in January to authorize the raising of the required amount of money.

Steel Market.

There is no change as regards the iron and steel markets. The volume of business has naturally depreciated considerably since the outbreak of hostilities, but the situation is gradually improving and present conditions are not much worse than those obtaining previous to the war. They are certainly better than might have been expected, although there is room for improvement. The building trade suffered a severe setback, but has revived to some extent and work is being proceeded with in a few cases which call for structural steel. The large Government orders for shells has stimulated the market, and it is probable that this business will continue as long as the war lasts.

Determined efforts are being made by the mills to obtain new business and it is anticipated that they will be successful and that the steel industry will receive permanent benefit. The British Government has sent out inquiries for heavy tonnages, but the greater part will not doubt go to United States mills, although it is probable that we may get a share. The output of the Dominion Steel Corporation for September shows a decline, as compared with the same month last year. The production of wire and wire rods, however, shows a substantial increase.

Conditions in the United States have not improved and there appears to have been a further contraction in the volume of new orders for steel products. The export business has in some lines improved, but the domestic trade has fallen off considerably. There has been no change in prices.

Pig Iron.

The pig iron market is dull and lifeless. There is practically no inquiry, and sales are very light. The situation is unprecedented, and there is little hope for relief until general industrial conditions improve considerably.

Machine Tools and Supplies.

The machine tool market is distinctly quiet; a few single machines being sold, but no inquiries of any size have been received by local dealers. The Government order for shells was responsible for several lathes being sold, as reported last week, but nothing further in this respect falls to be recorded. The demand for supplies is light and prices are steady.

Metals.

The metal markets are very dull, being practically unchanged from last week. There has been no change in prices, although there is a tendency to weakness all around. Comparatively little business is passing, and consumers are reducing stocks to a minimum.

St John, N.B., Oct. 10, 1914.—The heads of industry in the Maritime Provinces are aggressive. "Let well enough alone" is a slogan which has never won popularity with them, but "Business as Usual" is proving a money and trade-getter. That is the secret of their having met at Amherst, N.S., this week and decided upon the formation of an Atlantic body to replace the provincial branch of the Canadian Federation, and to be known as the Maritime Province Manufacturers' Association. George T. Douglas, of Amherst, was chosen president; Stanley E. Elkin, St. John, vice-president; C. C. Starr, Halifax, second vice-president; A. G. Robb, Amherst, secretary; W. Hunter, Moncton; Angus McLean, Bathurst; J. T. Cummings and Archibald McColl, New Glasgow; J. P. McNaughton, Sydney; George McKenzie and George Henderson, Halifax; Bruce Stewart, Charlottetown; W. L. Baker and C. S. Sutherland, Amherst; and H. S. Crowell, Yarmouth, members of executive.

Fully half a hundred manufacturers were convened. Various matters of business were considered, and it was the opinion of all assembled that there was every opportunity for Canadian industries to secure a foothold on the trade formerly held by the European belligerents. It is the purpose of the allied industrial heads in the lower provinces to send general commercial agents abroad whose scope is more specialized than the trade commissioners and consuls. These representatives will inquire into the possibilities for closer relations with importers in foreign lands, and endeavor to "dig up" new business for the Maritime Province houses individually. The advance guard, it was urged, should be at once sent out. Some manufacturers intimated that they would send their own private representatives on the scout for what might develop.

George McAvity, of the big industrial firm of T. McAvity & Sons, returned from Montreal this week after a conference with Mr. McNaughton, of the Dominion Iron and Steel Co., Sydney, N.S.; W. W. Near, of the Page-Hersey Tube Iron and Lead Co., of Guelph and Welland; and P. G. Donald, who represents two important English exporters, trade prospects between Canada and England being under consideration. Mr. McAvity said that he considered it only a matter of a little time before Canada would be sending across the Atlantic many lines of goods hitherto supplied to England by Germany. There was no doubt as to the ability of Canadian manufacturers to supply many lines of hardware, such as set screws, nails, small tools, wire goods, barbed wire, screw eyes, and a variety of other articles. He looked to see quite a development of trade in this connection.

George Corbitt, of Annapolis Royal, N.S., in St. John this week, was another who shares the same views. "Germany for some time," he said, "has supplied Canada with practically all the barytes which we have been using, but we expect in the near future to have the barytes mines in Cape Breton, N.S., developed to such an extent as to supply the Dominion with all of this article needed." He and other Nova Scotia capitalists are interested in the project, which includes the manufacturing necessary to make the raw material marketable. They had had an offer from New York capitalists to buy all the raw material, provided it could be brought to the States and manufactured. Their intention, however, is to establish an industry in Cape Breton for the purpose. Barytes is an important fixture in the manufacture of paints and chemicals, and Mr. Corbitt says there is enough in the Cape Breton mines to last for centuries.

The Canadian Car and Foundry Co., of Amherst, N.S., have recently closed a contract for the building of six I. C. R. passenger cars to be built at the Amherst works. They also have an order for seven C. N. R. passenger cars and several dining cars for the same railway. These will keep the Amherst shops busy for some time.

The Bank of Nova Scotia has recently purchased the big Canadian sardine factory at St. Andrews, N.B., which cost originally more than half a million dollars, and which has been closed for about a year because of financial conditions. The price paid was understood to be $270,000. The bank is now looking to have the business resumed under new auspices.

The new refinery plant of the Atlantic Sugar Refineries, Ltd., in St. John, will be ready for operation in a short time. The work of building has been pushed rapidly ahead by the contractors, the E. G. M. Cape Co. and the Dominion Bridge Co.

Montreal, Que.—The Canadian Government has placed an order for 5,000 shrapnel shells with the Canadian Car & Foundry Co. of Montreal. The same company has an order for six passenger coaches to be used on the Intercolonial Railway.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

MARKETS FOR SCREWS, NAILS, BOLTS AND NUTS.

THE following statement shows for a recent year the value of screws, nails, bolts and nuts of iron or steel exported from Germany, Austria-Hungary, and the United Kingdom respectively to all destinations:—

EXPORTS FROM GERMANY (1912).

Horseshoe nails, nails with rosette-shaped heads, and nails not otherwise mentioned ....£	124,700
Wire tacks	518,800
*Screw, bolts, and rivets of all kinds	535,150
Nuts, washers for screws, insulator supports	62,500
Total £1,241,150	

EXPORTS FROM AUSTRIA-HUNGARY (1913).

Nails and tacks of all sorts, except wire tacks ....£	23,900
Wire tacks	41,600
Screws, nuts and bolts with screw-threads	16,400
Nuts and bolts without screw-threads; rivets	4,300
Total ....£	86,200

EXPORTS FROM UNITED KINGDOM (1913).

Nails and rivets ....£	388,400
Screws	294,200
Bolts and nuts	518.800
Total £1,201,400	

*Except railway fish-plate screws and bolts for sleepers.

The most important markets for the United Kingdom are Australia, British South Africa, and British India. In the Straits Settlements, Norway and Sweden, the trade is fairly equally divided between Germany and the United Kingdom. Most of the trade in Western Europe goes to Germany. In Italy, South-Eastern Europe, and Turkey the bulk of the trade goes to Germany or Austria. Germany supplies the major portion of the nails. screws, etc.. required by Russia and the Dutch East Indies, while German competition is severely felt in China, Japan and South America.

GERMAN TRADE IN INTERNAL COMBUSTION ENGINES.

THE very complete bulletin issued by the British Board of Trade on German exports of internal combustion and explosion motors, gas turbines, etc., clearly sets out the needs of the situation. From this we learn that Germany's exports of this class of machinery in 1912 amounted to $14,130,000.

The principal German markets for stationary combustion and explosion motors and blast furnace gas motors—in all Germany exported $5,610,000 of this class of machinery — were: Russia $2.250,000, France $585,000, Argentina $430,000, Roumania $480,000, Egypt $245,000, and the United Kingdom $165,000.

German made steam and gas turbines combined with dynamos, pumps, etc., were sent mainly, and to the values stated, to the following countries: Russia $340,000, the United Kingdom $265,000, Spain, $245,000, British South Affrica $240,000, Italy $220,000, and France $185,000, the total exports of these machines being $2,070,000.

Germany also exported parts of steam engines, steam and gas turbines, and internal combustion motors to the extent of $2,420,000. The principal markets for such parts were Russia $565,000, France $415,000, the Netherlands $350,000 (possibly for re-export), Italy $200,000, and the United Kingdom $195,000. It will be seen from the foregoing that Russia was in the year named Germany's best customer for the goods specified, her total, $3,165,000, being nearly three times that of France, which took $1.085,000 worth of these goods from Germany in the same year.

Dealing with this Russian trade, the bulletin quotes from a recent American Consular report in which it is strongly recommended that manufacturers should place on this market oil engines of limited power, suitable for both agricultural and general industrial and engineering purposes. The Canadian, South African, Indian, Egyptian, Japanese and other suitable markets are also discussed in the bulletin.

BRITISH VIEWPOINT CANADIANIZED.

We would urge the Canadian manufacturer to build up his selling and publicity organization in confident anticipation of a boom. This is not the time for him to keep silence or to sit with his hands folded upon the latest war news. There are contracts awaiting capture—contracts for machine tools, turbines, generators, transformers, motors, switchgear, and a host of electrical accessories given to Germany and never likely to be executed. Beyond these there is a vista of business in which the Canadian maker will have the strongest possible preference. He should therefore be prepared to make sacrifices to keep his name vividly before buyers at home, in the Mother Country, and in neutral markets. Now is the time for him to assert himself in every possible way, and to impress buyers with his capability for supplying them with all their wants.

When we speak of sacrifices, we do not mean the cutting of expenses so easily accomplished by discharging salesmen, depleting staffs, and insisting upon cash with every order. These are operations which cripple and paralyze. The money required for development and publicity during a period of slack trade should be drawn from reserves or from dividends. Shareholders are not likely to grumble at a reduction of dividend by one or two per cent., if they know that the money so released will be used to secure an adequate share of increased trade in the near future. The firms which drop from the public view during this period of reconstruction will be forgotten when the revival in trade takes place.

DOMINION REVENUE.

THE financial statement of the Dominion for the first half of the present fiscal year, April to September inclusive, shows a falling off in revenue of $16,546,505 as compared with the same period of last year, while current expenditures increased by $6,818,548. Expenditures on capital account decreased by $4,986,117. The net debt of the Dominion at the end of September stood at $343,386,584, an increase of $11,324,651 during the month, and of $43,799,309 as compared with September 30 of last year.

Drop During September.

As was to be expected, the September revenue shows a very considerable decrease, especially in the customs receipts. The total revenue for the month was $9,953,093, a decrease of $5,296,165 as compared with September of last year. Customs receipts for the month totalled $5,644,872 as compared with $9,696,181 for September of last year, a decrease of $4,051,309, or more than forty per cent. The decrease is, of course, due to the practical cessation of imports at Pacific and Atlantic ports. Imports from the United States have, it is understood, shown in many lines an increase rather than a decrease. For the six months the total revenue has been $70,331,211, as compared with $86,877,716 for the corresponding period of last year. Customs revenue for the six months totalled $41,906,668, a decrease of $16,047,969. Expenditure on consolidated fund account for the six months totalled $55,515,639, and on capital account $19,-151,736.

The issue of Dominion notes on September 30 totalled $132,432,100, as compared with $113,531,169 on September 30 of last year. Temporary loans made by the Government totalled at the end of the month $8,273,333, as compared with $4.866.666 on the same date last year.

From present indications, the total revenue for the full fiscal year will show a decrease of between thirty and forty millions, and the addition to the net debt will probably be upwards of seventy millions.

LAKE SUPERIOR ANNUAL MEETING.

AT the annual meeting of the Lake Superior Corporation held October 7, in Camden, New Jersey, 252,775 shares were represented and the old board of directors was re-elected, and at a subsequent meeting of the latter, the officers were all re-elected. These are: J. F. Taylor, president; W. K. Whigham, chairman; W. C. Franz and H. Coppell, vice-presidents; T. Gibson, secretary; James Hawson, treasurer, and Alex. Taylor, assistant secretary and treasurer.

In his address to the shareholders, the president pointed out that the efforts of the directors had been confined to the largest earner, the Algoma Steel Corporation, and to the disposition of all other concerns except those directly connected with the former. The City of Sault Ste. Marie has purchased the Tagona Water and Light Co., for which the sum of $450,-000 will be received, and negotiations are in hand for an extension of the street railway franchise in the Canadian Soo.

The total net earnings for the year ending June 30, 1914, amounted to $1,934,965.90. This leaves a surplus of $696,151.42.

C.P.R. ANNUAL MEETING.

THE annual meeting of the Canadian Pacific Railway was held at the company's offices in Montreal, on October 7. The meeting ratified an increase of the present authorized capital stock by $75,-000,000, that is, from $250,000,000 to $335,000,000, in order to make it accord with the amount for which the company has the sanction of the Government. No portion of the additional stock will be issued until the permission of the shareholders has been secured. J. K. L. Ross was made a director, while Sir Thomas Shaughnessy said that, when the peace of the world will have been restored, emigration from Europe to the newer countries, where lands could be obtained on moderate terms, would doubtless be on a large scale, and Canada should profit very substantially by the incoming of new settlers and the consequent increase in production.

Sir Thomas said that the contraction in the volume of the company's trade and travel during the year under review was greater than anticipated, but working expenses had been reduced by economical administration. The period of retrenchment and financial conservation that the country had passed through would have the effect of liquidating to a great extent the injurious results of domestic mistakes. When the tide turned, the country would be able to utilize her almost unlimited resources and prosecute development on sane and logical lines.

The company's financial condition was good, said the president. The C.P.R. had $50,000,000 of securities to issue for which the money had been advanced by the treasury, and when the outlook improved some of these could be readily sold.

Sir Thomas said further that the monetary loss from the sinking of the Empress of Ireland was not a matter of any special moment.

Trade Gossip

The Farney Truck Co. has been incorporated at Edmonton, Alta., with a capital of $25,000.

Francis Hankin & Co., Montreal, have received an order for a 10-in. Simplex Venturi water meter from the City of Regina.

Welland, Ont.—It is announced that the Electric Steel and Metals Co. has obtained a contract for a quantity of shrapnel shells from the Department of Militia.

Winnipeg, Man.—The Grey Nuns are enlarging their St. Boniface Hospital, and among the improvements being made is the installation of a complete 15-ton Arctic refrigerating plant.

Conner & Williams, the manufacturers of the Mycue carburetters, have taken premises on Park street, Niagara Falls, Ont., and are opening the building as the Niagara Falls garage.

The Regina Cold Storage Warehousing Co., Regina, Sask., is succeeding the City Cold Storage Co., and J. A. Wright has been appointed manager. Mr. Wright will assume his duties at once.

War Grist.—The town of Thorold will send a carload of flour to the Belgian Government to assist the sufferers by the war, and Thorold Township will add one hundred bags to the same shipment.

The Bennett & Wright Co., Toronto, have been awarded the contract for the ventilating and heating of the Huron and Essex schools in that city. The total value of contracts amounts to $9,821.

The Canadian Locomotive Co., of Kingston, Ont., has received an order through the Dominion Government to manufacture a large quantity of shrapnel shells, for the Imperial Government. Sixty men will be employed at this work.

The Collingwood Shipbuilding Co., Collingwood, Ont., has received a contract for a Scotch type boiler from the Naval Service Department at Ottawa. It is for the coast steamer Alfreda, and is to be delivered at Halifax as quickly as possible.

Hotson, Leader & Goode, contractors, of Lethbridge, Alta., have secured a contract from the town of Cranbrook to the amount of about $80,000 for the laying of a water system. Mr. Goode is now in Cranbrook supervising the commencement of the work.

Canada's Iron Resources.—A committee consisting of four members of the staff of the Department of Mines, has been appointed to make an inquiry into the condition of the iron mining industry in Canada. This follows the statement of the Minister of Finance in his 1913-14 budget that the industry would be investigated.

More Contraband. — Announcement has been made that certain additional commodities have been made "conditional contraband of war" during the present hostilities. These are unwrought copper, pig, sheet or pipe lead, glycerine, ferrochrome, haematite iron ore, magnetic iron ore, rubber, hides and skins, rough or rough-tanned, but not including dressed leather.

The Thor Ironworks, Ltd., launched at their yards, Toronto, last Saturday, the steel tug Emily Stewart, which is one of two being built to the order of the Canadian Stewart Co., for work on the Toronto harbor improvements. The christening ceremony was performed by Miss Emily Stewart, daughter of A. M. Stewart, in the presence of a distinguished gathering, which included A. M. Stewart, G. G. Greist, C. F. Powers, Alex. Lewis, Mr. and Mrs. J. C. Stewart, Mr. and Mrs. Chillas, Mrs. C. P. Ellis, jun., Major Boyd Smith, Controller Church, etc. The tug is built entirely of steel to the following dimensions:—Length, 80 feet; beam, 19 ft.; depth, 10 ft.; displacement, 123 tons. The engine is of the vertical type, with single cylinder, 20 ins. x 20 ins. The boiler is of the Scotch marine type, 10 ft. diameter by 11 ft. long, while the propeller is 7 ft. 6 in. diameter. The tug is constructed with four W. T. bulkheads, steel deck and pilot house.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Sarnia, Ont.—Excavating work for the new factory of the Sarnia Metal Products Co., on North Front street, has been completed, and construction work is now being started on the foundation.

Beaverton, Ont.—The new power plant at Wasdell Falls was formerly set in motion by Sir Adam Beck on Oct. 6. The plant, which is located on the Severn river, is part of the Provincial hydro-electric system, and was constructed to supply power to the surrounding municipalities. The plant has a capacity of 1200 h.p.

Toronto, Ont.—A settlement of the Schofield-Holden riparian rights case has been made. The City and the Harbor Board will pay the plaintiffs $48,000 for damages in connection with the harbor development, etc. The Harbor Board takes over the land held by the Schofield-Holden Co. and Rickey Bros. at the foot of Carlaw avenue.

Cedars Rapids Transmission Line.—The 45-mile transmission cable, to carry 85,000 horse-power electrical energy from Cedars Rapids through Cornwall and Massena, is expected to be completed by November 1. It is stated that so far $700,000 has been expended in construction. There are 321 towers, 600 feet apart, 15 feet square, and 45 to 200 feet high, with about 5,000 lbs. of galvanized angle iron, costing about $107,000, purchased in Pittsburgh, Pa., while insulators, costing $28,500, came from Hamilton, Ont. The wire for the cables, to cost $158,000, is to be aluminum and will come from a branch factory in Quebec of the Aluminum Company of America. Hardware costing about $10,000 and about $21,000 worth of wood and steel blocks came from the United States. One thousand five hundred telephone poles, value about $17,000, came from Minneapolis.

Electrical

Leamington, Ont.—The Hydro-Electric Commission will install an electric distributing system here.

London, Ont. — The Hydro-Electric Commission will construct a line from here to Lucan and Masonville.

Chatham, Ont—The local Hydro Commission will proceed at once with plans for the erection of a sub-station and a distributing system.

Grimsby, Ont.—The Cataract Power Co. have a large gang of men at work west of the village, erecting poles and stringing wires. They will commence work in the town overhauling the old plant in a few days.

Woodbridge, Ont.—Last Monday evening Hydro-Electric power was turned on in this village. It was expected that Sir Adam Beck would perform the ceremony, but in his absence Reeve C. L. Wallace turned on the power.

Weston, Ont.—Reeve Dr. E. F. Irwin stated that the extension now being constructed to Downsview from the local sub-station, was nearly completed, and that the district would be lighted with Hydro power within a short time.

St. Thomas, Ont.—Contrary to expectations the new system of lighting contemplated for Talbot street will cost the street railway department $3,701.18, as well as the city some $1,500 additional in the cost of lighting. Such were the

AUSTRALIAN RAILWAY WORKSHOP TENDERS

D. H. Ross, the Canadian Trade Commissioner at Melbourne, Australia, has forwarded to the Department of Trade and Commerce, Ottawa, for the information of Canadian manufacturers, tenders, forms, specifications and drawings for the supply and delivery of additional equipment required by the Victorian Government's railway workshops at Newport (a Melbourne suburb.) Particulars of the machinery required, together with the date on which the tenders close at Melbourne, are briefly outlined thus:—

27,170.—November 25, 1914.—Steam drop stamps, in battery form, with accessories.

27,171.—November 25, 1914.—1 5-cwt. steam hammer with accessories.

27,172.—November 25, 1914.—1 2½-cwt. steam stamp with accessories.

27,173.—November 25, 1914.—1 hand power combined shears, mitreing and notching machine and accessories.

27,174.—November 25, 1914.—1 universal tool and cutter grinder, including tools, gears and accessories.

27,175.—November 25, 1914.—1 shaping machine (single head) including tools, gears and accessories.

27,176.—November 25, 1914.—1 6-inch gap lathe including tools, gears, etc.

27,177.—November 25, 1914.—1 multiple spindle drilling machine including tools, gears and accessories.

27,178.—November 25, 1914.—1 1½-inch single-headed screwing machine including tools, gears and accessories.

27,179.—November 25, 1914.—1 multiple spindle screwing machine including tools, gears and accessories.

27,402.—December 2, 1914.—Alternative to contracts 27,519 and 27,520, 1,376 steel disc wheels, etc.

27,519.—December 2, 1914.—Alternative to contracts 27,402 and 27,520, 1,376 steel wheel centres and tyres.

27,520.—December 2, 1914.—Alternative to contracts 27,402 and 27,519, 1,376 steel disc wheels.

27,630.—December 9, 1914.—500 caustic soda primary cells and 500 renewals.

26,403.—December 9, 1914.—77½ tons steel joists, angle braces, etc., as per blue print drawing.

27,436.—December 9, 1914.—110 tons block tin.

The 'neutral' steamer of the Oceanic Company leaves San Francisco on October 27, and the mail is due at Melbourne on November 17 in ample time for the tenders closing on November 25. The last mail from Vancouver is that leaving on October 28, and arriving at Melbourne on or about November 29.

figures submitted to the members of the council.

St. Thomas, Ont.—The Hydro-Electric Commission in St. Thomas will consider the proposition of installing a telephone system in harmony with other Ontario cities. Hamilton's commission favors the scheme which is to have the Ontario Government install a long-distance line along the Hydro rigbt-of-way.

Stouffville, Ont.—A meeting was held here on Oct. 6 to further the interests of the hydro-radial movement. Sir Adam Beck was the principal speaker, while chief engineer F. A. Gaby, of the Hydro Commission; Robt. Miller, Stouffville; A. D. Bruce, Gormley; J. W. Lyons, Guelph, and several others also spoke briefly.

St. Mary's, One. — At the regular meeting of the water and heat commission, Weir & Weir wrote asking the board if it would furnish 50 horsepower delivered at the western corporation limits, at the same price as delivered to the Cement Works, and they would continue the power line on to Kirkton and intervening places, and that they would furnish and place poles and necessary wires for current, and also power to consumers between Kirkton and St. Marys.

Municipal

Hamilton, Ont.—The fire committee recommend the purchase of one pulmotor.

Sarnia, Ont.—A special session of Sarnia City Council will be called in connection with the new waterworks at Point Edward, where the infiltration basins have failed to produce necessary water.

Toronto, Ont.—Premier Hearst is to be approached by the Board of Control in regard to giving the city permission to borrow sufficient money to extend the Bloor street car line without first obtaining the permission of the people.

St. John's, Nfld.—The new civic commissioners have secured the services of Mr. Longley, of the firm of Hazen and Whipple, New York, to come here and report upon the question of the most effective distribution of the water supply.

Ottawa, Ont.—The City Council at a meeting on Oct. 5 decided to retain eminent counsel to test the constitutionality of the order of the Ontario Board of Health, which directs the city to spend over $8,000,000 on a water supply from Thirty-one Mile Lake, over fifty miles from the capital.

Toronto, Ont.—Works Commissioner Harris has written the committee of works, urging the necessity of providing funds for the erection of a building for the Waterworks Department on the site of St. Andrew's Market. The estimated cost of the structure is $100,000.

London, Ont.—The London Public Utilities Commission will fall in line with the suggestion of the Hamilton Hydro-Electric Commission that the Provincial Government be asked to inaugurate a Government-owned telephone system throughout the province, in connection with its hydro-electric scheme.

Ottawa, Ont.—Tenders will be received up till October 20 for the construction of a reinforced concrete tower on a wooden crib at Livingstone Channel, Detroit River. Essex County. Plans and specifications may be seen at the offices of the Department of Marine and Fisheries, Ottawa, the harbor-master at Amherstburg, Ont., or the collectors of Customs at Toronto, Windsor, and Sarnia.

Port Arthur, Ont.—On the recommendation of the Port Arthur hydro electric committee, which was submitted to the council, at the meeting held on Oct. 6, it was decided that the by-law required for the erection of a sub-station at the pump house be submitted to the people in January. The city solicitor was instructed to prepare a by-law for $44,600 for this purpose.

Toronto, Ont.—After three hours' discussion of the civic Hydro-Electric finances and the business methods of the commissioners, the City Council decided to allow the commission to increase its capital by another $1,000,000 to enable it to liquidate its immediate liabilities; also to have a friendly legal action to the city ought to bear the loss incurred by the unfortunate sale of the Hydro debentures at a discount of $443.100.

Peterborough, Ont.—A meeting of the Utilities Commission was held on Oct. 6, at which P. G. Jeffrey, engineer of the Hydro-Electric Commission of Ontario, was present. It was resolved to offer the Peterborough Light & Power Co. $4,450.55, for that part of their distributing system which lies outside the city limits, on the basis of their inventory of May 1, 1914, and any extensions or variations to be paid for on the same basis.

Peterborough, Ont.—It is possible that the city will operate a manufacturing concern this winter. At a recent Board of Works meeting, Mayor Buller suggested that the city should secure the Canadian Cordage Co. buildings and start manufacturing the cement pipes to be used next spring on the outfall sewer. According to Street Commissioner Evans' figures the city might save between two and three thousand dollars by taking such a step.

St. Thomas, Ont.—Residents of Yarmouth township, north and east of St. Thomas, are taking steps to secure a supply of natural gas in their homes and hydro-electric lighting for the roadways leading from the city. A deputation recently waited on the Yarmouth Council, asking that body to take steps to secure for them these two commodities. The natural gas asked for is from the Tilbury field, the same as is supplied at Talbotville, Fingal, and other points in Southwold.

Hamilton, Ont.—Plans are under consideration by Wentworth County for the expenditure of $350,000, of which $260,000 will be for a sewage disposal plant and $90,000 for water works. A deputation of Mountain residents have asked that the City Council enter into an agreement with the township to take care of the sewage from a small section of the Mountain. The deputation comprised John G. Farmer, K.C., Colin S. Snider, Reeve Gallagher, and the township engineer of Barton.

Medicine Hat, Alta.—The Board of Trade has decided to send a display of the products of the industries of the city to England for the purpose of catching some of the trade which will, as a result of the war, be coming to Canada. The Board of Trade will also support the suggestion for a conference of Canadian manufacturers, bankers, transport men, farmers, etc., to lay out plans for the securing for the Dominion of a share of the manufacturing trade which before the war was enjoyed by Germany and Austria.

Chatham, Ont.—By-laws providing for an expenditure of $90,000 for the installation of the Hydro system, and $2,000 for the purchase of a site for the Canadian Concrete Products Co., carried last Monday. The Hydro by-law had a majority of 938 out of a total of 1,268 votes cast. The concrete by-law carried by a majority of 33. This by-law required a two-thirds vote of the total vote cast, and the figures were 853 for, 376 against. The vote was comparatively light, only about two-thirds of the total pollable vote of the city coming out, due largely on account of the holiday.

Toronto, Ont.—Works Commissioner Harris on Oct. 8., asked the Board of Control to recommend the submission of a by-law to the people enabling the expenditure next year of $1,734,465 to cover several works in his department. Commissioner Harris in his report says the money will be spent as follows:—North Toronto water supply mains,

The Lighting Requirement of Metal Working Plants--I.*

By A. L. Powell and R. E. Harrington

Typical well-lighted metal working plants of various kinds, were investigated by the authors either through a visit to the plant or the data obtained from plans showing layout of machinery and lighting equipment. In each case inquiry was made as to the degree of satisfaction given by the lighting. The plants listed are well lighted and satisfactory to the management and employees, hence the data is of value as a guide for the designer.

GOOD lighting in industrial plants is an essential to satisfactory and efficient operation, and a summary of the contributory reasons may be said to include the following:—

Correct illumination reduces the number of accidents, makes a more sanitary shop, results in more agreeable and comfortable working conditions, protects the eyes of the worker, increases the amount of output, improves the quality of production, decreases the percentage of seconds, reduces the cost of the lighting itself in many instances; all of which factors combine to raise the standard of the organization along humanitarian and economic lines.

Methods of Lighting.

In general we may classify lighting systems in two ways; first as to the means of getting the light to the working plane or surface to be illuminated, and, second, as to the arrangement of units.

1.—Three systems of lighting are generally recognized: direct, indirect and semi-indirect. The last two require ceilings clean and light in color, and since in the majority of metal working plants the ceiling is either dirty or broken by trusses and skylights, the first alone is discussed here. (The authors consider a direct lighting unit as one from which over half of the emitted light flux is directed downward or to the side, reaching the surface to be illuminated without being reflected by the walls or ceilings.)

2.—The lighting units may be arranged in three fashions, furnishing what are frequently termed local, general and localized-general or group lighting. Naturally, combinations of these may be derived. General illumination supplemented by local lighting is often good practice and is much more frequently employed than any of the other combinations possible.

Local Lighting.—This system consists of the use of the smaller sizes of incandescent lamps placed close to the work and under the control of the workman. This system of illumination is inherently bad, for it produces a high intensity over but a small area, leaving the rest of the room in comparative darkness. Thus, whenever a workman looks away from his work, a certain time element is needed in order that his eyes may accommodate themselves to this great change in intensity. Very often the illumination on the work is far too great for the operation performed, which often results in ocular fatigue. In addition, when using this system the workmen lose time in adjusting their lamps and the breakage is increased by handling. It is true that there are certain processes where it is necessary to use a local lamp; for instance, when inspecting the interior of a mould or deep boring, or where extremely fine work is in progress, such as the manufacture of watch parts. In the last instance, it would be inadvisable to light the entire room with the very high intensity required by the work. In cases where local lighting is essential it is advisable to provide a moderate value of general illumination to prevent a great contrast in intensity.

General Lighting.—In this system, medium or high candle-power lamps are employed. They are spaced systematically with reference to the building construction, and such reflectors chosen as will produce approximately even illumination over the entire area. It has special application in large, open spaces where heavy work is done, such as rolling mills, forge shops, foundries, etc. Where closer work is carried on, a modification of this system should be used, for it is desirable here to have the maximum intensity at the working points with lower values between machines.

Localized-General or Group Lighting.—This is the system referred to a modification of general lighting. As its title implies, the lamps are located with respect to the work, medium size units being hung at moderate heights. The disadvantages noted under local lighting are done away with, and as satisfactory results are obtained as with general lighting and not as much energy is necessary.

Lamps.

Tungsten filament lamps are standard for 105 to 125 volts in steps from 10 to 1,000 watts, at efficiencies ranging from 1.30 to 0.55 w. p. h. cp. respectively. For multiple operation on circuits from 220 to 250 volts, the standardized lamps range from 25 to 500 watts with efficiencies varying from 1.33 to 1.00 w. p. c. In average practice, local lighting employs the smaller sizes, 10 to 40 watts; the localized-general system utilizes from 60 to 150 watts, and general illumination is supplied by lamps between 100 and 1,000 watts. Naturally, special cases produce deviations from this grouping.

Reflectors.

Reflecting devices may in general be divided into two groups — glass and metal. Glass reflectors may be very efficient and produce excellent illuminating results, and in the case of translucent types make a bright and cheerful shop. However, in industrial service the danger of breakage is an element which has prevented their adoption by the majority of plant managers. Another point, which often makes their use inadvisable, is the question of cleaning. Everyone realizes that periodical cleaning of lamp and reflector is extremely desirable and necessary if the system is to operate at its most efficient point. Nevertheless, in too high a number of cases this is neglected. In such instances an opaque metal reflector, if covered with a layer of dust on the outer surface, does not present as untidy an appearance as a dirty translucent reflector.

In practically all the plants investigated by the authors, metal reflectors were used, and their experience has indicated that a well made porcelain enamel finish is most generally opplicable for this phase of lighting, on account of its ease of cleaning, resistance to acid fumes, heat and moisture, high initial efficiency and lack of permanent depreciation.

A great deal has been said of the deep bowl versus the shallow dome shape. From a standpoint of eye protection, the deep bowl is to be preferred, but the investigation showed a far greater number of the dome shape in service. It is true that a large percentage of these may have been installed through clever salesmanship, or due to the fact that the lamp is visible and the exposed filament gives the layman the impression that he is getting more light. Yet, the shallow type has certain inherent advantages which indicate that in spite of the theoretical disadvantages, it is the

*From a paper read at the recent convention of the Illuminating Engineering Society, in Cleveland, Ohio.

shape which is of most general service. These are as follows:

The downward flux of light for a given wattage is considerably greater than with a deep bowl reflector; more light is emitted at the obtuse angles, producing better illumination over vertical surfaces; light escapes near the horizontal, permitting use on quite wide spacings without dark spots midway between the units; and lastly, a brighter and more cheerful shop results. Of course, the hanging height must be such that the lamps are well above the angles of the vision and, when this factor is taken care of, the glaring effect is not severe, as the light emitted at high angle makes the walls bright and lessens the contrast between lighting unit and background.

Ore Working.

This heading includes such a wide variety of plants so radically different in construction that it is difficult to attempt a tabulation of data which would be of service. In general, the building is broken up by elevators, chutes, conveyors, and the like, so that evenly distributed lighting is impractical. It is usually necessary to illuminate to a moderate intensity certain important parts of the system, such as racks, separators, concentrators, jigs, drying tables and loading platforms. In cases where crushing machinery, pumps, fans, motors, etc., are widely separated, it is essential to locate the lamps with reference to these, so there will be plenty of light for adjustment and repairs. In other words, local lights are needed at various points, but these should be in the form of medium size lamps with reflectors giving a wide spread of light, and hung fairly high so that they will furnish some general illumination. Passageways, stairs, ladders and hoists should all be adequately equipped as to lighting.

Heat Extraction of Metal.

As with the ore plant, the reducing plant varies widely in arrangement of apparatus and construction of buildings; hence, the citation of specific cases is difficult, and such discussion as can be given must be of a general order.

The molten metal itself and the fires, in a great many cases, provide plenty of light with which to carry on the operations. Nevertheless, safety demands that artificial lighting be supplied. The installation is often required to supply more light when the processes are not in active operation, or under emergency conditions than for the regular operation under normal conditions. Smelting and reducing furnaces for the rarer metals are usually small in size and a moderate intensity of general illumination should be supplied for the entire room. The blast furnace house should have light enough for the workmen to repair the tuyere mechanism, to watch the water system from the ground, and to readily discern tools lying about the floor. In the puddling and open hearth plants, the cranemen must be able to see the workmen pick up ladles and cinder or slag parts. The movement of charging cars and cranes must also be visible to the floorman, and there must be enough light for them to break up and load slag. The crucible house is usually adapted to a low intensity of general lighting from medium size lamps. Bessemer converters and electric furnaces should be well illuminated by large lamps to facilitate charging and operation.

Foundry Lighting.

Bench moulding and core making are usually carried on in a room separate from the pouring, or in a side bay. The methods of bench lighting , discussed later, apply here. Forty-watt lamps with reflectors giving intensive distribution on 8-ft. (2.44 m.) centres provide adequate illumination for small and medium work. Provision should be made for a portable lamp or a mirror with which to examine the interior of deep moulds. Where tables are scattered about the entire room general illumination serves very well.

Machine moulding is ordinarily done in the main bay and the general illumination here will meet the requirements of this process, if in a separate part of the plant, present practice provides medium size units localized with reference to machine. The dome reflectors give sufficient spread of the light for adjoining spaces. Although no plants were examined where any one part was devoted exclusively to machine moulding, it is safe to estimate that from 0.3 to 0.8 watt per square foot would be required depending on the fineness of the work.

Floor moulding and pouring occupies a large open space which is adapted to general illumination. Two schemes are in common use for arranging lighting units. Large lamps with dome or bowl reflectors, symmetrically spaced above the crane travel, or medium size units with angle reflectors at the sides below the crane tracks. The second arrangement has, among other good features, an advantage that the crane does not have to be employed in replacing a burned-out lamp, and no shadows are cast by the crane. Naturally, the amount of light necessary will vary with the kind of output. Large iron castings require less illumination than small brass parts. Where a diversity of product occurs it is necessary to make provision for meeting the most difficult condition. This requirement of providing sufficient light for the safety of employees will always be taken care of if there is satisfactory light for the work.

Another feature that must be borne in mind in designing the installation is the deterioration. While initially the lighting used may give plenty of light for the work done, when the dirt, dust and moisture accumulate on the equipment between cleanings, the illumination may be reduced below the deseirable value. Hence, it is always advisable in foundries to provide somewhat higher wattage than calculations on effective lumens indicate necessary.

Charging.—In most cases the general illumination of the main bay will be sufficiently spread to light the firing doors. In some plants, however, the cupolas are located on a mezzanine, and in this event general illumination of a moderate value should be provided for safety.

The lighting of tumbling barrels does not demand a great deal of attention, for there is little danger of accident, and close inspection is not essential. However, for small material, localized general illumination is often successfully installed.

Cleaning, rough chipping and filing of large pieces in most instances are done in the main bay after breaking up the flasks, and in some plants a separate section is allowed to this work which should have a low intensity of general illumination.

CRANE GEARING

IT is the usual practice to cover all gearing on cranes, not only to avoid contact with repair men or inspectors who may be on the crane when it is in motion, but to prevent falling of loose pieces in case of breakage of the gears and to keep out grit and dust. Such covers, however, must allow easy access for lubrication and inspection, else, by inducing neglect, the guards themselves may indirectly cause injury and damage. Where the gears are not exposed to excessive dust, the covers may be made of perforated steel, and can be arranged to allow inspection and lubrication without removal. Gear teeth must be lubricated freely, and must be closely watched, especially small pinions which are subject to most wear.

Consideration must be given to the condition of the gears, as gears with stripped teeth may drop the load at a critical moment. Sometimes excessive wear and breakage of gear teeth, especially on foundry cranes exposed to much flying grit, is traceable to gears which are too finely pitched. Frequently the crane design will allow the substitution of more coarsely pitched gears, thus providing stronger teeth and less wearing surface.

Power Plant of the Standard Iron Co., Parry Sound, Ont.

By C.T.R.

Although furnace gas was available, the convenience of gas-fired boilers and the direct rotary drive of steam turbines, together with the ease of starting up, made the use of turbines preferable to that of gas engines for the motive power requirements of this plant.

THE charcoal iron manufacturing plant of the Standard Iron Co., Ltd., situated on an inlet of Georgian Bay, at Parry Sound, Ont., includes among its other interesting features an installation of power equipment which, in addition to its turbo-blower feature, is also unique in the variety of purposes to which steam turbines have been applied.

Boilers.

The steam generating equipment consists of three Robb horizontal return tubular boilers with flush joints, available for the use of either coal or blast furnace gas. Each boiler is 78 ins. diameter by 20 ft. long, and is rated at 200 horse power. There are 2,000 sq. ft. of heating surface, and the working pressure is 150 lbs. per sq. in. The products of combustion are discharged into a 5 ft. dia. x 125 ft. stack.

Steam Turbo-Blower.

For supplying air blast to the furnace, a Fraser & Chalmers Rateau turbine-driven blower is employed. This blower has a capacity of 12,000 cu. ft. of free air per minute delivered at from 6 to 8 lbs. per sq. in., and runs at 4,000 r.p.m. All the bearings are fitted with forced lubrication, oil being delivered from a gear pump driven off the main shaft, and circulating through an oil cooler and filter before being returned to the bearings. The air is taken in through a ¼-in. mesh wire gauze screen and filter outside the building, and is carried in a duct under the turbine room floor to the blower. Non-return and relief valves, which appear in Fig. 1, are provided in the air main to the furnace.

The turbine end of the blowing unit consists of a Fraser & Chalmers impulse steam turbine, taking saturated steam at a boiler pressure of 150 lbs., and exhausting into a low level jet condenser at 28 in. vacuum, referred to 30 in. barometer. The steam consumption is 13.8 lbs. per b.h.p. hour. Non-condensing operation is provided for by the installation of a 10 in. Multiflex atmospheric relief valve and a gate for isolating the condenser. A steam separator is placed between the turbine and the lowest point in the main steam header. The overall dimensions of the turbo-blower, which is illustrated in Fig. 2, are 5 ft. 10 ins x 15 ft. 10 ins. x 6 ft. 2 ins. in height from bottom of bedplate.

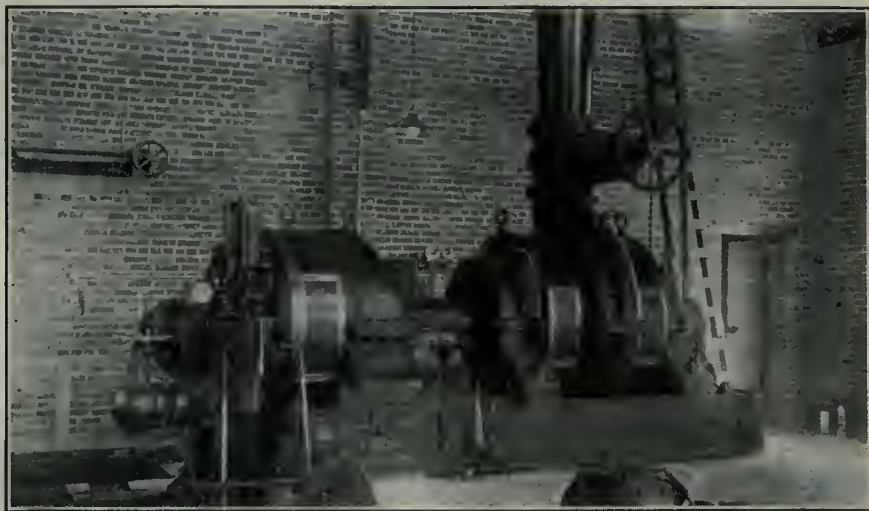


FIG. 2. TURBO-BLOWER ARRANGEMENT.

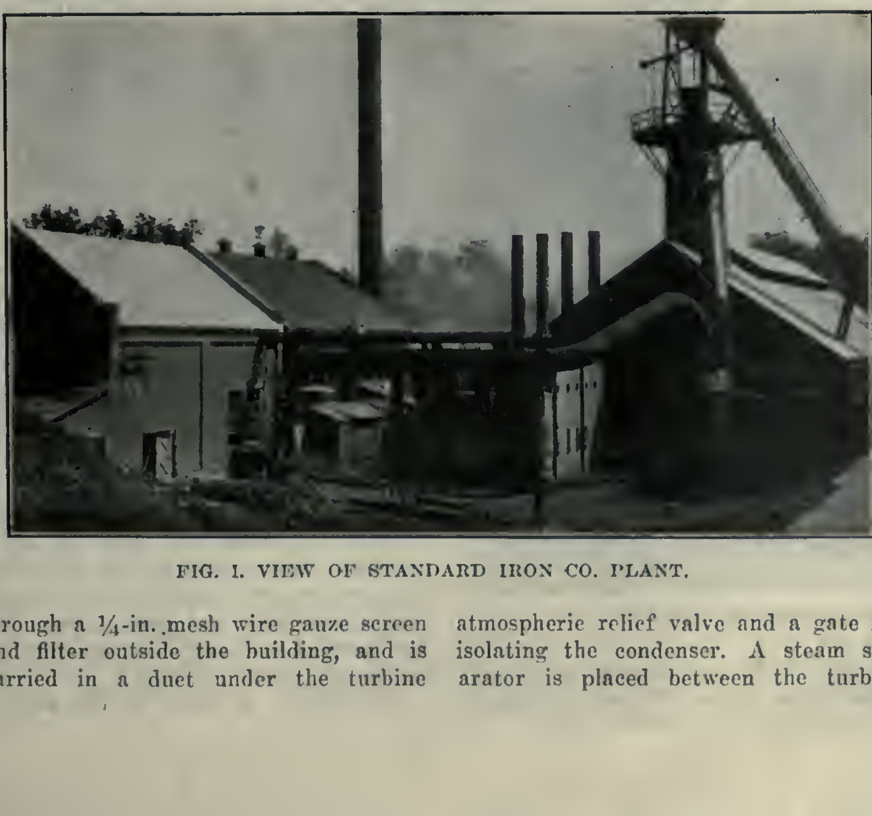


FIG. 1. VIEW OF STANDARD IRON CO. PLANT.

For driving the removal pump of the jet condenser made by the C. H. Wheeler Mfg. Co., a Terry 14 b.h.p. steam turbine is used, running at 1850 r.p.m. The condenser is placed in a basement below the turbine to facilitate the flow of injection water. The vacuum is maintained by a Rotrex dry air pump, engine driven, and withdrawing air from the top of the condenser. Part of the pump is shown in Fig. 3.

Electrical and Pumping Equipment.

The other machines in the power house consist of a 40 k.w. turbo-generator for lighting and power purposes, one 5-in. and one 8-in. turbine driven centrifugal pumps, two duplex outside-packed boiler feed pumps, and a Stillwell closed feed water heater, through which the above units exhaust their steam. The 40 k.w., d.c. generator, see Fig. 3, runs at 2,800 r.p.m., and is driven by a non-condenser Terry steam turbine taking 37¼ pounds of steam per b.h.p. The 5-in. and 8-in. Platt centrifugal pumps operated by Terry turbines are for general service and deliver cooling water to the furnace.

The turbine driving the 5-in. pump, rated at 40 b.h.p., takes 1,500 lbs. of steam per hour non-condensing, see Fig. 4. These pumps together with the condenser, draw their water from a 14-in.

suction main running direct from the bay, which is 256 ft. from the power house. The lake level, being 15 ft. 6 in.

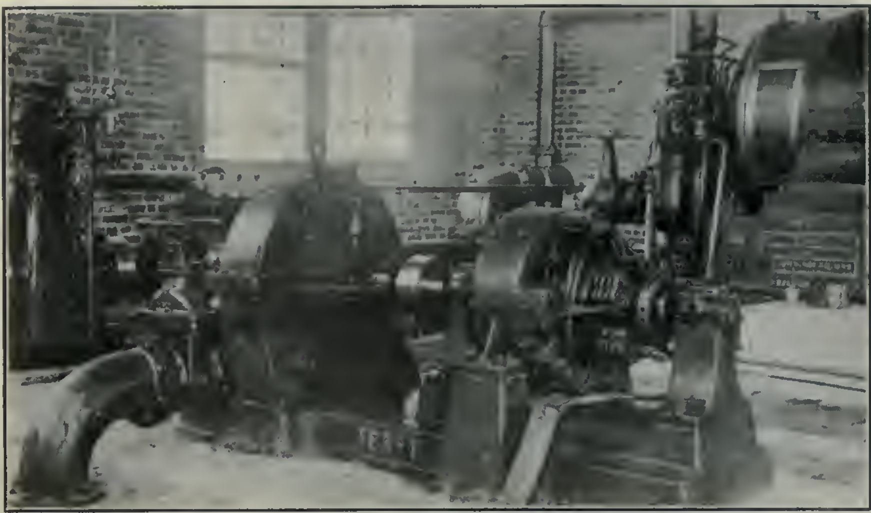


FIG. 3. TERRY STEAM TURBINE AND 40 K.W., D.C. GENERATOR.

below the centrifugal pump centres, and 13 ft. 10 in. below the condenser injection inlet, makes an unusually long suction lift. The pumps are primed by a steam injector.

The two duplex Platt feed pumps each have a normal capacity of 108 U.S. gals. per min., and are situated in the boiler room. They are arranged to draw water either from the condenser hot well or from the main centrifugal pump suction line mentioned above. The feed pump discharge is led through the feed heater on its way to the boilers, a bypass being provided for cutting out the heater for cleaning, etc. This will be of rare occurrence, as no oil is carrned over with the exhaust from the turbines.

Piping.

Steam is conducted from each boiler by a 6-in. branch and an isolating valve leading into a 6-in. steam main to the turbine room, where by a vertical drop of 17 ft. the pipe passes to the level of the trenches in the concrete floor, through which the branches to the different units are led. The vertical length of pipe does away with any necessity for an expansion bend and facilitates drainage, which is designed to gravitate towards the steam separator. Water of condensation is removed by an automatic steam trap directly attached to the separator. Although steam piping in trenches is not usually advantageous, the fact that all the turbines in this instance are placed above the piping renrers the chance of damage by water very remote. The high pressure main and branches above 2 in. dia. consist of extra heavy wrought steel pipe with screwed-on flanges. For $2\frac{1}{2}$ in. dia. and less malleable iron screwed fittings are used.

The blower turbine is connected to the condenser by a large cast iron exhaust bend and a corrugated copper expansion joint. All the other units exhaust into a galvanized wrought steel exhaust main connected to the feed heater. Isolation of the heater is attained by closing a gate valve next the heater, and opening another valve on the exhaust main leading direct to the atmosphere. These valves will also be used in cold weather to build up a slight back pressure for exhaust steam heating. A relief valve is fitted to the main in a conspicuous position to draw attention to any undue rise in pressure.

FIG. 5. PLATT 5-IN. CENTRIFUGAL PUMP, 40 K.W. GENERATOR AND TERRY TURBINES.

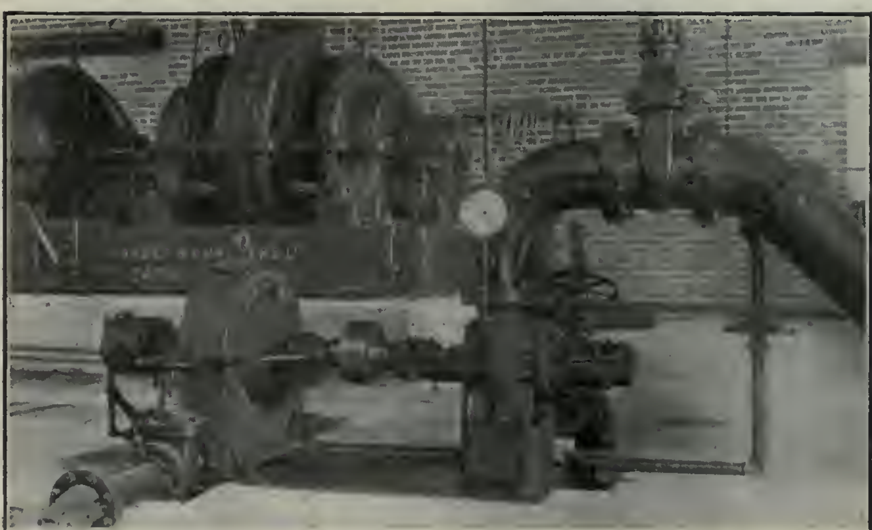


FIG. 4. PLATT CENTRIFUGAL PUMP AND TERRY TURBINE.

The water connections to the centrifugal pumps and condenser consist of cast iron flanged pipe with long radius elbows, and taper pipes make connections with the pump branches. The main suction line consists of flanged piping and was tested to a pressure of 30 lbs. per sq. in. after erection to guard against air leaks. In addition to a necessary foot valve at the intake, check valves are placed in the branches to the condenser and feed pumps, and water sealed gate valves in the branches to the centrifugal pumps.

The velocity of water in the suction

main under normal conditions of working is 280 ft. per min., and the friction head loss between the lake and the pumps is estimated at about 2.7 ft., not including the resistance of the foot valve. The presence of solid rock immediately below the engine room prevented the power house being situated at a lower level, and prohibited the construction of an intake flume. The satisfactory working of the present arrangement shows that any other scheme would have been an unnecessary expense. The feed piping to the boilers is extra heavy, being similar to the main steam piping, and each branch to a boiler is provided with the usual stop, check and feed regulating valves, the latter arranged at the front of each boiler at hand level. With the exception of two angle valves, all water and feed valves are of the straightway type.

Operation Record.

The plant was started up and the blast furnace "blown in" on August 21, 1913, and on August 24 the furnace was tapped and several tons of charcoal pig iron drawn off. The simplicity of operation is quite worthy of comment. In the first place, the boilers are gas fired, and need very little attention, while the only reciprocating motive power is that driving the Pratt Rotrex air pump, and the oiling of that is automatic. The rest of the apparatus is all steam turbo-driven, the result being that the whole plant can be easily handled by one man, and his duties are practically limited to watching the feed water and keeping the log book entered up.

The contractors for the whole equipment were the Rudel-Belnap Machinery Co. of Montreal, and the turbines were supplied and erected by Fraser & Chalmers of Canada, Ltd., Montreal.

FIG. 6. BLAST FURNACE AND PIG BED.

The Method and Manner of Laying-Out Plates

By Joseph W. Ross

The laying-out of plates to form the various shapes for which sheet metal parts are used involves difficulties that are only discovered when such a job is undertaken. System and intelligent application are therefore of the greatest importance in procuring successful results.

PARALLEL DEVELOPMENT OF CYLINDERS.

WHERE cylindrical work is to be fitted to an angular or irregular surface, the shaping of the sheet so as to roll up to the required angle requires that a development of the angular edge be made. This development is simply the stretch-out of the angular surface. The development of a plain cylinder would be a rectangle and that of a bevelled cylinder would be a rectangle with one curved edge, as will be seen.

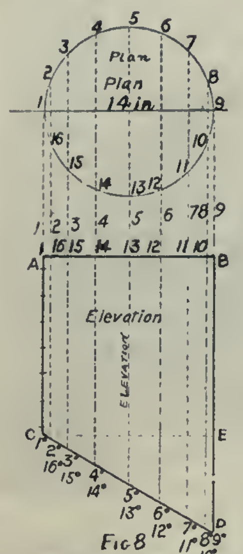
In Fig. 8 is seen the plan and elevation of a cylinder cut at an angle of about 30°. In developing this, it is necessary to draw it out full size on a spare piece of plate, but for home study it may be reduced to a smaller scale, according to the wishes of the student. The figure A C D E B represents the elevation view. Above this, describe a circle to represent the plan, and divide the circle into a number of equal parts as deemed necessary. In this case, 16 parts have been chosen. Number each part from 1 to 16 in their consecutive order. Greater accuracy can be obtained in the development by the use of a larger number of divisions.

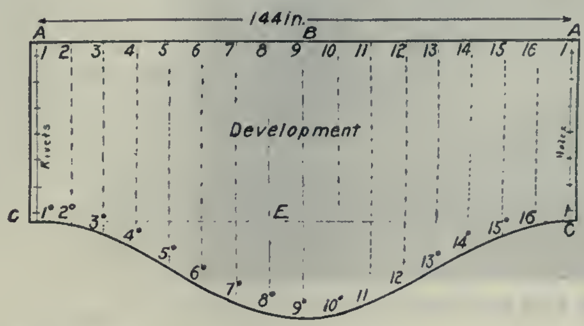
From each divisional point in the plan Fig. 8, draw to A C and B E D, lines parallel to the intersection of the inclined line C D as shown in the elevation, Fig. 8. It will be observed that if the line circle of the plan be straightened out, the divisional points maintaining their equally spaced positions, that the straightened line or the stretch-out of the circle will be equal to the circumference of the circle divided into 16 equal parts. Each division will represent the starting point of one of the parallel lines, which cut the angular part of the elevation. The diameter of the circle is 14 in. Its circumference or stretch-out is, therefore, by the decimal formula, 3.1416 $\times$ 14 which is 43.98 in. By the fractional formula. 14 $\times$ 3 1-7 equals 44 in., which is quite near enough for practical purposes.

Measure off on the required plate, a stretch-out of 44 inches. As the part A B C E, Fig. 8, constitutes a right cylinder (one that is square at both ends), it will require a rectangular section of plate; therefore, bisect the line A B A on the development, Fig. 9, and square up the plate, using the height A C or B E. It will now appear, after squaring up, as the rectangle A B A and C.E.C. Divide the lines A B A into 16 equal parts and with the dividers in conjunction with the lath, transfer all these points to the line C E C. Connect these points by lines parallel to lines A C and B D. Number all lines as shown in Fig. 9, obtaining the numbers from the plan view in Fig. 8, and allow all the parallel lines to project below the line C E C.

From line A B, Fig. 8, measure with the trams, the length of line 1.1° and transfer this length to 1.1° on the development Fig. 9. Measuring from line A B again, reset the trams to distance, 2.2°, Fig. 8. Mark this off on corresponding number in the Fig. 9, and reset the trams to distances 3.3°, Fig. 8, and so on until all the lengths of parallel lines in the elevation view, Fig. 8, are transferred to corresponding numbers on the development Fig. 9. Measure in each case from A B, Fig. 8, and transfer the measurement to the plate, working every time from the line A B A. Connect all the points thus located with an even curve, as shown by the curved line C C. Mark off the rivet holes and add the required laps.

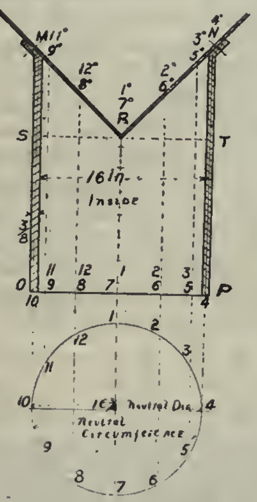
In Fig. 10 is shown a cylindrical chute of ⅜-in. plate fitted to the bottom of an angular bin. Divide the neutral circumference view into 12 equal parts, and from these points of division extend parallel lines to the angle of the bin M R N. Number each line as shown in Fig. 10. Now calculate the stretch-out of the plate. The neutral diameter is, therefore, 16 + 3/8 = 16 3/8 ins. The neutral circumference or stretchout equals 16 3/8 × 3.1416, which is 51.4, or 51 13-32 ins.





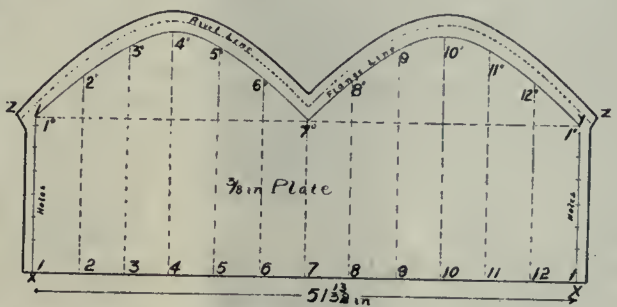
FIGS. 8 AND 9. ELEVATION AND DEVELOPMENT OF CYLINDER WITH ONE BEVELED END.

Measure off a distance equal to 51.4 inches; bisect the line and square up with a height equal to S O or T P. This



gives the development of the right cylinder S O P T. To this must be added the sections M S R and R N T, the development of which will now be explained. Divide the line XX into 12 equal parts in accordance with the divisions in Fig. 10. Transfer these points from XX to YY and connect by lines parallel to XY, XY, prolonging these lines some distance past the line YY. Number each line in manner similar to Fig. 10.

Set the trams to distance 1.1° of Fig. 10, and transfer this length to line 1.1° in Fig. 11. Reset the trams to distance 2.2° and transfer this distance to 2.2° in Fig. 11. Continue this process with each point of identification until all



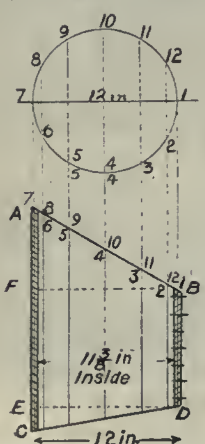
FIGS. 10 AND 11. V-SCHUTE CONNECTION FOR BIN AND ITS DEVELOPMENT.

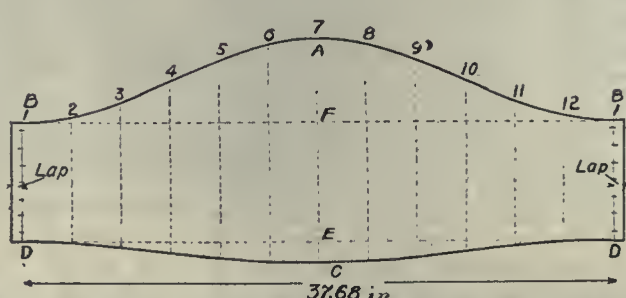
have been transferred to Fig. 11. Connect all the located points with an evenly drawn curve. Mark off from lines XY, XY, 1½ inches for laps, and divide the rivet line into the desired equal number of rivet spaces.

Measure from the developed curved line a distance of 3 inches for the flange allowance and also space off the requisite number of rivet holes on the rivet line of the flange. These holes may be punched in the templet, and after rolling fitted into place so that the holes may be marked off on the angular bin which is afterwards drilled. If the holes are already in place in the plates of the bin, they may be omitted in the templet until after being rolled and fitted into position, being then marked off on the templet and drilled or punched, according to conditions and facilities. An addition is required at the points ZZ to counteract the drawing in of the metal during the operation of flanging. In general practice it is advisable to allow plenty of metal. If too much is allowed, it is easily removed after flanging and good work is assured.

The completed templet is shown in Fig. 11. It is also necessary to note that one of the points, Z (the one on the inner lap), is thinned out or scarfed to permit the plates to be closed up at the point of contact with the side of the angular bin. In Fig. 12 is shown a cylinder bevelled at each end. The pattern is seen in Fig. 13, which will readily be understood after following closely the foregoing examples.

The next article of this series will illustrate the principle of obtaining the developments of conical forms by radial lines. The method of obtaining the camber as in the telescopic system of plating used in smokestacks, blast pipes, water pipes, lines, etc., will be explained and illustrated.





FIGS. 12 AND 13. ELEVATION AND DEVELOPMENT OF CYLINDER WITH TWO BEVELED ENDS.

CRANE LUBRICATION.

PROPER lubrication of the wire ropes, chains and gear teeth on cranes is of great importance as a safety factor; equally important also is the proper lubrication of all wearing parts. Lack of lubrication causes stiff and troublesome operation, hot journals, and loose parts. The eventful result may only be expensive operation, decreased efficiency, excessive repair cost or a stalled crane; but in many cases lubrication neglect will result in stripped teeth, wear-weakened axles or loose bearings which may cause injury to workmen as well. Such risks warrant exceptional care in providing adequate oiling devices that are easily accessible. These should not be allowed to become clogged or inoperative, and daily lubrication, at least, is advisable on all working parts. Sheaves and bearings in hoist blocks should not be overlooked in the regular lubrication. Before oiling, the main switch should be opened and locked in the open position.

War Grist.—Canadian manufacturers in certain lines promise to be busy for the next few months as a result of the desire of the British War Office to obtain large quantities of munitions of war in Canada.

Bonecourt Flameless System of Surface Combustion

It has been demonstrated by many everyday phenomena that, to get the greatest effect from combustion, it must take place through some medium. The strongest light effect is obtained with the help of calcium as in the Welsbach mantle and the greatest heating effect is furnished by the glow of a refractory material as in hot coal. The Bonecourt system aims to convert all the heat value of the fuel into radiant energy.

IN all the systems of burning fuel at present in use, there may be found ample evidence of serious inefficiency. The average good boiler will absorb but from 50 to 75 per cent. of the heat value of the coal supplied to it. The products of incomplete combustion, besides being the direct outcome of serious waste, are the cause of much extra work, and contribute much to the dirty end of the mechanic's duties and often lead to more or less rapid deterioration of the machinery involved.

In the burning of gas in the usual manner, a flame is produced which may be said to consist of a number of layers of air and gas of different temperatures. Only one of these layers is at the incandescent heat necessary for combustion, and when this is cooled or has insufficient air, an imperfect combustion of both this and the succeeding layers results. Furthermore, as a flame, very little of the heat is present in the radiant form and is not readily absorbed by a cold surface. The result is that gas fired boilers as a class, are less efficient and are more bulky than coal fired boilers of equal power. With both liquid and solid fuels as well, we have the difficulty of incomplete combustion and the ever present necessity of admitting a great quantity of excess air to the furnace.

Much is lost by applying the heat of combustion to the work in a form that does not permit of its most rapid absorption, and the overcoming of this difficulty is the strongest feature of surface combustion. The system of surface or flameless combustion then, makes a gain over ordinary methods in two distinct ways:—

1.—Combustion takes place over an incandescent surface, no flame being produced all the heat of combustion being available in the form of radiant energy.

2.—The gas, before being presented to the incandescent surface is thoroughly mixed with the exact amount of air required for complete combustion, and the process is therefore complete without loss through the addition of excess air.

It is particularly to be noticed that, in the case of gas being burnt in an ordinary burner, the air required is not supplied to the zone of combustion in any positive manner. The ascension of the heated products of combustion draws in fresh supplies of air to the flame, or, in other words, the draught produced is the agency which feeds the flame with air. This somewhat precarious method is the one which is mostly in vogue in industrial combustion processes. In other cases, the gas flame is fed with air

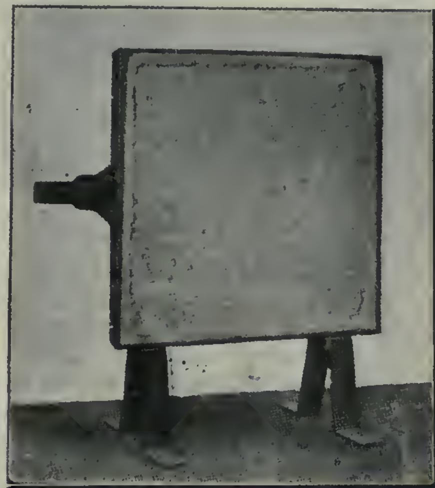


FIG. 1—PLAIN DIAPHRAGM UNIT.

delivered in a more positive manner, as, for example the ordinary blow pipe where a stream of air supplies the oxygen required for the oxidation of the fuel.

It is in the method of supplying the air and gas to the combustion zone that we find the first difference between surface combustion and the ordinary form of flame combustion. In the former case, the gas and air are thoroughly mixed together in the proportions theoretically required for complete combustion, the resulting mixture being a highly explosive one and constituting a self-burning medium—a medium ready to

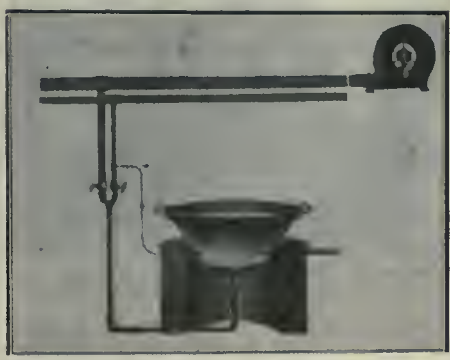


FIG. 2—DIAPHRAGM UNIT APPLIED TO BOILING SUGAR SOLUTION.

undergo combustion without further addition of air. The mixture is delivered, in such a manner as to avoid pre-ignition, on to an incandescent surface which serves to accelerate the burning process. The manner in which the gaseous mixture is delivered to the hot surface is of two kinds:

1—The "diaphragm process," in which the mixture of gas and air is delivered under a slight pressure to a chamber, one or more sides of which are composed of a porous, refractory material. As the mixture permeates this diaphragm, it burns uniformly over the whole outer surface which is kept in an incandescent condition without flame. In the meantime, the inside surface is kept cool by the continual addition of fresh gas and air.

2—The alternative process consists in gaseous mixture being shot at the incandescent surface from nozzles of refractory material at a speed greater than the speed of ignition so that the fire cannot come back into the nozzles. The incandescent surface, in this case, is composed of a bed of small pieces of refractory materials.

Fig. 1 illustrates a diaphragm unit in which the supply pipe and the diaphragm are easily seen. This diaphragm is composed of fire-clay fragments of uniform size held together by a ceramic cement used in such a small quantity as to leave the slab extremely pervious to the passage of gases. It is sufficient to supply the air to the diaphragm at a pressure of 1 in. or 2 in. of water, the gas entering at the pressure obtaining in the town main.

In Fig. 2 is represented a diaphragm unit designed for boiling sugar solutions. The unit comprises a circular diaphragm surrounded by a brickwork setting on which rests the cooking utensil. By the old method of Bunsen burner, the gas consumption was 80 cubic feet per heat, but, by the installation of the diaphragm system, this was cut to 40 cu. ft. for the same work. No trouble is experienced by the spilling of materials on the surface of the diaphragm as the heat is such that this soon burns off, leaving the surface in no way impaired. Another method of firing these diaphragms consists in employing the gas at a pressure of from 2 to 4 pounds per sq. in., and causing it to carry in its air supply by means of an ejector device.

In either case the result, as far as the incandescence is concerned, is the same, the selection of the method to be employed being simply a case of convenience, and determined by the availability of a low pressure air supply. Diaphragm heating units of this kind can be employed with any kind of gaseous fuel provided its heating power is sufficient to maintain the surface of the diaphragm in a state of glow. Thus, with Mond gas the same brilliancy is obtained as with coal gas but with the lower grades of producer gas, the incandescence is less bright although the effect is still useful for many purposes. Petrol air gas also produces the same incandescence as coal gas, but with this advantage that it contains in itself nearly sufficient air for its proper combustion so that, by slightly increasing the air content of the gas, it can go directly to the diaphragm without the further addition of air or the use of mixing apparatus.

Considerable improvements have been made of late in the manufacture of these diaphragms, so that it is now possible to work them at higher temperatures than was the case at first. The safe limit of temperature which the radiating surface of the diaphragm can attain without risk of pre-ignition of the gaseous mixture is in the neighborhood of 1,000 deg. Cent., and the actual temperature of the surface when radiating freely into space is from 800 to 900 deg. Cent. When the diaphragm forms part of a heated enclosure, as for example, when it forms part of the wall of an oven or drying chamber, the heat of the enclosure has the effect of conserving more heat upon the surface of the diaphragm, so that the temperature tends to increase somewhat. It is found that diaphragms are suitable for the construction of enclosures where the temperatures are to be anything up to 500 or 600 deg. Cent. If the temperature of the enclosure is higher, the combustion will gradually recede after a long time into the texture of the diaphragm and ultimately ignition of the gaseous mixture will take place in the diaphragm casing. This renders the diaphragm unsuitable for the construction of furnaces which are to work at high temperatures; but where the period is a short one, the temperature limits above stated may be exceeded. For example, it has been found that these diaphragms will heat an enclosure at 1,000 deg. Cent., in cases where the high temperature is only required say, for an hour at a time.

The Second Process.

In all cases where really high temperatures are required and where the use of diaphragms is inconvenient for any reason, the alternative process is employed, which consists of delivering the mixture at a high speed on to the incandescent surface. The explanation for the resulting flameless combustion is that the mixture burns on the incandescent surface in thin layers too quickly to allow the flame to develop. This is the process which is applied to the construction of furnaces, in steam generation, and in numerous heating devices.

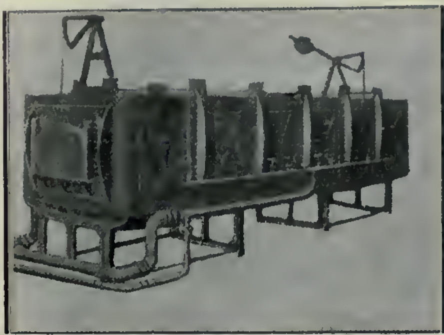


FIG. 3—BONECOURT FURNACE FOR ANNEALING COPPER RODS.

The application of the process to any particular purpose consists in the arrangement of suitable surfaces to become incandescent. Such surfaces may be obtained by making up a bed of refractory materials. The gaseous mixture is supplied to this surface from pipes which lead into refractory conduits or relatively small cross section which gives the gas and air a sufficiently high speed to prevent the combustion from going back into the pipe.

The Products of Combustion.

One point of considerable importance in this and other furnaces operating on the same general principles deserves emphasis. The gas and air being thoroughly mixed so as to constitute a homogeneous mixture of the proper proportions before being delivered to the combustion zone, combustion is absolutely complete even though there be no excess of air whatever. Every particle of gas is surrounded in the most intimate manner by oxygen, and these assemblages have to run the gauntlet of a mass of refractory material in an incandescent state which ensures that no part of the combustible gas shall escape complete combustion. It, therefore, follows that the products of this form of combustion contain the maximum quantity of carbon dioxide and none whatever of the products of incomplete combustion.

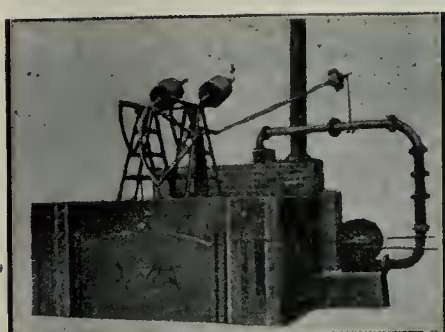


FIG. 4—BONECOURT FURNACE FOR ANNEALING MALLEABLE CASTINGS.

This is a point of great importance in a large number of trades. In the enameling industry for instance, until recently it has been necessary to employ muffle furnaces in the heating of the ware, so that the products of combustion are carefully excluded from contact with the work. When a muffle cracks, the lead oxide in the enamel is attacked by the free oxygen in the products of combustion and the work is ruined. The use of the muffle is necessitated by the fact that the combustion gases are not completely burnt and the air and carbon monoxide which they contain must be kept away from the material being heated. Having in view the completeness of the combustion in surface-combustion furnaces, it appeared that it might be found practicable to do away with muffles in enameling operations.

Enameling Furnaces.

With a view to determining this point conclusively, an important firm of enameled ware manufacturers were approached and sent representatives to carry out a special test. It was found that although no muffle was used, the combustion products therefore having free access to the work, the enameled surface was in no way impaired, thus proving that the products of complete combustion do not, in any way, injure work of this kind and that the damage is done by the reducing gases contained by the products of incomplete combustion. The importance of this point will be realized when it is considered that, by direct heating of the ware, a very great saving in fuel is obtained. Fire clay muffles are extremely bad conductors of heat which tends make the process slow, and leads to a great loss of heat.

Temperatures Obtainable.

There are no limitations as to the nature of the gaseous fuel which can be advantageously used in this way. So long as the gas is in any degree combustible, it is available for use. The temperature obtainable is dependent upon the calorific or heating value of the gas. Approximately, the temperature obtainable when burning blast furnace gas in a granular bed, is in the neighborhood of 1,000 deg. Cent.; in the case of Mond gas, about 1,500 deg.; and in the case of coal gas, coke oven gas, or water gas, about 1,950 deg. Cent.* These are the highest temperatures obtainable in the combustion zone itself when pre-heating

* These temperatures are questioned by some good authorities.

neither gas or air. They are the temperatures of combustion and not necessarily the temperatures obtained in the body of the furnace. The intensity of the heat obtainable is limited by the refractoriness of the furnace materials used.

A furnace for the purpose of annealing copper rods is shown in Fig. 3. It is fired with coal gas, the working temperature being 700 deg. Cent. The working space inside the furnace is 12 ft. long, 2 ft. 6 in. wide, and 11 ft. 3 in. high. This furnace has now been in operation for some months and turns out work at an unusually high rate, the normal gas consumption being 800 cu. ft. of gas per hour. In spite of the fact that no muffle is employed, undue oxidation of the surface of the metal does not take place.

The furnace shown in Fig. 4 has been constructed for the annealing of malleable iron castings. The working space is 5 ft. by 4 ft. by 2 ft. 6 in. high. The pots are put into the furnace cold and Mond gas is supplied at the rate of 6,000 cu. ft. per hour for the first five hours. A temperature of 850 deg. having been obtained, the rate is gradually cut down and the consumption then kept at 1,500 feet per hour for the last half of a total heating period of twenty-four hours. The interior of the furnace is heated by two beds of refractory material disposed along opposite sides and into which the gaseous mixture is injected. This furnace has given good results and is found to be convenient in practical use.

BRIGHT DIP FOR BRASS AND BRONZE CASTINGS.

IT is often necessary in a brass foundry to dip castings, but just how to make a dip that will give good results is not known. Castings require a different dip from that of sheet metal goods, and in order to remove the scale, oxide and sand, and leave a bright surface, it must act rather energetically. A dip that will give good results on castings is usually too violent for sheet metal goods, and will give too rough a surface. In the case of castings, however, the surface is rough to begin with, and the acid does not render it any more so. With a strong nitric acid dip, the casting is given a bright surface, but not of the character desired, and the acid also is apt to work too rapidly. If sulphuric acid is mixed with it in the regular dip proportion, it works too slowly. The addition of a small amount of water has been found to give the necessary action and allow the dip to work rapidly and smoothly. The following dip will give good results on brass, bronze or composition castings:—

Nitric acid	2 gallons
Sulphuric acid	1 gallon
Water	½ gallon

The water is first poured in a stone crock and then the nitric acid poured into it. The sulphuric acid is then poured into this mixture. It will become hot, and should be allowed to cool down a little before using as it works too rapidly when very hot. The nitric acid used is the same as aquafortis, of course, and should be from 38 to 41 degrees. Beaume in strength. The sulphuric acid is oil of vitriol and should be about 66 degrees Beaume. The dip works best when warm, and a temperature of from 100 to 120 degrees F. is satisfactory. If cold it works too slowly.

The Dipping Process.

In dipping the castings they should be free from grease or oil, or the dip will not work evenly. Immerse them in the dip and as soon as the acid begins to "bite," remove and rinse in cold water. If the surface is not even, a second dip is usually necessary, but care must be taken about introducing water into the dip. If it contain too much, it will not work well and the surface of the dipped castings will be dull and flat.

In case the dip does not remove all the scale and oxide from the surface, as frequently happens with badly discolored or oxidized castings, it is well to remove the casting from the dip, and without rinsing, allow the acid to act upon the surface in the air. Next return to the dip and afterwards remove and rinse. In this manner, the surface will be bright and uniformly clean.

After the castings have been dipped and the surface is bright and clean, they should be well rinsed in cold water to remove every trace of acid, then in hot water that is clean and be afterwards allowed to dry off spontaneously. It is an excellent plan, after the castings have been well rinsed, to immerse them in a hot water solution containing soap of some kind. Whale oil soap, fig soap or other varieties of a similar nature which are not too strong in alkali may be used.

The solution need not be strong. Dissolve an ounce of the soap in a gallon of water and keep hot. Immerse the castings in this solution and then take out and allow them to dry off. In this manner a film of soap is left on the surface which causes the water to dry off or run off from the surface easily, and also covers the metal with a greasy coating which will serve to prevent stain and tarnish. This method is used extensively in drying off metal goods after plating or dipping and can be applied to castings with equally as good results.

CRANE HOISTING MECHANISM.

WHEN loads are started or stopped suddenly or carried in a jerky or swing manner, an extraordinary strain is exerted upon the chains, wire ropes and hoisting mechanism. Such careless operation frequently doubles the ordinary lifting strain and under some conditions subjects the crane to indefinitely greater shock. The severest strains are commonly caused by speeding the hoist motor before the slack has been taken up, although similarly dangerous shocks are imparted by too sudden stoppage of any of the crane motions when hoisting or lowering loads. Careful operators will overcome this hazard by placing the hoist block directly over and by slowly and gently taking the load, by a like precaution in coming to a full stop, and by refraining from moving the load while it is swinging abnormally. When chain links on cranes show the slightest sign of fracture or weakening by wear, they should be immediately replaced. Similarly, wire ropes should be renewed as soon as individual wires begin to break.

In foundries and steel mills where hot metal is handled, this is more than usually important. In some plants it is the practice to use wire rope exclusively for this service and to replace them as soon as two wires have broken; such discarded cables are then utilized for less hazardous duty. It is important, too, that the chain or wire rope should always be long enough to allow at least two complete wraps to remain on the drum when the hook is at its lowest working position, in order to avoid direct strain at the point of fastening. The latter precaution should be especially kept in mind when chains are shortened by cutting out defective links or when worn ends are cut from wire ropes. The removed chain links must be replaced by perfect ones, and the wire ropes must be renewed when they become too short.

Tool Stealing.—Probably there is no one thing that causes more inconvenience and annoyance to machine shops and manufacturing plants in general than the theft of tools. Occasionally this may be done by employees, but usually by others who either want the tools for their own use or expect to sell them to persons not so careful in making inquiries as to how the tools came in the possession of the seller as they should. James H. Matthews & Co., Pittsburgh, manufacturers of steel lettering, dies and stamps, are making for a number of their customers steel stamps reading "Stolen from —— Company," to be used in marking tools or other supplies likely to be taken. Such a stamp would certainly prevent their being sold.—Ex.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

WEDGE FOR HAMMER HEADS.

By E. S. H.

THE recent article by J. E. T. in Canadian Machinery has prompted the writer to offer another, which has been proven by practice to be very efficient, and, as will be seen by the sketches, is very easily made. All mechanics have trouble sooner or later with loose hammer heads and disappearing wedges, but few bother to buy the patent contraptions sold to prevent this trouble. Let your mechanic try a "home-made-un" before loosing his temper.

Take a strip of flat or round iron of

WEDGE FOR HAMMER HEADS.

suitable size. Flatten and spew out the end and nick at the proper length for breaking off. Hold edgeways on an anvil and edge-in to a slightly wedge shape, when the entering edge will frill up, as shown in the sketch. All that is now necessary is to nick the shaft with a hack saw or chisel, and drive the wedge home. It will enter easily, do the expanding and not come out. With suitable material it can be easily made cold as well as hot.

PLUG MANDRELS.

By A. Granville.

WHERE gear blanks are bored and faced on one side in a screw machine, some means must be provided for holding

PLUG MANDRELS.

the blanks while facing the opposite side. Of course, an ordinary mandrel may be used, but, where a large number of blanks have to be machined, it is best to have something a little more convenient, especially when extreme accuracy is not needed. For this purpose, the type of plug mandrel shown is quick and sufficiently accurate for all ordinary purposes.

Two split sleeves are shown at A and B. These are used to fit different sizes of bores, and are screwed directly on to the spindle nose of the lathe. After one of these is in place, a gear blank is slipped on, and then the taper plug C is forced into the bore of the sleeve, which is taper-reamed to receive it. As the sleeve is made to closely fit the bore of the gear blank, only a slight expansion is needed to hold the blank firmly. As a rule, simply forcing the taper plug in by hand is sufficient. In some cases it is advisable to knurl the shank of the plug to facilitate removal. With a smooth shank, a lathe dog may be placed on it to aid in removing from the sleeve.

QUICKLY MADE BORING TOOL.

By E. S. H.

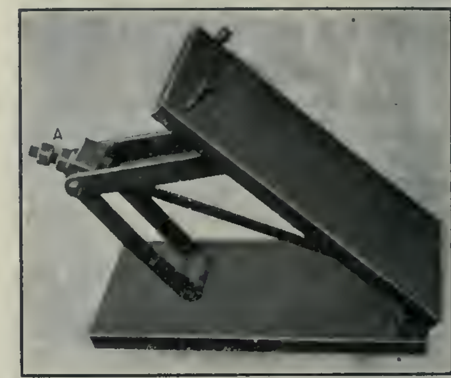
THE boring tool shown in the accompanying sketch will be found very useful for cleaning out old holes or tubes or for removing scale and other accumulation in boiler gauge and water glass mountings. Take a piece of steel wire of convenient size and bend part of it in the form of a crank. Flatten out the other end evenly for a length greater than the depths of the holes to be cleaned. Heat evenly and, by holding the point with pliers and making use of the crank, twist in the backward or unscrewing direction, and grind the point similar to an ordinary drill. Fix a disc or small wheel on the other end and you have a little tool made in a few minutes that will replace many pointed wires, and will do a job of such quality and with such ease that the artifice will pay for itself in the first attempt.

QUICKLY MADE BORING TOOL.

AN ADJUSTABLE ANGLE PLATE

By G. E. Avery.

AN adjustable angle plate that is very handy for doing various odd jobs on the shaper, planer, miller or drill press, is shown in the accompanying illustration. The steady rod A is threaded for quite a distance, so that the lock nuts may be placed to hold the hinged brace wherever desired. The plate as made was intended for milling some small brass parts, but with slight changes it can be easily made for heavier work. For instance, where heavy work has to be machined on it, a locking bolt should be used on the lower plate hinge to prevent chatter.



AN ADJUSTABLE ANGLE-PLATE.

BROACHING D-WASHERS.

By G. Edward.

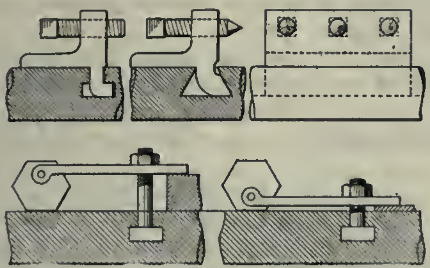
A QUICK way of making D-washers is here shown. The clapper block is removed from the shaper and a split collar A is bolted in place. An angle plate B is bolted to the shaper table. A broach C is then locked into the split collar, and a washer with the hole drilled small is placed at D. The shaper ram is then moved forward on the slow speed. As it returns, another washer is dropped into the holder, and this is repeated till the shank of the broach is full. The broach is then taken out, the washers dropped into a box, the broach replaced, and so on.

BROACHING D WASHERS.

PLANER CLAMPING DEVICES.

By H. Womersley.

A combination clamp and stop is almost a necessary adjunct to every planer. In the top part of the accompanying cut is shown a useful type suited to different kinds of planer slots. Either pointed or flat-nosed set screws can be used as desired. It is evident also that



STOPS AND CLAMPS FOR PLANER.

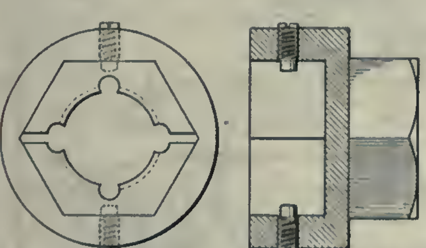
these can be made singly or in groups of as many setscrews as desired.

In the bottom part of the illustration is shown a very useful clamp for the planer. The hexagon part is simply a section of hexagonal cold rolled bar of convenient size to which the strap can be attached either inside or out. As is seen, the combination has three instantly attainable working positions, and, by placing the bolt as near to the work end as possible, the clamp will take a considerable strain. By offsetting the strap as shown, it is evident that three more heights can be obtained.

SPLIT DIE NUT AND HOLDER.

By Armley Leeds.

"WORTH its weight in gold." Such is the expression that has more than once been used in connection with this die holder since it was introduced into the shop. There is a considerable amount of repair work to be done, and among other things, many more or less battered studs have to be put in shape to receive the nuts. The removal of studs which have been in place for a considerable



SPLIT NUT FOR CLEANING STUDS.

time is a tedious process, to say nothing of the new ones entailed. The idea of arranging the nut for a split die came to the writer while watching a mechanic in his efforts to get a solid die started on a stud that had been badly battered on the end, and when listening to some uncomplimentary terms which he applied to such jobs.

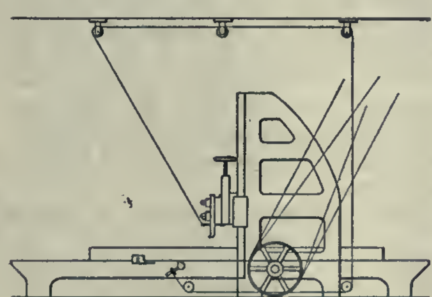
The illustration is self explanatory. All that is necessary is to loosen one of the set-up screws which may be a thumb-screw for convenience, and let the die back so that it can be slipped over the damaged end and on to the good part of the screw. The die is now closed on the thread end and the whole backed off in an instant. The die holders are simple to make. The set-up screws must be made long enough to allow the die to be loosened up without permitting its parts to fall out. The hole through the back must be made an easy fit for the over-all size of the studs and the outside, hexagonal part is best made to fit a wrench to take similar nuts to the studs. These split dies can be used for every purpose to which solid ones can be applied, and have the additional advantage claimed.

We have seen solid dies for this purpose attached to a brace similar to a wood boring bit, which greatly expedites the work. No doubt the above could be easily arranged in like manner.—Ed.

PLANER TOOL LIFTER.

By W. Henry.

MANY large planers have no arrangements for lifting the tool on the return



TOOL LIFTING DEVICE FOR PLANER.

stroke. As it often happens that large chips get between the tool and the work, and do damage, it is advisable to have an automatic arrangement to prevent any such accident. In the illustration herewith is shown a simple device for this purpose. True it is that this is not the most up-to-date way of accomplishing the desired end, for it could be improved by having a positive return for the tool and other additions, but it is cheap and can be installed by the planer hand himself in a few spare moments.

At the trip lever of the machine there is a ring attached to the handle by means of a knurled set-screw. Four small pulleys are attached, three to the ceiling and one to the floor at suitable points as shown. One end of a cord is fastened to a strip of metal which may be clamped to the clapper block by means of one of the tool bolts. The cord then passe up over the pulleys on the ceiling, down to the floor and along to the trip, where it is fastened to the collar before mentioned. This collar may be adjusted nearer or farther from the fulcrum end of the lever, to gain the desired lift of the tool. The slack is always kept out of the cord by twisting the collar around the trip lever upon which the surplus is thus wound. A small weight attached to the cord under the ceiling and a piece of wood fastened to the sloping part serve to prevent it going too far. This simple rig has proved is practicability in such jobs as planing tee slots and the like.

THE NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION CONVENTION.

THE official programme of the Thirteenth Annual Convention of the National Machine Tool Builders' Association, to be held at the Hotel Astor, New York, October 22 and 23, is as follows:

First Session, October 22.

9 to 10 a.m.—Registration of members.

Roll call.

Reading of minutes.

Report of Membership Committee, J. H. Drury, chairman.

Announcement of convention committees:

11 a.m.—Adress, "The Establishment of American Banking Facilities in South America," H. R. Eldridge, vice-president National City Bank, New York.

Second Session, October 22.

2.30 p.m.—Adress, "Reform in Drawing," E. H. Fish, Worcester, Mass.

Address, "Waste in Hiring and Discharging Men," Magnus W. Alexander, General Electric Company, Lynn, Mass.

5 p.m.—Executive Session—"Heart to Heart Talks on Trade Conditions."

Third Session, October 23.

Friday morning, the Lathe, Sensitive Drilling Machine, Boring Machine, Gear Cutting Machine and Grinding Machine Committees will meet in their respective rooms at 9 o'clock; the Hand Screw Machine and Radial Drilling Machine Committees at 11.30 o'clock; the Planing Machine and the Milling Machine Committees at 11 o'clock, and the Shaping Machine, Vertical Drilling Machine and the Turret Lathe Committees at 11.30

Fourth Session, October 23

The fourth and final session of the convention will begin at 2.30 o'clock Friday afternoon and be conducted as follows:

2.30 p.m. — Reports of Convention Committees.

Address—"A Closer Commercial Relationship with Latin America," James Logan, United States Envelope Company, Worcester, Mass.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

It will be found by those who have followed the previous lessons and profited by them that the various practical applications can now be easily observed, applied and appreciated.

IN the present article the question of speeds is further discussed, a practical example of their determination and application relative to drill press drive being the feature.

Chart 37 shows a sketch of a gear and pulley drive and a formula for the solution of same.

In the sketch of the drill press drive, Chart 38, what would be the speed of the spindle S with the belt on the cone as shown, with and without the back gear, main shaft running 160 revs. per min., with a 15 in. drive pulley? By formula, Chart 37,

$$\text{rev.} = \frac{R \times D \times D^1, \text{ etc.}}{P \times P^1, \text{ etc.}} = \frac{160 \times 15 \times 7 \times 25}{10 \times 5.5 \times 40}$$

=191 revs. per min. for direct drive.

For gear drive:—

$$\frac{160 \times 15 \times 7 \times 24 \times 24 \times 25}{10 \times 5.5 \times 60 \times 60 \times 40} = 30.5 \text{ revs. per minute.}$$

What would be the cutting speed of the circumference of a ½ in. drill, running at the highest speed?

$$\frac{160 \times 15 \times 8.5 \times 25 \times .5 \times 3.1416}{10 \times 4 \times 40 \times 12} = 41.7 \text{ ft. per min.}$$

The positive cutting speed of a shaper or slotter is not so easily found, as the cutting speed varies for every position of the stroke, as will be clear by looking at the sketch of the shaper action in Chart 38.

When the link L is in the position shown, the tool, ram and link is practically stationary, but the action of the machine causes the reciprocating parts to gradually increase their speed until the link L is in a vertical position. Further movement causes the reciprocating parts to gradually derease their speed until the link L is at the extreme left; it is then returned to its former position by a gradual increase and decrease of speed, but with a greater velocity, according to the angle through which the block C travels.

The ratio of return to that of advance in the position shown, or on a 16 in. stroke is 2 : 1, as the angle of advance C B A is twice that of the angle of return A D C; but if the block C is moved toward the centre, or to a position that will give a 4 in. stroke (as that shown by the skeleton sketch) the ratio of return to that of advance will only be about 9 : 8, as the angle of action of link L has been greatly reduced. As long as the belt is on the same step of the cone pulley, the number of strokes per minute will be the same, whether it be a 1 in. or 16 in. stroke, but the velocity will vary in proportion to the length of stroke.

To find the maximum cutting speed, which will be when the link L is in a vertical position on the cutting or forward stroke, first determine the number of revolutions of gear G by formula, Chart 37. The main shaft pulley, 12 ins. diameter, runs 150 revs. per min., and the counter-shaft pulley is 18 ins. diameter, while the cone pulleys are same as on the machine.

For high speed, number of return

$$\text{strokes} = \frac{150 \times 12 \times 11 \times 25}{18 \times 5 \times 70} = \frac{550}{7}$$

=78.6, and other speeds=45.9, 27.8, 16.2.

The maximum cutting speed of the tool is to the speed of the link block circle, as the length of the link is to the distance of the link block C from the fulcrum, when in a vertical position on the forward stroke.

Find the cutting speed for 16 ins. stroke on slowest speed. Speed of link

$$\text{block circle} = \frac{8 \times 3.1416}{12} \times \frac{16.2}{1} = 33.9 \text{ ft. per min.}$$

Maximum cutting speed is to the speed of the link block circle as 16 : 12, or maximum cutting speed =

$$\frac{33.9 \times 16}{12} = 45.2 \text{ ft. per min.}$$

For a 2-in. stroke on the same step of cone pulley:—

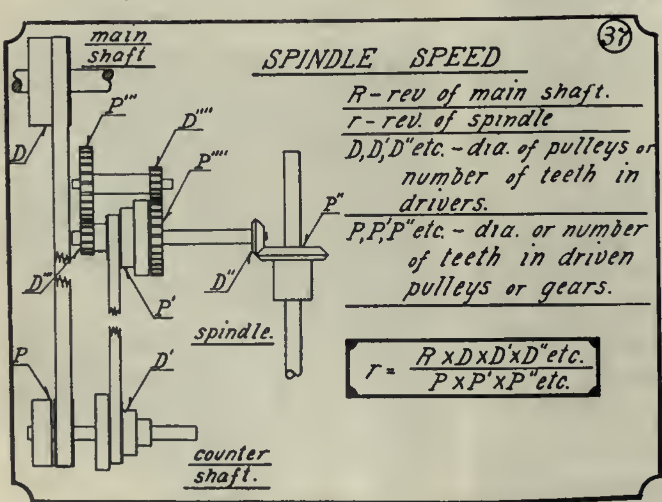
$$\frac{1 \times 3.1416 \times 16.2}{12} = 4.24 \text{ ft. per min.}$$

speed of link block circle. Then maximum cutting speed =

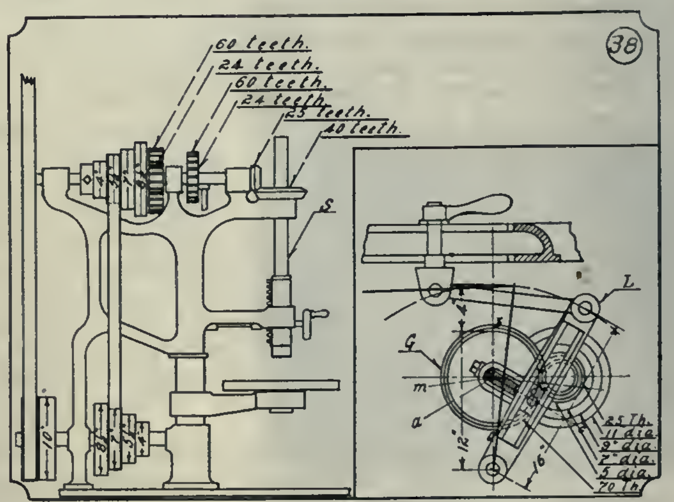
$$\frac{4.24 \times 16}{8.5} = 7.98, \text{ or 8 ft. per min., and}$$

by changing belt to the highest speed, the cutting speed for 2-in. stroke=

$$\frac{1 \times 3.1416 \times 78.6 \times 16}{12 \times 8.5} = 38.7 \text{ ft. per min.}$$



ARITHMETIC CHART 37.



ARITHMETIC CHART 38.

A NEW TYPE OF TRANSMISSION.

By Sidney Caden.

I WOULD like to offer to the readers of your esteemed journal, an idea in connection with power transmission which may, with the help of some better heads than mine, be developed to a stage where the plan will be of some practical value.

In a lumber mill where I was employed for some time, it was necessary to operate a small plunger pump at some distance from any line shaft. The power required was almost nominal, and was required more or less in impulses.

A small rope drive was at first tried, but the ropes flopped around too much and, when fenced-in, gave considerable trouble.

A long narrow belt was made by splitting up a wider belt but, in spite of guides this sometimes ran off the pulleys. We were much interested in an article which appeared in a technical paper on steel belting as developed in Germany, and used in both that country and England. This gave us an idea. The two light wooden sheaves used for the rope drive were packed in the V's, with strips of old rubber packing so as to give a smooth, even bottom to the groove. A single band was next made of spring wire brazed together at the ends, and one of the sheaves was made adjustable to take up slackness in the wire.

The arrangement worked very satisfactorily for about a month when the rubber packing in the grooves gave out. This was overcome, however, by substituting leather for the rubber, and the transmission has been running for a year. As an experiment, we set up a three-wire drive for a duplex crank driven pump on the same principle as the American system of rope drive. The sheaves were made of wood, leather covered and, instead of making grooves in the face of the wheels the wires were guided by little rings fastened close to the receiving sides of the sheaves. These guides were very soon worn out, but the wires had by that time made slight depressions in the leather, and the rings were no longer needed.

Adjustment for tension was made in the same way as before, so that only one sheave was required to guide the wire to the starting edge of the driving sheave. This gave remarkably strong turning force with very little tension on the wires. The drive was cheap, light, noiseless and steady and, up to the time I left the plant (three months) had been running without a hitch.

COMMUTATOR AND OTHER TROUBLES—II.

By H. C. Thomas.

PART I. of this article appeared in our October 15 issue, and discussed the steps to be taken relative to sparking, bedding and spacing of brushes, also the removal of projecting mica. Further common troubles and their remedies are dealt with in the present instance.

When the commutator has become so worn that it is considered advisable to true it up in a lathe, it should preferably be held by two steadies placed at the points where the shaft usually rotates in its bearings. These steadies will help to prevent vibration. The writer has known cases where, in overhauling small motors, the commutator was turned up and the old centres were undamaged, but owing to a slight spring in the shaft, when the armature was replaced in its bearings the commutator was slightly out of truth. This could not have happened if the commutator had been turned up with the shaft running in two steadies at the points where it usually ran in its bearings.

When turning commutators, use a sharp pointed tool, take light cuts, and avoid the use of a file if you can get the desired finish with the tool. Polish afterwards with sandpaper, two or three thicknesses of it in a concave block being best. If any small pieces of copper have dragged over from one segment to the next, remove them carefully.

The commutators of large armatures which can be revolved slowly by an engine or separate motor are best trued up in their bearings, using a turning tool or an emery wheel attached to a portable slide rest. A special commutator grinding machine may be used, rotating the armature by its own engine, and the grinding machine taking its power by belt from the generator shaft. This method is perhaps the most satisfactory, where the expense of purchasing a grinding machine is justified.

Before commencing to true up a large commutator, the bolts of the end plate should be tried to see that they are tight. Care must, however, be exercised in tightening up the bolts under normal working conditions, as the commutator may be thrown out of truth; in fact, the commutator must at all times be treated with care, because owing to the nature of its construction it is easily damaged. It must never be allowed to support the weight of the armature when being removed from the machine, nor must ropes be passed around it when being raised by blocks or crane; the weight should be supported by the shaft.

Commutator Lubrication.

Regarding the use of a lubricant on the surface of a commutator, there is a divergence of opinion, and much depends on the conditions and the amount of attention which the machine usually receives. It will generally be found that the occasional application of fine sandpaper, followed by a clean cloth slightly moistened with good machinery oil, tends to keep the commutator in good order. Excess of oil and lack of cleaning may result in the accumulation of carbon dust and oil on the windings; this mixture being of course a conductor, will tend to cause a breakdown. The use of emery cloth on the commutator or anywhere else on the machine is not advisable.

Air Gap Adjustment.

The correct adjustment of the air gap is a matter which calls for occasional attention, due to wear of the bearings or, what may happen in some bipolar machines, movement of the pole pieces, although this rarely occurs. A hardwood wedge 8 ins. long by ½ ins. wide and tapering from ⅜ in. to a fine edge is a useful little tool for checking this. When inserted between a pole piece and the armature, the amount by which it projects from the former provides ready means of ascertaining whether the shaft has worn down in the bearings and needs re-alignment. This checking should be made at about the middle of the pole-piece. In this connection it should be noted that any downward movement of the armature and consequent lessening of the air gap underneath it tends to throw a considerable extra strain upon the bearings due to the unbalanced magnetic pull, hence the importance of watching for any reduction in the bottom air gap. Some cases of sparking have been cured by increasing the air gap all around, that is, boring out the pole pieces, but it must be remembered that this is done at the expense of efficiency, which falls off rapidly as the air gap is increased.

Hot Bearing Trouble.

A case of persistent hot bearing in a six-pole generator was traced to the fact that the yoke was not in the correct position with reference to the armature, causing considerable end thrust at the enlarged portion of the shaft where it pressed against the bearing. To eliminate the trouble, the yoke was moved in the direction of the axis of the shaft, new bolts being used to keep it in its new position.

Insulation Resistance.

The gradual reduction in the insulation resistance of a machine, which often takes place before an actual breakdown of the insulation occurs, may be detected by the use of an ohmmeter and generator. Where there are a number of motors operating in a plant, particularly where the conditions are severe, the man in charge of them should take periodical readings, say once a month, and each set of results compared with those previously obtained. In this way the condition of the machines may be kept under constant observation, and the chances of a sudden breakdown reduced to a minimum. These readings should be taken as nearly as possible under the same conditions—e.g., after a day's run, because the readings will not be the same when the machine is hot as when it is cold.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals, will be found useful companion study.

Question. — A water tank for a sprinkler system is fastened to a wall. One side is sloping, and the other three are vertical. The top is 7 x 4, and the bottom is 7 x 2, which are parallel, and the length of the sloping side is 6 ft. How much water will it contain?

Answer.—The end section can be divided into a triangle and a rectangle. The area of the triangle is its base multiplied by half its height. The height is $\sqrt{(6^2-2^2)} = \sqrt{(36-4)} = \sqrt{32} = 5.65$ ft.

Area of triangle is $\frac{5.65\times 2}{2} = 5.65$ sq. ft.

Area of rectangle $= 6\times 2 = 8$ sq. ft. Total area of cross section of bin $= 8+5.65 = 13.65$ sq. ft.

Volume of tank $= 13.65 \times 7 = 95.55$ cu. ft.

One gallon $= 277.274$ cu. ins. No. of gallons then is $\frac{95.55\times 1728}{277.274} = 595.4688$ gallons.

* * *

Question.—A coal bin feeding a mechanical stoker is rectangular in shape, with a bottom coming to a point like a pyramid. The walls are 6 ft. by 12 ft. by 5 ft. high, and the tapered part is 6 ft. deep. How many tons of pea coal will it contain?

Answer.—The volume of the rectangular part is $6\times 12\times 5 = 360$ cu. ft., and the volume of the pyramid shaped part is the area of the base multiplied by one-third the height.

Volume then is $\frac{6\times 12\times 6}{3} = 96$ cu. ft.

Total volume of bin $= 360+96 = 456$ cu. ft. One ton of coal occupies 32.767 cu. ft.

Number of tons in the bin is $\frac{456}{32.767}$

$= 13.917$ tons.

* * *

Question.—A number of mushroom anchors are to be made. These are shaped like a segment of a sphere, and are made of cast iron. The diameter of the base is 30 in. and the height is 12 in. What would the weight?

Answer. — Rule, add three times radius of base squared to height squared, and multiply by height and also by .5236, or $15^2\times 3+12^2 = 819$.

$819\times 12\times .5236 = 5145.9408$ cu. in.

Weight $= 5145.9408\times .26$ for cast iron $= 1337.9$ pounds.

Question.—In the above example, what radius should the pattern-maker use to draw his templet by, or, in other words, what would be the radius of the sphere, of which the above segment forms a part?

Answer.—Diameter of the circle is equal to the length of the chord (diameter of segment base) squared divided by the height of the arc (height of segment).

Chord $= 30$ in. Height $= 12$ in.

Diameter of circle $= \frac{30^2}{12} = 75$ in $= 6\frac{1}{4}$ ft

* * *

Question.—A slide valve is 10 inches long and 16 inches wide. If the steam pressure be 125 lbs. per sq. in., what should be the size of the valve stem?

Answer. — Area of valve $= 10 \times 16 = 160$ sq. in.

Force pressing the valve to its seat is $160\times 125 = 20{,}000$ pounds. Taking the co-efficient of friction for unlubricated cast iron surfaces at .25, the force required to move the valve will be $20{,}000 \times .25 = 5{,}000$ lbs.

Taking the ultimate strength of steel at 60,000 lbs., and using a factor of safety of 10, we get for the working strength $\frac{60{,}000}{10} = 6{,}000$ lbs. per sq. in.

With this factor of safety we may consider only the tensile strength of the rod.

Area required $= \frac{5{,}000}{6{,}000} = .833$ sq. in.

Diameter $= \sqrt{\frac{\text{area}}{.7854}} = \sqrt{\frac{.833}{.7854}} = \sqrt{1.0606}$ $= 1{,}029$ in. Use a 1-inch valve stem.

* * *

Question.—A marine engine has an 8-inch crank shaft having five collars in the thrust bearing. If the bearing is subjected to a thrust of 18,000 pounds, what should be the dimensions of the collars?

Answer.—Allowing a pressure of 60 pounds per sq. in. on the bearing surfaces, the number of square inches necessary would be $\frac{18{,}000}{60} = 300$.

Area required for each collar $= \frac{300}{5}$

$= 60$ sq. in.

The inside diameter of the collar must be 8 inches.

Let D = outside diameter and d = small diameter = 8 in. Large diameter or $D^2 = \frac{A}{.7854} + d^2$ where A = area, or

$D^2 = \frac{60}{.7854} + 64 = 140.394$.

$D = \sqrt{140.394} = 11.85$ ins. dia.

The thrust on each collar $= \frac{18{,}000}{5}$ $= 3{,}600$ lbs. Shearing area $= 8\times 3.1416 = 25.1328$ in.

Using high safety factor, we allow shearing strength of 2,000 pounds per sq. in. Number of sq. ins. required $= \frac{3{,}600}{2{,}000} = 1.8$ sq. in.

Necessary thickness of rings would be $\frac{1.8}{25.1328} = .07162$ in., so that, for shearing strength, $\frac{1}{8}$ in. would be thick enough. The shearing strength need not, therefore, be considered. This collar would be weakest as a cantilever beam with length of $\frac{3.85}{2} = 1.92$ in. and a width of 25.13 inches.

Formula for this is $\frac{I}{C}\quad\frac{M}{S}$ in which

I = moment of inertia $= \frac{bh^2}{12}$ where b = breadth of section and h = height.

c = greatest distance from centre line of section to outside surface.

M = Bending moment $= 1.92$, or, say, $2\times 3{,}600 = 7{,}200$.

S = allowable stress $= 6{,}000$ lbs. per sq. in.

Formula becomes $\frac{bh^2}{12} \div \frac{h}{2} = \frac{bh^2}{12} \times \frac{2}{h} = \frac{M}{S}$, or $\frac{bh^2}{6} = \frac{7200}{6000}$, or $bh^2 = .2$, or $h = \sqrt{\frac{.2}{25.13}} = \sqrt{\frac{6}{.80}} = .28$, or 5/16-inch nearly. For practical reasons these collars would be made about 1-in. thick.

* * *

Question.—An engine makes 120 turns per minute, and is to drive a dynamo at 1,200 r.p.m. through a counter-shaft which is to run at 450 r.p.m. Engine fly-wheel is 8 ft. and dynamo pulley is 10 inches in diameter. What must be the diameters of the driving and driven pulleys on the counter-shaft?

Answer—Size of driven wheel on counter-shaft is $\sqrt{\frac{8\times12\times120}{450}} = 25.58$ ins. dia., or, say, 25-inch pulley.

Size of driving pulley on counter-shaft $= \frac{10\times1200}{450} = 26.6$, or, say, 27-inch pulley.

TURBO-GENERATORS FOR HIGH OUTPUTS AND SPEEDS.

By W. Kieser.

THE frequency of the alternating current supply adopted in most countries makes it essential to select the maximum speed of 3,000 revs. per min. for turbo-generators, or one-half of this figure for the next lowest frequency—that is, 1,500 revs. per min. In view of the great difference in the amount of material required to ensure the same steam consumption at these two speeds, keen competition has existed for some years in generator and steam turbine construction, with the object of producing a machine giving the largest possible output when running at a speed of 3,000 revs. per minute.

The output of the generator has been increased from year to year, chiefly by improving the ventilation of the machine, and by the more favorable distribution of the magnetic or current-carrying material. The progress made in the manufacture of the constructional materials has also contributed towards an increase in the outputs. It has been possible to carry out this increase without endangering the reliability of operation in any way.

The increase in the unit output of the steam turbine has also been accompanied by an increase in the size of the generators. The difficulty, however, in steam turbine construction lies in the fact that the quantity of steam which has to flow through the turbine attains a volume in the last low pressure stage corresponding to the available vacuum, which is too large for turbines of the customary construction. Two ways of solving this question present themselves. The high pressure stage has only a partial admission, while the diameter of the next runner is so selected that the resulting section of the steam passage through the blades has a given value, and therefore the blades themselves, do not fall below a certain minimum length. A dependence further exists between the output of the machine, or in other words, the available quantity of steam, and the ring surface over which the steam flows through the wheel.

At larger outputs also (always under the assumption that the speed $n=3,000$) a proportionately smaller diameter is thus obtained for the runners following the high pressure section, so that in consequence of the comparatively low peripheral speed for this part of the turbine, it is necessary to select a low steam velocity. The small runner diameter, however, will not permit the necessary quantity of steam to pass through the last low pressure stage with a good efficiency when the vacuum is high. Thus, even when the blades are constructed as long as possible, it is necessary to select a much larger diameter and higher steam velocities for the last runner. For this purpose the runner must be specially rigidly constructed in order to give it the necessary strength.

The second solution is found in the employment of two wheels placed in parallel in place of the last low pressure runner, independently of the size of the runners following the high pressure section; it is then necessary to make special provision for diverting the steam from the runner next to the end one to the latter of the two wheels forming the last stage.—A. E. G. Journal.

CRANE ACCIDENTS

THE practical immunity from crane accidents in many plants has been traced to a system of careful and regular inspection, which forestalls failure of a weak or defective part by locating the weakness or defect before it becomes dangerous. Loose bolts, loose keyways, loose set screws, hot bearings, worn gear teeth, worn wheel flanges, or worn sheave grooves; motor brushes, limit switches and other electrical devices which are out of adjustment, as well as clogged oiling devices and many similar conditions, are revealed through the inspector's vigilance. Flats in wheels, spreading or creeping of rails, loose or uneven rail joints, settling of a section of the runway, are some of the important defects that will come under his watchful care.

The spotting of lacquered goods is seldom, if ever, to be attributed to the fault of the lacquer. The real cause is to be sought in the condition of the surface of the castings. Practically all castings are porous and some parts may be found to be more porous than others. The larger pores will retain a proportion of the solutions in which the castings have been dipped and do not get rid of them in hasty rinsing. More efficient cleaning is the general remedy to be applied.

CONCERNING GAS ENGINE GAS CONSUMPTION.

AS an average figure, it may be stated, says a writer in The Power User, that a gas engine is capable of efficiently utilizing about 25 per cent. of the fuel supplied to it—that is to say, for every 10,000 heat units contained in the gas, 1 b.h.-p. will be available for transmission from the pulley or flywheel for the space of one hour; 1 h.-p. being the equivalent of 2,545 B.t.u. of heat consumed per hour. With town gas of the value of 500 B.t.u. per cubic foot, therefore, 20 cu. ft. will be required for every brake horse-power developed for one hour. With producer gas of 130 B.t.u. per cubic foot, the hourly consumption would be about 77 cu. ft., and so on for other gases, according to their caloric value.

Statements of gas engine performances based on the output of brake horse-power only hold good for engines working at a uniform load approaching the maximum, and consequently, when the mechanical efficiency is the greatest and therefore, according to the increasing proportion of frictional horse-power with lower outputs, so the rate of consumption (but not the actual consumption) at the lower loads will be correspondingly higher.

Statements as to gas consumption per i.h.p., however, are not affected by the mechanical efficiency in the same manner. Modern gas engines can develop 1 i.h.p. for one hour at a thermal efficiency of 30 per cent., being practically the equivalent of 25 per cent. on the brake horse-power basis—and this figure is practically constant for all but the lightest loads, when the relatively cool internal temperatures and slower combustion reduces the thermal efficiency. Thus it may be said that with town gas of 500 B.t.u. per cu. ft, 1 i.h.p. will require 17 cu. ft. per hour; and with producer gas 65 cu. ft., and so on.

To gain an idea of the possible variation of the increased rate of consumption on the brake horse-power basis, on reduced loads from the above figures relating to town gas let it be assumed that the frictional horse-power is constant between full load and half load, then an engine requiring 20 cu. ft. per brake horse-power hour at full load will need 24.3 cu. ft. per brake horse-power hour at half load, or an increase of slightly over 20 per cent. in the rate of consumption. All the same, the rate of consumption on the indicated horse-power basis would be constant, the difference on the brake horse-power basis being merely that due to the proportionately higher frictional losses.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

FOUR-WAY DRILLING MACHINE.

THIS four-way drilling machine was designed and built specially for the Ford Motor Co., of Detroit, Michigau, for drilling four holes simultaneously in their universal joint rings. The rings, 3⅛ ins. in diameter, are held in individual fixtures, several of these fixtures being used, so that while one ring is being drilled another fixture is being loaded. On completion of the drilling of the four holes, the main fixture on the machine is unloaded and another ring already clamped in a subordinate fixture is reloaded into the main fixture ready for operation. The general features of this machine are as follows:

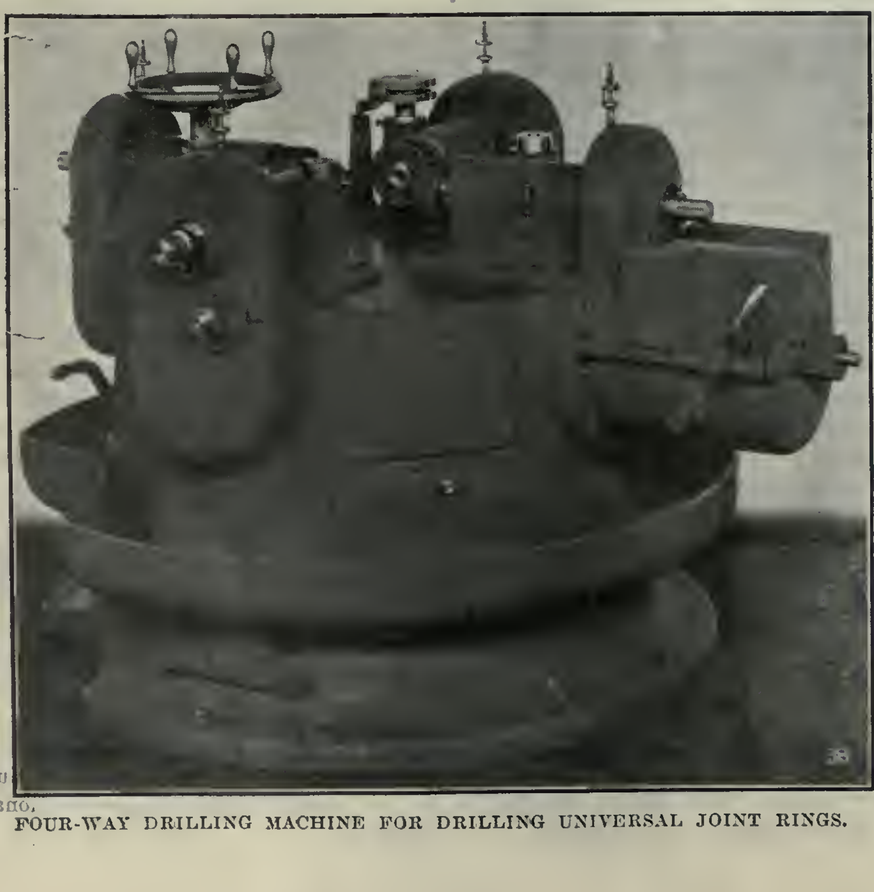
The spindle speed is obtained from a main driving pulley at one side of the machine, and power is delivered to each of the four spindles through the medium of spur gears, shafting and bevel gears. The heads are securely fastened to the main base so as to maintain as nearly as possible absolute alignment and accuracy of right angles of the holes to one another. The feed mechanism is of the rack and pinion type, power being delivered to each of the spindles by a large bronze worm gear and hardened steel worm.

In order to start the feed, a lever conveniently located at the operator's left hand engages the worm and worm gear, and, when the spindles have traveled their proper distance, an automatic knock-off cam, located at the top end of one of the rack pinions, compresses the rod and automatically trips the feed mechanism. The spindles are then returned to their original starting position by the operator, who can control their return by the hand wheel shown in the head at his left hand.

The driving gears are all of the helical type; all bearings are bushed with the best quality phosphor bronze and, wherever possible, the shafts are double supported. The lubricating system is taken care of by a pump and piping leading to each individual bearing, providing thereby a generous supply of oil. This arrangement permits continuous cleaning out of the bearings, the oil draining back through a main source of supply, where it is filtered before being again pumped through the bearings.

The general dimensions of this machine, which is a product of the Reed-Prentice Co., Worcester, Mass., are 6 ft. 6 ins. wide, 5 ft. 6 ins. long, and 4 ft. 6 ins. high. The weight is approximately 7,000 lbs.

COMBINATION FIXTURE SOCKET, DIM-A-LITE AND SHADE HOLDER.



FOUR-WAY DRILLING MACHINE FOR DRILLING UNIVERSAL JOINT RINGS.

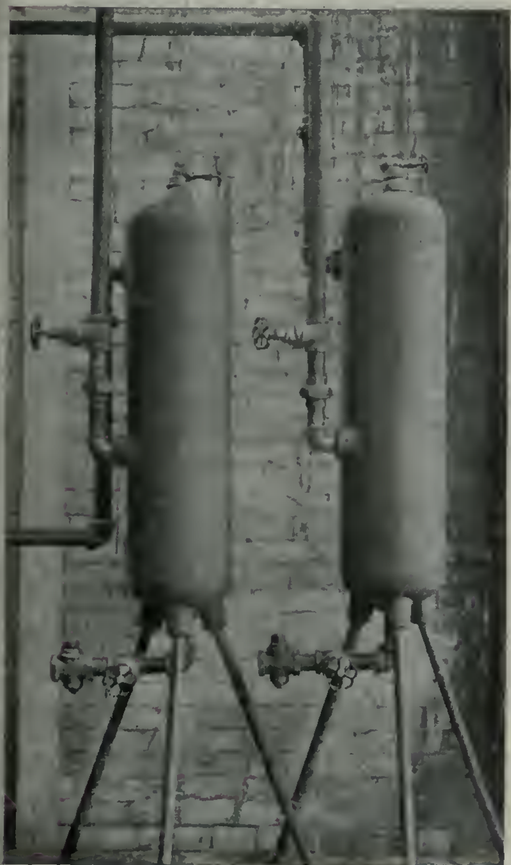
COMBINATION FIXTURE SOCKET, DIM-A-LITE AND SHADE HOLDER.

THE accompanying illustrations show a new type of dim-a-lite, recently put on the market, which is a combination of a fixture socket, a dim-a-lite, and a shade holder. It is made to be fastened permanently to the fixture stem with thread and set screw, and wired to the chandelier or fixture in the same manner as an ordinary socket. The dim-a-lite as a portable attachment that can be easily unscrewed from the fixture socket and removed is well known, but this new type was designed to meet a demand from institutions, hotels and other public places for a dim-a-lite that could not be removed or stolen.

The dimming features are the same as in the standard pull chain dim-a-lite, but the operation is entirely different. Instead of pulling a chain to obtain the different degrees of light, a slight turn of the shade is all that is needed to get the five changes of light; viz., full-on, dim, low, night-light, out. The dimming is effected by means of a series of helically wound resistance coils, properly insulated and connected to contact bars.

The resister drum is but $1\frac{1}{2}$ ins. in diameter and 1 in. long, while the coils are all zero temperature resistance co-efficient wire moulded under pressure in a stone-like insulating composition, known as dielite. The wires are well protected from oxidation or mechanical injury, as the wire and dielite form a solid body. By turning the shade, this resister drum is rotated, and the various degrees of light are secured, as the point of contact shifts from one commutator bar to the next.

One of the interesting features of this dim-a-lite is that the light can be turned on and off without the need of a key or pull chain. The absence of a chain makes it a particularly neat and attractive socket for high-grade fixtures. The device is manufactured by the Wirt Company, Philadelphia.



NEW DOUBLE PURPOSE FILTER

NEW DOUBLE PURPOSE FILTER.

THERE has recently been put on the market a simple and ingenious device for the purpose of continuously removing impurities from the water as they are precipitated in the boiler. The system depends for its success largely upon a rapid forced circulation of the water in the boiler, the value of which as a help to raising steam is well known to all engineers. This forced circulation does not require pumps or other mechanical means for its maintenance, but is brought about by the arrangement of the apparatus itself.

The Scale Feature.

The principal scale forming materials are known to be the carbonates and sulphates of calcum and magnesia. The carbonates are precipitated at about 212 degrees F., or the boiling point of water at atmospheric pressure, while the sulphates are not brought down until a temperature of 300 deg. F. is reached. This represents a pressure of about 52 pounds gauge, the complete action taking place between this and 60 pounds. It is seen that the carbonates or soft scale can be removed in an open heater, which has a filter attached. The usual method of dealing with the sulphates which form the hard scale is to add soda ash or potash to the feed water before it enters the heater. The action of these substances is to change the sulphates to carbonates or to soft scale, which can then be removed in the filter, as before stated.

The new device does away with the use of compounds of soda, etc., and all auxiliary filters, in that with it the carbonates may be removed before the water enters the boiler in the usual way. The sulpahtes are precipitated in the boiler, but, on account of the rapid circulation, are not allowed to settle there, being carried to the filter and there deposited.

Filter Details

Two of these filters are shown in the accompanying half-tone. The body is of cast iron, and is in a single piece. The lower pipe connection is for the purpose of blowing off the accumulated impurities; the middle ones comes from the top part of the boiler just below the water-line, and the upper pipe goes down to the floor and rises to the lowest part of the boiler through the fire box. The filtering material is placed in the top part of the filter and, on account of the facility for cleaning by blowing off, lasts indefinitely. The section which goes through the fire box is larger than the rest of the pipe system, and passes upwards in a steady slope through the hottest part of the fire. This produces a strong circulation similar in principle to that obtained in the hot water heating system and the ordinary kitchen range boiler.

It is seen that if the piping be well lagged, little or no loss of heat is encountered, and that an amount of water equal to the capacity of the boiler would pass through the filter a number of times in the course of a day. Also with this forced circulation added to the natural circulation due to the steaming of the boiler, mud, precipitated salts and other such imprities would have little opportunity of settling upon the boiler heating surface. The advantages to be derived from the enforced circulation from a steaming point of view would not be so marked in water tube boilers as in tubular boilers, where no definite circulation exists. The above apparatus is known as the Carter Filter, and is made in Toronto, Canada, by the Siemon Company, Ltd.

THE AMALGALINE SYSTEM OF METAL JOINING.

A DEMONSTRATION was given at the Institute of Marine Engineers on September 21, of the Amalgaline system of metal jointing, by Mr. Harden, the inventor of the process. Before giving the demonstration, Mr. Harden read a short paper, in which he stated that the process effected a complete fusion between the surfaces joined. In marine work, the principal uses to which the system is applied are the flanging of pipes the seaming of lead used in refrigerating chambers and general sanitary work. The system of flanging now in general use among ship-builders on the Clyde, the Tyne, the Tees, and the Wear, is not confined to the use of small pipes, but is used in an ordinary way on pipes varying in bore from 3 in. to 9 in. Like lead burning, it is an autogenous process, but instead of using an intense local heat, the fusion is effected by the action of the amalgaline on the surfaces it is in contact with, forming an amalgamation between the lead of the flange and the lead pipe.

The material used is in the form of a mtallic ribbon, .002 in. in thickness, practically a pure metal, which, when placed between the surfaces of lead and subjected to heat, fuses at a temperature of 160 degs. C. lower than the actual fusing point of lead, and in fusing it causes the lead surfaces to run together at a lower melting point than that of the body of the lead. This running together has an autogenous effect and, by intermolecular absorption, the minute particles of amalgaline are dissipated into the body of the lead, which, by reason of the absorption, becomes stronger at the junction than elsewhere. Demonstrations of flanging and various other uses of the process were given.

"QUAZARC" WELDING.

IN the paper by T. G. John on "Shipbuilding—Present and Future," mention was made of the quasi-arc process of welding. As its name implies, this method is an electrical one, but differs from its predecessors in the fact that it is neither a pure fusion of the original metal nor a weld with addition of molten resistance metal. It has the advantages of both these. The article to be welded is connected to one pole of the dynamo while the other pole is attached to a special composite electrode. This consists of the metal to be used in the weld surrounded by slag instead of carbon.

The Electrode Feature.

The marked superiority which is claimed for these electrodes is due to the non-volatile character of the slag so that, when the arc is struck, the slag remains as a fluid mass which protects the molten metal from oxidation. As the electrode moves along, it melts uniformly, leaving behind the pure metal in the weld, protected by slag which eventually scales off leaving a bright surface.

The character of the weld is said to be most uniform and free from cavities and has little effect on the nature of the surrounding metal, which is only affected to a distance of 1.50 inch from the added metal, although the actual combination of old and new is complete and gives a tenacity greater than the unwelded metal possessed. The special fields in which the process has successfully replaced older and more cumbrous methods are riveting, reinforcement of shafts, and welding of girders. The electrodes can be obtained from Slaughter & Co., Ltd., Caxon House, Westminster, who are the sole patentees.

BALL-BEARING CLUTCH.

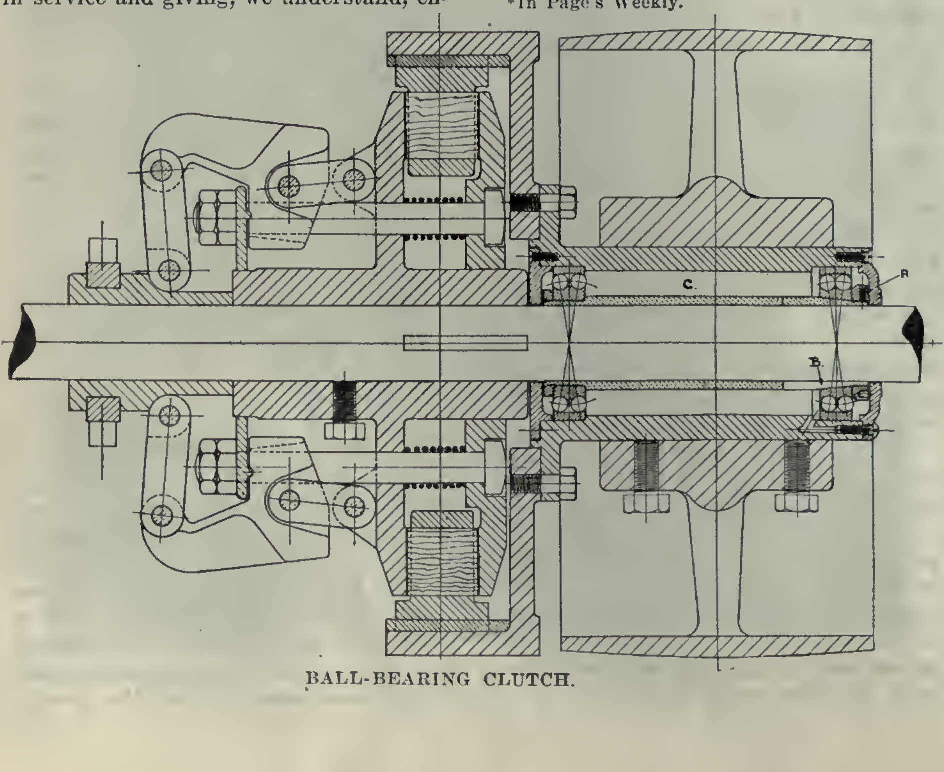
THE drawing shows a universal giant friction clutch fitted with Skefko double-row, self-aligning ball bearings. This is a new ball-bearing clutch recently placed on the market by the Canadian Fairbanks-Morse Co., Toronto, several being in service and giving, we understand, entire satisfaction. This clutch is thoroughly modern, and embodies many points of excellence in design and construction. It is of compact form, unusually strong, and is easily applied and readily adjusted. The clutch is complete within itself, and does not require specially constructed appliances to be fitted to it.

The extended hub fitted with ball bearings is locked to the shaft when in position by the one nut A, which causes the split taper sleeve B to grip the shaft with great pressure owing to the fine pitch thread and very slow taper on the sleeve. Any pulley, gear, rope sheave or sprocket may be fitted to the hub in the usual manner.

The use of ball bearings in a friction clutch has many advantages, the chief being that of durability and freedom from trouble due to heating of hub through the lubrication being thrown by centrifugal force away from the shaft surface. The chamber C need be filled with lubricant only once every six months.

The outer rim of the clutch covers and protects the friction surfaces from dust, dirt or other foreign substance, making the apparatus especially suitable in cement mills and elevators, or places where dust or gritty substances are afloat in the air. The friction surfaces, which have a large area, are wood and iron. Selected hardwood blocks are fitted into the friction disc so as to present two end grain surfaces, which come in contact with the two iron surfaces of the friction plates.

The mechanism for drawing the friction surfaces together is powerful, and can be easily adjusted to take up any wear that may occur. When thrown into or out of engagement, the friction disc and follower plates adjust themselves within the clutch, thereby eliminating end thrust.



BALL-BEARING CLUTCH.

The Successful Design of Worm and Screw Drives*

By Helix

A worm or screw drive was, until quite recently, looked upon as an inefficient, power-consuming arrangement, the use of which should be avoided wherever it was possible to employ any other form of transmission device. Even at the present time there are many people who look with suspicion on any form of screw drive.

IF a worm or screw drive made fifteen or twenty years ago be closely examined it can be quite easily understood that a great deal of power would be wasted by its use, and that, notwithstanding an almost unlimited application of oil, considerable friction and wear would be inevitable. It is also unfortunately true that some modern designs display a woful lack of knowledge on their designers' part of the fundamental principles of successful worm and screw design.

It should be remembered that inefficiency and lack of durability are practically synonymous terms, so that inefficiency almost inevitably results in a high rate of wear. A moment's consideration will show why low efficiency means that of the power put into a machine or mechanism only a comparatively small proportion is actually taken out in the doing of useful work. This being the case, it is perfectly evident that the power lost has been dissipated in its transmission, and the only way in which it can be so lost is in overcoming the friction of the sliding parts.

Friction is the chief cause of wear; therefore, if the frictional resistance is unduly high it will probably be found that the rate of wear will be very high also. Even if the actual visible wear is not very great, the tendency to wear will be. It will, therefore, be recognized that the power lost is really worse than wasted, because its only function is to wear out the sliding elements of the me-

*In Page's Weekly.

chanism. It was on account of the low efficiencies obtainable in the designs then available that the worm type of drive was held in such small favour in the past.

The efficiencies were so low that probably in a large majority of cases by far the greater proportion of the power transmitted was dissipated in overcoming friction, with the result that the parts were very soon worn out. That this state of affairs is not necessarily inevitable is now generally recognized, and it is also more or less apparent that the failure of the early designs was due to a failure to understand the main principles upon which depend the success of this form of drive.

Present-day Experience.

In the light of more recent knowledge of the subject, it is now quite legitimately claimed that so far as efficiency is concerned, a correctly designed and accurately made worm drive is practically as good as any other form of drive; while for smoothness of action and comparative noiselessness of operation, it is probably one of the best in existence. A proof of this is to be seen in the extensive adoption of worm-driven rear axles for motor cars in place of the now nearly obsolete bevel gear drive. It will be admitted that the durability and efficiency of the worm drive must be above reproach, to merit its adoption in such examples as the one quoted. It should, therefore, prove of interest to discuss in a rather elementary way the essential requirements of a successful worm or screw drive; but, before proceeding further, it may be best to briefly explain some of the definitions used, so that a clearer understanding of what follows may be obtained.

Worm Definitions.

Fig. 1 shows a worm having a right-hand single thread. The linear or axial pitch P is the distance from a point on one thread to a corresponding point on the next thread, measured parallel to the axis. The normal pitch N is exactly similar to the axial pitch, except that it is measured normal (that is, at right angles) to the thread. The pressure angle or angle of obliquity D is the slope of the sides of the thread taken on a section through the axis. This pressure angle varies from nothing in the case of a square thread to 30 or more degrees. The standard in most general use is without doubt that of the Brown & Sharpe Co., which is 14½°, but some firms are now adopting a 20° standard, while others again favor 22½°. The helix angle B is the angle the thread makes at the pitch circle normal to the axis.

A single thread worm is one in which there is only one thread, which is continuous; while a double or multiple thread worm has two or more separate and distinct threads. The lead is the distance a point on the pitch circle circumference of the worm gear would move in one revolution of the worm. In a single thread worm, the lead and axial pitch are equal, while in a double or triple thread worm the lead is two or three times the axial pitch respectively. A useful rule to bear in mind regarding the hand of worms and screws is that a right-hand screw advances through its nut when turned in a clock-hand direction. The co-efficient of friction is the ratio of the pressure (between two surfaces) to the force required to slide the two surfaces on each other. A frictional co-efficient of .1 means that the force required to cause sliding between two

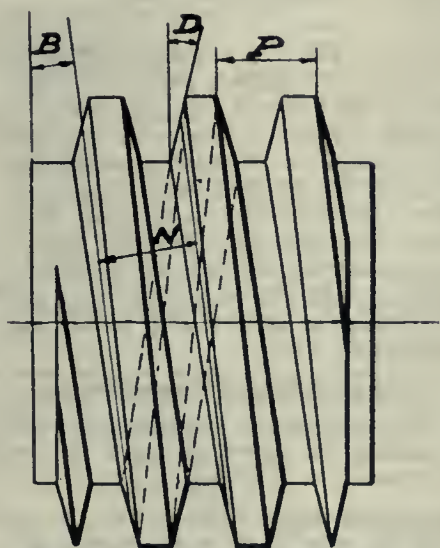


FIG. 1. RIGHT-HAND SINGLE-THREAD WORM.

surfaces will be .1 times the pressure between those surfaces.

Successful Worm Design.

Having stated some of the most important definitions, we are now better able to make clear the requirements essential to successful worm design, and since the action of a screw thread is practically identical with that of a worm thread, most of our conclusions will also be equally applicable to the design of screws. To secure the highest efficiency, without doubt the most important requirement is a large helix angle (as near 45° as possible), and since this angle varies inversely, as the diameter of the worm and almost directly as the lead, it follows that the diameter should be as small and the lead as large is possible.

Fig. 2 shows a single thread worm, ½-in. lead, 6-in. diameter, while in Fig 3 a 2-in. diameter, 2-in. lead quadruple thread worm is represented. In one revolution of the latter the worm gear would be turned through 4-N of a revolution (N being the number of teeth in the gear), while the larger worm would have to make four revolutions to turn the gear an equal amount. Referring to Fig. 4, we have the circumference of the larger worm straightened out, AB being the helix and EF the circumference. Similarly in Fig. 5 CD is the helix of the smaller worm and GH the circumference.

It is evident that in four revolutions of the larger worm the length through which sliding has taken place will be four times AB (Fig. 4), while to accomplish similar results with the smaller worm (that is, move the gear through 4-N of a revolution), sliding has only operated through a distance of CD (Fig. 5), obviously a much shorter dimension. Though the normal pressure between the thread of the worm and the teeth of the gear is somewhat greater with the smaller worm, the losses due to friction will be considerably less than with the larger one. It must also be pointed out that exactly similar reasoning applies to the end thrust friction, so that a large helix angle proves of benefit in two ways.

The actual efficiency for each of the two arrangements (not including the end thrust) would be about 85 per cent. and 35 per cent. for the smaller and larger worms respectively, but with the end thrust included, these efficiencies would be reduced to 75 per cent. and 24 per cent. This means, of course, that the frictional loss is 76 per cent. in one case and 25 per cent. in the other; obviously a saving well worth effecting if conveniently possible.

Anti-Friction Thurst Bearing.

Another important element in worm design is the provision of an anti-friction thrust bearing of the ball or roller type. Twenty years ago, ball or roller bearings were not as reliable as at the present time, while they certainly were not made in such a widely adaptable range of sizes. There can now be no excuse under this head, as ball or roller bearings can be obtained in practically any size, while their load-carrying capacity and reliability can be definitely depended upon. That a ball or roller thrust is of great importance is shown by the two sets of efficiencies given above relating to the worms shown in Fig. 3 and 4. Neglecting end thrust, these efficiencies are 85 per cent. and 35 per cent., while the end thrust (assumed to be taken on a bearing of the ordinary collar type) reduces them to 75 per cent. and 24 per cent. respectively. Since ball thrusts are practically frictionless, it naturally follows that in the examples given the loss of efficiency due to the end thrust would be almost entirely saved by the use of anti-friction thrust bearings.

It should also be noticed that whereas with the wide angle worm a tall thrust only increased the efficiency by slightly more than one-eighth in the other example the increase is from 24 per cent. to 35 per cent.—that is, nearly 50 per cent. It may, therefore, be stated as a general rule that the lower the efficiency of the worm the greater the need and effectiveness of a ball thrust.

The Co-efficient of Friction.

The third important consideration in worm and screw design is the co-efficient of friction. Since, as previously mentioned, all the transmission losses are due to the overcoming of frictional resistance it is obviously necessary to arrange the design so that the co-efficient of friction will be as small as possible. The contact surfaces of the gear and worm—that is, the teeth and thread—should be as smooth as possible, while the load-carrying capacity should be great enough to ensure that these surfaces will not cut up or seize when under load. The materials from which the worm and gear are made have also some influence in this direction, and the combination most generally used seems to be phosphor-bronze for the gear and hardened steel for the worm, the latter

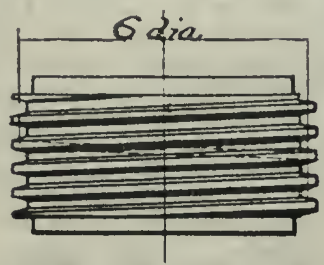


FIG. 2. SINGLE-THREAD WORM, ½-IN. LEAD, 6-IN. DIAMETER.

in many cases being ground on the thread after hardening.

Lubrication.

Another item, possibly even more important than the question of materials, is the thorough lubrication of the worm and gear. By thorough lubrication is meant that which provides a film of oil between the sliding surfaces, a condition which should be met by all lubrication if the best results are desirable. To allow of this, the surfaces must, as stated, be perfectly smooth, and the tooth curves correctly formed. The latest experiments seem to suggest that a greater obliquity angle by giving flatter tooth curves, increases the area of contact and, as a result, allows of more efficient lubrication. It may be mentioned that the hollow face worm wheel with hobbed teeth was introduced to give a greater area of contact. Though the contact is, theoretically, only a point, it is reasonable to assume that its area is considerably greater than if the worm wheel teeth were not cut to embrace the worm more or less intimately.

It has, however, been claimed that one of the most efficient types of worm drive is that in which the worm shaft is set round at an angle equal to the helix angle, thus allowing the worm to engage with a straight and spur gear. An adaptation of this idea is used in the well-known Seller's drive for planing machines, the table rack being driven by

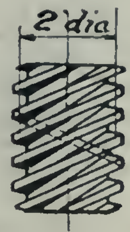


FIG. 3. QUADRUPLE THREAD WORM, 2-IN. DIAMETER, 2-IN. LEAD.

a worm. Fig. 6 is a sketch diagram of such an arrangement, particular attention being drawn to the fact that the cutting pressure is distributed over several teeth, while the wear is equally distributed over the full width of the rack face. With a correctly designed, effectively lubricated worm drive the wear is very small indeed, because, practically speaking, there is scarcely ever an actual metal to metal contact on account of the film of oil.

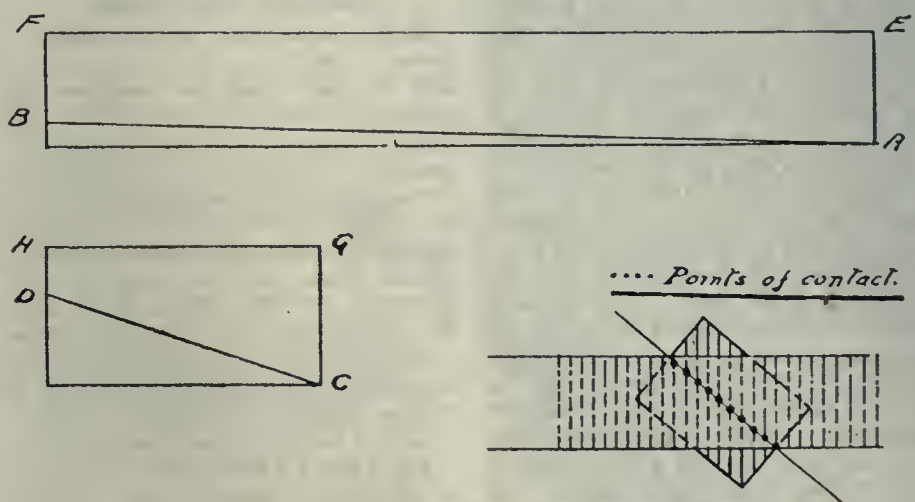
Highest Efficiency Fundamentals.

The fundamental requirements, then, to secure the highest efficiency may be enumerated as follows:—

(1) The helix angle should be as large as possible up to 45 degrees; (2) the worm diameter must be small and the lead large; (3) the worm gear should be of phosphor-bronze; (4) hardened steel worm with thread ground after hardening; (5) the drive should be totally enclosed and run in oil; (6) axial thrust of the worm taken on a ball bearing; (7) to give maximum contact area the wheel should be either hollow face and hobbed or else a spur gear with the worm swiveled as in the Seller's drive. With the exception of 3, 4, and 7, these requirements are equally necessary in the successful design of screws.

Limitations of space prevent a complete treatment of the subject; the various types and styles of designs have hardly been touched upon, while the methods of manufacture have been entirely ignored as outside the scope of the present article. It is, however, hoped that sufficient has been written to at least indicate the requirements necessary to efficiency, and if the ideas outlined are closely followed no doubt reasonable success is assured—in any case the features enumerated can be taken as fundamental foundations on which can be constructed economical and efficient worm or screw drives.

Factories Busy at Renfrew, Ont. — Logans, Ltd., a 60-year-old concern, which has been closed down for two or three weeks prior to the breaking out of hostilities, is now being operated at full capacity day and night. The Renfrew Knitting Co., where only a small portion of the staff had been employed for some time before the war began, is also running at full capacity, and with as much overtime as its eighty employes can stand. In the plant of the Renfrew Textile Co., a temporary shutting down has also been replaced by the employment of a full staff and considerable overtime. While it is true that each of these three factories secured a share of the Dominion Government's textile order, the increased activities are largely due to increased orders from regular customers. All three factories report a considerable improvement in this direction since the breaking out of hostilities.



FIGS. 4, 5, 6. DESIGN OF WORM AND SCREW DRIVES.

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PRINCIPAL CONTENTS.

MEETING THE SITUATION.

To at one and the same time increase the factory quality and quantity output so as to meet not only competition, but to offset the efficiency practised in purchasing one's product as exemplified in the methods to be noted of doing so, is admittedly shrewd business generalship. That only a competitors' methods, plant and equipment are considered and given prominence in shaping business conduct seems to be an all-too-common practice. We seem to fail to realize that much can be learned from those with whom we trade, and as an example of what is available in the direction indicated, the following incident is rehearsed.

A strenuous kick was registered against the editorial department of our mechanical papers in that they, in ordering cuts of illustrations, successfully contrived by bunching these to make the minimum cut size as to cost, inoperative. Naturally, we took the kick as a compliment; however, occasion was taken by our representative to point out to the complainant that it was his business to legitimately combat the situation by increasing the detail efficiency of his plant and, in the latter connection, one or two specific instances were indicated as to where this could easily be done.

Is it not the case that too many of us adopt the "growler" attitude because a competitor or even a customer through organized and efficient methods gets ahead of us. We fail to note, yes, have not at this late day realized that the continuous and enlarging success of our enterprise is dependent to a great extent on what others are consciously or unconsciously laying to our hand and teaching us. We seem to forget that what another can do, so can we likewise if we set ourselves.

The whole fabric of business intercourse, producing and purchasing, hinges on this system of appropriating to ourselves what is worth while, and in the suppression of our discontent and harsh criticism of the progressive methods of others.

ORGANIZATION EFFICIENCY TESTING TIME.

A PERIOD of business depression such as the industrial world is now experiencing may not be altogether so unsalutary both in its present and after effects as would seem at first sight to be unmistakably probable. We refer to the opportunity it affords of testing the individual and collective efficiency of an organization. In boom times and even in normal times of business, although perhaps more noticeable in the former, less effort, comparatively speaking, is needed, and certainly less display of resourcefulness is required than in circumstances like the present. In the matter of results, it matters not the nature of the enterprise, neither does it concern only those who manage or direct, for in the ultimate analysis each individual unit must bear a part.

Ebbing business returns in the experience of an organization may or may not be due to a widespread general depression, nevertheless, be it from such a cause or simply an isolated happening, there is an unmistakable call to search out and get rid of the deadwood.

Reference to this being a testing time for our captains of industry in the matter of initiative in securing business in new directions has already been made in these columns. Slowing-up of the wheels of industry permits of opportunity by a management to look more closely at and get into more intimate touch with the individual worker. It operates to bring out what lies below the surface, if such there be, and enables a line of action to be framed and a disposition of forces made that will not only meet existing conditions successfully, but will lead to greater and more extended future achievement.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 65	
Lake Superior, charcoal, Chicago	15 75	
Ferro Nickel pig iron (Soo)	25 00	
	Montreal.	Toronto.
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 50	17 25
Victoria, No. 2X......	18 25	17 00
Victoria, No. 2 Plain..	18 25	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto	2.00
Common bar iron, f.o.b., Montreal.	2.00
Steel bars, f.o.b., Montreal	2.00
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.05
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.70
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws....	75 & 5
Stove bolts	80 & 7½
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes.	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh ...	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh..........	26 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 50
Copper, crucible	10 00	9 50
Copper, unch-bled, heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	10 75	8 50
No. 1 compos'n turnings	8 50	8 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings ...	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Sandard	Buttweld Black	Gal.	Lapweld Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in...	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ..	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b. Toronto.

METALS.

	Montreal.	Toronto.
Lake copper, carload	$14 25	$13 50
Electrolytic copper	14 00	14 00
Castings copper	13 50	13 50
Spelter	6 00	6 00
Tin	33 00	33 00
Lead	4 75	4 75
Antimony	16 00	16 00
Aluminum	20 00	21 00

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	6.40
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine, single bbls.	0.67
Linseed oil, raw, single bbls.	0.63
Linseed oil, boiled, single bbls.	0.66
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.16
Lard Oil, per gal.	0.60

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	$1.10 lb.
Leather in sides	$1.00

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3.45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4 95
1 inch	8 05
1 1/4 inch	12 65
1 3/8 inch	15 30
1 1/2 inch	16 50
1 5/8 inch	19 40
1 3/4 inch	22 50
1 7/8 inch	25 80
2 inch	29 30

Prices quoted are cents per foot.

CAST IRON PIPE.

6 inches and upwards	$32 00
4 inch	33 00
Specials per 100 lbs.	3 00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1 1/2-in.	$37.50	$30.00	$17.50
33/64 to 3/4-in.	41.25	33.00	19.25
7/16 to 1/2-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2 50	$2 60
Canada plates, ordinary, 52 sheets	3 70	3 85
Canada plates, all bright	3 90	3 95
Appollo brand, 10 3/4 oz. (American)	3 90	3 90
Queen's Head, 28 B.W.G.	4 30	4 35
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4 00	4 20

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Oct. 19, 1914.—No particular developments fall to be noted in the iron, steel and allied markets, the prevailing dullness of the past two months maintaining its hold in industrial circles generally. A break in the monotony is freely prophesied from Pittsburgh, and even should the improvement be in large degree downward, as is anticipated, there is quite the possibility that the shake-up will lead to increased activity all round.

Steel Market.

What business there is passing in the steel market continues to be of the small lot variety. Sales of structural shapes are at a low ebb, due in large measure to the suspension of building operations on the approach of winter. The wide distribution of orders for shells for military purposes has served to fill in and to increase the activities of many of our leading industrial enterprises, and with the continuance of the fighting in Europe, the demand for these and other engineering equipment commodities is likely to increase.

Machine Tools.

Throughout all lines of the machine tool trade, much inactivity in still in evidence. A few sales have been reported in connection with the equipment of some shops for the handling of steel shells.

Pig Iron.

The pig iron situation, although bad, gives promise of improving in the near future. Several furnaces in the Pittsburgh district have blown in with the idea of making high manganese pig iron. The nominal quotations have not been tested to any great extent, although showing a tendency to weaken when business was presented. There are many foundries whose operation will no doubt be resumed at an early date because of the increasing demand for work which can no longer be sidetracked.

Metals.

As in the case of iron and steel, the metal markets too show stagnation. The price of copper has declined somewhat. Bolivia, which has for years carried on an immense trade in minerals with Great Britain and Germany, consisting mainly of tin and copper ore, is diverting this now to the United States, and there is a rumor that a tin smelter will be erected in Bolivia.

Toronto, Ont., Oct. 20, 1914.—Little change is to be nothed in the general industrial situation this week. The trend of business is satisfactory, considering the present state of affairs, and the outlook is gradually improving. A condition has, however, been reached from which there is little probability of any very marked improvement for some time. Trade conditions have reacted from the set-back received during the initial stages of the war, and are now on a much firmer basis; confidence has been restored to a more normal degree. The present depression, following on several months of a similar state of things, has been exceedingly trying on manufacturers and others, but it is reasonable to suppose that the worst is over and that the next change will be for the better.

The firms supplying military equipment of various kinds are working at full capacity, and will no doubt continue to do so for some considerable time. This business has given a welcome impetus to trade, and has done much to improve industrial conditions all round. Normal conditions cannot be expected, however, until the war is over. With such extraordinary conditions in Europe, trade here is bound to suffer; the surprising feature is that business has not been more seriously affected. For those concerns which are slack, this is a good opportunity to put their plants in order ready for the time when business picks up again, for at the conclusion of the war there is bound to be a largely increased demand.

Business men have, on the whole, handled the situation in a creditable manner. During the early weeks of the war there was a tendency to close up tight, but the fallacy of such a proceeding soon became evident, and now those concerns not engaged upon Government orders are doing their best to keep things going, and are ready to take advantage of the situation immediately an improvement is manifest. It is to be assumed that those firms able to secure foreign business will lose no time in getting in touch with the various markets, and that they are making all necessary arrangements for securing orders. We understand that several firms in the States have already despatched an increased force of travelers to South America, and also to Canada, with a view to obtaining as much as possible of the portion of trade that formerly went to Germany.

Steel Markets.

There is no improvement in the iron and steel markets, which are distinctly quiet. There is little hope of improvement in the immediate future unless the efforts to obtain new English and foreign trade are successful. It is perhaps rather early to expect much business from these markets, although some orders have already been placed in the United States. It remains to be seen how much of this business can be obtained by Canadian manufacturers. The first shipment of wire nails and rods, etc., recently ordered from England, has been despatched from Sidney by the Dominion Steel Corporation. Orders for shells continue to come in from the War Office, and the firms interested are working their shell departments to capacity. This business is stimulating certain sections of the trade, and will be of considerable benefit to those concerned.

Prices are showing weaker tendency, and steel bars, beams and angles are now being quoted $1.20 f.o.b., Pittsburg. Ferro-manganese is lower, being quoted at $68 f.o.b., tidewater. The continuation of dullness in domestic demand in the United States and failure of foreign business to develop into orders of appreciable size is more or less responsible for the weak market.

Pig Iron.

The pig iron market is extremely dull, the foundries only buying in small lots for immediate requirements, while other firms using pig iron are still operating at reduced capacity.

Machine Tools

There is little business being done in machine tools, and dealers report the market as being very quiet.

Metals.

The metal markets are dull, and the little business that is passing is of the hand-to-mouth order. Prices have a weaker tendency. Tin is easier at $33, while lead and aluminum are also a little lower.

Trade Gossip

The John Inglis Co., Toronto, has received from the Dominion Government a large contract for shrapnel shells.

Montreal, Que.—Damage which will probably exceed $10,000 was done on Oct. 8 by a fire which nearly destroyed the sash and door factory of Isaie Allard at 1360 Des Erables street.

The Independent Pneumatic Tool Co., Chicago, Ill., manufacturers of Thor pneumatic tools and electric drills, have appointed V. W. Robinson their representative in Michigan with headquarters at Detroit.

Vancouver, B.C.—It is reported that a party of Boston capitalists are in communication with the City Industrial Commissioner with a view to securing a suitable site for a contemplated box factory on the Fraser River.

F. J. Passino, the Michigan representative of the Independent Pneumatic Tool Co., has been appointed that company's representative in the southwest to succeed H. F. Finney, promoted to a position in the general sales office in Chicago.

E. Laurie & Co., Montreal, have received an order from the City of Montreal for a 24,000,000 gallon steam turbine driven pump to be made by the De Laval Turbine Co., Trenton, N.J. The pump will cost $47,000, and is to be delivered by next April.

Aid Canada's Industries.—Mr. Fred Stobart, purchasing agent for the British War Office, has arrived in Ottawa. He is here to meet the representatives of different Canadian manufacturers and secure supplies required by the army, particularly clothing, underwear, blankets and saddlery.

War Grist.—A contribution just received by the Naval Service Department is the gift of $2,500, worth of ship bottom composition paint for the use of the Canadian navy. The Martin-Senour Co. of Montreal, are the donors. The paint referred to is the only one of its kind manufactured in the Dominion, and will prove a very useful donation.

New Harbor Commissioner.—Word has been received from Ottawa that John Laxton of Parkdale, has been appointed to succeed Ald. F. S. Spence as the Dominion Government's representative on the Toronto Harbor Board. Ald. Spence has been a most energetic member of the Harbor Board since its inception, and was largely instrumental in carrying to fruition the extensive plans for improvement now under way.

C. P. R. Scholarship.—Sir. Thomas Shaughnessy announces, in a special circular, and on behalf of the C. P. R., one free scholarship, covering four years' tuition in the Faculty of Applied Science of McGill University, subject to competitive examination, to apprentices and others enrolled on the permanent staff of the company and under 21 years of age, and to minor sons of employees. This examination will be the regular entrance examination provided for in the annual calendar of the university, and will be held at the university and other centres throughout Canada in June, 1915.

Siemens Bros Employees and the War. — The employees of Siemens Brothers Dynamo Works have responded with great enthusiasm to the call to arms. A large number of men from their works and offices at Stafford, amounting in all to about 400, have already joined the forces, and, together with the reservists and volunteers from their head office, branch offices and other departments, the total amounts to over 520. The firm is arranging to keep the posts of all these men open, and ample provision is being made for all the dependents of those who have gone to serve.

The Mesta Machine Co., Pittsburgh, Pa., are now building for the Pennsylvania Steel Co., of Steelton, Pa., two gas blowing engines of 46 in. and 84 in, cylinder diameters and 60 in. stroke. These engines are believed to be the largest gas blowing engines ever built in the United States or on the American Continent. The gas cylinders and blowing cylinder are arranged tandem—that is to say, the air cylinder is directly back of the gas cylinder. An innovation, as far as American gas engines are concerned, is the use of a centre crank instead of an overhung crank. While it is possible to build large engines with overhung cranks, it is considered that the centre crank provides a more rigid construction. All of the company's large reversing engines have been built with centre cranks, and have been universally successful. Finally the blowing tub is equipped with the well known Mesta automatic plate valve (Iversen patent), which, since its introduction in 1911, has been a great success. With these valves, the efficiency of the air end is increased and the cost of maintenance and repairs reduced.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Welland, Ont.—Electro Metals, Ltd., propose to make an extension to their plant and it is announced that provision will be made for additional furnaces.

Quebec, Que.—Fire burned to the ground on Oct. 14, the plant of the Modern Joint Foundry Co., in Three Rivers annex. The company's offices are at Montreal. Nothing was left of the various buildings, and the damage is heavy, although covered by insurance.

Regina, Sask.—The new power house is rapidly nearing completion. The cost of the building will be approximately $170,000; the cost above ground level being $90,000, in addition to $36,000 for steel. The foundations and ground floor were constructed by the city by day labor at a cost of about $40,000. Up to the present time nearly $100,000 worth of machinery has been installed.

Redcliff, Alta.—Preparations are at present being made by the management of the Redcliff Rolling Mills for the extensive alteration and enlargement of their present plant. It is the intention of this company to instal machinery suitable for making all kinds of nuts, bolts, washers and spikes, and also to add a complete galvanizing plant. Mr. Husband, the manager of the mill, is at present in the east arranging details in connection with this work, and as soon as he returns operations will start to prepare the building for the new machinery.

Montreal, Que.—It is said that Sir Rodolphe Forget is the real purchaser of the plant of the Eastern Canada Power & Pulp Co., and that A. E. Bradbury of Ottawa, was acting for him in buying the plant recently for $200,000, after the company had been in liquidation for some time. Bradbury Bros. are the Ottawa correspondents of Forget & Co., and Sir Rodolphe was formerly president of the Eastern Canada Power & Pulp Co. Charles Donoghue, of the Donoghue Construction Co., is a close associate of Sir Rodolphe's, and it is thought that the plant will probably be operated by the Donoghue Company.

Municipal

Saanich, B.C.—Ratepayers have carried by-laws to expend $375,000 on a waterworks distribution system.

Orillia, Ont.—The town has raised $85,000 for waterworks extensions, work on which has already commenced.

Stratford, Ont.—The local Light and Heat Commission has voted $3,500 to the Canadian Patriotic Fund and $200 for Belgian relief.

Sudbury, Ont.—A by-law will be voted on by the ratepayers on Nov. 2, to provide for borrowing $10,000 for extensions to the existing sewerage system.

Montreal, Que.—Plans are being prepared for an extension to the filtration plant now under construction. It is proposed to increase the capacity to 90,000,000 gallons per day.

Toronto, Ont.—George H. Gooderham, M.P.P., has succeeded in getting Hamilton to sign the agreement respecting the construction of the Toronto-Hamilton highway which is to cost some $600,000.

Hamilton, Ont.—The city engineers are working on schemes to employ as many as possible of the idle men in the city and expect to have ready in a day or two a list of jobs on which men can engage.

Stratford, Ont.—The City Council last Monday finally passed by-laws for $20,000 of thirty-year debentures and $16,000 to run twenty years, to recoup the Water Commission for money expended on new mains and extensions.

Sudbury, Ont.—A by-law will be voted on by the ratepayers on Nov. 2, to authorize raising the sum of $12,500 for the completion of sewer, waterworks and electric light extensions, also pumping station.

Walkerville, Ont.—With the passage of the by-law authorizing the town to purchase the street lighting system for $26,000 it was decided at the council meeting on Oct. 13, to extend the system along many streets.

Walkerville, Ont.—On Oct. 12, the ratepayers voted to authorize an expenditure of $26,000 for the purchase of the street lighting system. Twenty-three votes were polled, 21 for the by-law and 2 against.

Brockville, Ont.—The Board of Trade has initiated a movement for a "Made-in-Brockville" fair, and a campaign of education to induce citizens to give the preference to the products of Brockville factories when making their purchases.

Woburn, Ont.—At a meeting of the Scarboro Township Council on Oct. 12, a by-law was passed whereby residents of Scarboro Township can have their streets lighted by applying to the township council for street lamps, as a local improvement, the cost to be charged to the property benefited.

Winnipeg, Man.—The Board of Control has approved of an agreement under which the city will sell water to East Kildonan. It calls for the delivery of 40,000 gallons a day at the city limits, and East Kildonan will have the right to dispose of water as it sees fit.

Chatham, Ont.—No time will be lost by the Public Utilities Commission in giving Chatham consumers the advantage of hydro power, and it is planned to hold a meeting within a day or two with Engineer Jeffrey, when plans will be outlined for the erection of the distributing system.

Calgary, Alta.—Having successfully operated waterworks, street railway and electric light and power systems as as municipal enterprises, the city council is now asking the legislature for amendments to the charter, whereby the drilling of oil wells be permitted also, there are now thirty-five wells being drilled in various parts of the oil fields.

Cornwall, Ont.—The ratepayers of Cornwall, carried two by-laws on Oct. 14, one to exempt from taxation, other than school taxes, the Dundas mill, a branch of the Canadian Colored Cottons, Ltd., for a period of ten years, and the other to extend the franchise of the Cornwall Street Railway, Light & Power Co. for a period of 20 years.

Kingston, Ont.—The city council has decided to take action at once to provide work for the unemployed. The city engineer has been instructed to prepare plans and specifications for constructing a wharf, for rebuilding a breakwater, and for carrying out a considerable amount of macadamizing under the local improvement system.

Fort Erie, Ont.—The town council has received estimates from various firms on the cost of enlarging the capacity of the pumping station. The lowest estimate so far received has been from the Rumsey Pump Co., of Seneca Falls, N.Y.

Their bid was $1,750 for pumps and electric motor which will double the capacity of the pump-house. This is exclusive of freight and duty.

Winnipeg, Man.—Mayor Deacon announces that, as a result of their trip to Ottawa and Montreal, he and his colleagues received definite assurances that they could get two million dollars to spend next year in construction work on the Shoal Lake aqueduct, in connection with the Greater Winnipeg water district scheme. This will make four millions expended by the end of next year.

Montreal, Que.—The board of control has decided to grant one year's extension of time to Norman McLeod, contractor for the construction of the city filtration system. Following a conference with Mr. McLeod and J. W. Mc Connell, who is associated with him, the board further resolved to advance $50,000 to the contractor out of reserves, and to assume the responsibility of paying $27,000 in wages due to the men. The filters were to have ben ready by next December. The board's decision grants till December, 1915.

Toronto, Ont.—Eleven tenders for the construction of the Don section of the Bloor street viaduct were received and opened by the Board of Control on Oct. 14; the amounts of the various tenderers ranged from $849,055.35 to $1,353-,-074.91.. All were referred to the Works Department for consideration and report. Five of the tenders were for reinforced concrete construction, the lowest being $849,055.35 and the highest $1,249,701.90. For steel construction, the lowest was $996,564.81 and the highest $1,353,074.91. The difference between the two lowest tenders is about $150,000, which is the difference between the two forms of construction. Works Commissioner Harris will undoubtedly recommend the acceptance of the lowest tender for steel construction, as he refuses to accept the responsibility for concrete construction. Before any contract is awarded, the battle of concrete versus steel will have to be fought out again in the council.

General Industrial

Vancouver, B.C.—It is reported that the Colonial Brewery Co., will erect a brewery here at a cost of $300,000.

Medicine Hat, Alta.—The plant of the Alberta Linseed Milling Co. has been almost completely destroyed by fire, with a loss of $20,000.

Listowel, Ont.—Fire of unknown origin on Oct. 16, destroyed the building and cooperage stock of the Pfeffer Milling Co., causing a loss of $2,000, fully covered by insurance.

Aylmer, Ont.—The Aylmer Shoe Co. have received an order from the Government for a considerable consignment of army shoes, and the factory is now working overtime getting them out.

Calgary, Alta.—Construction work will be commenced shortly on a factory for the Western Canada Cordage Company. The building will cost about $150,000, and will be 400 ft. x 120 ft.

Winnipeg, Man.—The C. P. R. million-bushel elevator at North Transcona, which sank in the soft earth last fall, is now straightened again. It now rests on 70 concrete piers, which go down to bed rock, and will be at once filled with grain.

Kingston, Ont.—C. Schnell, of Paterson, N.J., is in the city on business connected with the establishing of a feldspar plant here. He is a German-American, and thoroughly understands the reduction of potash from Feldspar, of which there is a large amount close to Kingston.

Toronto, Ont.—A wind-up order in connection with the Northern Islands Pulpwood Co., with a capital of $100,-000, has been made by Chief Justice Falconbridge at Osgoode Hall. The company, which was incorporated in 1907, had headquarters at Windsor, and its entire stock was issued.

Kingston, Ont.—Gananoque factories are busy as a result of the war. The harness works has booked large orders for military harness, and has doubled its staff of employees. The Skinner Co. has started manufacturing bits, spurs, buckles, etc., and has so many orders that it, too, has added materially to its staff of operatives.

Toronto, Ont.—The Ontario Government have passed an order-in-council providing for the commencement of the work on the new road between Toornto and Hamilton. Mr. George H. Gooderham, chairman of the Commission, states that this will go a long way toward straightening out the little difficulties that have caused something like stage fright on the part of the municipalities.

Toronto, Ont.—From thirty-two to thirty-five thousand brick are leaving the Ontario Government brick plant at Mimico every day for use upon Government buildings in Ontario, chiefly at Whitby. These brick, laid down in carload lots, would ordinarily cost the province from $10 to $11 a thousand, so that the Mimico plant is producing a revenue at the rate of about $350 a day. There are about sixty prisoners employed in the plant, and after their keep and the general operating cost of the plant is allowed for, the province is getting the millions of brick it will need in the next year at about $5 a thousand. In addition to the brick the Mimico plant is regularly shipping red tile for the roofs of the Whitby buildings.

Building Notes

Toronto, Ont.—C. Legg, 1683 Danforth avenue, has been granted a permit to erect a $3,000 brick and stone garage.

Regina, Sask.—The McKenzie-Hazel Supply Co., will build a warehouse. Cushing Bros., Co., are the contractors.

Vancouver, B.C.—The National Mercantile Co., will build an office building to cost $20,000. The general contract has been awarded to G. Lloyd, Robson street.

Toronto, Ont.—The William Wrigley Co. took out a permit on Oct. 8, to erect a three-storey brick and cement factory building on Carlaw avenue, north of Queen. It will cost $135,000.

Toronto, Ont.—The city architect issued to the Wolseley Tool & Motor Car Co. a permit for the erection of an addition to their garage on Avenue road near Bloor street to cost $18,000.

Toronto, Ont.—The Board of Control will at their next meeting consider the details of the new police administration building. It will be necessary to get special legislation before contracts can be let.

London, Ont.—The Ontario Hydro-Electric Power Commission has taken out a building permit to erect a concrete and brick addition to the commission's plant on Highbury Avenue at a cost of $15,000.

Regina, Sask.—At a cost of approximately $10,000 a warehouse for the use of the MacKenzie-Hazell Supply Co. is being erected on the corner of Eighth avenue and Smith street this fall by Cushing Brothers. The permit for this building has just been issued by the building inspector's department.

Railways—Bridges

Ottawa Line Opened.—The Canadian Northern Railway inaugurated its passenger service between Toronto and Ottawa Monday, and the private coach of the president was attached to the first train.

Ottawa, Ont.—The C. P. R. has given notice in The Canada Gazette that application is being made to the Board of Railway Commissioners for approval of a lease of the Lake Erie & Northern Railway Co. for 999 years from December 1 next.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

THE EVOLUTION OF A DESIGN.

By George Laidler.

IN designing a piece of machinery for some particular purpose, no hard and fast rules can be laid down for the draftsman to follow. Every designer has some points in his method of attacking a problem, which are peculiarly his own, being the outcome of his past experience on similar lines of work. If the problem be entirely new to him, he looks up the available data on the subject and then combines his technical knowledge with a large percentage of engineering instinct, which is merely common sense applied to engineering.

Machine Design a Tentative Process.

At best, designing machinery is a tentative process. A certain effect is wanted on a particular thing, usually with some restrictions as to how it may be obtained. The designer undertakes to "work it up," and gropes through a maze of data, suggestions and sketches until he alights on what he considers to be the "right idea." At this point in the evolution of the machine he probably discusses the scheme with a superior or a confrere for, it has ever been admitted that, in the search for an idea, two heads are better than one.

The criticism thereby afforded may be constructive or destructive, depending upon the brightness of the idea and the ability of the critics: constructive, if the idea is approved and amendments suggested; destructive, if it be condemned or altered beyond recognition. If the latter, the designer should remember that it is always easier to criticize a scheme than to evolve one. A host of considerations may necessitate various modifications—the cost of the finished machine or mechanism, the time taken in manufacture, limitations in the methods of and appliances for its production, the time to operate, the power required, its mechanical efficiency, etc.

Assuming that a satisfactory plan is arrived at after the problem has been discussed from many points of view, and that the fads of the "powers that be" have been duly incorporated, the draftsman may commence to draw the assembly of the machine and assign proportions to the principal parts. Then, when he is assured that the design is quite feasible, often after much rubbing out and re-drawing of intractable parts, he may proceed to the quicker but less fascinating work of detailing the parts, usually to a larger scale than the assembly. In a large office, the preliminary sketching, which is the most difficult part of the process, is performed by an experienced man, the work of detailing is relegated to an assistant, and the tracing of the plans to a junior. Even at the detailing stage it may be necessary to modify some points in the general arrangement, as the fitting in of the details cannot always be foreseen from the assembly.

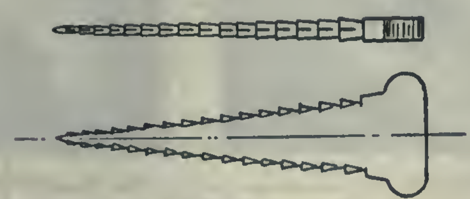
The Completion Stage.

Eventually, after careful checking, the designs are completed, the prints made and distributed, and in due course the machine takes form in the workshop. The enthusiastic designer will now find much pleasure in his work as he witnesses its erection, for is it not a product of his creation? He should not feel discouraged is his ideas meet with adverse comment at this point wrom those who are handling the work, and who frequently do not entirely understand the function to be performed. Minor defects and occasional impracticabilities may require attention, revealing unforseen difficulties, carelessness, or lack of ingenuity; but these are forgotten when the appliance is tested and performs satisfactorily the work for which it was intended. The designer should, therefore, feel his little worries quite compensated for by the glory of its success. If it should not be so successful as was expected—well, he will doubtless hear of it for some time, and if he is an optimist he will appreciate the profit gained by his errors and experience.

A FILE-HANDLE BROACH.

By C. E. Hartford.

WHEN putting a new file-handle on a file, it is necessary to gouge out a hole in the end of the handle large enough so that the shank can be driven in with-



FILE HANDLE BROACH.

out splitting the handle. This is usually done by first twisting the file-shank in the end of the handle, which of course makes a round tapered hole in the latter, and as the shank is flat it soon works loose, no matter how tightly it is driven in the hole.

A better method for fitting new handles on files in which holes can be made the same shape as the shank, is by means of the tool shown in the inclosed sketch. This tool is made from a file shank that has been annealed and cut off from a worn file. A number of teeth are filed on the sides as shown. The tool is simply driven into the end of the file-handle, and thereby cuts out an opening of sufficient depth for the file-shank to be driven in to fit snugly.

RAPID WORK METHODS.

By J. E. Cooley.

IMPROVED methods of doing work rapidly are made possible by special machinery. The latter saves time and is more and more coming into use. The day was when a monkey-wrench and a cold-chisel served for what now requires a special wrench and a special planer or miller to make a cut.

We hear a lot nowadays about improved methods, as if the phrase was of recent coinage or that a limit had been reached and no further progress towards improvement were possible; at least for some time to come, as regards some special working process. The fact is, nearly all methods of work-production relating to machine shop practice were once improved methods, no matter how antiquated they may now be; therefore, in order to increase output or, what is the same thing, to extend the present limit of production without any special effort in speeding on the part of machine operators, it is necessary to still further improve on the present methods in use. This is possible only by special tools and special machinery.

The Tardy Tendency to Change.

The reason why some manufacturers are slow to change is because of their failure to see where they can easily improve upon existing methods of doing work. Take, for example, the simple operation of putting screws in machinery. Why, in many places there is still used the slow method of turning the screws in with a common screw-driver, using a monkey-wrench with the driver to finally tighten the screw; whereas a bit-holder containing a screw-driver blade would send the screw down rapidly and bind it tightly in the work. Again, take the common practice of putting set-screws in pulleys, gears, etc. The screw is placed in the hub and turned with a fork wrench, the operation requiring the wrench to be removed from the screw-head at every half turn. A special designed socket-wrench for this purpose would send the screw through the hub in a few quick turns.

It is these little and often unnoticed things that hold back production. Where tools are required to be picked up and laid down continuously, it means just so much more added to the cost in producing the work, but when tools, such as wrenches, clamps, etc., can be attached to jigs and fixtures and thus save handling these separately, it means a great saving in time, which in turn means a greater output.

It has been mainly through the use of jigs that larger quantities and better quality of work has been producer, but, as regards these, they are useful only so long as they are constantly improved upon. The possibilities in change jig-designs are unlimited. For instance, the general practice is to make one-piece jigs, when it is possible to make them to hold several pieces of work at the same time.

Drawing and Pattern Cost.

It is in the study of these details that great strides in work production methods are made. The first cost, such as drawings and patterns, should never be considered where quantity is concerned. It is where the work itsself is being produced, either at the bench or the machine, that the methods of operation and handling, whether done singly or in pairs, etc., etc., should be given the undivided attention of those in charge.

Care should be taken in a case where an improvement has been adopted in machining work, not to spoil the gain already made by a wasteful process in connection with it. Thus, if a quick method is discovered for milling certain pieces, and these are required to be washed in hot soda, it would be folly to wash them separately on a hook or similar tool, instead of several at a time in a specially designed washer, since a common washer may not be adaptable.

As many operations as possible should be made at one setting of the work piece. All slow processes, such as chiseling, filing, using single cutters, etc., should be eliminated. A suggested example of rapid production is here cited. Spindle-sleeves on sensitive drill-presses require a toothed rack cut on them. This is usually done by putting a sleeve on an arbor, taking the time to clean the sleeve-hole and also the arbor, and then cutting each tooth separately with a single cutter. The better way is to lock the sleeve in a box jig, and with a gang cutter, cut all the teeth at the same time. Again, the inside of the sleeves require an oil channel, which is generally chiseled out by holding the sleeve in a vise. A quicker way, and a more serviceable oil channel results, is that of placing the sleeve in a chuck and cutting a spiral groove with a round-nose boring tool.

In all working operations, from the act of taking a piece of work from a box to the final washing of it in a soda-kettle, there is always a "better way" in which these things can be done, and the "better way" means most always a quicker and cheaper way.

To make further production possible every detail in connection with any particular operation must be given careful study, even to the smallest and most insignificant. To notice how the operator stands up to his work, whether he has a piece ready to put in, where a finished piece is taken out; whether he picks up and lays down a wrench slovenly, and whether the use of the wrench can be eliminated by having a handle attached to a screw-head, etc., etc., are a few of the many minor points to be looked into, in order to lessen the cost of labor, and increase production and profits.

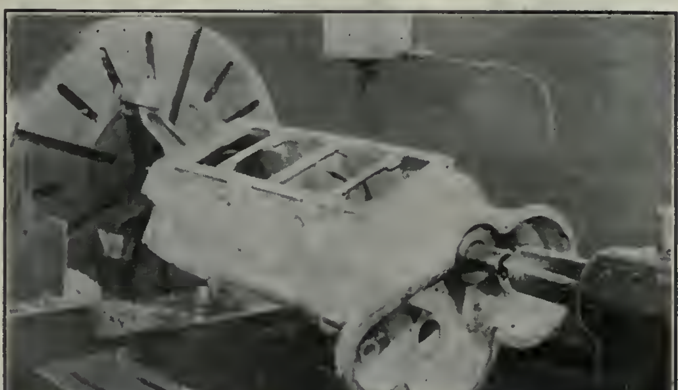


FIG. 1. A HINGED MANDREL.

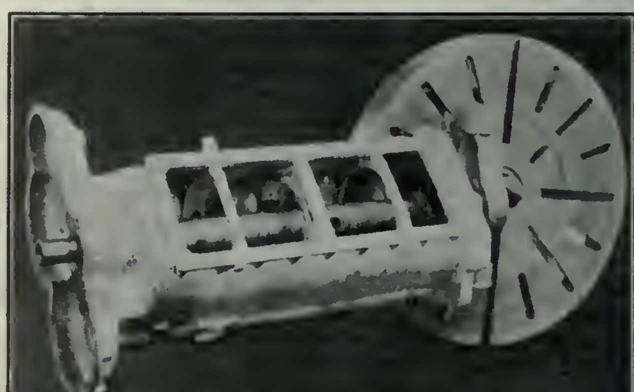


FIG. 2. MANDREL AND WORK SWUNG OUT IN FRONT

A HINGED MANDREL.

By G. A.

A LARGE firm building automobile motors first bores out the bearing seats in the crank cases, then places them on a mandrel while facing the ends in a lathe, as shown in Fig. 1. As the crank cases are rather awkward pieces to handle, brackets are placed on one end of the mandrel, and made to swing in other brackets bolted to the lathe face-plate, so that, in putting on or removing the work, the mandrel may be swung out, as shown in Fig. 2. While the brackets act as a hinge, and also as a driver for the mandrel, the mandrel itself rests on the lathe centres when in working position. With the mandrel and work swung out in front of the lathe, the workman can easily get both arms around the work and handle it to suit himself without being off balance in the least.

FLAMING ARC LAMPS

A PAPER devoted to the flaming arc lamp in the steel industry and presented by Allen T. Baldwin at the recent convention of the Association of Iron and Steel Electrical Engineers at Cleveland contains, says the Iron Age, information that has been collected from the various lamp manufacturers from numerous industrial establishments in the iron and steel industry and from the different departments of the National Carbon Co.

Data secured from 158 manufacturing organizations throughout the industry, ranging from receiving docks to fabricating shops and foundries, including blast furnaces, rolling mills and departments of steel plants themselves indicate, that since 1909, 93.1 per cent. of the plants have retained and increased their equipment of flaming arc lamps. Results are given of tests that were made of long burning, flaming arc and vacuum Mazda lamps in two similarly constructed modern factory buildings having a large window area and white finished walls, where machine work on large castings was done. Based on an annual burning period of 2200 hrs., a saving of $88.88 was recorded in favor of the flaming arc lamp when the price of current was 3c. per k.w.-hr.

As compared with a nitrogen filled tungsten lamp, a saving of $30.52 was recorded in favor of the flaming arc lamp with current at 1c. per k.w.-hr.

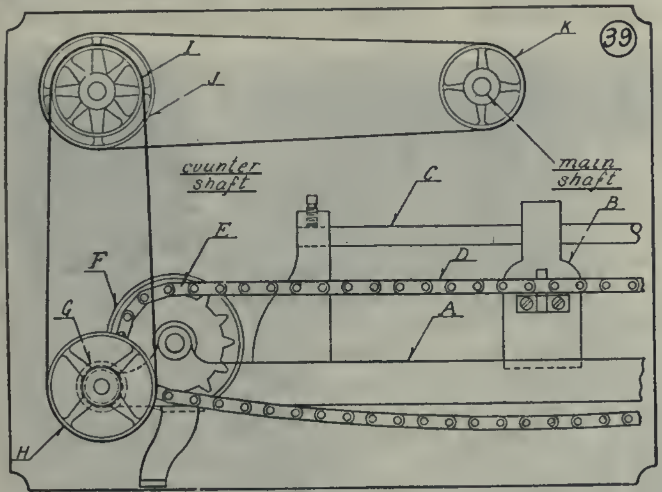
Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

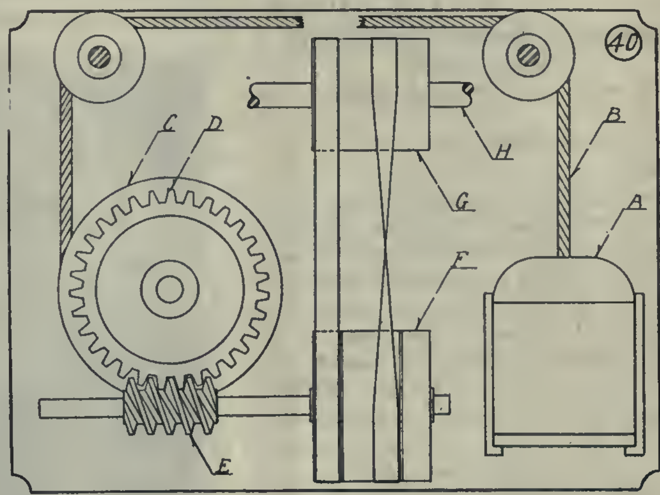
It will be found by those who have followed the previous lessons and profited by them that the various practical applications can now be easily observed, applied and appreciated.

SPEEDS.—III.*

IN chart 39 there is shown a partial sketch of a special machine. The head, B, is required to travel along the bed from end to end, and is stopped and started by means of a clutch operating within pulleys run by open and crossed belts. To complete an operation upon the work requires four strokes (two return) of the head B and completion of the operation in 12 seconds, or 3 seconds per stroke.



ARITHMETIC CHART 39.



ARITHMETIC CHART 40.

The travel of the head B is 12 ft., and the movement is by two link chains (one on each side) passing over two sprocket wheels E of 13 teeth 2-in. pitch secured to the shaft upon which gear F of 36 teeth is secured. The pinion G has 18 teeth and pulleys have dimensions as shown; required the diameter of the line shaft pulley K when shaft has a speed of 180 revs. per min.

Now as the speed of the chain D will equal that of head B, or 12 ft. in three seconds, we have $\frac{12\times60}{3} = 240$ ft. per min.

This will also be the speed of the pitch circle of the sprocket wheel E; therefore, the revs. of the wheel E equals

$$\frac{240\times12}{13\times2} = 110 \text{ revs. per min. nearly}$$

or dia. of line shaft pulley K=

$$\frac{110\times36\times14\times15}{18\times12\times180} = 21.4 \text{ ins., or } 21\tfrac{1}{2}$$

ins. pulley.

To prove, using the general formula, Chart 37.

$$r = \frac{R\times D\times D^1, \text{ etc.}}{P\times P^1, \text{ etc.}}, \text{ or in this case}$$

taking r as the travel of head B in ft. per second, we have

$$\frac{180\times21.4\times12\times18\times13\times2}{15\times14\times36\times12\times60} = 3.97 \text{ ft.}$$

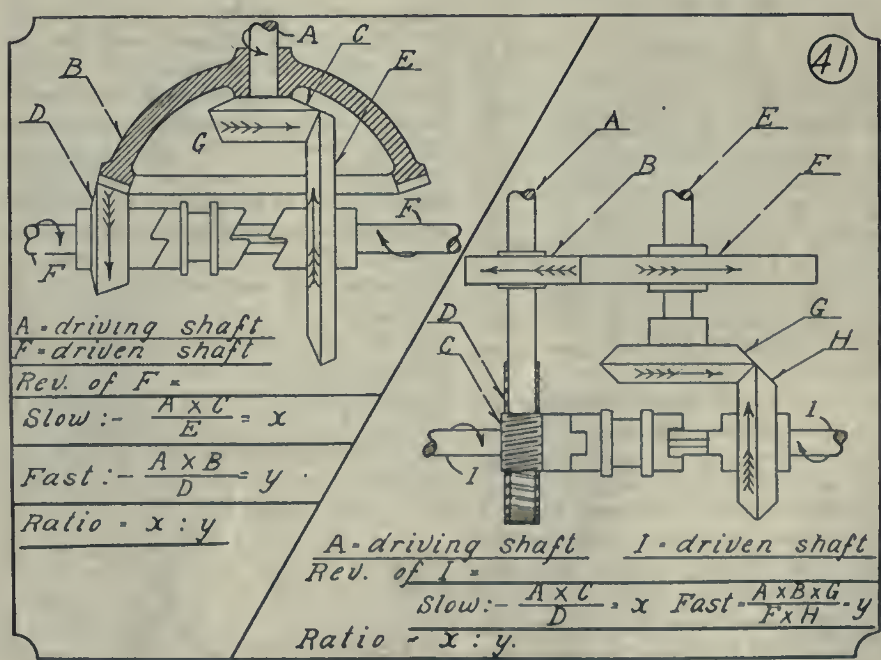
per sec., then $3.97 \times 3 = 11.91$ ft. in three seconds, which is approximately the desired result.

Chart 40 shows a sketch of a gear and pulley drive on an elevator. Car A is required to move vertically at the rate of 130 ft. per min. With the dimensions given in the sketch, and a drive pulley of 24 ins. diameter on the line shaft running 200 revs. per minute, what will be the diameter of the driven pulley on the counter-shaft H? The car A, cable B and pitch circle of drum C will all travel at the same speed, that is 130 ft., or $130 \times 12 = 1560$ inches per min.

The revolutions of drum C and worm wheel will be

$$\frac{1560}{28\times3.1416} = 17.7 \text{ per min., then}$$

$$\frac{17.7\times31}{2} = 274 \text{ revs. per min. of worm}$$



ARITHMETIC CHART 41.

*Parts I. and II. appeared in our October 15 and 22 issues, respectively.

E and pulleys F; x or diameter of required pulley $= \frac{200 \times 24 \times 16}{274 \times 18} = \frac{6400}{411}$ $= 15.56$ ins., or a 16-in. pulley.

In Chart 41 are shown sketches of two quick return mechanisms sometimes met with in machine drives. That on the left is through bevel gears operated by the clutch G, and A being the drive shaft running at 110 revs. per min. What are the two speeds of the shaft F when B has 60 teeth, C 25 teeth, D 25 teeth, and E 55 teeth? From formula:—

$$\text{Speed of F (slow)} = \frac{A \times C}{E} = \frac{110 \times 25}{55}$$

$= 50$ revs. per min.

$$\text{Speed of F (fast)} = \frac{A \times B}{D} = \frac{110 \times 60}{25}$$

$= 264$ revs. per min., and ratio $= x : y$ $= \frac{50}{264} = 50 : 264$

The sketch on the right shows drive through worm, bevel and spur gears, A being the drive shaft running 105 revs. per min. What are the two speeds of the shaft I, when B has 30 teeth, C a single pitch worm, D 30 teeth, F 60 teeth, G 40 teeth and H 40 teeth?

$$\text{Speed of I (slow)} = \frac{A \times C}{D} = \frac{105 \times 1}{30}$$

$= 3.5$ revs. per min.

Speed of I (fast)

$$= \frac{A \times B \times G}{F \times H} = \frac{105 \times 30 \times 40}{60 \times 40}$$

$= 52.5$ revs. per min., and ratio $= 3.5 : 52.5 = 1 : 15$

THE FOREMAN'S TROUBLES.

By R. Micks.

THE position of foreman in a plant is not so easy a task as it may look to an outsider, for if everything is not going satisfactorily in his department, he is the one who must shoulder all the complaints, whether they come from the employer or the men under him. The superintendent should give the foreman all the help in his power and should not expect him to turn out large quantities of good work unless he has the up-to-date equipment to do it with as have other plants.

There is always a trouble-maker or two in most shops, and when a grievance has to be aired, the superintendent should see that the foreman has a chance to present his side of the case, for if a superintendent interferes between the foreman and his men the men will soon lose their respect for him. In most cases the trouble-maker is too big a coward to come out in the open and air his views; he rather sneaks around on the quiet and tries to stir up all the trouble he can.

Another mistake made by many employers is that a foreman who does a lot of manual work comes to be reckoned an ideal boss. In my experience, I have never seen a case where the foreman could get right down and work at the trade and make a success of running a shop. A good foreman is like a general with an army of soldiers; he is there to give orders and see that they are carried out, and if he were on the firing line it would be impossible for him to accomplish this. On the other hand, a foreman should do his best to do justice both to his employer and the men who are working under him, treating them with due respect and showing no favors to any. He should also aim to turn out the best quality of work and also use every effort to increase the output. Every foreman should try to improve his mind along all branches in connection with his trade, for the old-time systems are being rapidly consigned to the scrap-heap and, in a few years, the foreman of any department who has not acquired a technical knowledge of his trade will find he is very much of a back number.

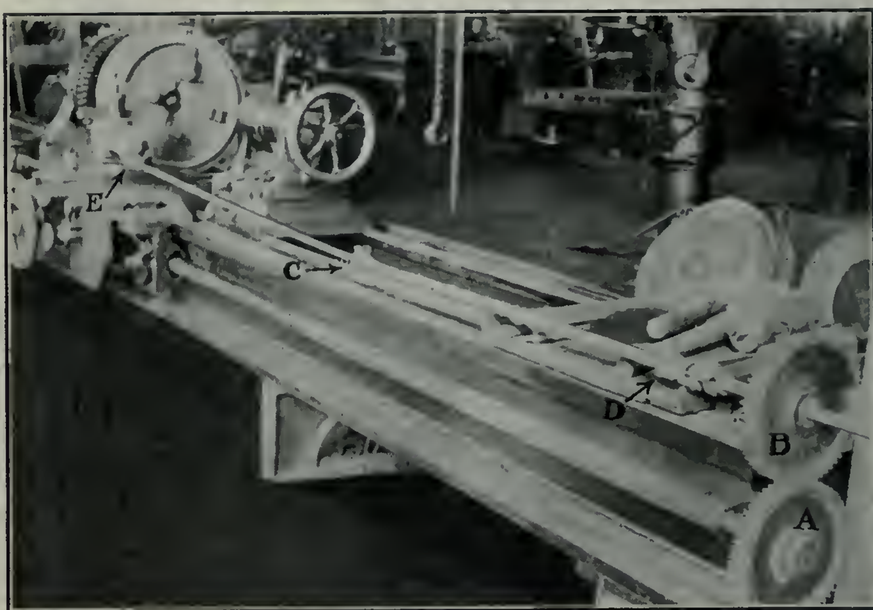
It would make things much easier for both the foreman and the men if, when any trouble arises, they would go to the boss and explain frankly their greivance. In most cases it could be righted without disturbing the harmony of the shop. Nothing is gained by nursing a grouch as it grows larger with time.

It is to be hoped that the time is not far distant when the bosses and men will co-operate more with each other in their efforts to work for their interests, by settling all disputes without friction or loss of time and money.

TURNING BEVELS.

By A. E. G.

THE application of a power feed to a compound rest not originally fitted for power feed is shown in the accompanying cut, being in service in the L. & N. R. R. shops, Mobile, Ala. The lathe is used for turning short bevels, and the turning of the feed screw on the compound rest being a slow, tedious operation, a gear was placed at A on the end of the lead screw. This meshes with the gear B which drives a rod connected to the feed screw of the rest, as shown. The rod is squared where it goes through the gear B, so as to allow for changes in length during a cut. For setting of the carriage, the rod telescopes, and is locked by a collar at C, while universal joints at D and E allow for changes in the setting of the compound slide. When not in use, the attachment is easily removed and placed back in the tool-room.



POWER FEED APPLICATION TO COMPOUND REST.

H. F. H. Hertzberg, mentioned in last week's issue as being with the Canadian contingent, is engineer of the Trussed Concrete Steel Co. of Canada, Ltd., Walkerville, Ont., and not connected with the Canadian Bridge Co., as then stated.

Lubricant for Ball Bearings.—According to Prof. F. W. F. Goss, a combination of graphite and lard oil makes up a lubricating mixture which, when applied to ball bearings, will accomplish everything which lard and oil will do, and which, at the same time, will give a lower frictional resistance of the bearings and permit a large increase in the load which they can carry.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

EFFICIENT TRANSMISSION.

By J. P. Sanderson.

THE advantages of interchange of visits among plant foremen and managers are nowhere more evident than in the opportunity to compare different systems of organization. Although the essential points—the costs and cash investments—are not often available, the visitor always has the opportunity of adopting expedients into his own organization for experiment which, if carefully carried out, would give much more satisfactory results. In no department is more to be gained by the traveling engineer than in the sphere of power transmission. Everywhere one goes, the individuality of the master mind of the place is evidenced in the different methods adopted to obtain the same or modified results.

The writer once had charge of a heating plant which necessitated a number of long steam mains. The system gave such proofs of efficiency that a neighboring firm adopted a similar arrangement which, however, never seemed to give satisfaction, although it really had less to do. During the second year of its operation the writer was called in to inspect and offer suggestions. The only fault found was that the exhaust steam mains leading to the different heating units were not covered, and insufficient provision had been made for removing the condensation which was the real cause of the difficulty. Upon the piping being well lagged, the trouble entirely disappeared, and the plant has been working satisfactorily ever since.

This instance goes to show that more often depends upon the man in charge of a plant than on the type of machinery employed for its success. Also, a man who favors any particular system is very apt to work it under conditions where it will be inefficient and where another system should be adopted. For a useful comparison, different systems should be operated when in the best or under a similar condition.

Transmission Vagaries.

In the case of power transmission, similar conditions hold. In an Eastern plant known to the writer is located an induction motor driving a line shaft less than 4 feet away through a countershaft carrying about 1,600 pounds of fixtures and 110 feet of ten-inch belting. This machinery is elaborately fenced and much difficulty is encountered in getting men to work continuously under it on account of the draught caused by the belts and pulleys.

In a Western plant again, is to be seen the same type of motor bolted to the ceiling and driving its line shaft through a rocker joint chain. This chain is tightly enclosed and runs in a bath of oil. There is no noise, no wind, no daily oiling and little evidence of loss of power.

In this same plant, whose superintendent is a chain enthusiast, is a chain-drive operating a tumbling mill. This chain is too long to be completely enclosed, and is so located that it is impossible to lubricate it. One of the sprockets requires to be replaced about once a month and the other about once in two months, while the link belt itself has been renewed several times. The power required to wear out this machinery is not only wasted on destructive work, but must be paid for. If this machine were driven by a good leather belt through a tightly enclosed gear and pinion, the above loss would be largely prevented and shutdowns for repairs would not be required oftener than once a year.

In another plant supervised by a very capable master mechanic, but who, by the way, is strong on line shafting and belts, is located a tumbling barrel for the purpose of grinding up the droppings from the cupola. This mill is necessarily located so close to the furnace that the driving mechanism is subjected to considerable heat. A line shaft extension is run 130 feet to operate it and is connected by means of a belt, the speed being considered too great for a chain. On account of the heat it is necessary to replace this belt every few weeks, while a large part of the time the machine is in an unsatisfactory working condition. The obvious cure in this case would be a motor-drive and electrical transmission.

The scheme adopted in a Buffalo plant to operate a stoker could be easily applied to the above case. This consists of a motor directly connected to a chain of gears which reduces the speed to that required by the machines. On the motor spindle is placed a small fan similar to that used behind the radiator of an automobile. The motor and gears are tightly enclosed with sheet metal, a pipe connecting this casing to the outside of the building. The result is that cool air is drawn through the casing into the fire room. When the motor is stopped, there is sufficient natural draft in the sloping pipe to prevent the machine from becoming overheated.

Numerous other cases of ill-adapted transmission schemes have come under the observation of the writer, but the above should be enough to set the man who is inclined to partiality towards any particular system to studying the others. In many new plants the greatest improvements are possible in the power distribution system.

OPERATION OF TRANSMISSION MACHINERY.

By Lycurgus Carson.

WHILE the trend of thought of mechanical engineers and millwrights seems to be towards the perfection, from an efficiency point of view, of the power generators and the machines which use the power, the means of getting the energy from the source to the work has, by no means, received such careful consideration. The transmission system is, in fact, one of the items classified as non-productive investment and, for this reason if no other, gets put into the hands of incompetent persons or is more or less neglected altogether.

Electrical transmission furnishes the one glowing exception to the above assertion and, when once installed, offers little room for increasing its efficiency except by supplanting the equipment with new and more up-to-date apparatus. Have more capable minds been devoting themselves to the electrical form of transmission than to the line shaft, gears and belts? Ordinary line shafting which still predominates in our factories, and is likely to for some time, is rarely operated within even a reasonable range of efficiency. So long as the driving power is ample and the bearings do not smoke, no concern is felt and no investigations are made. In fact few mechanics have any idea of the amount of power that should reasonably be consumed by shafting and bearings.

A Plant Example.

In a plant of which the writer took charge some years ago, considerable power was required to operate machinery. This power was furnished by an automatic high speed engine, whose exhaust steam was used for heating and cooking processes which were such that a back pressure of 5 pounds could not be prevented. The engine was in charge of a very competent engineer but, in spite of the fact that he had done everything possible to boost up its efficiency, it was continually overloaded and considerable exhaust steam had to be allowed to escape to the atmosphere. The firm had got to the stage of considering the advisability of either buying current for lighting, or installing an electric motor to take part of the load, and use current from a central station.

After a careful investigation, no way of reducing the load could be found although some rearrangements of machinery and belting were made which helped some. The peak loads were still much beyond the capacity of the engine. However, the engineer was asked to take some cards from his engine on a holiday when no machines were in operation. These cards showed an indicated horse-power equal to 38 per cent. of what was developed when the plant was in full operation. This gave a clue as to where some of the power was going, and a careful study of the great quantity of line shafting was the result.

Each bearing was visited and inspected. Those which showed signs of heating were lined up and re-fitted. Some few of the easily evident cold ones were found to be much too large for the shaft, the babbit having run out of one or two of them altogether at some time or other. Some of the idler pulleys were found to be in as bad shape as the bearings but, on account of being in rapid motion, most of the heat was radiated to the atmosphere. These also were corrected. Much work was found to be done, and the spare time of several mechanics was utilized in this way for six weeks. An indicator calculation made when this work was completed showed that the lost power had been reduced to 9 per cent.

Much of the shafting was placed in very awkward positions so that oiling and other attendance was difficult. To overcome this, all shaft bearings were fitted with large grease cups. These cups were unique in that they were fitted with a small ratchet wheel and lever having a short section of light chain attached. The oiler was provided with a hooked steel rod long enough to reach the fairly large rings on the ends of the chains from the floor. By inserting the hook and giving a slight pull with the rod, the cover of the grease cup would be screwed down one-fifth of a revolution, and if more were deemed necessary, two pulls did the trick.

By this scheme, the attendance was reduced to about one-third, and the cost of grease was found to be very much less than the cost of the oil. The cups were given attention once every two or three days and were filled every two months. The grease cups had to be bought, but the attachments were all made in the plant.

The power required to drive the shafting and loose pulleys was finally cut down to from 6 to 8 per cent. More machinery has since been added, and the engine is using less steam than at any time previously.

EFFICIENT HEATING AND TRANSMISSION ARRANGEMENT.

By J. Thorn.

A HEATING plant was installed by the shops, Peterboro, Ont., of the Canadian General Electric Co., about 14 years ago. It worked perfectly for a number of years and may still be in successful operation. Its principal feature consists of successful long heat transmission. The main and returns were run from the power house to the shops, a distance of 1,400 feet and about 10,000 feet of one-inch pipe was used in the radiation coils. The run of the mains is shown in Fig. 1. Two expansion joints securely anchored were used in the 500 ft. run and two in the 700 foot pipe line. The method adopted to support the pipes to allow for expansion and contraction is shown in Fig. 2. The pipes are represented by A and B, while C and D are short pieces of 1½ inch pipe, which are held in place by loosely fitting flanges. This allows free movement for expansion and contraction.

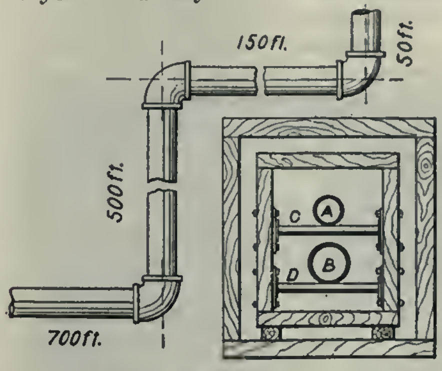


FIG. 1. MAIN PIPE LINE.
FIG. 2. ENCLOSURE FOR STEAM MAINS.

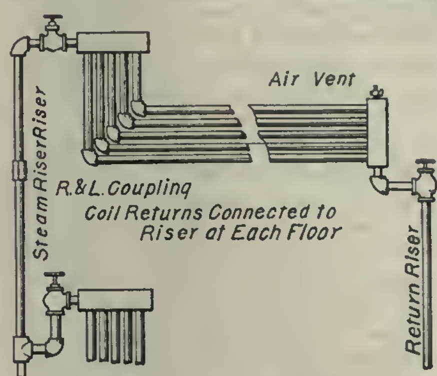


FIG. 3. WALL COIL CONNECTIONS.

The double wood protection was made of 2-inch planks and care was taken to make them water-tight by packing all joints and coating both with a good preservative. The result was remarkable in that the radiation loss in this pipe-line was exceedingly small and, when the plant was running at full capacity, almost negligible in zero weather.

The steam main is 4 inch and the return 2½ inch pipe. The condensation returns by gravity to a closed tank in the power house, from which it is automatically pumped through the separator to the boiler by a small duplex pump. The method of connecting the coils is shown in Fig. 3.

All pipe stem wall coils were never troubled with poor circulation in spite of the long main and the back pressure on the engine never exceeded five pounds. A by-pass valve was arranged to let live steam into the mains when the engine was idle. The whole system proved to be economical, efficient and noiseless.

POINTERS FROM THE EXISTING INDUSTRIAL SITUATION.

FREDERICK A. WALDRON, industrial engineer, New York, in a paper entitled "Panic Economies and Engineering Problems, with Special Reference to the Present Industrial Situation," read recently under the auspices of the American Society of Mechanical Engineers, expressed the opinion that the following, among other lessons, might profitably be learned by those affected:

That the world is growing smaller.

That nations are becoming more interdependent for internal financial and industrial prosperity.

That the more civilization advances, the more nations co-operate in this advance.

That the lessons of thoroughness and preparedness are driven home.

That our factories are not prepared to meet the demands of trade for other countries.

That the mental attitude of take what is made or leave it must be changed if we expect to obtain and hold the trade of other nations.

That whatever the outcome of this war may be, it will be the engineering of the past 40 years that develops the successful nation.

Factories that are near supply points, he thinks, ought to reduce the amount of materials carried in stock to a minimum and buy on short notice. If materials were handled the same as money, and distributed from territorial storehouses as requirements demanded, the burden of speculative losses would be eliminated. It could be done if sound and broad business methods were substituted for the speculative craze of the individual who lives by his wits at the expense of some loser.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

PROBLEMS RELATING TO BELTS.

Horse-power calculations concerning belting are the same in principle as those in connection with steam engines—that is, the distance in feet through which a force in pounds is caused to act is divided by 33,000. This force, or pull of the belt, depends upon the friction between the belt and pulley, which in turn depends upon the arc of contact or that part of the pulley circumference which is covered by the belt. The effective pull in cases where the pulleys are approximately the same size and the arc of contact can be taken as 180 degrees is 55 pounds for every inch in width. For double belts this becomes 88 and for triple belts, 110.

Question.—An engine fly wheel is 8 ft. 2 in. in diameter and makes 110 r. p. m. What is the belt speed?

Answer.—8 ft. 2 ins. = 98 ins.

$$\text{Speed} = \frac{98 \times 3.1416 \times 110}{12} = 2822.2 \text{ feet}$$

per minute.

* * *

Question.—Two shafts are 13 ft apart and are connected by a belt which runs over pulleys 26 and 28 inches in diameter. Determine the necessary length of the belt.

Answer.—Rule, two pulleys nearly alike, add the two diameters, multiply the result by 3.1416 and divide by 2. Add twice the distance between centres of shafts.

$26+28=54$ inches. $54 \times 3.1416=169.6464$

$$\frac{169.6464}{2} = 84.8232; \left(\frac{84.8232}{12}\right)+(2\times13)$$

$= 7.068+26=33.068$ ft.$=33$ ft. 0.8 ins.

* * *

Question.—Driving pulley is 52 inches in diameter. Driven pulley is 14 inches diameter and centre to centre distance is 7 ft., 6 ins. Find length of belt required.

Answer.—Rule, pulleys differing very much in size, add the two diameters, multiply by 3.1416 and divide by 2. To this add, twice the square root of the distance between centres squared plus the difference between the two radii squared.

$$52+14=66; \frac{66\times3.1416}{2}=103.6728$$

$(7 \text{ ft. } 6 \text{ in})^2 + (26-7)^2 = 90^2+19^2=8461.$

$\sqrt{8461} = 91.98$; $91.98\times2=183.96$.

Length of belt $= 103.6728+183.96 = 287.6328$ inches $=23$ ft. 11.6 inches.

* * *

Question.—Determine the length of a crossed belt. Pulleys 36 and 20 inches diameter and shafts 10 feet apart.

Answer.—Rule, take the square root of the diameter of the large pulley squared plus the distance between centres squared. Take also the square root of the diameter of the small pulley squared plus the centre distance squared. To the sum of the two roots add one-half the total circumference of the two pulleys.

$\sqrt{(36^2+120^2} = \sqrt{15696} = 125.28.$

$\sqrt{(20^2+120^2)} = \sqrt{14800} = 121.65.$

Circumference of large pulley $=36\times3.1416 = 113.097$.

Circumference of small pulley $=20\times3.1416 = 62.832$.

$$\frac{113.097+62.832}{2} = 87.964$$

Total length of belt $= 125.28+121.65 +87.964 = 334.894$ inches $= 27$ ft., 10.9 inches.

* * *

Question.—Find the horse-power of a 6-inch single belt running over pulleys 18 and 20 inches in diameter, the latter of which runs at 500 r.p.m.

Answer.—For case in which arc of contact is approximately 180 deg. multiply the belt speed in feet per minute by the width of the belt in inches and divide by 33,000. For single belts, multiply this result by 55, for double belts by 88, and for triple belts, by 110.

$$\text{Belt speed} = \frac{20\times3.1416\times500}{12} = 2618$$

feet per minute.

$$\text{Belt horse-power} = \frac{2618\times6}{33000} \times 55$$

$=26.18$.

* * *

Question.—The above condition is not the most satisfactory. Belts running over pulleys more than twelve inches in diameter should be double thickness. What width of double belt should be used instead?

Answer.—The width of belt required would be the product of the horse-power multiplied by 33000, divided by the belt speed and by 88.

Width of double belt then is.

$$\frac{26.18\times33000}{2618\times88} = 3.75 \text{ inches.}$$

Use in this case, a 4-inch belt.

Question.—Two pulleys, 10 in. and 36 in. in diameter, are connected at 10-foot centres by a straight belt. Determine the arc of contact on small pulley.

Answer.—Rule, multiply the difference between the diameters of the pulleys in inches by 4.75; divide the product by the centre distance of the pulleys in feet and subtract the quotient from 180.

$$\text{Arc of contact} = 180° - \frac{26\times4.75}{10}$$

$=180-12.35=167.65$ degrees.

* * *

Question.—Two pulleys, 12 in. and 40 in. in diameter, are connected by a straight belt at 12 feet. Determine the effective pull for a double belt.

Answer.—Rule, divide the arc of contact by 180 and multiply by 55 for single, 88 for double, and 110 for triple belts.

$$\text{Arc of contact} = 180° - \frac{28\times4.75}{12}$$

$= 180-11.08=168.92$ degrees.

$$\text{Effective pull} = \frac{168.92}{180} \times 88 = 82.58$$

pounds.

* * *

Question.—A double belt from a motor to a line shaft runs over pulleys 12 in. and 48 in. in diameter; it is 8 in. wide, and the motor runs at 420 r.p.m. What horse-power will it transmit.

Answer.—Arc of contact

$$=180° - \frac{36\times4.75}{12} = 166.75 \text{ degrees.}$$

$$\text{Effective pull} = \frac{166.75}{180} \times 88 = 81.52$$

pounds.

$$\text{Belt speed} = \frac{12\times3.1416\times420}{12} = 1319.47$$

feet per minute.

$$\text{Horse-power} = \frac{1319.47\times8\times81.52}{33{,}000} = 26.4$$

Montreal, Que.—Definite word was received by the Council of the Board of Trade from Lord Desborough, president of the British Imperial Council of Commerce, that, despite the war, the next Congress of Chambers of Commerce of the Empire would be held at Toronto next autumn. This will be the first meeting of the Congress in Canada since 1903.

Relative to Steam Piping in the Factory Power Plant--I.

By G. W. Sutcliffe, Wh. Sc.

This writing is a recapitulation of the principal matter contained in a series of articles, the compilation of which was the result of observation and experience derived from the inspection and other records of the Vulcan Boiler and General Insurance Co., Manchester,

ACCIDENTS more or less serious in the material sense, and generally equal as to loss of life when compared with actual boiler explosions, are all too common experiences resulting from badly laid-out, faultily-constructed, ill-adapted material of, and carelessly operated steam pipe lines, valves, fittings, connections and supports. The data here given is quite comprehensive in its scope, and is such as to make direct appeal to all interested in steam power plant practice.

Drainage of Water.

Sectional Area of Pipe.—This should suffice to pass the required amount of steam at a mean velocity of 100 ft. per second at 100 lbs. pressure, or at 60 ft. per second at 200 lbs. pressure. At 12 lbs. vacuum, the velocity should not exceed 350 ft. per second. Higher velocities are liable to be attended with excessive vibration.

Accumulation of Water.—This must be prevented. Pipes nominally horizontal should drain with the current, say, with a fall of not less than one foot in 500, accurately determined. Pipes falling towards boilers are attended with grave danger.

Safety and Length of Service.—The safety of any particular arrangement cannot be held to be established by length of service. Several serious accidents have occurred to plants after twenty or thirty years of uninterrupted work.

Discharge of Water under Steam Pressure.—This is always attended with danger.

Drainage Fittings.—These are required at each low point and air discharge cocks at each high point.

Vacuum Valves.—Such valves to admit air may suffice in exceptional cases to avert water-hammer, but they are not reliable.

Boiler Stop Valves.—These should be arranged to keep clear from water on both sides. The whole system may be divided into sections; each preferably with long falls and short vertical or steep rises.

Water Separators.—Water entrained in steam from boiler or precipitated by condensation should be removed by separator. In minor positions the pipe may be modified to act as a drainage leg. In either case the condensed water should be removed by automatic steam trap. The separator should be arranged for the steam to impinge upon a perforated plate; also with access openings.

Straight-line Stop Valves. — Such valves of the screw down type, when placed in a horizontal pipe, should be placed with the spindle horizontally to give free drainage of water and discharge of air.

Steam Traps.—These are employed to control the adjustment of drainage discharge valves by automatic means which are more or less peculiar to each type of trap. Many modern traps give a flush or intermittent discharge by which wear of the valve surfaces is much reduced. A dirt interceptor should always be interposed before the steam trap to prevent the access of foreign matter to the valve surfaces. If this is omitted, the valve surfaces abrade and fail to close completely. The retained matter should be removed by free scouring at frequent intervals. A trap should be ordered to discharge — gallons per hour, in flushes at — gallons per second, at a steam pressure of — lbs. per square inch on gauge, and to deliver the effluent water at a level of — ft. above or below the trap.

Sundry Pipes.—Pipes required for drainage, heating, or other purposes should be arranged, as far as possible, parallel and neatly fixed against a wall or foundation. Levels should drain accurately, and if any pipe is intended to be continuously hot, space should be allowed for the necessary covering. All joints should be freely accessible and flanges or unions provided for convenience in taking apart.

Effluent Pipes.—All these should deliver separately into a drainage tank, conveniently accessible and arranged for convenience in ascertaining quantities of water delivered.

Pressure and Temperature.

High Pressure means High Temperature.—Steam of high pressure only exists at a correspondingly high temperature, and any water freshly formed by condensation from such steam also exists at the same temperature. If such water is withdrawn by means of an automatic steam trap or a manually-operated cock, it immediately becomes exposed only to atmospheric pressure and falls to the corresponding temperature of 212 deg. Fah., thereby suffering loss of heat and loss of weight by evaporation. In many cases these losses may be prevented or minimized by judicious arrangement of the pipe leading to the point of relief, so that this shall present surface sufficient to distribute the required amount of heat and to effect some useful application of this heat.

Pipes and Pipe Flanges.

Cast Iron Pipes.—This was the only material available for pipes in the early days of the steam engine. For the moderate pressures at that time current, this material was not very unsuitable, but it is most objectionable for high pressures. It is seldom free from defects—obvious or concealed—and it is conspicuously imperfect in regard to elasticity. When exposed to high pressure and especially to superheat temperatures, it is liable to continuous depreciation in strength and also to become porous.

Copper Pipes.—This metal is unfitted for exposure to high temperatures; it is better suited for withstanding vibration, and is particularly useful for prompt and convenient application to irregular lines and positions, especially in small sizes. In large sizes, copper pipes are usually made by bending plates, the longitudinal joint and the flanges being secured by brazing, which determines the line of weakness. Solid drawn copper pipes are in general much superior, but are almost equally unfitted for exposure to high temperatures.

Mild Steel Pipes.—These are best obtained by solid drawing process. Lap welding is, however, most frequently adopted, and in general such pipes are reliable and efficient; the same applies to welded flanges. Exceptional cases of lap weld and flanges are given in which serious failures have developed.

Cast Steel Pipes.—These are adopted for special purposes, particularly for bends to suit limited space; also for all valve casings and like fittings for use with steam of high pressure, or with superheated steam. Notwithstanding the time occupied in annealing, this operation should not be curtailed. Special examination should be made as to uniformity of thickness and for sponginess, also hydraulic pressure tests, after machining and on completion.

Pipe Flanges.—These are best welded solid with the pipe. Sometimes they are fixed by screw threads, which are good for normal treatment, but bad for strain or vibration. A raised screw thread may succeed where the stress and strain are too great for a thread of ordinary type. A failure of a screw thread is generally shown in first instance by leakage along the thread; when this occurs to any marked extent, the conditions should be corrected. If neglected, the pipe may pull out of the flange. Riveted flanges are stronger and more reliable than screwed ones. The heads of rivets should be ample. The same applies to fixing of branches.

Bends of Mild Steel.—These should not be curved to a radius of less than three times the bore. The thickness of material may with advantage be one-sixteenth of an inch greater than that of straight pipes, to allow for drawing down.

Bends of Cast Steel.—These may be curved to a radius equal to the bore, but they are much better made to a radius 25 to 50 per cent. greater.

Importance of Uniform Strength and Elasticity.—The strength and elasticity of the system should in all cases be kept as uniform as possible. In case screw threads are adopted, the best results are obtained by raising these above the outer diameter of the pipe to make the thickness beneath the thread uniform with the rest of the pipe. To this, however, there are practical difficulties, and to avoid them the screw threads are usually cut out of the pipe, but the loss of strength is partially corrected by gradually running out the thread.

Screw Threads.—Where screw threads are used for uniting pipes and flanges, they should taper slightly in diameter to compress the paste used for jointing, thereby promoting soundness of joint.

Couplings and Branches. — Socket couplings may be used for special purposes, but subject to skilled attention in examination and erection. Branches of small size cannot be fixed in wrought steel pipes by simple drilling and screwing, as the thickness of main pipe is insufficient; therefore, forged bosses are necessary, and these should be carried outward to clear the pipe covering; such steam branches usually on top and drainage branches below.

OIL THROWN FROM BEARINGS.

THE trouble caused by a motor throwing oil from the bearings is generally caused, says a writer in the Electrical Review and Western Electrician, by the rings picking up so much oil from the well and carrying it on to the shaft that it is impossible for it to leave the latter by means of the lubricating oil grooves fast enough. The oil will then creep along the shaft until outside the bearing housing, where the centrifugal force will throw it off in small drops or as spray. Manufacturers use various means to eliminate this, one of the most common being to cut a groove about one-eighth to one-quarter of an inch wide, and correspondingly deep, in the bearing near the ends. A hole is drilled through this groove in the bottom of the bearing to allow the oil to escape as it is collected on the shaft. Very often, however, this groove is not cut deep enough, or the hole in the bottom groove may be plugged up with dirt, waste, etc., and cause oil-throwing. The groove should be cut deeper and the hole cleaned or drilled out a little larger in this case. It may sometimes be necessary to drill an additional hole in the bottom and cut the groove as deep as the metal will allow before the oil-throwing is stopped.

SURFACE HARDENING OF IRON.

A PROCESS has been patented by Vickers, Ltd., and C. L. Sumpter, of Grindleford, Derby, engineer, for the local hardening of cast iron and cast malleable iron. They explain that it is desirable to impart to castings, such as gear wheels, worm wheels, drilling jigs and the like, a hardened surface. The ordinary methods of hardening are inapplicable owing to the cracking or distortion that would result, and also owing —in the case of cast iron when heated as a whole—to the tendency of the combined carbon to change to graphitic carbon, and, in the case of cast malleable iron, to the loss of malleability when quenched as a whole. The object of the invention is to surface harden such castings efficiently only at the portions of which hardness is required. The surface hardening is obtained by retaining in the surface to be hardened, either during the ordinary manufacture or by treatment afterwards, an amount of combined or temper carbon sufficient to ensure the subsequent formation of a hardened surface, and subjecting the surface of the article to the special hardening process.

The precautions are different for the two kinds of iron. In plain cast iron it is found that heating tends to convert the combined carbon present into free graphite carbon, and it is therefore necessary to provide or retain ample combined carbon in the iron from which the castings are to be made by keeping the silicon content in the iron low. In "blackheart" malleable iron it is found that the surface hardening tends to convert amorphous temper carbon into combined carbon, thus providing combined carbon for the hardening effect. In ordinary malleable cast iron, the annealing process to render it malleable tends to remove the carbon altogether, leaving only traces in the free and combined condition, and the amount of combined carbon essential for surface hardening must be ensured either by stopping the annealing process before completion or by recarburising the surface after annealing by the ordinary method of case-hardening. In "blackheart" malleable cast iron, if it is required to surface harden an unmachined surface, this surface must be protected from decarburisation during the annealing, by the known expedient of a suitable paint or powder, for example, or by recarburising the surface after annealing by case-hardening.

The surface hardening process is by an oxy-acetylene blow pipe or other intensely hot flame being directed upon the iron castings. It is advantageous, to ensure the sufficiently rapid abstraction of heat from the heated surface and avoid any general heating, to immerse the greater portion of the casting in water with the surface to be hardened either just above the liquid, or slightly immersed so that the film of liquid superposed upon the surface is temporarily driven away by the impact of the flame. The immediate return of the liquid to the heated surface when the flame is withdrawn or moved away causes a rapid cooling, in addition to the rapid cooling effected by the conduction of heat through the cool body of the casting, and in consequence an intense hardening of the heated portion takes place. A stream of liquid may be directed on the casting for the same purpose.—Practical Engineer.

High-speed Steam Engines.—In a recent paper on this subject, the author, in speaking of the long runs made by high-speed steam engines, instanced the case of one engine which only stopped for five hours in twelve months, running 8,755 hours out of 8,760. Another fact, dispensing with the old-fashioned theory that the engines would rack themselves to pieces, was that an engine ran from July 1 to November 30, making 85,000,000 revolutions. At a colliery in South Wales an engine which had its low pressure cylinder cut out in an accident, ran for six months on the high pressure and intermediate cylinders without stopping.

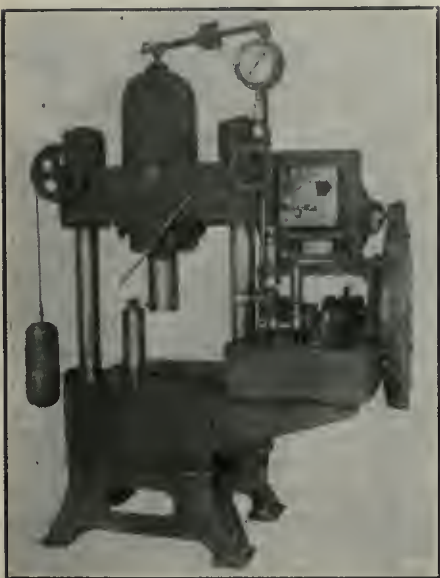
The Modern Machine and Engineering Co, 1410 C. P. R. Building, Toronto, representing Potter & Johnston, Pawtucket, R.I., have supplied the John Inglis Co., Toronto, with four of their latest type chucking automatic machines for work on shells for the Government. They have also sold two machines of the same type to the Chapman Double Ball Bearing Co., Ltd., Toronto, to be used for a similar purpose.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

75 TON SELF-CONTAINED HYDRAULIC BROACHING AND FORCING PRESS.

THE hydraulic broaching and forcing press here illustrated is a self-contained machine tool, with both motor and pump mounted on an extended base, which is attached to one side of the press. It is a new hydraulic design which has recently been added to the extensive line of hydraulic presses and pumps manufactured by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio.



75-TON SELF-CONTAINED HYDRAULIC BROACHING AND FORGING PRESS.

This is a sturdy and well built press, being compact, yet suitable for the wide range of broaching and forcing work coming up in machine and automobile shops. The ram is counter-balanced and controlled by a hand windlass operating with slight effort on the part of the operator. The ram can thus be raised or lowered to admit various sizes or work. When the ram is moved downward by the hand windlass, the cylinder is filled with water by the vacuum which is caused by the ram's downward movement. By this action the pressure upon the broach or the material in the press is initiated as soon as the motor and pump are started.

The ram is fitted for extension blocks, which may vary in shape or length, according to the size of the pressing surfact, or the height of the daylight space, and is operated by a two-plunger horizontal pump, having plunger diameters which vary from ⅝ in. to 1 in., but with a standard stroke of 3½ in.

The pump is equipped with an automatic knock-out attachment, which limits the pressure to a predetermined maximum point. This may be any pressure which the material requires within the maximum rated capacity of the press. All parts of the pump are easily accessible, thus eliminating all difficulty in making adjustments and repacking the pump plungers. The pump shown in the accompanying illustration has a single reduction of gears. It may, however, be equipped with a double reduction if desired. The motor and starting rheostat are conveniently located, being within easy reach of the press operator. A motor of 2 h.p. is required. The speed at which the press may be operated varies with the plunger diameters of the pump. The larger the pump plungers, the more rapid will be the movement of the ram, more water being forced into the cylinder at one stroke of the pump.

The machine has a 10-in. ram, upon which can be initiated a maximum pressure capacity of 75 tons.

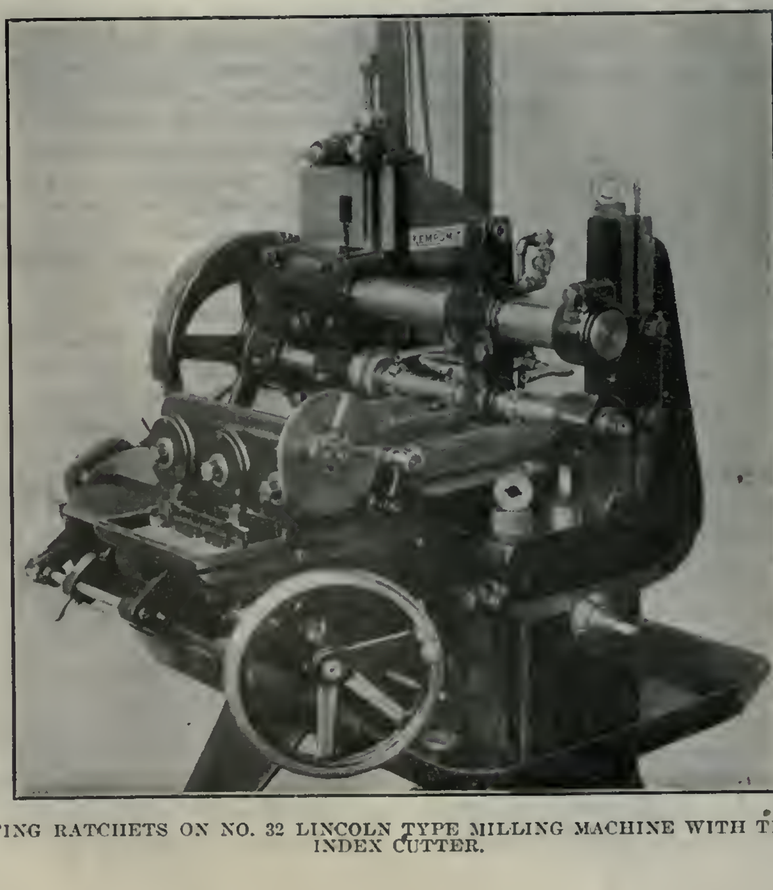
The entire press proper is of steel construction, the beams being formed of steel lugs cast on the cylinder, while the sills are formed by steel lugs cast on the base plate. Bright cold-rolled steel shafting is used for the strain rods. The two brackets which form the pump base are of cast iron, and are bolted securely to the main part of the machine. Bolts are used here, because it is sometimes desirable to operate the press from an independent pump or an accumulator system. The motor base in this case is omitted.

The daylight or stock space is 18 in. wide, with a 12-in. run of ram. The press bed or pressing surface is 24 in. square, and has an opening directly under the ram to receive the broach as it passes through the work. A wooden box receives it as it drops. The extreme height of the press is 6 ft. 4 in.

6¼-INCH TRIPLE INDEX CENTRES.

THE KEMPSMITH MFG. CO., Milwaukee, Wis., have recently put on the market a new attachment in the shape of 6¼ in. triple index centres.

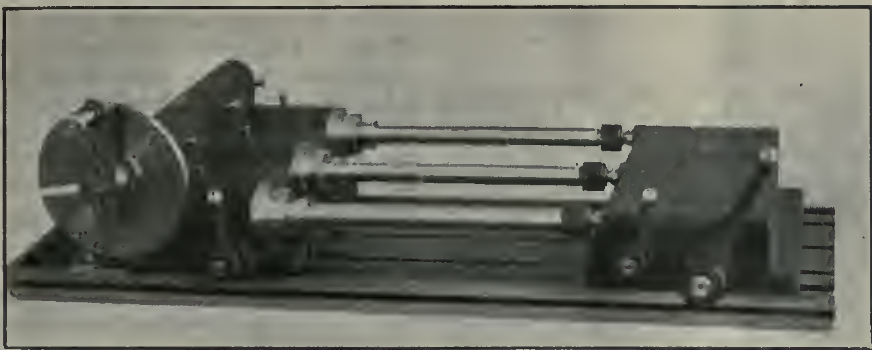
These triple index centres are useful for cutting ratchets, small spur gears, rotary pump cams, etc., and are designed for use on such work as can be mounted on arbors only. The centre distance of spindles is 6¼ inches; centre line of spindles is 3¼ inches above the table, and width of T slots ⅝ inch. Centre dis-



CUTTING RATCHETS ON NO. 32 LINCOLN TYPE MILLING MACHINE WITH TRIPLE INDEX CUTTER.

tance of spaces for T slot bolts are made to suit the machine for which the attachment may be ordered.

The three spindles are indexed simultaneously, and are provided with No. 10 B. & S. taper hole in the front end. The hole through the spindle is 1 inch diameter. Each spindle has 5/8 inch draw-in bolt for holding arbors firmly in place, and the three spindles are all clamped at one time by the lever shown at the lower right-hand side of headstock. The index plates and index crank are the same as furnished with the Kempsmith universal dividing head, and the same number of divisions can be obtained; that is, all numbers up to 60, all even numbers and multiples of 5 up to 120, and a liberal number in addition up to 300—195 different divisions in all. A chart showing the number of divisions and how they are obtained is furnished with each set of centres.



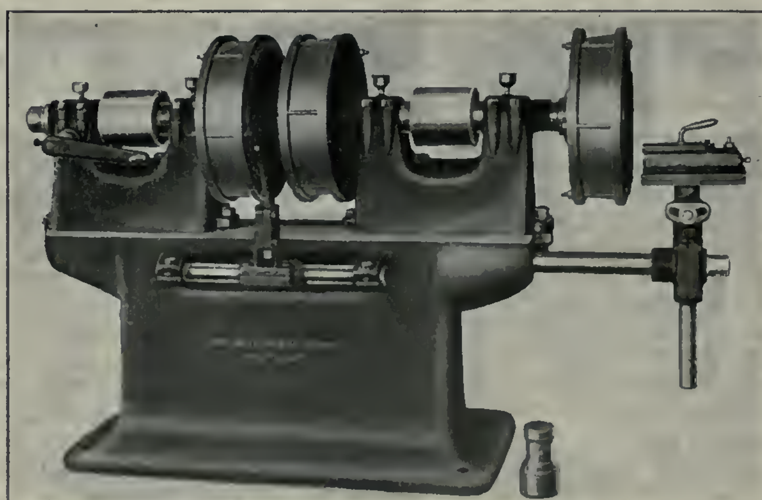
KEMPSMITH TRIPLE INDEX CENTRES.

The tailstock is of improved quick acting design, and the steel centres are held in place by coiled springs. In withdrawing the centres from the arbor holding the work, the entire tailstock is moved back, thus releasing the three centres all at once. With the work again in place, the tailstock is shoved forward and locked in position by means of the long lever at the right; the steel centres are then clamped by the shorter lever. Any inequality in the length of the arbors is automatically taken up by the coiled springs back of the centres. The regular equipment consists of two index plates with necessary wrenches and clamp bolts, but arbors are not included.

16 IN. RING WHEEL GRINDER.

THE ring wheel grinder illustrated is manufactured by the Ford-Smith Machine Co. of Hamilton, Ont., and is their standard heavy type twin disc and ring wheel grinder, with an extra ring wheel and special end table. The wheels in the centre grind wrench jaws on both sides at once to exact thickness from the rough, the left-hand spindle being advanced toward the right-hand stationary head by the lever shown, and up to a micrometer gauge top. The right-hand end table has a small top slide with lever feed for the wrench saddles, finishing them all over from the rough in three short operations.

Ring wheels are preferable to discs on this rough and heavy class of grinding, where the replacing of emery cloth discs would become too frequent and costly. Also, ring wheels prove more efficient than cup wheels, are less expensive, and when contained in the chuck shown, are safe and can be worn down to $1\frac{1}{2}$ inch thick. The end thrusts of the wheels are taken on ball thrust bearings, and the heads are fitted with a guard for dust exhaust attachment.



16-INCH RING WHEEL GRINDER.

CANADIAN TRADE.

THE annual report of the Department of Customs issued a few days ago, reviews the trade of Canada, Customs revenue and shipping in comparative tables covering the whole period since Confederation. The grand aggregate trade of the last fiscal year is given as $1,129,744,725, of which the exports amounted to $478,997,928 and the imports to $650,746,797. The duty collected amounted to $107,180,578.33, the percentage of duty on the total value of goods entered for consumption dutiable and free being 16.91 as against 17.03 in the previous year. The Customs duty collected is shown by ports, and under this head there are some large totals, $24,460,814.30 being collected at Montreal, and $18,866,881.27 at Toronto.

SQUARE END PIPE CUTTER.

FOR years, hand pipe cutters have labored under the drawback that the metal of the cut was simply squeezed out, not removed. This produced a large burr both inside and out, which, for most purposes, must be removed and, for the more particular jobs, making the pipe quite unserviceable.

To overcome these troubles, the Borden-Canadian Company of Toronto have brought out the square end cutter shown in the illustration. The device is simplicity itself, consisting of a heavy frame which carries the guide vees, the handles, and the cutters. These cutters are fed to their work by compression springs, the depth of cut being accurately regulated by the opposite leg of the cutting tool. The tools last a long time without regrinding and when necessary, this can be easily done.

SQUARE END PIPE CUTTER.

Question and Answer Series for Foundrymen

Foundrymen having difficulties in connection with their work are invited to forward particulars of them to this department for solution. The greatest possible care will be taken to give only reliable and tried-out advice on all questions submitted.

GRAY IRON MIXTURE FOR BEDSTEAD WORK.

Question.—Can you advise us of a a first class mixture for bedstead work, also any other information that would be of advantage in connection with this line.

Answer.—You should use a high silicon pig iron having anywhere from 2.80 per cent. to 3 per cent. silicon and about 1 per cent. phosphorus. The melting is continuous and your iron must be very fluid and soft. Stove plate scrap works very well when operations are carried on continuously and will give the proper composition for the above line of work. Permanent moulds or chills should be made from a still softer mixture, as it will withstand the heat much better than a harder iron. You can use any kind of scrap with the exception of car wheel or white iron, and sufficient silicon should be added to soften the mixture as required, it being too expensive to use pig iron for this class of work.

Brass Casting Difficulty.

Question.—We are having trouble with our brass castings, which draw at the gate. They weight ½ lb. each, and are cored out to ⅛ in. in thickness. The mixture we use is as follows: Copper 15 lbs., zinc 1 lb., tin 1 lb., lead 2 lbs., and the balance scrap. We would like to make this work from all scrap. The castings must be clean, as they are drilled and threaded. This mixture is also too tough for us.

Answer.—In this case all depends on your scrap, and it is difficult to give intelligent advice without a knowledge of its composition. If your metal is too tough, the addition of 3 lbs. of lead to every 100 lbs. of metal will overcome the trouble. If you use red scrap, the metal should contain enough lead to work easily. Your 19 lbs. of new metal does not help any, and can be omitted. Castings as light as yours should never draw at the gates in either yellow or red brass, so there must be something wrong with your method of moulding, and as we have no information regarding this, can only advise larger sprues and runners to feed the castings.

Bronze for Patterns.

Question.—Will you give us a first-class bronze mixture for metal patterns. We can obtain a considerable amount of this work, but our castings, although good, have not got the fine finish required by the trade.

Answer.—A mixture that can be recommended for this class of work is as follows: Copper 90 lbs., tin 5½ lbs., zinc 3 lbs., and lead 1½ lbs. The metal is not the only point to be taken into consideration in these castings, as you should have the work made by a skilled mechanic, and he should have the best of material to work with. First class moulding sand is one of the most essential things in turning out good, smooth castings, and great care should be taken in melting your metal that it does not get burnt. Put your flux in on the first metal in your crucible, and keep covered with charcoal; also remember it takes time to make perfect work and do not expect your moulder to compete with a moulding machine, or you will not get first-class work.

Slag in the Tuyeres.

Question.—We melt about six tons of iron each heat and when the wind is reduced towards the last of the heat we are troubled with slag or a kind of sponge-like dirt running into the tuyeres and wind belt. We have been using about 50 or 60 lbs. of limestone broken up small as a flux, and we have a blast pressure of about eleven ounces. Can you advise us how to overcome this trouble?

Answer.—When you use limestone you must slag your cupola, as the limestone makes the slag very fluid, and when the blast is reduced it must necessarily run out of the tuyeres. The slag must be kept below the tuyeres and use about 20 lbs. of good limestone to each ton of iron melted. This should work out all right, but if you had given the size of your cupola we could have given you more intelligent advice, as it is very necessary to have size and location of tuyeres when giving advice on cupola practice.

Sand Burnt Castings.

Question.—We make castings for clock frames and other light work, and have trouble in producing them smooth; some parts of the castings have the sand burnt on, and other parts are misrun. What would you advise to stop this trouble?

Answer.—Your pattern is not uniform in thickness, therefore it burns the sand in the heavy spots and mis-runs in the thin ones. Have your pattern made the same thickness and pour with the dullest iron it is possible to run into your castings. Use an attached gate on your pattern with the parting edge of your gate 1-32 inch below the surface of your pattern, and for facing shake on a mixture of plumbago and talc, equal parts of each. You must also have a high silicon iron for this work, as it must be soft and fluid to make perfect castings. On light work like yours use good fine sand as dry as you can possibly work it, and you will have a smoother finish on your castings.

Blow Holes From Chills.

Question.—We are using chills on some castings we are making which require a close grain iron and are having considerable difficulty with blow holes where the chills are used. We have coated our chills with shellac, plumbago and oil, and kerosene, and have also tried core wash, with no success. Can you suggest any way to prepare the chills to overcome this trouble?

Answer.—The less foreign substance you put on your chills the better, as it only burns off, and is likely to form blow-holes on account of the gas forming as it burns. All that is necessary is to prevent the moisture from settling on the chill. Get some black machine oil or crude petroleum and thin it with kerosene and rub over the chills and you should have no trouble from blow-holes. Do not use anything but oil, as any mixture that is affected by heat and must burn, is a bad combination and will form gas.

Brass Valve Mixtures.

Question.—Please give us several mixtures of brass for valves, some with a large percentage of scrap brass, and some with new metals.

No. 1.

Answer.—Red scrap brass 75 lbs., yellow scrap brass 14 lbs., copper 8 lbs., lead 1 lb.

No. 2.

Red scrap brass 73 lbs., yellow scrap brass 18 lbs., copper 4 lbs., zinc 3 lbs., and lead 2 lbs.

For mixing with new metals use the following:

No. 1.

Copper 84 lbs., tin 10 lbs., zinc 4 lbs., lead 2 lbs.

No. 2.

Copper 87 lbs., tin 7 lbs., zinc 4 lbs., lead 2 lbs.

No. 3.

Copper 88 lbs., tin 5 lbs., zinc 3½ lbs., lead 3½ lbs.

In the mixtures where large amounts of scrap brass are used, care should be taken in selecting the scrap, as a large quantity of it received these days is doped with lead and aluminum, and will give you a lot of trouble in your mixtures if not watched closely.

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Vol. XII. OCTOBER 29, 1914 No. 19

PRINCIPAL CONTENTS.

CAPTURING THE ENEMY'S TRADE.

THE above slogan is becoming daily more familiar to every Canadian. The average citizen has been led to think that the huge German commercial interest and all the prosperity it may bring will be thrust upon us as part of the fruits of victory in the great European war. It will be well, therefore, for us at this time to consider how we may capture this German trade and, if not, why not?

Germany has secured her great export trade by her ability to produce for the consumer in different parts of the world the articles desired at a lower price than her competitors. This has been vigorously supplemented by a campaign, largely through secret societies, to influence the foreign press in a favorable way as well as by advertising. The war has temporarily shut out this trade but, at the present rate of destruction, this impediment cannot last long and, after it is over, even should Germany conquer, the poverty of her people will be such that it will be possible to manufacture goods in that country much more cheaply than it has been. Customers will not have had time to forget German prestige; old stocks will have been used up and they therefore will readily absorb the new and, if anything, cheaper exportations.

The Canadian social organization does not at present seem to be in a position to meet these conditions. The machine is extremely inefficient. For instance, in a Western town recently it was determined that 26 per cent. of the people lived directly or indirectly from the results of trading in real estate, a business which produces nothing and is a parasite to effective industry. The industrial community consists of two great bodies each, in a short-sighted way endeavoring to "work" the manufacturing business for all it is worth. The result is that the cost of commodities, in spite of wonderful advances in science, is continually going up.

As examples of this, it is a well-known fact that a certain automobile manufacturer was prevented from selling his product at as low a price as he desired by other members of the association to which he belonged. On the other hand, the unalterable attitude of labor organizations towards the wages question is well known.

We do not advocate the lowering of wages and salaries, but if the parasites be limited in their activities and social efficiency be promoted in other ways, this need not be necessary. The cost of production, however, must come down and, if both capitalists and working men would exercise a little more generosity towards the common cause, with our brains and organizing ability, we could make ourselves richer in a double sense by the maintaining of our incomes and the lowering of the cost of manufactured goods and, at the same time, conquer a large part of the commercial world.

IMPROVE THE TOOL ROOM.

THE RAPID growth of plants whose sole purpose is the design and manufacture of dies, fixtures, jigs and special machinery cannot help but bring to thoughtful minds the question of what is becoming of the old-time tool room. Is the tool room keeping pace with the rest of the institution?

In the automatic machine department of a large eastern factory are numerous turret lathes, monitors, etc., yet in the tool room we noticed a man tediously turning punches one at a time in batches of fifty. Reamers and straight fluted drills were made one at a time and indexed by hand while similar work in the factory was done at one-fourth the cost. If manufacturing methods be carried into the tool room and the tools be manufactured rather than made, the tool room will again be a profitable adjunct.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 50	17 25
Victoria, No. 2X......	18 25	17 00
Victoria, No. 2 Plain..	18 25	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto	2.00
Common bar iron, f.o.b., Montreal.	2.00
Steel bars, f.o.b., Montreal	2.00
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.05
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.70
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws....	75 & 5
Stove bolts	80 & 7½
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes.	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh ...	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh..........	26 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 50
Copper, crucible	10 00	9 50
Copper, unch-bled. heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	10 75	8 50
No. 1 compos'n turnings	8 50	8 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings ...	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Sandard	Buttweld Black	Gal.	Lapweld Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in...	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ..	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b. Toronto.

METALS.

	Montreal.	Toronto.
Lake copper, carload	$13 00	$13 00
Electrolytic copper	12 75	13 00
Castings copper	12 50	12 75
Spelter	5 75	5 75
Tin	33 00	33 00
Lead	4 75	4 75
Antimony	16 00	16 00
Aluminum	20 00	21 00

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	6.40
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine, single bbls.	0.67
Linseed oil, raw, single bbls.	0.61
Linseed oil, boiled, single bbls.	0.64
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Pure Manila rope	0.16
Lard Oil, per gal.	0.60

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50% & 10%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3.45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4 95
1 inch	8 05
1 1/4 inch	12 65
1 3/8 inch	15 30
1 1/2 inch	16 50
1 5/8 inch	19 40
1 3/4 inch	22 50
1 7/8 inch	25 80
2 inch	29 30

Prices quoted are cents per foot.

CAST IRON PIPE.

6 inches and upwards	$32 00
4 inch	33 00
Specials per 100 lbs.	3 00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1 1/2-in.	$37.50	$30.00	$17.50
33/64 to 3/4-in.	41.25	33.00	19.25
7/16 to 1/2-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2 50	$2 60
Canada plates, ordinary, 52 sheets	3 70	3 85
Canada plates, all bright	3 90	3 95
Apollo brand, 10 3/4 oz. (American)	4 25	3 90
Queen's Head, 28 B.W.G.	4 30	4 35
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4 00	4 20

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Oct. 26, 1914.—Little change has taken place in the industrial outlook during the past week. The amount of business passing is very satisfactory, considering all things. A little impetus was evident in shipping circles here since the transports conveying troops to England have been released and allowed to return to their regular service. In the metal trades, business is quiet in all lines; prices have been very firm, however, there having been but the slightest tendency to weaken. The pig iron demand is at almost as low an ebb as it has ever been, yet the price is only moderately low. Foundries are not working full time except in rare instances, and their melts in addition are small in quantity, so that little pig is moving. The steel trade is extremely quiet, the mills rolling but little stock. Metals seem to be a little more active than steel and iron. Those factories which were equipped so that they could handle the manufacturing of shells have now all been awarded their part of the contract and are busily engaged in turning out this product.

The feeling is pretty general now that the European struggle will be a long one. Confidence, however, is being evidenced at every turn, and with the first intimation that the final chapters of the war are being enacted there is sure to be a rapid recovery in business. Canadian factories will benefit perhaps more than any others in the world, and the patriotic spirit created will tend to join Canada to the Mother Country more strongly than ever before.

Steel Markets.

No very interesting developments in the steel business have appeared during the week. Sales are still remaining at about the same level as for the past few weeks. All orders have been for small lots. Building shapes are particularly dull. Machinery bars are, however, selling a little better. Little improvement is looked for in this market until industrial conditions have improved generally. The tendency of all firms has been to husband their resources and this policy coupled with weak buying, has brought about the existing dullness.

Pig Iron.

The foundries throughout the country seem to be doing little or nothing. On account of the low price of pig iron before the war was declared, many foundrymen purchased liberal stocks. The declaration of war thus found most foundries with large quantities of iron on hand and little or no prospect of business. The result is that since the war the sales of pig iron have been reduced almost to nil. This same condition exists to a greater or less extent throughout the States.

Machine Tools.

From time to time small orders are reported, but aside from these there is but little business. This condition follows directly, of course, on the upset condition of the manufacturing business. Until manufacturing interests come into their own but little change is anticipated.

Metals.

The metal situation presents a slightly different outlook. Owing to the small export of copper, the amount being produced has exceeded largely the demand and prices have taken a further drop. In tin the situation is tending to look a little stiffer, although no actual increase in price has been made. Apparently supplies of this metal from the East have been interfered with and some small excitement prevails. Spelter has weakened a little. In other channels, business is small and there is but little demand.

Toronto, Ont., Oct. 27, 1914.—Industrial conditions have not varied to any appreciable extent from those which have prevailed during the weeks immediately preceding. The feeling in business circles, however, continues to improve, due largely to the orders for supplies and equipment which have been placed in this country by the British Government. Not only will money come to Canada freely on this account, but it is also having a stimulating effect on business generally. Factories engaged in filling the various orders are working to capacity, but those not so favored are, as a rule, quiet, although the outlook for them is somewhat brighter.

A representative of the British Government is now in Canada for the purpose of placing large orders for equipment; this, in addition to the orders already contracted for, the amount of business given out depending upon the ability of the manufacturers to meet the price and supply the quality and style of goods required. It has been stated on good authority that the French and Russian Governments may probably purchase considerable quantities of equipment in this country. The fact that Canada will benefit, in all probability, to the extent of millions of dollars, should dispel much of the depression now prevailing. The steel mills and machinery manufacturers will benefit both directly and indirectly from this business. A welcome feature in this regard, to be noted, is that this new business will benefit principally the larger towns and cities, where the industrial depression is being more keenly felt, than in the rural districts.

Municipalities have, in the majority of cases, been obliged to stop or considerably reduce operations on civic works on account of the financial stringency. In some districts arrangements have been made for extensive work on road building, primarily intended as relief work for the unemployed, but also to provide a public necessity. The Dominion Government is going ahead with several public works as far as weather conditions will permit.

Steel Market

The iron and steel markets are quiet, but there are indications of increased activity. Structural material is moving slowly on account of the restriction in building operations. Some mills are experiencing considerable activity in producing large quantities of barbed wire for the British Government. With the exception of this business and the shell contracts, we are not aware of orders of any magnitude having been placed for steel products. Hopes are entertained, however, that considerable business will be booked by Canadian mills in due course. Such business would stimulate the steel trade, which has been seriously affected by the war. According to the Department of Trade and Commerce report, there is an opening for considerable business in France for steel products, provided Canadian manufacturers are prepared to send representatives to that country with full power to conclude transactions.

There has been no change in prices this week, and they are fairly steady. The steel trade in the States has not improved, and mills are operating at much reduced capacity. The local market for old material is dull, but prices have not changed. Cast iron pipe is quiet, and very few contracts have been given out by municipalities recently. Orillia, however, has placed an order with the National Iron Works.

Pig Iron.

The pig iron market continues very dull, owing to the foundries and allied industries being quiet. Prices have not changed, but there is a weak tendency.

Machine Tools

Dealers report dull conditions in machine tools. No specifications of any importance have been received, and the outlook generally is not particularly hopeful. There has been a better demand for second-hand tools recently.

Supplies.

Business in machine shop and mill supplies is quiet, and prices are unchanged, with the exception of leather belting, which has advanced on account of the heavy demand for leather for saddles and boots, etc. There has been a shortage of hides for some time, and the effect of this is being felt more acutely now on account of the heavy demand for leather. The new discounts are as follows:—Extra heavy, 50 and 10 per cent.; standard, 60 per cent., and leather lacing, No. 1, $1.25 per lb.

Metals.

There is comparatively little change in the situation. The metal markets generally are dull, but prices are steady, with the exception of copper and spelter, in both of which cases the prices have declined. The following prices are being quoted to-day:—Lake copper and electrolytic, 13c; castings, 12¾c per lb. Spelter is weaker at 5¾c per lb.

Trade Gossip

Lindsay, Ont.—It is understood that F. J. Carew has been successful in securing the contract from the Militia Department for all engineering fixtures in connection with the new armories.

Ottawa, Ont.—It is announced that here will be no let-up this winter in the ig public works of the Government in so far as weather conditions will permit. The harbor works at St. John, Halifax, Quebec and Montreal, the Port Nelson terminals, the Welland Canal work and the coastal terminals at Vancouver and Victoria are to go ahead. Any cutting down of operations will be with the smaller undertakings. A large contract now being awarded provides for a breakwater at Goderich, which has been urged since the big lake storm of last year.

Port Arthur, Ont.—J. J. Carrick, M.P. for Port Arthur, states that the Government is doing everything possible in connection with the erection of the new custom house, construction of docks, and dredging work here and at Fort William, to reduce unemployment to the minimum. The stone required for Government contracts is brought in and put where the work is needed. The Ontario Government had also been induced, he said, to throw open some timber limits, and more men will be put to work in lumber camps.

German Exports of Railway Supplies.—Recent British statistics, dealing with British and German exports of railway supplies and equipment to the principal markets of the world, have an interest and pertinency of unusual keenness at the present moment. During the year 1912 the total value of railway material exported by Germany to all destinations amounted to $29,490,200. Of this $6,844,200 consisted of railway wheels and axles and parts of railway wheels, hubs, tires, frames, etc., and $22,656,000 of other railway material. British exports in the year 1913 amounted to $6,050,000 for railway wheels, axles and their parts, and $25,948,000 for other railway material, making a total of $31,998,000. Exports from Austria-Hungary in 1913 amounted to $194,350, of which $7,000 was for railway wheels, axles, hubs, tires and parts, and $187,350 was for other equipment.

Nova Scotia Steel Co. Shell Contract.—Thomas Cantley, general manager of the N. S. Steel and Coal Co., speaking of the production by his company of two hundred thousand shells for militia purposes, states: "Our company received the order for the reason that it is the only one in Canada which has a fluid compressor plant. At the Halifax plant we are forging the shell bodies and the steel discs which go inside of them. The finishing of the shells has been divided between ten different engineering concerns, three of which are in Montreal, two in Sherbrooke, one in Galt, one in Dundas, three in Toronto, and one in Kingston. The whole order must be completed before the end of March, 1915, and we have guaranteed to turn out a certain number each month. At the present time we are turning out from fifteen hundred to two thousand shell bodies a day."

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

REVIVAL OF CANADIAN NICKEL INDUSTRY.

THE nickel industry in the district of Sudbury, Canada, is manifesting plain signs of a revival, says "The American Metal Market." The The International Nickel Co., viewing the market as more favorable, have opened up two more of their furnaces at Copper Cliff, and now have four out of the six running. Ever since the beginning of the war they have operated but two. So far there has not been more than 25 per cent. of the staff of the Canadian Copper Co. at work, but it will be now nearer 60 per cent., or over 1,000 men.

The holding company of "Canadian Copper" which is the International Nickel Co., were caught with large supplies of refined nickel distributed all over the world, particularly in Germany. Almost 75 per cent. of this trade was with Germany and for purposes of armor plate manufacture. Although good uses have been discovered for nickel steel in other lines, such as in bridges and rails and parts of motor cars, the great bulk of the nickel goes into armament. The German market being absolutely cut off from the Canadian producer, it was not surprising that the industry should have slackened operations. Upon the ultimate outcome of the war much depends. Should the nations decide upon a reduction of armaments, as seems possible, the Canadian nickel industry would stand to lose a large section of its market.

The Mond Nickel Co., the only other producing firm in the Sudbury field, have gone ahead steadily, mining and producing. Their plan has been to keep their drills in the ore and to cut out all dead work that can possibly be avoided. In spite of this they reached the apex of their production in July, and August gave little evidence of reduction. They are working no less than five mines—the mother mine at Victoria Falls, the Garson, Kirkwood, Levak and Worthington. The new smelter at Coniston was completed about a year ago. The Mond people also make matte and ship it to their refinery in Wales. Since the beginning of the war their shipments have been irregular, but there is little doubt that everything mined can be marketed eventually.

An agitation has been fostered by some influential Canadian newspapers to place an embargo on all nickel steel except what is directed to Great Britain and her allies. The Canadian Government could very easily effect such a drastic measure which would place hostile countries in an unenviable position. Canada has practically the only extensive nickel fields in the world, and the scheme to cut off Germany as a customer is at the moment highly popular and may possibly come into operation following the declaration of peace.

INJUNCTION GRANTED IN PATENT CASE.

AN injunction was granted by Mr. Justice Baudin at Montreal recently in an important case, involving $74,000. Charles de Tonnacour, merchant, and John Carroll Broderick, architect, both of Montreal, are the plaintiffs, and the British Metal Spray Co., of London, England, are defendants, the Imperial Trust Company being mis en cause.

On July 18, 1914, the plaintiffs bought from the defendant, represented by H. Litthauer, its entire right, title and interest in certain patents, the consideration of the sale being $74,000, under the following conditions: The plaintiffs were to deposit with the Imperial Trust Co., to be held in trust for account of defendant, three hundred shares of the Regent Construction Co., of a par value of $30,000, and a properly drawn bill of exchange for $44,000 in favor of the defendant. If on Sept. 2, 1914, the petitioners, after the patents had been delivered, did not pay the said sum of $74,000, the Imperial Trust Co. had to hand over to the respondent the said three hundred shares and to take such steps as might be necessary to collect the amount of the bill of exchange. The patents were supposed to be basic patents for the supposed invention of M. U. Schoop, of Zurich, for the spray process of metallic deposition, which was for the spraying of pulverized metal on any suitable surface, and were guaranteed as such by the defendant.

Plaintiff's plea said that the defendant claimed and represented to the plaintiffs, although knowing such to be false, that the said M. U. Schoop was the original inventor of the process, and that the patents obtained by him were basic patents. The defendant gave a demonstration of the operation of the process to the plaintiff, John C. Broderick, when he was in London, Engnad, in April, 1914.

On his return to Montreal in June, 1914, plaintiff, J. C. Broderick, sent to London for an agent of the defendant to come to Montreal and demonstrate the process. The agent came to Montreal and gave demonstrations of what he represented to be the Schoop process. The patents were granted by the Canadian Government on the 18th of July, 1914, and plaintiffs discovered that the said inventions of M. U. Schoop were worthless, null and void, because the application for the issue of Letters Patent contained material allegations that were false, and the inventions were really the inventions of one Alexander Watt and of one Felix Meyer, who had obtained patents for the said inventions, and had neglected to register the same at Ottawa within a year in accordance with the Patent Act. By fraudulent manoeuvres, plaintiff contended, the defendant induced plaintiffs to sign the agreements. The plaintiffs had deposited with the mis-en-cause a bill of exchange for $44,000 and 300 shares of Regent construction Co. in accordance with the agreement.

Plaintiffs therefore asked that the agreement be declared null and void, that the mis-en-case be ordered to hold the 300 shares and the bill of exchange until the final judgment be rendered, that the plaintiffs be ordered to pay the costs, plaintiffs reserving the right to take any further action they may deem necessary. Defendant's attorneys have entered a motion for particulars.

Justice Beaudin granted an interlocutory injunction, and fixed bail at $5,000. Perron, Taschereau, Rinfret, Genest, Billette and Plimgold represent plaintiffs, and McLellan, Howard and Aylmer the defendant.

QUEBEC HARBOR EQUIPMENT.

WITH the arrival at Quebec of the floating grain elevator for the Harbor Commissioners, John Reid & Co., of Glasgow and Montreal, have completed one of the most important orders for marine equipment ever placed in Canada.

When the Quebec Harbor Commission was reconstituted, under the chairmanship of Mr. Wm. Price, it was determined to obtain an up-to-date marine equipment, and St. George Boswell, harbor engineer, made seven recommendations, as follows:—

A sea-going suction and reclamation dredge.

A self-propelling bucket-ladder dredge.

Six steel scows to attend on the bucket-ladder dredge.

A large sea-going tug and service vessel fully equipped with salvage and fire fighting appliances, to be used on occasion as an ice-breaker.

A small tug for service with scows in shallow waters and for general duty around the harbor.

A floating grain elevator, 30,000 bushels carrying capacity, with ability to unload grain from canal and coasting vessels and deliver direct into the largest liners frequenting the harbor of Quebec, and a floating crane of 50 tons capacity.

John Reid & Company received the order for the whole equipment except the floating crane; and contracts were placed for the dredge plant in Germany and Great Britain, the scows being built by the Polson Ironworks, Toronto; the large tug on the north-east coast of England; the grain elevator also in England; and the small tug at Sorel in the Sincennes-McNaughton yard.

The complete plant was assembled from these various countries and delivered at Quebec within a period of twelve months without mishap, delay occurring only in the delivery of the grain elevator, occasioned by the outbreak of war.

John Reid & Co. also secured the order from the Transcontinental Railway Commission for the train ferry Leonard, with elevating tidal deck, built by Cammell Laird Co., and recently delivered at Quebec.

These orders for Quebec involved the expenditure of over a million and a half dollars.

SUSPENSION OF ENEMY PATENTS.

THE Order-in-Council with reference to the cancellation or suspension of patents held by subjects of the enemy, which appeared in the Canada Gazette under date of October 5, may be reprinted herewith for the benefit of those who may be interested and who may not have seen the original notice:

The Governor-General in Council, under and in virtue of the authority conferred by "The War Measures Act, 1914," is pleased to order as follows:

The following orders and regulations respecting patents of invention are hereby made and established:

1. The "Commissioner" means the Commissioner of Patents and includes the Deputy Commissioner of Patents.

2. The Commissioner may, on the application of any person, and subject to such terms and conditions, if any, as he may think fit, order the avoidance or suspension, in whole or in part, of any patent or license, the person entitled to the benefit of which is the subject of any State at war with His Majesty, and the Commissioner, before granting any such application, may require to be satisfied on the following heads:

(a) That the person entitled to the benefit of such patent or license is the subject of a State at war with His Majesty;

(b) That the person applying intends to manufacture or cause to be manufactured the patented article, or to carry on, or cause to be carried on, the patented process within the Dominion of Canada;

(c) That it is in the general interests of the country, or of a section of the community, or of a trade, that such article should be manufactured or such process carried on as aforesaid.

The fee payable on such application shall be ten dollars.

The Commissioner may at any time, in his absolute discretion, revoke any avoidance or suspension of any patent or license controlled by him.

Provided always that the Commissioner may at any time, if in his absolute discretion he deems it expedient in the public interest, order the avoidance or suspension in whole or in part of any such patent or license upon such terms and conditions, if any, as he may think fit.

3. In any case in which the commissioner makes an order by virtue of the powers vested in him under these rules and regulations or any of them, avoiding or suspending in whole or in part a patent, he may, in his discretion, grant in favor of persons other than the subject of any state at war with His Majesty, license to make, use, exercise or vend the patented invention so avoided or suspended, upon such terms and conditions and either for the whole term of the patent or for such less period as the commissioner may think fit.

4. The commissioner may, at any time during the continuance of these orders and regulations, avoid or suspend any proceedings on any application made under the Patent Act by a subject of any state at war with His Majesty.

5. The commissioner may also, at any time, during the continuance of these orders and regulations, extend the time prescribed by the Patent Act or any rules made thereunder, for doing any act or filing any document, upon such terms and subject to such conditions as he may think fit in the following cases, namely:—

(a)—Where it is shown to his satisfaction that the applicant, patentee, or proprietor, as the case may be, was prevented from doing the said act, or filing the said document, by reason of active service, or enforced absence from this country, or any other circumstances arising from the present state of war, which, in the opinion of the commissioner, would justify such extension;

(b)—Where the doing of any act would by reason of the circumstances arising from the present state of war, be prejudicial or injurious to the rights or interests of any applicant, patentee or proprietor as aforesaid.

Such extension of any prescribed time, if granted after its expiration, shall have the same effect as if granted prior thereto, provided such expiration occurred on or after the fourth day of August, 1914.

6. The commissioner may refuse to register the assignment of any patent made by a subject of any state at war with His Majesty and filed in the Patent Office on or after the fourth day of August, 1914, unless satisfied that such assignment was made in good faith and not for the purpose of evading any of the provisions of the foregoing orders and regulations.

7. The term 'person' used in these orders and regulations shall, in addition to the meaning given thereto by par. 20 of section 34 of 'The Interpretation Act,' include any government department.

8. These orders and regulations shall come into operation as and from the fourth day of August, 1914.

9. The orders and regulations respecting patents of invention made under 'The War Measures Act, 1914,' and dated the 11th September, 1914, are hereby rescinded and repealed.

APPEAL TO CANADIAN MANUFACTURERS.

D. H. ROSS, Trade Commissioner at Melbourne, Australia, has written the Department of Trade and Commerce, Ottawa, urging that a special appeal be made to Canadian manufacturers to forward their catalogues to Canadian Trade Officials. Price lists and discount sheets should also be sent, as without these essentials, the catalogues are of no avail. In view of the present opportunity for the extension of Canadian trade everything possible should be done to assist the Canadian Trade Officials in their work. It is to be hoped therefore that this appeal will meet with a ready response from Canadian manufacturers and that a material benefit will accrue therefrom not only to the manufacturers concerned but also to Canadian trade generally.

Turret Lathe and Vertical Boring Mill Practice

By Albert A. Dowd *

Beginning with our July 9 issue this year, there have appeared more or less frequently articles contributed by the author of this further series. To our readers who have followed what has already been published on the above subject, and more particularly to those recently added to our list of regular subscribers, it will be sufficient to state that the writer is a thorough master of his subject.

AUTOMOBILE PISTONS AND RINGS.—I.

IN the manufacture of pistons and rings for automobile work, there are points in machining to be considered which are entirely different from those usually encountered. In connection with the machining, there are problems of holding the work to the best advantage, and these problems are fully as important as the others. In these days of high productive efficiency the item of cost of tooling and fixtures is always a secondary consideration, providing the seasonal output is such as to wardant the expenditure.

It is generally conceded that in handling an automobile piston some method of holding by the interior cored surfaces gives best results for the first operation, on account of possible lack of concentricity of exterior and interior surfaces. It may not always be found necessary to hold the work during machining by the interior, but the location should be determined from this point. As each automobile engine requires from four to six pistons, depending on the number of cylinders, it will be seen that the number used during a season permits the expenditure of a considerable amount for special tooling if production can be correspondingly increased thereby.

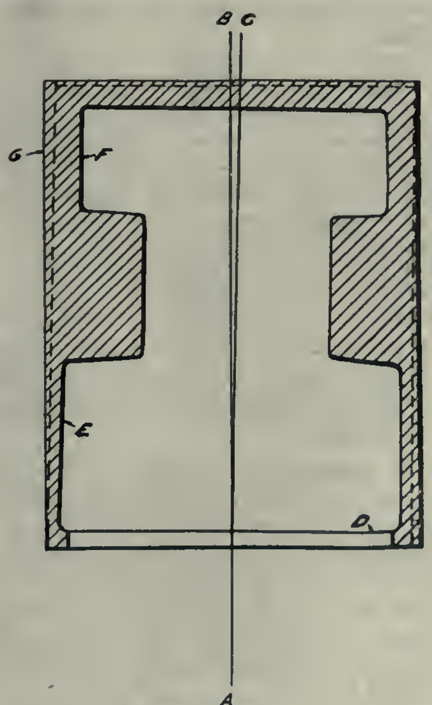


FIGURE 1.

Fig. 1 represents a sectional view of a piston in the rough and the centre lines A B and A C show in an exaggerated way the lack of concentricity between the exterior and interior surfaces. It is clearly apparent therefore that if piston were held for the machining of the open end D by the exterior surfaces G, the boring would be eccentric to the core, and any further method of holding from this open end would result in the same thing. After all the machining had been done, the walls of the piston would be found of very unequal thickness, and in a four or six-cylinder engine there would be no two pistons of the same weight, which would produce a poorly balanced engine. If, however, the method of holding is by the interior surfaces F and E, the machining naturally follows the dotted line shown in the illustration, and the result is a piston having walls of uniform thickness and therefore equal weight irrespective of irregularities in the setting of the core.

Machining a Piston on a Vertical Turret Lathe.

In the design of tools and fixtures for work of this character on the vertical turrent lathe, there are several important points to be considered, viz., method of holding and clamping; design of tools which will not require too great an outlay for upkeep; accuracy in the finished surfaces. Let us first consider a method of holding by the exterior after the location has been determined by the interior.

Fig. 2 shows one method by which a piston can be handled in this way, the piston itself being represented at A. A four-jawed independent chuck is built into the table on the machine and the special jaws B B are mounted on the sub-jaws in the table, being located by the keys Y Y. The jaws are provided with shoulders C C, on which the end of the pattern rests. In operation, the jaws are opened somewhat larger than required to hold the work and the piston is placed in position, coming to a stop on the shoulders of the jaws C. The turret containing the locating device is brought down until the end of the device strikes the surface E, after which the lever P is utilized to force down the rod N, the lower end of which is tapered at O, which serves to force the pins K out against the cored interior. These pins are three in number and are spaced 120 degrees apart in the body D.

At the upper end of the piston, the tapered collar F falls by its own weight and gives a centering action at this point also. The pin G is a stop pin only to prevent the collar falling down on the body after the device has been drawn out of the work. The lever P, which controls the movement of the plunger rod passes through a slot in its upper end and is pivoted at Q. A slot in the lever permits the necessary radial movement to take care of the pin R. The upper end of the body is shouldered at H and enters the turret hole, the pin J simply serving as a locater in this instance, as there is no twisting strain on the device.

While the locating arrangement is in position, the jaws B are brought up lightly, one by one, on the outside of the piston until all are in contact. The lever P is brought into play, and it is pulled up until a snap catch (not shown) secures it firmly. The pins K now spring back away from the walls of the piston as they are constrained to do by the action of the springs L. The turret is next raised and the jaws are tightened

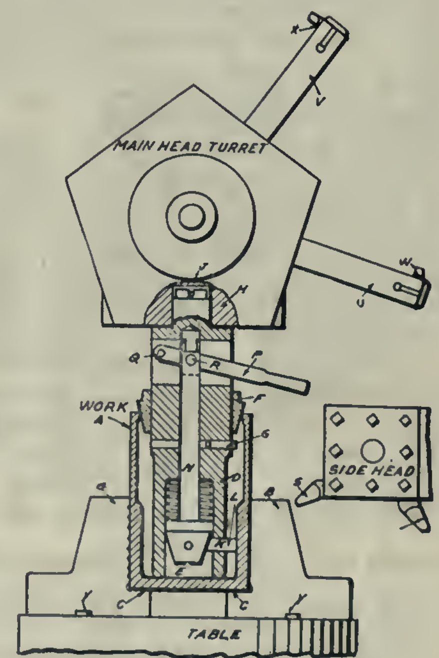


FIGURE 2.

*Production Engineer, Bridgeport, Conn.

securely, after which the piston is ready for the first operation.

It will be seen that although the piston is held by the outside it has been located by the core, so that although slight variations in concentricity may occur, due to unequal setting of the jaws, no serious consequences will be found. The piston can be placed in position and jaws tightened for work in less than two minutes.

The first two operations on the piston are the rough and finish boring and facing of the open end. The rough boring is accomplished by the tool W in the boring bar U, while the finishing is performed by tool X in the bar V, the turret being set off-centre the right amount to give the correct diameter. These bars are both of the slip cutter variety made by The Bullard Machine Tool Co. for use in their turret lathe. During the operation of the roughing and finishing boring bars, the tools S and T are respectively used for rough and finish facing the end of the piston, the side head being indexed for the two operations. Attention is called to the fact that the side head is shown lower than its actual working position in order to avoid confusion.

Lighting Requirement of Metal Working Plants*

By A. L. Powell and R. E. Harrington

Typical well-lighted metal working plants of various kinds, were investigated by the authors, either through a visit to the plant or the data was obtained from plans showing layout of machinery and lighting equipment. In each case, inquiry was made as to the degree of satisfaction given by the lighting.

BENCH WORK.

THIS classification covers a very wide variety of processes from rough filing, chipping, and assembling down to fine engraving, small machine work, gauging and inspecting. Fortunately, the requirements are similar and the principal variation is in the intensity of illumination needed.

Single benches may be located along the wall or in the centre of the room; double benches are usually systematically spaced in the room with operators on both sides. The bench is usually 3 to 3½ feet in height: single benches varying in width from 2 to 3 feet, and the double benches from 4 to 6 feet.

Rough work on benches, regardless of what type, may be lighted by general illumination, but due to the liability of shadows, localized-general illumination is, therefore, most generally applicable for bench lighting. With the proper arrangement of units, shadows are eliminated, and a variation in the size of lamp specialized will meet the intensity requirements. The height of 5 feet above the bench will meet most conditions.

Bench Work.

Class of work.	Size lamp. Watts.	Type of reflector.	Type Illumination	Average spacing Feet	Hanging height Feet.	Watts per sq. ft.
Fine and med. iron	60	Enamel extensive	—	8 ft. centers	5	—
Small iron	60	Aluminum intensive	—	8 ft. centers	5	—
Med. brass	40	Aluminum intensive	—	6 ft. centers	5	—
Med. iron	40	Aluminum intensive	—	6 ft. centers	4	—
Med. brass	40	Aluminum intensive	—	9 ft. centers	4	—
Fine jewelry	25	Aluminum focusing	—	3 ft. centers	2	—
Bearing inspection	100	Enamel intensive	—	10 ft. centers	5	—

The single bench arrangement is very satisfactory. Employing lamps spaced on 6 to 8 feet centres in the 40 to 100-watt sizes with intensive type bowl reflectors. The row of lamps should usually be located about 6 inches in from the front of the bench.

Double benches used for ordinary work can be well lighted by a row of intensive units down the centre line of the bench, while double benches for fine work should have two rows of lamps arranged similarly to the recommendation for single benches. Where vises are permanently attached, it is desirable to locate the lights between two workmen, as there is less liability of shadow and more illumination on vertical surfaces.

Wire Working.

The lighting requirements in a majority of the processes found in wire working are not very severe. Localized-general illumination of a medium intensity will be found to be quite satisfactory. In cold wire drawing, sufficient light should be provided so that operators may perceive the moving wire, loose pieces of wire about the floor, and the reels. As the operation of drawing is done on a bench, this is the place where the best light should be provided. After the operation is once started the work becomes entirely mechanical, although the operator must occasionally see that the wire is running to gauge and that there are no flaws.

Wire Drawing.

Size lamp Watts	Type of Reflector	Type Illumination	Average spacing. Feet.	Hanging height. Feet.	Watts per sq. ft.
250	Porc. dome.	Loc. gen.	22 x 36	12	0.30

Wire Weaving.

Size lamp Watts	Type of Reflector	Type Illumination	Average spacing. Feet.	Hanging height. Feet.	Watts per sq. ft.
150	Porc. dome.	General.	15 x 15	12	0.75

In weaving and twisting, if the machines are uniformly spaced, a system of general illumination will meet the requirements. The intensity should be medium with a higher value for the finer wire. If the machines are not uniformly spaced and are far apart, a system of localized-general illumination should be used.

Finishing processes such as tempering, galvanizing, tinning, etc., may be lighted to good advantage by a system of general illumination. The intensity need not be high as the work carried on is not very close. For such processes as braiding and wire fence making, localized-general lighting is more applicable. The units should be so located that the light will reach the machine in such a manner as to enable the operator to follow the work readily.

*Part III. of a paper read at the recent convention of the Illuminating Engineering Society in Cleveland, Ohio.

Sheet Metal Working.

Punching, pressing and stamping machines, unless equipped with safety devices, are quite dangerous to operate, and the protection of employees demands that these be well lighted. The actual operation is largely mechanical after the machine is set up, but the moving parts must be clearly visible. Lamps must usually be arranged so that the light comes from the front of the machine, and from the right or left of the operator to avoid shadows from the machine head or workman's body. In some cases, large punch presses are advantageously lighted by general or localized-general illumination supplemented by localized lamps at the rear, the lamp itself being concealed from view by the machine.

Localized-general illumination with medium size units, or general illumination supplemented by local lights, are two alternatives. The local lamp should preferably be equipped with angle reflector arranged to direct the light as indicated.

Sheet Metal Working.

Class of Work.	Size lamp. Watts	Type of Reflector.	Type Illumination	Average spacing. Feet	Hanging height. Feet	Watts per sq. ft.
Heavy power press	150	Porc. dome.	Loc. gen.	8 x 20	10	1.05
Small foot and power press	250	Porc. dome.	General	17 x 17	10	0.95
Medium power press	250	Porc. dome.	Loc. Gen.	20 ft. centers	11	0.65
Heavy structural punching	500	Porc. dome.	General	37 x 37	33	0.35

Cutting and shearing can be satisfactorily lighted with general or localized-general illumination of medium intensity, provided lamps and machines are so spaced that the predominating direction of light is toward the front of the machine.

Spinning and buffing are similar as to lighting requirements and present practise indicates that a localized-general system is well suited, although a slightly different arrangement of lamps is desirable. The spinning lathe should be illuminated from the front, whereas, a light directly above the front of the buffer will give the maximum intensity on the piece being polished.

Spinning and Buffing.

Class of Work.	Size lamp. Watts	Type of Reflector.	Type Illumination	Average spacing. Feet	Hanging height. Feet	Watts per sq. ft.
Brass pipe	60	Aluminum bowl	Loc gen.	10 x 18	8	0.30
Fixture pts.	150	Porc. dome.	General	12 x 13	10	1.05

Erecting, Assembling and Testing.

Since the work is likely to be placed at any point on the floor, evenly distributed general illumination seems most desirable. The intensity of light will, of course, depend on the class of goods being manufactured. There are three general methods of arranging the lamps and, naturally, combinations of these may be found, the height and spacing is often determined by the character of machinery being manufactured.

1.—Medium or large lamps with bowl or dome reflectors placed close to the ceiling above the crane travel.

2.—Medium lamps with angle reflectors placed at the sides of the bays below the crane tracks.

3.—Medium or large lamps with dome reflectors placed below the crane tracks, when two or more bays are to be lighted.

Erecting, Assembling, Testing.

Class of Work.	Size lamp. Watts	Type of Reflector.	Type Illumination	Average spacing. Feet	Hanging height. Feet	Watts per sq. ft.
Elevators	400	Porc. dome.	General	15 x 15	20	1.2
Condensers	250	Porc. dome.	General	12 x 18	21	1.3
Metal sashes	150	Porc. dome.	General	16 x 16	10	0.65
Locomotive pts.	400	Paint dome.	General	28 x 28	13	0.55
Structural	250	Porc. dome.	General	25 x 25	18	0.45
Steel	150	Porc. dome.	General	20 x 20	18	0.40
Platform scales	250	Porc. angle	General	20 x 20	16	0.70
Street car	150	Porc. dome.	General	22 x 22	18	0.35
Gas engines.	500	Porc. dome.	General	12 x 40	15	1.15
Heavy met. She.	150	Porc. dome.	General	15 x 15	18	0.75

Paint Shops.

These usually have a clear overhead space and are well adapted to general illumination. A unit giving a fair percentage of light at obtuse angles is desirable for the illumination of vertical surfaces. As a great deal of the work is done with black paint, a medium intensity is desirable to properly inspect the product. When lighting tanks, cars and other high objects, special attention should be given to the location of lamps, avoiding objectionable shadows.

Paint Shops.

Class of Work.	Size lamp. Watts	Type of Reflector.	Type Illumination	Average spacing. Feet	Hanging height. Feet	Watts per sq. ft.
Cars	150	Alum. angle Alum. bowl	General	15 x 18	13	0.6
General product	250	Porc. dome.	General	18 x 18	23	0.85
Tanks	500	Porc. dome.	General	16 x 34 Staggered	31	1.00

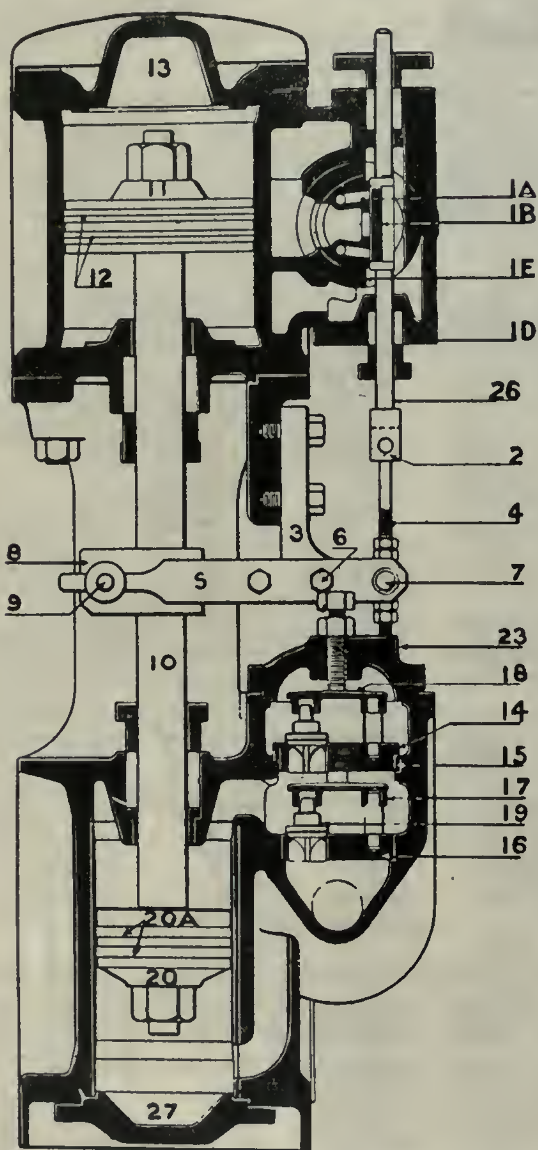
Conclusions.

While it will be noted that there are many classes of metal manufactory, where the character of buildings and other local conditions are so varied as to prohibit any useful standardization of the lighting, the practise in general can be greatly improved by the classification and dissemination of information concerning what is being done in representative plants. It is hoped that further extension of the work along the lines suggested will be helpful in bringing about the adoption of methods, which will not only increase the efficiency and effectiveness of manufactories, but also better the conditions as regards the safety, vision and health of operators. Such improvements will benefit not only the employers and workmen, but also the country at large, to whom individual workers are often changed from assets to liabilities through injuries received in their daily work.

Service Applications of Weir Steam Driven Pumps

Staff Article

In our October 29 issue, the design, construction and operative features of the valve mechanism with which the various Weir pump products are equipped, was dealt with at considerable length. The reliability of service rendered is indicated by their adaptation to every sphere of steam engineering practice—stationary, marine and locomotive.



SECTION THROUGH "WEIR" LOCOMOTIVE BOILER FEED PUMP.

"WEIR" VERTICAL TYPE LOCOMOTIVE FEED PUMP.

AMONG the standard types of marine equipment manufactured by the Weir Co. there may first be noted the arrangement of a **Pair of Pumps and Direct Contact Feed Water Heater.** In this layout, the main engine feed pumps are fitted in the usual manner, but have a change valve fitted on the main feed pipe with a branch leading to the heater. Drawing from the hot well they discharge direct to the heater, which is always placed as high in the ship as possible. These pumps draw from the heater and discharge to the boilers. They are usually fitted with suction connections from the hot well, condenser and sea, and two discharges, one to the main feed check valves and the other to the auxiliary feed check valves. The pumps are independent of each other and duplicate in every part, with the exception that one pump is generally fitted with a cast iron liner and steel piston rod, the other having a sea suction being fitted mith a gun metal liner, bucket, and cold-rolled manganese bronze rod. The iron-lined pump is used chiefly for feeding the boilers when the heater is in operation, but the brass-lined pump should always be used when drawing water from the sea.

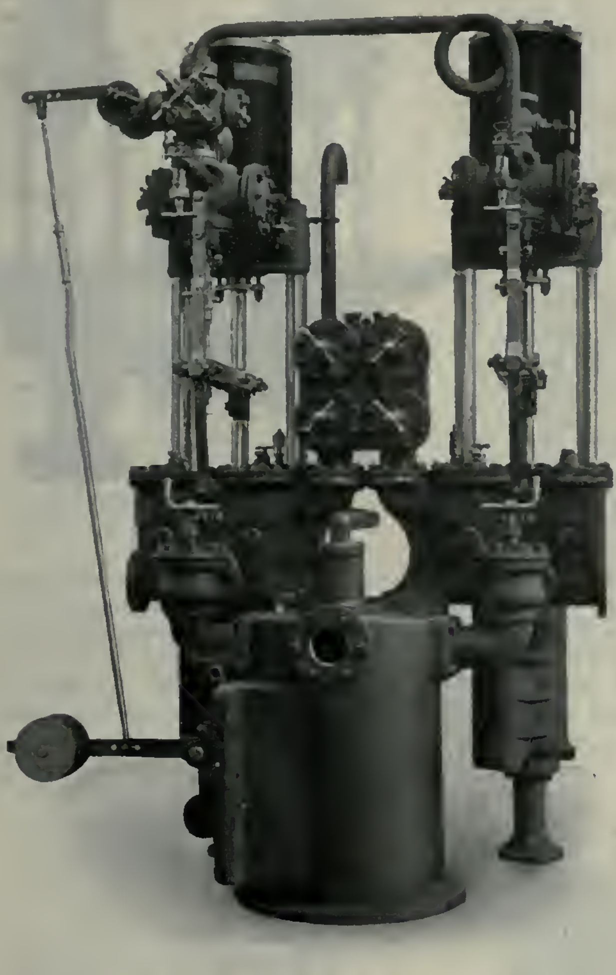
One pump is usually sufficient to deal with the entire feed water and the other can be kept as a stand-by in case of emergencies. The action of the pump is automatic, as a float in the heater controls it, and the exhaust is usually connected to the low pressure casing or condenser. The pumps can be arranged to circulate through the boiler when raising steam, and where this is done it is usual to fit the pump bucket with gun metal packing rings instead of ebonite rings, the latter not being suitable for dealing with water over 190 and 200 degrees F. At higher temperatures the ebonite is likely to soften and seize on the pump cylinder walls.

Single Pump and Direct Contact Feed Water Heater.

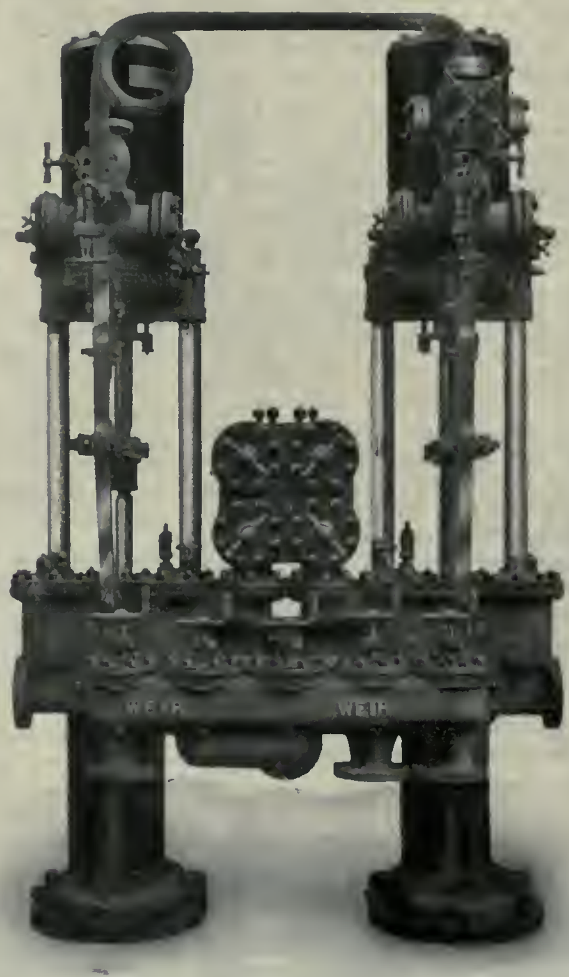
This arrangement is similar to the above except that only one pump is fitted instead of two and this draws from the heater and discharges to the boilers. It is usually made to draw also from the condenser, and is generally fitted with cast iron liner, steel piston rod, etc. It may also have hot well and sea connections. When the latter is required, the pump is provided with gun metal liner, bucket and cold rolled manganese bronze rod.

Pair of Pumps, Float Tank and Direct Contact Feed Water Heater.

When this arrangement is installed, feed pumps are not required on the main engine. A float tank with automatic float gear similar in principle to that in the feed heater is placed under the feed pumps and into this the air pump discharges the feed water. One of the pumps draws from this tank and discharges to the feed heater, this pump being regulated by the float in the tank. The other draws from the feed heater and discharges direct to the boilers, and is regulated by the float in the heater. The pumps are in duplicate, one being fitted with gun metal liners, etc., and they are arranged so that either can discharge to the heater or the boilers. In case of an accident happening to one of the pumps,



PAIR OF MARINE FEED PUMPS WITH FLOAT TANK AND CONTROL GEAR.



PAIR OF "WEIR" MARINE BOILER FEED PUMPS.

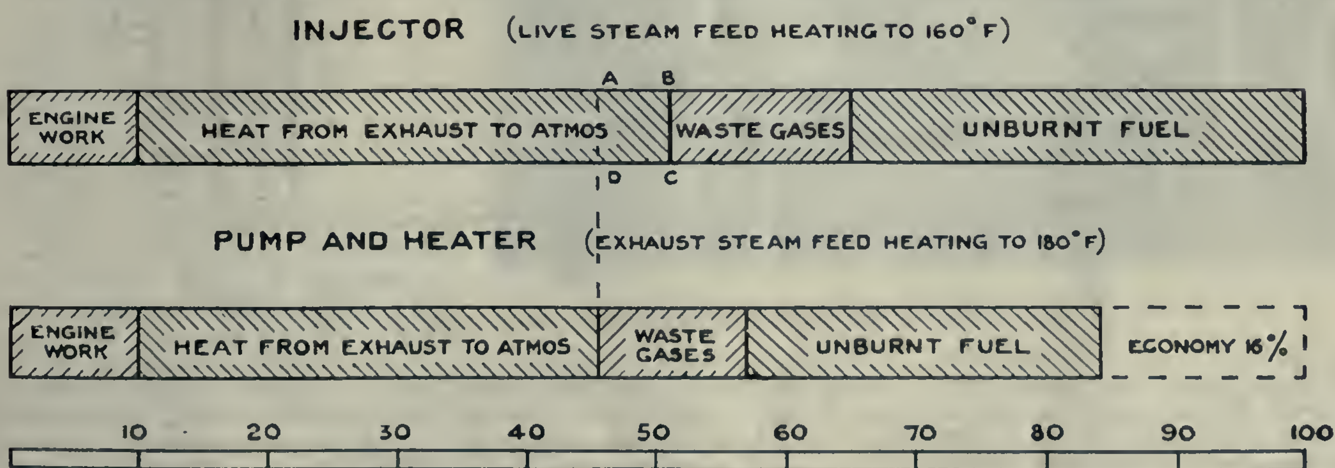


DIAGRAM OF SAVING IN FUEL EFFECTED BY USING WEIR FEED HEATER AND BOILER FEED PUMP AS COMPARED WITH INJECTOR.

the other can feed direct to the boilers from the float tank without using the feed heater, but a third pump is sometimes supplied to act as a stand-by.

Pair of Pumps and Float Tank with or without Surface Feed Water Heater.

In this arrangement, feed pumps are unnecessary on the main engines, a pair of pumps and float tank being used to deal with the feed water heater. This arrangement is fitted in a great many vessels where the engines run at a high speed, and it is accordingly inadvisable to use pumps on the main engines. With these independent pumps, the water is returned to the boiler independent of the main engines, and the engineer has two pumps automatically controlled by the quantity of feed water: each pump being capable of doing all the work when the engines are running at full power. The water is discharged by the air pump to the float tank placed under one of these pumps in any suitable position, and as this is placed lower than the float well there is no extra strain on the air pump. In this tank the usual float arrangement is placed which regulates the speed of the pumps. The pump draws from the float tank and discharges direct to the boilers, the second pump acting as a stand-by, or both can be used together. Both pumps have gun-metal liners and buckets. and cold-rolled manganese bronze rods. They have usually separate discharges to main and auxiliary feed checks

The direct contact feed heater is not used with this arrangement, but the feed may be heated in two ways—first, by leading steam from the L.P. receiver and the exhaust of the pumps and other auxiliaries to the float tank through a non-return check valve. This valve should be fitted immediately under the diaphragm in the upper part of the tank, so that the steam may not impinge upon or damage the float. It is not advisable to raise the temperature above 180 degrees F., as the pump has to lift the water two or three feet, and a higher temperature would interfere with its working. The other method is to use a surface feed heater which is placed between the pumps and boilers, forming, in fact, a portion of the main feed pipe.

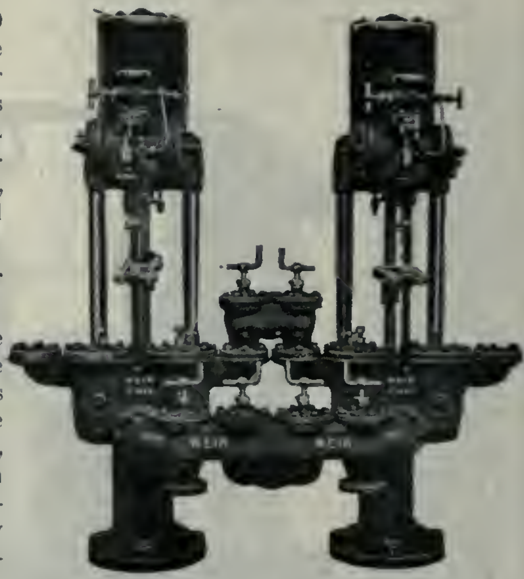
Single Jump and Float Tank, with or without Surface Feed Water Heater.

This arrangement is similar to the previous arrangement but without the second pump as a stand-by; and in this case the surface feed heater can also be used as above. In all of the foregoing, arrangements, the pumps are fitted with a steam connection direct from the boilers to enable them to draw from any source independent of any float regulating gear which may be fitted.

The Units as Applied to Locomotives.

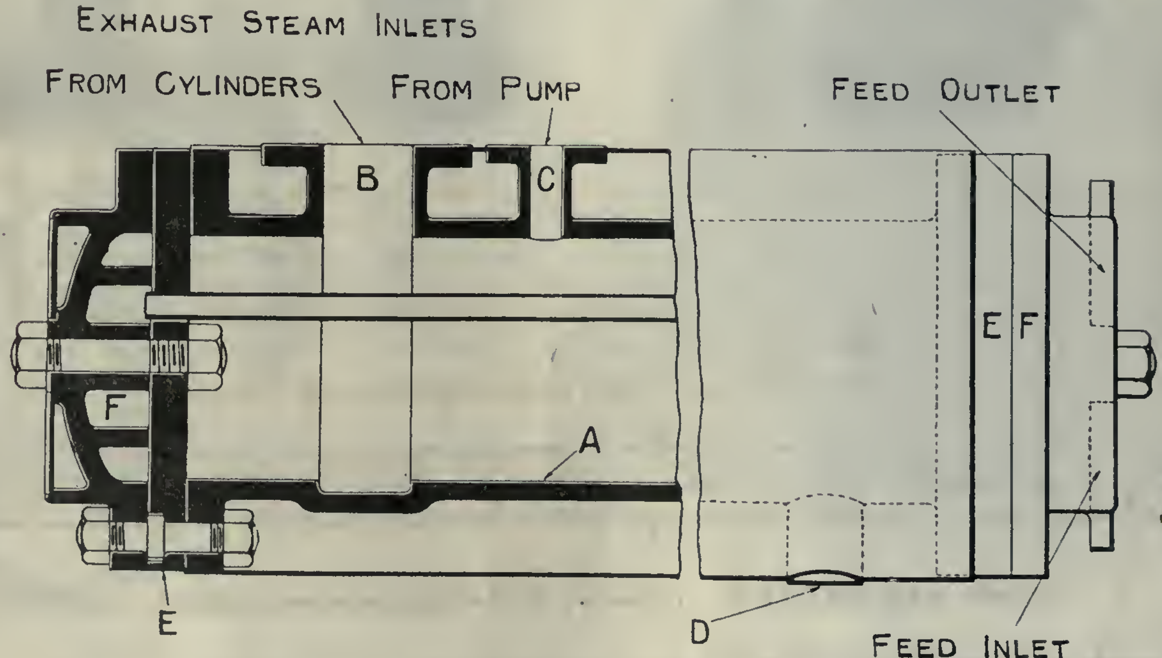
The boiler feed of locomotives has been chiefly by means of injectors. There have, however, been many experiments made with locomotive feed pumps in Europe. In fact, for over thirty years, these tests and experiments have been going on, and the savings in many cases over the existing forms of feeding have been rather a surprise, there being to-day many European roads using a pump to feed their locomotive boilers to the exclusion of all other methods. In all cases, feed water heaters are also installed. The Weir Pump has been applied to this use with very satisfactory results.

Our Canadian railroad companies have stuck very closely to the injector and



PAIR OF "WEIR" PUMPS FOR LAND INSTALLATION.

inspirator. but they have about reached the limit of locomotive capacity in so far as size and weight is concerned. and any further increase will have to come through the channels of increased efficiency. When this fact became evident then the merits of the feed water heater and the boiler feed pump were investigated. The result is that we now find our great railways using Weir pumps in conjunction with a feed-water heater to great advantage. The heater utilizes some of the exhaust steam to heat the



PART SECTION, "WEIR" LOCOMOTIVE BOILER FEED WATER HEATER.

water, and is arranged in such a way as not to interfere with the draught, which this exhaust passing through the chimney is depended upon to give the fires.

The locomotive feed pumps are built in both vertical and horizontal units, and the saving in some comparative tests made in Europe have shown a saving in fuel of about 16 per cent. The reliability of the system has been, we understand, fully proved. It has also been shown that its adoption is economical on the small yard shunting locomotives as well as on the large main line types. The additional weight is largely unimportant.

Key to Loco. F. P. Sectional View.

1A.—Main slide valve.
1B.—Auxiliary slide valve.
1C.—Main slide valve bells.
1D.—Bottom cover of piston valve chest.
1E.—Liner for piston valve chest.
2.—Double joint.
3.—Front stay.
4.—Bottom spindle.
5.—Valve gear levers.
6.—Front stay bush.
7.—Ball crosshead.
9.—Crosshead pin.
10.—Piston rod.
11.—Piston body.
12.—Piston rings.
13.—Cylinder cover.
14.—Discharge valve seat.
15.—Discharge valve seat ring.
16.—Suction valve seat.
17.—Suction valve guard.
18.—Discharge valve guard.
19.—Water valves.
20.—Bucket.
20A.—Bucket rings.
23.—Valve chest cover.
26.—Auxiliary valve spindle.
27.—Pump bottom cover.

GRINDING LOCOMOTIVE LINKS AND BLOCKS.

By E. Granville.

THE North-Western Railway Shop, Chicago, Ill., has an interesting machine in use for grinding locomotive links and bushings, and shown in the accompanying illustration set for grinding a block. It will at once be noted that there are no complicated cam movements or other attachments so common to machines made to perform similar work. To be sure the feeding and rocking movements are done by hand, but it is believed that that this is more of an advantage than otherwise.

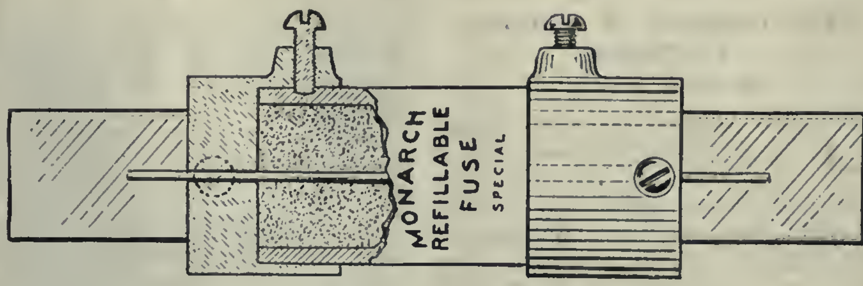
The link or block to be ground is carried on a small wheeled truck, which is made to rock back and forth on the double-sloped track at A and B. The side A is stationary, but the side B may be adjusted up or down by means of the hand-screw C, to change the radius of grinding when desired. The grinding wheel D may be raised or lowered by means of ball crank E. The work truck, tracks and table, are carried on cross-ways F and G, and may be run out or in by turning ball crank H. A belt tightener at I keeps the belt taut at all times, and a suction pipe J carries off the dust. As both the link and its block can be ground on the machine without changing the track slope or radius, as accurate a fit as desired may be obtained.

MACHINE FOR GRINDING LOCOMOTIVE LINKS AND BLOCKS.

A REFILLABLE FUSE.

ON power lines, subject to heavy overloads, sudden motor reversals and similar treatment, in order to afford adequate protection to the machinery on the line, fuses will be blown out more or less frequently. This not only incurs some expense, but the operator is inclined to prevent a recurrence of the trouble by replacing the burnt-out fuse by a stronger one. To simplify the problem of renewals, the Monarch Refillable Fuse Co., of Hamilton, Ont., has developed a special refillable fuse for heavy service, such as cranes, mine hoists, etc.

The caps are of cast brass, fastened to heavy fibre barrels by means of set-screws. The fuse element consists of copper wire held in contact position, also with set-screws. As seen by the illustration, the fuse can be easily renewed by releasing the burnt ends of the old one and clamping the new one in place.



A SPECIAL REFILLABLE FUSE.

RELIEF FROM EMBARGO HARDSHIPS.

CANADIAN traders and manufacturers, who are finding themselves inconvenienced by the embargo placed by the British Government upon the exportation of certain articles, notably wool and chemicals, will be relieved to hear that efforts to obtain licenses for such articles to be sent to Canada are meeting with success. Secretary Griffith, of the High Commissioner's office, is taking up the matter officially in London and is pointing out that present restrictions are making unemployment in Canada more acute than would otherwise be the case, and also that many of the goods which are thus prohibited, are used in connection with the outfitting of the Canadian troops now preparing for active service.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

THE FINISHING OF FOUNDRY PATTERNS.

By W. J. Horner.

GOOD patterns are nearly always given two or three coats of varnish, and are glass-papered a similar number of times after the constructive work is done. Occasionally this finishing process is omitted when only one or two castings are required from the pattern and the work is unimportant. In most shops patterns for castings to be used on the premises are not varnished and, in a few others, the majority of patterns are not varnished, because the habit of sending them to the foundry unvarnished, to save time and expense, has become the rule.

Varnish and its Constituents.

Varnish seals the pores of the wood and prevents moisture from entering and causing it to swell and warp. It also gives a smoother surface for withdrawal from the mould, and in many cases adds to the strength of the pattern by causing adhesion at the joint edges of parts independently of the screws or nails. Shellac varnish is used, consisting of shellac dissolved in methylated spirit or alcohol. The spirit completely evaporates and leaves a film of shellac on the wood.

Ordinary shellac is of a light orange brown color, but is transparent in the thickness usually applied in varnishing. Occasionally other coloring matter is added to the varnish to distinguish prints or machined surfaces, for the moulder's guidance, or merely to thicken the varnish for filling coarse grain. In a few instances, paint is used instead of varnish, and sometimes for loam work the wood is simply oiled. Shellac varnish, however, is universally recognized as the best coating for ordinary patterns. It dries quickly and is hard and elastic and waterproof, besides being an adhesive, with no stickiness when dry. Shellac and spirit are usually bought separately, and the varnish made by the patternmaker.

Shellac dissolves very slowly in spirit, and is dissolved cold, as heating would evaporate the spirit very quickly. Shellac and spirit in suitable proportions are put into a receptacle, preferably with a small mouth, which can be corked to prevent loss by evaporation, and with occasional stirrings they are left for two or three hours to dissolve. A wood plug rather than a cork is used, because it is liable to get stuck by the shellac, and a cork would break in pulling it out. The proportions may be about ¼ lb. of shellac to a pint of spirit, but the consistency is easily modified afterwards by adding more shellac or more spirit if the varnish is too thin or too thick. The tendency is for it to thicken by evaporation.

Glass papering.

A considerable amount of glass-papering has to be done before the first coat of varnish can be applied to a pattern. It is done not so much to smooth the surface as to level it by removing tool marks. Gouges and chisels leave ridges, which must be obliterated, and planes working on a broad surface leave a series of shallow waves, which are noticeable when viewed against the light. The cabinetmaker, dealing with hard wood and requiring a highly-finished appearance, uses a scraper before glass-paper, but the patternmaker simply glass-papers his work and spends comparatively little time in the process. Often the glass-paper is used across grain. regardless of scratches, for appearance in a pattern is of less importance than a true surface. Parts which show no sign of tool marks, such as narrow planed edges, are not touched with glass-paper until after the first coat of varnish. A coarser grade of glass-paper is used at first, and a fine grade of paper worn smooth with use is employed for smoothing down the roughness caused by the raised grain in varnishing.

Glass-paper is almost always used on a rubber, the ordinary type of which is shown in Fig. 1. It is a block of wood or cork of any convenient size for use in the hand. It keeps the glass-paper flat, and so tends to level a surface rather than accommodate itself to unevenness; besides, the glass-paper can be held and used more conveniently with than without a rubber. A flat rubber is often used in removing tool marks on convex surfaces, but for merely rubbing down varnished surfaces which are not flat or not of large extent, a rubber is often dispensed with. Cylindrical rubbers, as in Fig. 2, are used a great deal by patternmakers, but not much in other trades. A stock of these is kept in diameters ranging from about ½ in. to 3 in. or 4 in.

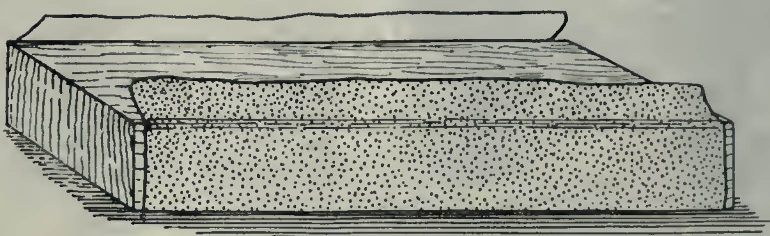


FIG. 1. ORDINARY GLASS PAPER RUBBER.

Larger sweeps may be done with a narrow flat rubber, or a flat one may be specially planed on one face to the curvature required.

Varnish Application.

More varnish is consumed in a first coat than in subsequent ones, owing to absorption by the wood. A coat of varnish is apparently dry within a minute or two after it is applied, but to get the best results it should be left for half an hour or more, if the time can be spared, before rubbing down and putting on the next coat. There should be no glass-papering after the final coat. The number of coats required depends on the consistency of the varnish and the degree of finish desired. Two coats may be regarded as a minimum and four as a maximum. A better and more uniform appearance can be obtained with thin varnish and more coats than with thick and fewer coats. This is because, owing to quick drying and the impossibility of coating a large surface with only a few strokes of the brush, there is bound to be slight overlapping in places where the color shows deeper, and this is less apparent with a number of thin coats than with fewer but thicker ones. This diffi-

FIG. 2. CYLINDRICAL OR ROUND RUBBER USED CHIEFLY FOR CORE-BOXES.

culty does not occur with small patterns, the surfaces of which can be coated in a second or two. Each individual surface is, of course, dealt with separately, and often it is an advantage to wait a little between finishing one and beginning another, in order to turn the pattern over without detriment to a surface just coated.

Ordinary brushes as used by painters are suitable. Round ones are generally preferred. Specially large and small ones are best for large and small work respectively, but often an average size only is employed. The varnish is poured from the larger receptacle in which it is prepared, and kept in quantity in a cup or small pot for use, and this is covered by a wood cap when out of use; a hole being bored through the middle or cut in the edge of the cap for the brush handle to project through. This is the commonest way in shops where the varnish is frequently wanted.

The varnish is applied with the usual precautions to avoid brush marks and running over at edges. It is put on with no filling or preparation of the surface, such as is usual in other trades, but only sufficient glass-papering to remove tool marks and the filling of nail and screw holes. These may be filled either before or after the first coat, after being generally regarded as the best. The holes are filled with putty or with beeswax or a mixture of powdered chalk and varnish, or plaster of Paris, or with solid shellac or cabinetmaker's stopping melted in with a warm iron.

A well varnished pattern has an appearance not much inferior to French polish. Shellac varnish is the essential in French polishing. Generally small amounts of other ingredients are added, and polishing is done with a rag instead of coats being applied with a brush. Polishing is preceded by scraping, filling, staining, matching, careful glass-papering, and regard for appearance, which is quite unnecessary in pattern work. Nevertheless the final result in both cases is a film of shellac on the wood.

BROACHING TO A SHOULDER.

By E. Avery.

ONE is often puzzled as to the best method to employ in cutting small keyways or shaping out small parts. A very good way is to use a turret broaching head in an arbor press, as shown in Fig. 1. A broached piece is shown lying on the bed at the left. There are six tool carriers in this turret head, each successive cutting tool being made to cut out a little more than the one ahead of it—that is, six cuts are required to finish a piece of work. As the tool-holders are piloted, no other method of guiding them is needed, the operator simply starting the pilot in the hole in the work, and then bringing down the ram lever.

Another turret head, used to make a hexagon-shaped hole in a brass fitting,

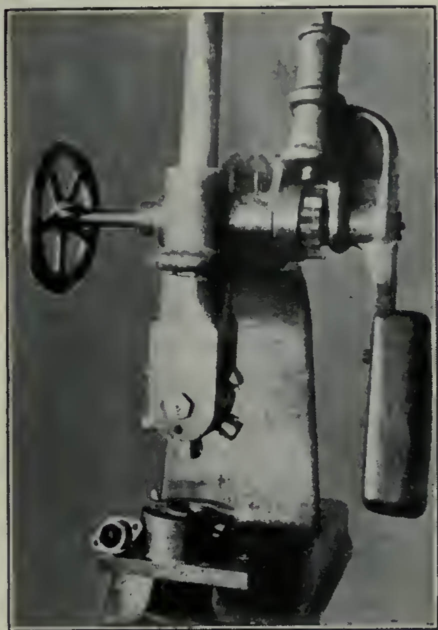


FIG. 1. TURRET BROACH IN HAND PRESS.

is shown in Fig. 2. The nature of the work makes it necessary to have a very short pilot on the tool-holders, so a locating pin A is employed to lock each tool in position as it is indexed. As the

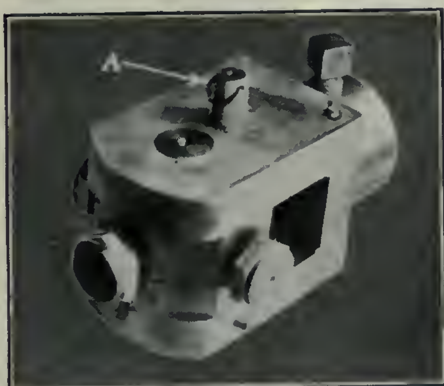


FIG. 2. TURRET HEAD FOR HEXAGON HOLE.

depth of cut is not as great as in the former case, only four tool-holders are needed.

TESTING OF FILES.

By J. Davies.

THERE comes a time in the life of every file when it has either to be thrown out to the scrap heap, or be put carefully away to be recut. It requires sound judgment on the part of the responsible person to know just when this time arrives. To throw it away sooner or keep it longer than that time means a loss to the organization.

The writer has known firms to adopt the erroneous system of giving the men a certain number of files in a given time, regardless of the nature of the work or quality of the tools. On the other hand, if there is no restriction placed on the workmen, the chances are that the files will find their way to the scrap heap before their time, particularly if the men are on piece work. This period of usefulness often seems to be a matter of judgment. A good workman does not use as many files as a bad one, because he carefully selects them and grades them, and only passes them on to the scrap heap, when they are unfit for any kind of work whatever.

It once fell to the lot of the writer to make a selection of files from the products of several different makers, all claiming theirs to be the best. A sample of each make was chosen, the specimens being as near as possible of the same length and cut. They were subjected to the following tests, which, as far as known, gave satisfactory results.

The blade of an old power hack saw was removed and replaced by some home-made attachment for holding the files. The machine was set to the longest stroke possible, and the frame carefully loaded with a dead weight. Some pieces of cast iron of a given area and thickness, measured with a micrometer, were carefully prepared from the same bar. After one of these pieces had been put in the machine, one of the files was placed in position, care being taken to see that the stroke was uniform, and the machine started up. The procedure was carried out, not only with all the files of a set, but with several sets of different sizes. The decision as to the quality of the files was placed upon the quantity of the material removed by a given number of strokes, these being also registered by the machine.

It is possible that some file manufacturers may not consider the foregoing a scientific or fair test for their products. If this is so, there is no doubt but that a great many general users of files would welcome some suggestions relative to a fair test.

When casting brass in sand, if the amount of zinc in the brass much exceeds 34 per cent. (2 parts of copper and 1 part of zinc), the castings will come dirty on account of the formation of zinc oxide. In other words, the more zinc the brass contains, the dirtier the castings. It has been found that 34 per cent. is about the limit which can be used for successful work. This rule, however, does not apply to yellow brass containing aluminum, as the zinc can then be increased to any desired limit.

Relative to Steam Piping in the Factory Power Plant--II.

By G. W. Sutcliffe, Wh. Sc.

This writing is a recapitulation of the principal matter contained in a series of articles, the compilation of which was the result of observation and experience derived from the inspection and other records of the Vulcan Boiler and General Insurance Co., Manchester.

IN part 1 of this highly important subject, which appeared in our October 29 issue, the features of Drainage of Water, Pressure and Temperature, Pipes and Pipe Flanges, were discussed at length.

Expansion Joints.

Expansion Movements.—These may be allowed for by the provision of suitably disposed elbows. Incidentally pipes thus arranged possess special advantages in regard to erection. In some cases, stuffing boxes or metallic surfaces are arranged for permanent rotary movement with the same object. Expansion or contraction due to changes in temperature may reach one foot in five hundred in the case of saturated steam, or one in three hundred in the case of superheated steam. In either case, one-half may be allowed to take effect in compression and the other half in expansion, whereby the maximum resulting stress is also reduced by one-half.

Stuffing Box Sliding Expansion Joints.—These are successful, but they must be constructed to prevent blowing out at gland; also to prevent water-logging at gland and setting fast by corrosion. Double stuffing boxes may be arranged to balance and supersede the use of tie rods.

Flexibility of Steel Pipes.—This is most useful in yielding to expansion and in facility of erection. Steel coils are particularly effective in this way.

Automatic Steam Trap.—A trap of this description should be provided for the drainage of each separate section, and so that the drainage of any point in the system shall be incapable of interruption as by the closing of any stop valve .

Pipe Joints.

Pipe Joints.—These are usually made with paste or putty. This should not exude into the steam space, and the paste is more securely kept in position by corrugated metal rings or other equivalent means. Sometimes joints are made with compositions prepared in large sheets, from which the joint ring may be cut out to any form desired. In screwing up care should be taken to prevent crowding the joint material around the studs, as this prevents the two flanges from coming into close pressure contact. Narrow rings give better pressure on the joint, but they involve a cross bending force on the flange which has occasionally led to serious accident. Sometimes flanges are recessed in pairs, and in this way the adjoining pipes are kept in accurate alignment and the rings prevented from blowing out. In special designs of pipe joints many failures occur by reason of their inability to withstand rough usage.

Leakages. — All leakages, however small, should receive immediate attention. Generally the joints should be cleaned off at once and made anew. It is usually impossible to stop even the smallest leakage by the application of any reasonable amount of force upon the bolts, and any attempt to tighten a leaky joint under pressure is attended with extreme danger.

Pipe Supports.

Supports for Pipes.—The best support for pipes is afforded by suspension rods attached to special clips, fitted with spring and with adjusting screw. Vibration is promoted by uniformity in length of suspension or multiples thereof; it is checked by irregularity in same, and prevented by stays. Vibration may also be caused by pulsation in steam current. In some cases supporting rollers are adopted either to roll upon level ways or to rotate upon axle ends. Such rollers are carried in frames, which may be arranged to stand upon the level surface of a bracket, or to suit the top of a column. Means should be adopted to minimize loss of heat in all details adopted for support of pipes. Definite instructions should forbid the use of pipes as supports for ladders, stages, etc.

Barometric Elevation of Water.—This may lead to serious accident, and should be prevented by the use of an automatic vacuum breaker. In such an instrument a displacer-float heavier than water is used with a counter-balance and to work without friction. Such danger is mostly incurred when crawling the engine around, or with a leaky feed-heater in the exhaust pipe.

Valve Types.

Types of Valves.—Stop valves inserted in a straight line of pipe are generally one of two types. The first is the plain screw-down type with the stopway across the centre line, involving a tortuous passage for steam. The second is the gate type, with the centre line of the stopway placed along the main centre line of the pipe. In the screw-down type. the screw thread should be placed outside the casing. Valves of gate type give a straight course of uniform area, and, therefore, minimum resistance; but they occupy a large amount of space, and possess large surface for loss of heat by radiation. The surfaces of the seatings and valve pieces are subject to much friction, and the opening or closing is a lengthy operation. A stop valve is sometimes required in a high position and to be actuated from a lower position. This could be met by an inverted valve, with the spindle continued downwards, but a much better arrangement is obtained by a spindle in usual upward position, driven by a pair of spur wheels and a vertical side shaft.

Junction valves usually take in the steam by a bottom branch, and deliver it by a side branch. The course of the steam through the valve is somewhat tortuous, but less so than with the straight line screw-down type. The fittings of the junction valve are practically identical with those of other screw-down types.

Auxiliary or by-pass valves are used to equalize the pressure above and below the main valve, and thereby to facilitate the movement of the main valve; also to pass small quantities of steam for warming. These should always be provided as a separate valve outside the main casing. Valve spindles are usually of gun metal, which is subject to derangement by expansion due to temperature, and various devices are adopted to compensate for this. In all cases, during raising of steam, the valve spindle should be frequently tried and kept free from jamming.

Valve Details.—Seatings and counterparts should possess ample strength, stiffness, and hardness whereby to resist presure, distortion or abrasion. For such purposes, gun metal has been largely used, but it now largely replaced by special alloys.

Isolating Valves.—These effect automatic separation of boilers to secure the safety of men who may be engaged in the boiler at time of an accident to pipes. Incidentally, improvements are also effected in regard to uniformity of working the boilers. A junction valve may be modified to act as an isolating valve.

Hydraulic Test.—All pipes and valves should be tested by hydraulic pressure. Generally this test should be double the working pressure, or to 100 lbs. above the working pressure. This should be maintained not less than ten minutes in each case, and the work kept under continual observation.

Steam Pipe Design.

Design of Steam Pipes.—Steam pipes should be designed to secure high efficiency in regular work. Closing lengths should be made to dimensions taken after all other pipes are fixed. To allow time for this, a temporary pipe may be adopted of reduced diameter, but complete reliability in regard to general safety and freedom of drainage must be assured. Accurate drawings showing lines and levels of pipes should be prepared in every case. Parallel, horizontal, vertical and right-angled lines for pipes should be adopted as far as possible. Fittings and other objects should be avoided and means of convenient access provided throughout. Pipes, stages, etc., should not cross gangways. The most dangerous levels of such obstructions are below one foot height from the floor and between the heights of 5 ft. and 6 ft. 3 in.; also any level within reach in dark positions. Sand and foreign matter generally should be thoroughly removed from all steam spaces, and a final cleaning effected by blowing steam through them after closing up.

Preventing Heat Radiation.

Heat Radiation and Non-conducting Coverings.—Loss of heat by radiation from exposed heating surfaces of pipes, etc., is continuous. The amount lost principally depends upon the amount of surface exposed and the temperature of such exposed surface. The amount of loss is susceptible of important reduction by the use of non-conducting coverings, the efficiency of which as a rule is roughly proportionate to the quantity of air which exists finely diffused in the materials, and also to the fineness of diffusion. Air posseses low conducting power for heat, but is freely transparent to the passage of radiant heat rays, and is subject to convection. For these reasons the use of jackets or belts containing free air is never attended with success.

A crude plastic covering is principally of clay, with organic material, principally fibrous, to hold it together until dry, or to improve its insulating power. This never gives good results.

Slag wool is attended with a variable amount of success. It is liable to disintegrate under vibration, and to shed globular dust which is objectionable in proximity to bearing surfaces, etc.

Magnesia, with sufficient asbestos to hold it together, is a good composition.

Pure asbestos is one of the best insulators available, but it is not easily applied, and its cost is high.

Mica of suitable quality is very efficient.

Each of the best materials is liable to admixture with other matter. In some cases the admixture may be beneficial; in others perhaps neutral, and in the majority distinctly prejudicial to efficiency, since the principal object of admixture is to increase the weight. Incidentally, the amount of surface covered per ton is reduced. Combustible matter is useless for high temperatures.

The non-conducting covering should extend over the whole of the heated surfaces and be of ample thickness. Also the application should be carried out with due regard to future necessity for access to the various parts of the work. The use of superheated steam increases the necessity for good coverings.

As an example of heat loss from radiation it may be stated that the heat loss of one pair of ordinary flanges for a 10-inch pipe freely exposed to the air while under a pressure of 200 lbs. is in twelve months equivalent to about $5 with saturated steam, and to about $8 with superheated steam. Non-conducting compositions should be protected against abrasion by painting and varnishing, or by steel sheets, or by canvas. Steel covers should not be allowed to come into contact with hot flanges, etc.

SPOTTING FOR DRILLING.

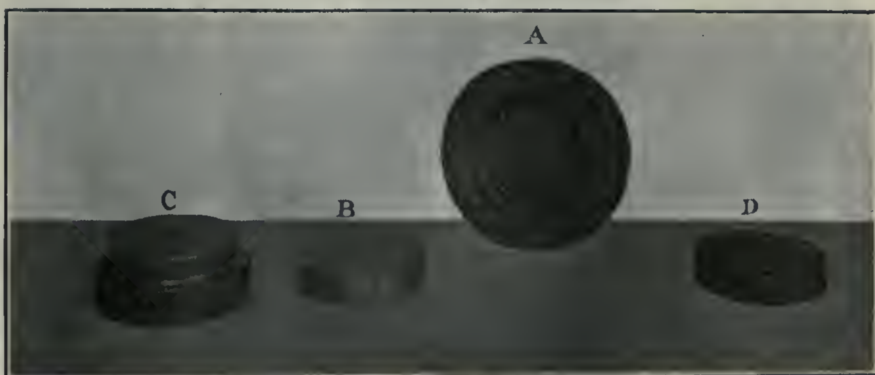
By G. Edwards.

ON some kinds of small work it is often desirable to spot the work and then drill it without a jig in order to prevent the excessive breakage of small drills. As a rule, a jig is used to hold the work while spotting, and one hole is spotted at a time. This is a slow and tedious process.

A better way, where the shape of the piece will permit, is to spot all the holes at once in a punch press, using a multiple punch made on the plan of that shown at A in our illustration. The punches are made of drill rod, rather bluntly beveled on the end. These are set just far enough out of the punch block to make a good impression in the work.

The set shown is used in a small hand press, and the part A is laid on the bed-plate. The work B is next laid in it, and the piece C placed on top and the ram brought down. The work can then be drilled in any ordinary sensitive drilling machine.

The work shown is used to make false jaws for a small jeweler's vise, and a drilled and split piece is shown at D. The method just described is also used by the Illinois Watch Factory, Springfield, Ill., for spotting watch plates. As the location of the holes in a watch plate must be accurate, they are all bored in small bench lathes after being drilled.



SPOTTING FOR DRILLING.

EFFICIENCY IN SELECTING EMPLOYEES.

IT is very noticeable that there are business men and department heads who have the faculty of engaging competent employees, while others are constantly experimenting. Frequently a man will engage three or four and sometimes five or six employees before one is found who meets the requirements of the position.

It is very evident in view of the experiments that have been made, when a department head is constantly engaging and discharging help, he needs to be discharged himself, as it shows lack of care and study of the needs and requirements of the position when people are constantly being selected that do not fit into their positions.

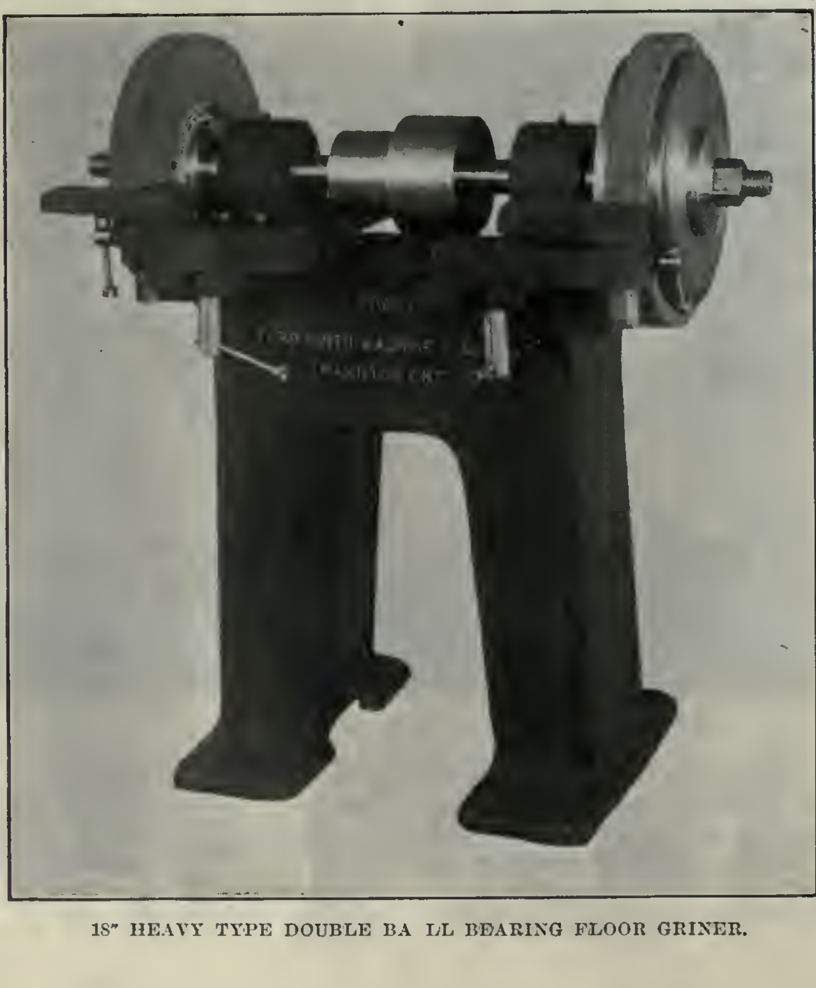
It is a very costly thing to be constantly engaging people for positions. Business concerns are waking up to a realization of this fact and many have already adopted rules that will not permit of department heads either indiscriminately engaging or discharging employees, while others have gone still further and are taking the "misfits" and giving them opportunities when they are qualified to fill other positions. It is found that ofttimes employees who have fallen down on one class of work have proven more efficient than ever before when given a task that is to their liking.—Efficiency Magazine.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

18-INCH HEAVY TYPE DOUBLE BALL BEARING FLOOR GRINDER.

THE illustration and description refer to the 18-in. size of a new line of ball bearing grinders, developed and manufactured by the Ford-Smith Machine Co., of Hamilton, Ont. The frame is of their usual heavy type, designed to allow the operator to stand close up to the work, and with very short overhang from the bearing. The rests are standard, heavy, rigid, and fitted with steel vise handles, doing away with the need of wrenches. This latter fixture allows no excuse for the operator to leave a gap between the emery wheel and rest, being the cause of most accidents. The bearings are manufactured especially for heavy exacting service by the Chapman Ball Bearing Co., Toronto, and are of their double ball race type. The power saved in high speed and heavy duty machines of this type by the use of these bearings is an important factor, especially where operated in large numbers. The saving in emery wheels and loss of time from neglected lubrication in the ordinary type of bearing is considerable, and soon offsets the slightly increased cost of this type of grinder. Ball bearing counter-shafts are supplied with the whole line of Ford-Smith grinders, particulars of which will be illustrated at a later date. These machines are regularly built for either belt or motor-driven in sizes using emery wheels from 12 in. to 30 in. diameter.



18" HEAVY TYPE DOUBLE BA LL BEARING FLOOR GRINER.

A SCALE-PROOF BOILER.

CANADIAN rights to manufacture a scale-proof boiler have been obtained by the Alex. McKay Boiler Works of 1194 De Montigny Street East, Montreal, P.Q. This product is a recent development, and is more easily applied to boilers of the internally fired fire-tube design. Extensive tests have, we understand, been carried out on a small vertical boiler, the results of same being of considerable interest. The general design of the boiler is as follows:—

General Design.

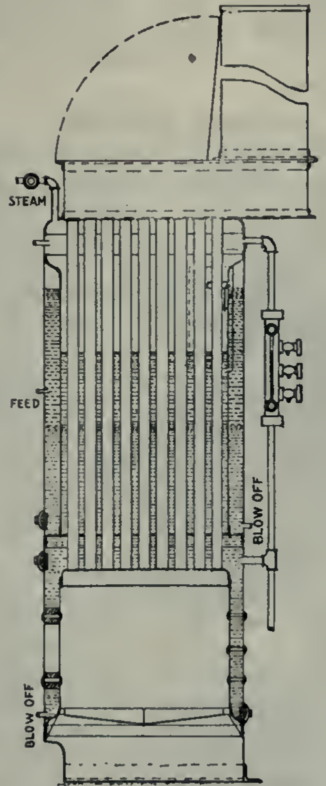
By referring to the accompanying cut the description can be more easily followed. The crown and top sheets of the boiler are constructed in the usual manner, as is also the outer shell. The scale-proof feature is a settling chamber, where all scale-forming material is precipitated. A flanged ring is attached to the inside of the boiler shell a little above the lower tube sheet. To this inner flanged ring a casing is riveted, which extends well above the normal water level. Thus, a water-tight annular chamber is formed inside the boiler shell. This annular chamber is, however, open at the top to the steam pressure in the higher portion of the boiler. Near the top of the casing, and well above the normal water level, are punched several holes.

When in operation, the feed water is fed into this annular chamber at a point opposite to the holes cut in the casing, and when the water in the annular chamber rises sufficiently high, it overflows into the boiler proper, and here comes in contact with the fire-swept heating surfaces. Over these holes is placed a hood, which extends below the level of the water in the annular chamber some fifteen inches. Any floating material, such as oil and other scale-forming substances, will not thus overflow into the boiler proper, as the water that passes through these holes is drawn from a level fifteen inches below the surface. At the bottom of the settling chamber is a blow-off valve, and placed at small intervals around the bottom of the settling chamber are several hand holes. These constitute the principle new features of the design. The fire-box is surrounded by the water which has passed through the annular settling chamber to the boiler proper, this construction necessitating the use of stay-bolts. In other details, the standard methods of boiler construction have been adhered to.

The Working Principle.

As the steam pressure is acting upon the water in the annular chamber, this water becomes very warm. In boilers delivering steam at 100 pounds' gauge pressure the water in the annular chamber often rises above 300° F. The effect of this is to precipitate all solid matter dissolved or in suspension.

Experiments have shown that the carbonates are nearly all precipitated at or about 200° F., and the sulphates at or about 280° F., and these two scale-forming nuisances comprise nearly all of the impurities in water which have any bad effects on boilers. They are precipitated to the bottom of the settling chamber, and stay there in a jelly-like mass of sludge until blown off. The reason why this sludge does not form scale is because it does not come in contact with any fire-swept or heating area, and the blow-off valve located at the bottom of the settling chamber, if opened once a day, will carry off all the sludge that accumulates.



DESIGN OF SCALE-PROOF BOILER.

The feed water is fed into the annular chamber on the opposite side of the casing to where the holes are located, through which the water flows in entering the boiler proper, and the hand holes around the bottom of the annular chamber provide a means whereby the bottom of the annular chamber is made easy of access. Hand holes are also provided in the lower portions of the boiler, giving access to these lower portions in the fire-swept heating surfaces. The water that passes over into the boiler is practically distilled water.

Recent Tests.

In a small vertical boiler of the type just described two very severe tests were made. Twenty pounds of dry earth, twenty pounds of lime, ten pounds of plaster of Paris, making a mixture with a quantity of water that strongly resembled milk, was fed into the boiler. After the whole mixture was fed in and evaporated, the boiler was shut down and the whole quantity of earth, lime, and plaster of Paris was recovered from the settling chamber.

The second test was even more thorough. The Montreal water by analysis contains 5 grains of scale-forming material per Imperial gallon. In the test, 600 Imperial gallons of water were evaporated. By calculation there should be four pounds and fifteen ounces of scale-forming material in this amount of water. During the test, the boiler was not blown off at all, and upon the total amount being evaporated the boiler was allowed to cool off. The sludge was collected in a pail and dried out. The dry weight was four pounds two ounces. A certain amount, of course, was not scraped out of the boiler, and naturally so much got on the clothes of the man who gathered up the sludge, thus the other thirteen ounces are quite easily accounted for.

Smoke Box and Stack.

An offset smoke stack is usually fitted on these boilers, together with a large well-designed smoke-box. The smoke-box is made so that it can be easily removed, thus, when the flues need cleaning, a man can get right at them. This equipment, although standard, is not by any means necessary to the proper operation of the boiler, but is simply a method of making the flues easier of access.

LOW PRESSURE AND EXHAUST STEAM HEATING.

TO operate a steam plant at the greatest efficiency, every available unit of energy must of course be extracted from the steam. Taking steam that is raised to one hundred pounds pressure in a boiler, we find that its temperature is about 337 degs. F., and in the average non-condensing engine it is rarely that the steam is expanded until it is down to a temperature of 220 degs. F. Thus, all the heat used in raising the steam

HAND HOLE COVER OF TRAP WITH WORKING PARTS ATTACHED.

from a normal temperature of say 60 degs F. (which is a rather high normal temperature), is lost.

To the lay mind this loss is great, but upon investigation it is discovered that the loss is much greater than it appears to be upon casual observation. The amount of heat required to raise one pound of water one deg. F., is defined as one calorie, and it also requires one calorie

END ELEVATION, MANNY HEATER.

to raise one pound of steam one deg. F. For all practical purposes this law applies to water at all temperatures and to steam up to all temperatures usually met with in boiler practice. However, at 212 degs. F., the temperature at which water becomes steam under atmospheric pressure at sea level, a peculiar phenomenon occurs.

One pound of water at 212 degs. F., absorbs 535 calories without the temperature being raised. The water turns from a liquid into the vapor, steam, and it appears that a pound of water must absorb 535 calories of heat in accomplishing the physical change. In such cases we always find action and reaction are equal and opposite. The result is that, when steam is condensed, this heat is given off. Thus the waste of heat energy through the use of any atmospheric exhaust is much greater than would appear from a casual glance. There are two ways of utilizing a portion of this energy. The first is to use a condenser in connection with the engine and to feed the hot water of condensation back into the boiler again. The second way is to use the exhaust steam for the purpose of heating buildings.

Many successful systems of low pressure and exhaust steam heating have been devised, and thus many adaptations are in service to-day.

The New Manny Heater.

Among the number of very interesting heaters is that designed and manufactured by the E. S. Manny Co., Montreal. This heater employs an old idea in a new way. The exhaust steam is passed into the heater tubes and the water is heated. This water is the medium through which the heat is carried to the various portions of the building to be heated. The old principal applied is that of the surface condenser, but the manner in which it is employed is unique. The heater is placed upon a pedestal consisting of two cast iron pieces, the upper one of which contains the flanged elbow through which the water enters the heater. The upper flange of the elbow fits to a round machined boss on the cast iron body of the heater. The outlet is similar to the inlet and is placed on top of the heater body. One head of the heater is a simple casting as shown in the cut while the other head to outward appearances is similar to the first, but upon closer examination it is found to differ largely.

There are two separate cast iron plates in the head, and these serve as a crown sheet in the construction of the heater. The tubes are only fastened at one end, the idea being that, if the brass tubes were fastened with ends. the expansion of the brass and iron being unequal, would soon cause the tubes to become leaky. The brass tubes are not expanded into the iron plates but are screwed in, and the pipes are not threaded by dies, but in a lathe so they all stand perpendicularly to the plate.

When in position, the heater is so placed that the tubes are horizontal. The tubes are all screwed in the outer plate of the heater head. In the inner plate of the head, there are screwed small ½ inch brass tubes. These are located concentrically to the larger 1½ tubes, and extend right through the latter to within a few inches of the end. The two chambers in the heater head are entirely separate from one another and are also both separate from the water chamber.

The steam is passed through the inlet and is forced through the ½ inch brass pipes and because the larger brass tubes are plugged with cast iron pipe plugs, the steam after it passes out of the end of the small pipes returns through the annular passage in the large tubes and finally into the chamber formed between two crown plates, from whence it is drawn off through the outlet passage which connects to this chamber.

These heaters are made in five sizes; in all, however, the diameter of the tubes is just the same, the increased heating surface being obtained by using more tubes and increasing their length.

The Manny Steam Trap.

In conjunction with these heaters, a steam trap is often installed; however, these steam traps are also employed in various other cases as well. In long pipe lines, condensation is inevitable, and thus if reasonably dry steam is desired at the end of the line. a device to separate the water from the steam is necessary. In the case of the heaters, it is not economical to use other than exhaust or low pressure steam. The case of the traps is, however, different, because they must be designed to operate under all pressures of steam.

In the Manny steam trap, the mechanism is similar in the low pressure and high pressure designs. The size of the water discharge port is however changed. By referring to the cut an idea of the trap can be obtained. The water chamber is a well proportioned and neat looking casting. The inlet opening is threaded ready to receive the steam pipe. A small air cock is located on the top of the casting and a similar drip cock at the bottom. The gauge glass is fastened to one side. To the hand hole cover at one side of the chamber is attached the whole mechanism. Four cap screws hold this cover in place and by removing these four screws, the cover and mechanism can be quickly removed from the casing without in any way disturbing the pipe connections.

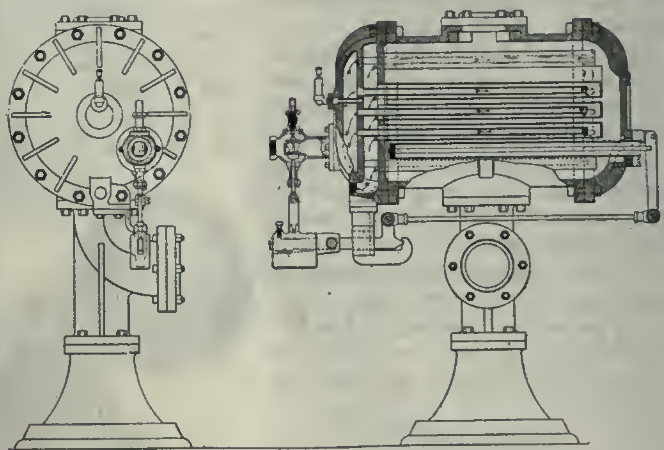
Operating Mechanism.

The mechanism is actuated by a seamless copper float ball attached to a brass rod. This rod is attached to a brass bell crank which opens and closes the water drain valve. All the working parts are brass, copper or bronze. The valve opens into a port in the hand-hole cover, which conveys the water around to the port in the body of the casting. This latter port leads to the discharge opening. The outlet is a double one, allowing the water to be piped from either side to the feed water heater or hot well. The outlet. not in use, has, of course, to be plugged.

The two outstanding features of this trap are its simplicity and accessibility. The whole mechanism can be removed from the tap and taken to a place conveniently situated where good light is obtainable to make any repairs or adjustments. Inside the float chamber a rib is cast which fills a dual purpose. The first purpose is to prevent the float from opening too wide the water discharge valve, and the second is to add strength to the sides of the cast iron chamber. When under high steam pressure, this reinforcing rib prevents the sides from spreading.

It is often advisable to quickly get rid of the water of condensation in a cold line of pipes and, to accelerate this, a by-pass is fitted to the trap. By this means the water is quickly gotten rid of. The trap works with steam at atmospheric pressure, but the greater the pressure of steam, the higher up the

THE MANNY STEAM TRAP.



SECTIONAL VIEW OF MANNY HEATER.

water of condensation can be forced to a feed heater. The traps are also built in five sizes.

MULTIPLE SPINDLE DRILLS.

THE description and illustrations refer to the 51A and 51B multiple spindle drills recently put on the market by Edwin Harrington, Son & Co., Philadelphia, Pa.

These machines are made with two sizes of heads, each of which has a different spindle area and maximum number of spindle units. Provision is made in the gear chest of each for the maximum number of spindle pinions, so that a machine purchased with less can be brought to full equipment at any time. Both machines have sufficient power to handle the rated number of drills in cast iron at a peripheral drill speed of 65 feet per minute and a feed of .010 inch per revolution.

The head frame is cast in one piece with the saddle, and has heavy gibs and a long bearing on the column, while a full counterbalance weight inside the column is connected to the head by two chains. Two T-slots are provided in the lower flange of the head for clamping the cast steel radius bars, in the inner end of which the bronze spindle sleeve is carried in a bored hole. The adjusting screw is arranged so that this sleeve can be regulated up and down for different lengths of drills without moving the position of the radius arms. The spindles have a long bearing in the bronze sleeves and are provided with ball thrust bearings. A telescopic shaft, with universal joints at each end, connects each spindle and its pinion.

The drive is by a quarter turn belt from a pulley on the base behind the column to another pulley on the top bracket, driving the splined vertical shaft, while a pinion on the lower end of this shaft drives ta the upper of a pair of spur gears, the lower one of which drives the spindle pinions. All pinions are heat-treated alloy steel, and all have accurately cut teeth and bearings at both ends of their shafts with ample provision for constant lubrication.

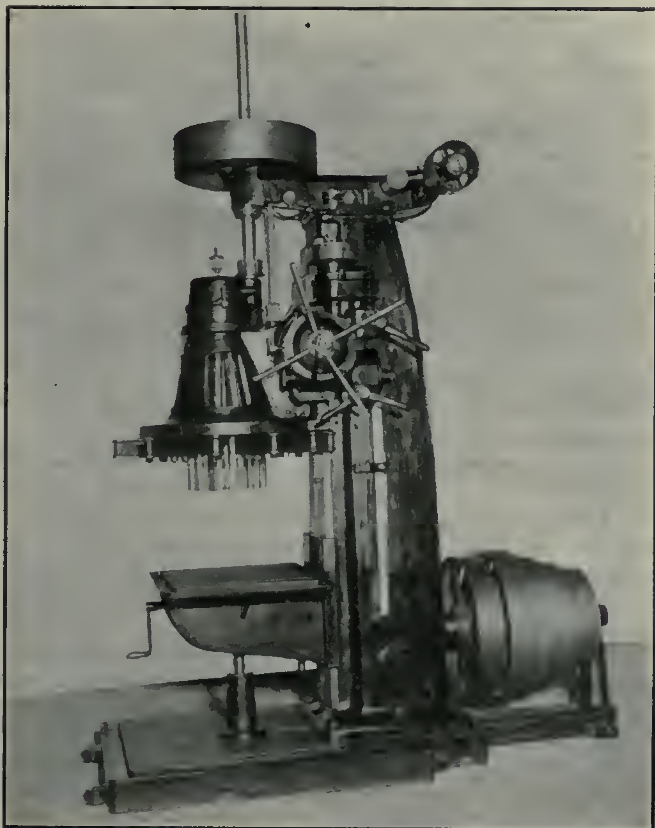
In belt-driven machines, a four-step cone is driven from an overhead countershaft and in motor-driven, the lower cone is replaced by a spur gear to which the rawhide motor pinion drives direct.

The feed is by belt from the vertical shaft to spur gears, with three changes by a pullpin, thence through bevel gears to the horizontal worm and worm gear. A planetary train of spur gears between the worm gear and rack pinions reduces the strain on the worm gear teeth. Both hand and automatic trip are provided on the worm, as well as a saw-tooth disengaging clutch for return of the head by hand.

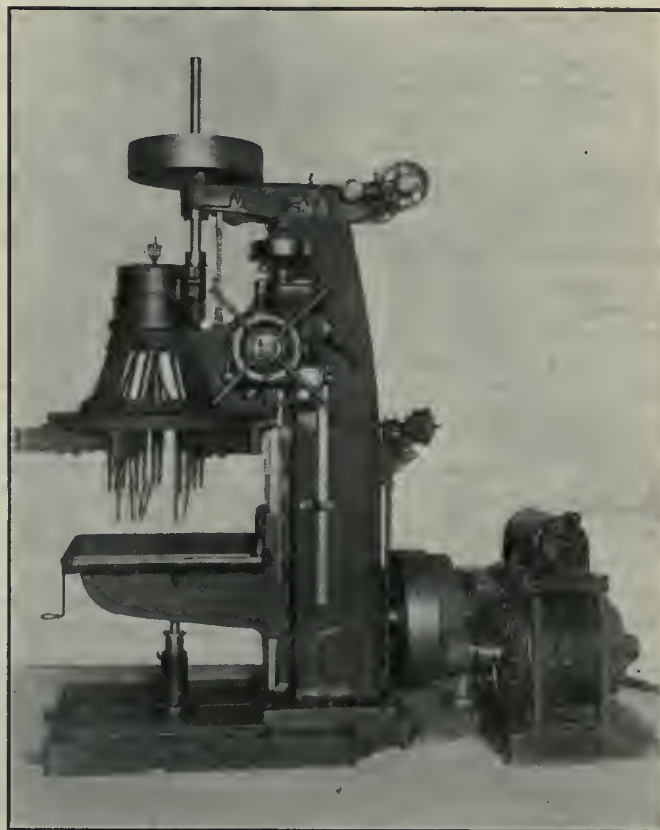
The frame of these machines is very heavy, while the base is heavily ribbed and provided with T-slots, oil gutter, and settling tank. An extension is bolted to the rear of the base for the cone bracket or the motor.

The table has a long bearing on the column with elevating screw under the centre of drilling area. Provision is made for planing three T-slots if wanted.

An oil pump, with suction and distributing piping, can be located on rear of the column and is driven by belt from the shaft below.



NO. 51A—MULTIPLE SPINDLE DRILL EQUIPPED WITH 12-½ In. SPINDLES.



NO. 51B—MULTIPLE SPINDLE DRILL, MOTOR DRIVEN, EQUIPPED WITH 16 ½-IN. SPINDLES.

The spindle capacity in cast iron of the 51A machine is 12-½ in. holes and that of the 51B, 16-½ in. holes, while spindle speeds range from 300 to 645 r.p.m., and feeds per revolution from .0050 to .01, or from .0050 to .0150 inch.

The size of motor is 20 and 25 horsepower for the 51A and 51B respectively, with relative speeds of from 780 to 1,560 r.p.m., and 650 to 1,300 r.p.m.

The floor space occupied by the belt-driven machines is in each case 7 ft. 6 ins. by 3 ft. 2 ins., while, for motor-driven machines, it is 7 ft. 11 ins. by 3 ft. 2 ins.

The weight of the 51A belt-driven machine with countershaft is 5,100 pounds, and of the 51B similarly equipped, it is 5,400 pounds. The weights when motor-driven, but excluding the motor, a- 5,100 and 5,500 pounds respectivel·

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

Question—What part of a cubic foot is a gallon?

Answer.—A cubic foot contains 1,728 cub. ins., and a gallon 277.274 cu. ins. A gallon is, therefore, $\frac{277.274}{1728}$ part of a cubic foot or approximately 1-6. In decimals this would be .1604, or 16 per cent.

* * *

Question.—The pumps require 2 per cent. of the steam used by the main engine and the engine uses 3,600 lbs. steam per hour. How much steam is required by the plant?

Answer.—Two per cent. of **3,600** $\frac{2\times3600}{100}=72$ pounds. Total steam capacity required is, therefore, $3600+72=3672$ pounds.

* * *

Question.—An engine runs at 236 r.p.m. when under full load and 240 r.p.m. when under no load. What is the percentage regulation of the governor?

Answer.—The variation is 240—236=4. The per cent. required is the per cent. which 4 is of 236 or $\frac{4\times100}{236}=1.695$ per cent.

* * *

Question.—Find the area of a segment of a circle 75 in. in diameter and 25 in. high.

Answer.—Use formula $A=\frac{4h^2}{3}\sqrt{\frac{D}{h}-0.608}$, in which D is the diameter of the circle of which the segment is a part and h is the height of the segment. Applying this in the above case,

$$\text{Area}=\frac{4\times25^2}{3}\sqrt{\left(\frac{75}{25}-0.608\right)}$$

$$1=\frac{4\times625}{3}\times\sqrt{(3-0.608)}$$

$$=\frac{4\times625}{3}\times1.546=1288.33 \text{ sq. in}$$

Question.—Two boiler shells are made of the same material. One is 30 inches in diameter and 1/4 inch thick, and the other is 50 inches in diameter and 3/8 inch thick, which is the stronger?

Answer.—In the first case there is a quarter of a square inch of metal to resist the pressure acting on 15 square inches, or 1 square inch of cross section of metal resists the pressure on 60 sq. in.

In the second case, 3/8 of a square inch of metal resists the steam pressure on—$\frac{50}{2}=25$ square inches. One square inch of cross-section of boiler plate has to resist the pressure on $25\times\frac{8}{3}=66\ 2/3$ sq. ins.

The smaller boiler is the stronger, and the ratio of the stresses is as 60 to 66 2/3, or the comparative strengths are as $\frac{1}{60}$ to $\frac{1}{66\ 2/3}$, or 100 to 90.

* * *

Question.—What would be the necessary thickness of plates for a steel penstock, 4 ft. 8 in. in diameter, the head of water being 157 feet, the efficiency of the joint being 60 per cent., and the tensile strength of the material is 60,000 pounds per sq. in.?

Answer.—A column of water of one square inch cross section and one foot high weighs .434 pounds. The maximum pressure per square inch then is $157\times.434=68.138$ pounds.

Consider a length of pipe 1 inch long. The total pressure tending to burst it would be 4 ft. 8 ins. $\times68.138=56\times68.138=3815.73$ pounds.

This pressure is resisted by two strips of plate 1 inch long. The stress on one strip of plate 1 inch long then is $\frac{3815.73}{2}=1907.86$ pounds.

The net working strength of the plate is $\frac{60,000}{6}\times\frac{60}{100}=6,000$ pounds per sq. in.

The necessary plate thickness then is $\frac{1907}{6000}=.318$ in., or approximately 5/16 inches.

* * *

Question.—What should be the diameter of fire-box stay bolts spaced at 5 inches to resist a pressure of 200 pounds per sq. in.?

Answer.—The area to be supported by each stay is $5\times5=25$ square inches. The total pressure on this area is $25\times200=5,000$ pounds. The allowable working load of such stays is usually about 6,000 pounds per sq. inch.

The area required $=\frac{5000}{6000}=5/6$ of a square inch.

The diameter of a circle whose area is 5/6 of a square inch is $\sqrt{\frac{\text{area}}{.7854}}=\sqrt{\frac{.833}{.7854}}=1.06$, or, say, 1 inch stay bolts.

* * *

Question.—In testing an engine by means of a prony brake, the brake arm is 6 feet long. The pressure on the scale pan is 20 pounds, and the engine runs at 120 revolutions per minute. What is the brake horse-power developed?

Answer.—Power is measured by multiplying force in pounds by the distance in feet through which it moves. The distance in this case is the circumference of the brake arm circle multiplied by the revolutions per minute

$=6\times2\times3.1416\times120=45239$ feet per minute.

Force=20 pounds. Number of foot pounds $=45239\times20$. Horse-power $=\frac{45239\times20}{33,000}=27.41$.

* * *

Question.—The area of an indicator diagram is 2.38 square inches; its length is 3.5 inches, and the spring used is 60. The diameter of the engine cylinder is 12 inches, the stroke is 18 inches, and the speed is 120 r.p.m. What is the indicated horse-power?

Answer.—The average height of the diagram is $\frac{2.25}{3.5}$. As each inch represents 60 pounds' pressure, the m.e.p $=\frac{2.38}{3.5}\times60=40.8$ pounds.

Indicated horse-power $=\frac{\text{plan}}{33,000}$

Area of piston $=12^2\times7854=113.1$ square inches.

Supplying values in the above formula,

$$\text{h.p.}=\frac{40.8\times1.5\times113.1\times240}{33,000}=50.34 \text{ h.p.}$$

* * *

Question.—The break horse-power of a steam engine is 44.22 and the indicated horse-power is 50.34. What is the mechanical efficiency of the engine?

Answer.—Mechanical efficiency,

$$=\frac{44.22}{50.34}=87.9 \text{ per cent.}$$

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Vol. XII. NOVEMBER 5, 1914 No. 19

PRINCIPAL CONTENTS:

EFFECT OF EFFICIENT PROCESSES ON THE NATION.

EFFICIENCY in the manufacturing business has been described as the elimination of waste in the processes involved. The first effects of its successful accomplishment are naturally detrimental to progress and harmony in industrial institutions. To the investor it brings increased or abnormal dividends and he, in turn, becomes dissatisfied if these are not maintained. To the mechanic it means increased production and often, under thoughtless management, increased labor without corresponding remuneration or other sign of appreciation.

Under such conditions, the net result is not beneficial to either of the parties directly involved, except that the spending capacity of the dividend-getter is increased which, in turn, goes to increase the discontent of the wage-earner and to widen the gulf between them. The production of manufactured commodities is greatly increased but, as the price remains stationary, the consumption remains practically unchanged. When there is not sufficient money to buy the products of industry, even at improper prices, money is said to be "tight."

The capitalist next curtails his personal and other expenditures, and the difference goes to the banks who are, in turn, accused of hoarding and keeping money out of circulation. The ultimate reaction follows: Production must be curtailed; factories are shut down and men must be idle when the country needs their services most.

How easily could success in efficient management and methods be made to have the opposite effect upon the nation. If it were used to increase the wealth of our people by decreasing the cost of commodities instead of placing them out of our reach, then our exporting power and hence our tangible wealth would be greatly increased and the painful operation of hard times would not be required. We would be rid of the surplus production which clogs industry and, in return, would have the financial stimulus to produce still further for ourselves, the substance of real wealth.

THE STATUS OF THE MECHANIC.

THE inaptitude of most successful financiers to grasp mechanical problems is very evident, particularly to mechanics and engineers. Unfortunately for our industrial progress, these people have in their hands, the direction of most of our industrial enterprises, including ofttimes the mechanical methods and processes employed.

It is notable that, when such a man is making an investment or becomes physically injured or ill, he hastens to consult, even to the smallest detail, his attorney or physician. When installing machinery, heating or power plant equipment, however, he is most likely to consult his own unreliable self. The result is that either the direct cost or smart salesmanship is the determining factor and not future economy and convenience. This has many discouraging effects. For instance, it has been stated on the highest authority that, if the best advised power and heating plants were employed throughout Canada, from 30 to 50 per cent. of the coal at present consumed, would not be required.

The engineer and mechanic has not the power or the usefulness in this particular sphere that should be credited to him. Both the engineering trades and engineering profession have no standing to indicate the capabilities of their men. They are littered with those who have little more to recommend than their self-styled and impressive cognomens.

Unfortunately those who have the least practical status are the most capable self-advertisers and it is little wonder that the investor, after a few dealings with such men should consider his own judgment superior to that of so-called professional men. All other professions are particularly active in ridding the calling of and protecting it from charlatans, quacks, and other unworthy persons, and until engineers and the better class of mechanics adopt the same or a similar policy, they will stand, in the public estimation, on a par with their most undeserving counterfeits.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	**Toronto.**
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X	18 00	17 00
Victoria, No. 2 Plain	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.00
Steel bars, f.o.b., Toronto	2.00
Common bar iron, f.o.b., Montreal	2.00
Steel bars, f.o.b., Montreal	2.00
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.20
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.05
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.70
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

		Montreal.	Toronto.
Plates, ½ in. 100 lbs.		$2 20	$2 20
Heads, per 100 lbs.		2 55	2 55
Tank plates, 3-16 in.		2 50	2 50
Tubes, per 100 ft.	1 inch	9 50	9 00
" "	1¼ in.	9 50	9 00
" "	1½ "	9 50	9 00
" "	1¾ "	9 50	9 00
" "	2 "	8 75	8 75
" "	2½ "	11 15	11 50
" "	3 "	12 10	12 50
" "	3½ "	14 15	14 50
" "	4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in.	75%
Finished Nuts over 1 in.	72%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75 & 5
Stove bolts	80 & 7½
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 50
Copper, crucible	10 00	9 50
Copper, unch-bled, heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	10 75	8 50
No. 1 compos'n turnings	8 50	8 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	.1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	72	62
7, 8, 10 in.	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

Net ton f.o.b. Toronto.

METALS.

	Montreal.	Toronto.
Lake copper, carload	$13 00	$13 00
Electrolytic copper	12 75	13 00
Castings copper	12 50	12 75
Spelter	5 50	5 50
Tin	34 00	34 00
Lead	4 50	4 50
Antimony	16 00	16 00
Aluminum	20 00	21 00

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	6.40
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine, single bbls.	0.67
Linseed oil, raw, single bbls.	0.61
Linseed oil, boiled, single bbls.	0.64
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Pure Manila rope	0.16
Lard Oil, per gal.	0.60

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50% & 10%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

CHAIN.

1/4 inch	$5.65
5/16 inch	4.70
3/8 inch	4.00
7/16 inch	3.65
1/2 inch	3.45
9/16 inch	3.45
5/8 inch	3.35
3/4 inch	3.25
7/8 inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COLD DRAWN STEEL SHAFTING.

3/4 inch	$ 4 95
1 inch	8 05
1 1/4 inch	12 65
1 3/8 inch	15 30
1 1/2 inch	16 50
1 5/8 inch	19 40
1 3/4 inch	22 50
1 7/8 inch	25 80
2 inch	29 30

Prices quoted are cents per foot.

CAST IRON PIPE.

6 inches and upwards	$32 00
4 inch	33 00
Specials per 100 lbs.	3 00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1 1/2-in.	37.50	30.00	17.50
33/64 to 3/4-in.	41.25	33.00	19.25
7/16 to 1/2-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, ordinary, 52 sheets	3 70	3 85
Canada plates, all bright	3 90	3 95
Apollo brand, 10 3/4 oz. (American)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 25
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	4 00	4 20

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Nov. 2, 1914.—Except for the increased activity due to the distribution of orders for munitions of war over a wide manufacturing area, no particular change falls to be noted either in the matter of a recession or improvement in general business from that prevailing during the past two months. Import, export and domestic trade are moving only as a matter of expediency and, as we see it, until banks and our large corporations loosen up and seek to stimulate the domestic feature, which is, after all, the mainspring of the two others, no great forward movement need be looked for.

We are ignoring the fact that we can and should help ourselves, and are too despairingly looking for others to come over and help us. What Canada needs at the present time, and, for that matter, needs always, is a lead from within herself, and until somebody steps out of their own accord and throws aside all conventionality, she will always be a follower.

The Steel Market.

Suffering alike with its sister activities, the steel trade has been very dull. The importing end of the business has dwindled down to a mere shadow of its former magnitude, and this is mostly being carried on with Scottish firms. American products, however, are also being handled.

Pig Iron.

Importations of pig iron have dropped considerably, because the demand has fallen so rapidly. Scottish pig has been arriving, but only in very small shipments. Foundry operations have been curtailed, and the demand is small.

Machine Tools and Supplies.

Business in machine tools has been very light. A few small orders continue from time to time to be reported, but the general trade is at a very low ebb. It is reported that Britain is importing lathes from the United States.

Metals.

There has not been much activity in the metal market during the last week. Prices have, however, been maintained pretty consistently. Spelter and lead have both weakened slightly but, aside from these, other prices are steady.

Toronto, Ont., Nov. 3, 1914.—A somewhat improved tone is noticeable in the industrial situation and a more optimistic spirit prevails in business circles. This condition is largely to be accounted for by the orders which have been placed in this country for military supplies and equipment by the British Government. It is understood that further large orders have yet to be placed and that as much business as possible will be given to Canadian firms. The concerns obtaining these orders will be actively engaged for several months and are in a much better position than they were previous to the war. Those industries not so favorably situated, such as the steel trade and machinery manufacturers, are quiet; an improvement in this respect may be expected in time, although it may be slow in materializing.

Generally speaking, Canada is, from an industrial standpoint, in a favorable position, the chief thing militating against any pronounced recovery of trade being the tightness of money. This stringency cannot, however, be very well avoided, owing to the difficulty of obtaining loans, on account of the unsettled condition of the money market and high rates. This difficulty is gradually being adjusted and will in time be less severely felt. Foreign exchange has recently dropped to a point almost approaching the normal, which will materially help both export and import trade. It also indicates a return of confidence in financial circles, tending to benefit trade generally. Collections show some improvement.

Steel Market.

There is little change in the condition of the iron and steel trade this week and prices are steady. The building trade is dull and demand for structural shapes light. Makers of finished steel sheets are busy and firms working on shell orders will have certain departments kept active for some time to come. Comparatively little advantage has so far accrued to the steel industry on account of the war, but it is possible that the industry will derive some benefit later when a greater volume of orders is being placed on this side.

At the outbreak of the war it was predicted that extensive orders for steel products would be placed in the United States by the European and other countries. It was also expected that Canada would benefit to some extent, or in other words, obtain a share of the business that was offering. This business has not come along in anything approaching the amount that was anticipated, but probably the situation may improve in this respect later.

Conditions in the steel trade in the States are no better, and the outlook for the immediate future is not particularly bright. The mills are operating at considerably reduced capacity and there is a tendency towards weakness in prices.

Pig Iron.

The pig iron market shows no improvement and is still very dull. There is little hope for any change in the near future. Prices are keeping steady, but with a weak tendency.

Machine Tools.

Machine tool dealers do not report very satisfactory returns and the volume of business is distinctly light. There will probably be little improvement in business until the money market is easier and general industrial conditions show some tangible improvement.

Supplies.

Machine shop and mill supplies are quiet, small orders being more general. There has been no further change in leather belting, although the supply of leather is becoming depleted. There have been no price changes this week.

Metals.

The metal markets are dull and there is no change in the general situation. Tin is stronger and is now being quoted at \$34. The spelter market is flat and the price is weaker, being quoted at 5½c. Lead is also weaker at 4½c per lb. It is announced that the London and New York metal exchanges will re-open on Nov. 9 for trading in tin.

CANADIAN ASBESTOS FOR AUSTRALIA.

THE Department of Trade and Commerce, Ottawa, is advised that a company has been formed in Sydney, New South Wales, for the purpose of manufacturing asbestos in Australia, and that they are erecting works for that purpose. As they will require crude asbestos, they have inquired as to the source of supply, freight rates, and other particulars concerning Canadian asbestos. They are contemplating sending a member of their firm to Canada to study the situation.

It has been suggested that they might desire to begin by importing manufactured asbestos goods, and that with this in view they might desire to get into touch with Canadian producers of these goods. It is hoped, therefore, that Canadian asbestos manufacturers will follow up this notice by communicating with this firm in question—the name and address of which may be had on application to the Department of Trade and Commerce, Ottawa—and that this may result in the establishment of a permanent connection.

MOOSE MOUNTAIN IRON ORES OF CANADA.

"THE Moose Mountain Iron-Bearing District of Ontario," by E. Lindeman, is the subject of a report recently issued by the Canadian Department of Mines, of which Dr. Eugene Haanel is director. This district has attracted considerable attention on account of its large deposits of low-grade magnetite. The ores are divided into two types—banded quartziferous magnetite and magnetite associated with hornblende, pyroxene and epodite. The former is the most common, while the latter is confined to one or two small deposits.

The total area of the various deposits is roughly estimated at 3,256,000 sq. ft., which, assuming that the specific gravity of the ore is 3.8, would correspond to about 38,665,000 tons of ore per 100 ft. of depth of the ore bodies. Diamond drilling carried out by the Moose Mountain, Ltd., has shown that No. 2 deposit is at least 400 ft. deep, while No. 1 deposit has been proved to a depth of 300 ft. The great bulk of this large tonnage is made up of banded silicious magnetite, of type No. 1, requiring fine crushing and concentration, with subsequent briquetting or nodulizing. The future of the district as an iron ore producer depends chiefly on the possibility of utilizing the type No. 1 ore. Concentration tests have demonstrated that by grinding the material to 80 to 100 mesh or finer an excellent concentrate having the following composition can be obtained:

Iron 65.6 per cent., phosphorus 0.019 per cent., silica 8.6 per cent., sulphur 0.029 per cent.

The cost of mining the ore will, no doubt, for years to come, be rather low, owing to the fact that a large tonnage can be obtained from No. 2 deposit by simply quarrying the ore in open cuts at various elevations. Cheap electric power is now available, being obtained from the Wahnapitae Power Co., over a transmission line of about 35 miles in length.

The report concludes with the statement: "Since it will be necessary to mine and crush to a fineness of 80 to 100 mesh about 2.2 tons of ore to obtain one ton of concentrate of 65 per cent. iron, and adding to the cost of mining, crushing and concentration that of briquetting, which by the Grondal process is rather high, it is evident that only by the most economical handling of the material on a large scale will it be possible at the present time to work these low-grade ores profitably."

SOUTH OF RUSSIA MOTOR CAR TRADE.

IN the south of Russia the demand for motor cars is growing rapidly, says a British trade report. All landowners of any position are buyers or prospective buyers; doctors, engineers, Government employees, and in fact all persons who are obliged to travel much are beginning to find out how indispensable the motor car is as a means of locomotion.

One of the principal reasons for this is that in Southern Russia there is no close network of railways, and long and wearisome journeys by circuitous railway routes or in horse-drawn vehicles have, up to now been the lot of travelers. For instance, it takes 24 hours to go from Odessa to Nicolaiev by train, while in a motor car it is an easy three hours' run.

The demand for cars is expected to increase very much in the next few years. Russia is such a large country that there are many people, living perhaps at some distance from an industrial centre, who have not yet been educated up to the motor car or realized its utility. The process of education is however, going on, so much so that the manager of a firm which has sold over 60 cars already this year, states that in four or five years time he hopes to raise the sale to 400 or 500 cars yearly.

Haileybury, Ont.—George Poppleton has nearly completed the construction of a foundry. Mr. Poppleton will specialize in automobile repairs and patent rock steel grinding tools.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

NO NICKEL FOR ENEMIES.

THE rich nickel exports of Canada will not in future be available for the manufacture of armor plate by the enemies of Great Britain. The Sudbury nickel deposits are the richest in the world, and heretofore there has been no restriction upon their export.

As Canada has practically a monopoly of nickel, therefore the announcement is of great importance that the Government has now passed an Order-in-Council prohibiting the unrestricted export of not only nickel, but a number of other minerals and manufactures, as well as foodstuffs for animals.

The export is prohibited "to all foreign ports in Europe and on the Mediterranean and Black Seas, save France, Russia (except Baltic ports), Spain and Portugal." the list including "graphite for range-finders, nickel and nickel ores, motor engines, aeroplanes and all other air-craft; wool and sheepskins, warships, including boats used on them, food stuffs for animals, gold and silver bullion, vehicles of all kinds, vessels, crafts and boats, powder and explosives, barbed wire, and devices for cutting it, unwrought copper, lead, sheet or pipe, haematite, iron ore, magnetic iron ore, hides and skins, raw or tanned, but including the dressed variety, and rubber of all kinds."

VANCOUVER ELEVATOR CONSTRUCTION.

CONSTRUCTION work upon the Government grain elevator at Vancouver will be commenced within a month, and will be completed by the end of November, 1915. The elevator will be erected on land immediately between Commercial Street and Salisbury Drive, fronting on Stewart Street. The plant will consist of working house, track shed, storage house, sacking plant, transformer building and conveyer galleries, to handle bulk grain. The buildings will be of reinforced concrete.

The main structure of the storage house will be 232 feet by 71 feet, with a capacity of 950,000 bushels. Therein will be 52 circular bins and 32 interspace bins. The workhouse will be 126 feet by 62 feet, with passenger elevator tower 12 feet by 16 feet. It will have 32 circular bins, 21 interspace bins and 15 outerspace bins, with a total storage capacity of 300,000 bushels. The sacking and transforming building will be 62 feet by 25 feet.

There will be seven parallel tracks on the wharf, and five tracks between the wharf and the C. P. R. tracks, the whole having a total length of a little under two miles. These tracks will connect directly with the C. P. R. tracks by means of three spurs. The track shed will be 52 feet by 150 feet, and will be of reinforced concrete frame structure.

Receiving hoppers, having a capacity of 2,000 bushels of grain each, will be placed at each of the three carways in the track shed basement. There will be hoppers at each of the three receiving legs, making nine hoppers in all. Forty-three-phase, 60-cycle alternating current motors, having 1,520 combined horsepower, will run the machinery. There will be two sets of automatic sacking scales, each scale having a hopper capacity of from two to six bushels and being capable of weighing 1,500 bushels per hour.

The grain will be conveyed from ship to the elevator or vice versa by two-belt galleries, one on each side of the wharf.

COMMERCIAL CONDITIONS IN RUSSIA.

AN excellent review of present commercial conditions in Russia, and the trade openings therein, published in the Board of Trade Journal, is the substance of the following article, and although it is written from the point of view of United Kingdom trade extension, it is nevertheless of value to Canadian trade as further bearing out the various notices on Russian opportunities already published by us.

Of all the countries concerned in the war, Russia is the most self-contained and self-supporting. As a nation she feed herself, and has in times of peace been a large exporter of foodstuffs to other countries. At present, owing to the interruption of communications and the consequent restriction of exports, Russia is in an exceptionally good position as regards food. Further, as only an extremely small portion of the Russian Empire at large has been in the war zone, the country has suffered practically no damage, and it is hardly likely in the future to receive any.

As regards manufactures, the mills and factories are working in quite a normal way and, so long as they can get the necessary raw material, there is every prospect of their continuing to do so. There has been practically no dismissal of workpeople. Business concerns which do not depend upon imports from abroad are, as yet, feeling very little of the consequences of the present conflict.

Anti-German Feeling.

The intensity of feeling against the Germans is very great. From the highest to the lowest this feeling is being fostered and will, no doubt continue for a long time after the war is over, and firms which have hitherto been getting supplies from Germany must consider what steps to take for the future. For many years German manufacturers have made a most systematic bid for the Russian market and their success has been, in a very great measure, the result of their own systematic organization and the way in which they have tried to meet the whims and fancies of the people whose orders they sought. In addition, the most progressive firms sent out their catalogues and circulars printed in the Russian language, giving Russian prices, weights and measures, which always gave their offers a better chance of being considered by the intending Russian purchaser than those submitted by firms from other countries, who could only supply their circulars and catalogues in a language which was usually unintelligible to the purchaser.

Canadian firms desirious of acquiring some of the Russion business which has hitherto gone to Germany must start now to complete their organization for such an attack, and they should remember that the greatest measure of success is most likely to fall to those first in the field.

German Business Tact.

The introduction of German machinery into Russia was aided by many circumstances. In the case of textile machinery, especially for use in bleaching, dyeing, finishing, printing, etc., many German colorists and other technical men gained situations in Russia at the expense of British subjects and they naturally recommended those makes of machines on which they had been originally trained in their own country. It was not always a question of the introduction of a superior class of machine, but merely the fact that they were trying to do a good turn to their country, or satisfying their own whims. It must not be overlooked, however, that whilst such people worked for the introduction of the German article, the German manufacturers themselves followed up the introduction with vigor.

Mechanical and Electrical Apparatus.

With regard to the engineering world, and especially the electrical and the more scientific mechanical sphere, the Germans secured the Russian market largely because so many Russians can speak German and can consequently discourse with the makers in their own tongue. They were also aided by the close proximity of Germany to Russia, and by the fact that the bulk of the Russian technical literature had its foundation in the German text books. The major part of the technical text books, reference tables, etc., published in Russia are translated from the German, and consequently the litre, kilogram, and the metre are well known to the Russians, whereas the more complicated English moneys, weights and measures are not so intimately known.

If there is to be a revival of business between the British Empire and Russia it will be necessary for our makers to adopt some of the methods of those nations who have succeeded so well. The honest methods generally in vogue amongst our manufacturers would succeed if they were worked in the right way. One thing is certain we are not going to snatch the Russian trade from the continental suppliers by the old-fashioned methods of submitting samples and letting the matter rest. We will need to ascertain what brand or quality of goods has been satisfying the users of German goods and then see what we can offer as near as possible to them, whilst, at the same time of course, keeping our regular standard articles before intending purchasers.

Supply of Consignment Stocks.

One feature of the methods which German manufacturers adopted to introduce their productions into Russia was the readiness with which they supplied consignment stocks. Quite small business people of exceedingly limited means, owing to the support given to them by the German makers, were able to develop good business connections, and any visitor can see scores of shops full of all kinds of goods from Germany, and when one seeks to find how much stocks are held the one answer is 'consignment.' The sending out of consignments by our firms is, however, not advocated unless they first satisfy themselves about the integrity of the people they are sending them to, and it is to be hoped that, when this war is over, our manufacturers will not, in their anxiety to get the Russian market, rush in without exercising due caution. The following may be mentioned amongst the articles which have been introduced extensively into Russia by the Germans:—

Russian Importations From Germany.

All kinds of textile machinery, especially that appertaining to bleaching, dyeing, finishing and printing; small engines and locomobiles (the latter have been sold in large quantities, although 20 years ago the trade belonged almost exclusively to the United Kingdom); boilers and steam piping; automatic looms and preparation machinery for weaving mills; apparatus for heating, lighting and ventilating large buildings; elevators and lifts; mining machinery; steam turbines and electrical apparatus of all kinds; steam pumps, especially those of moderate sizes, used for boiler feeding and the ordinary run of pump supply used in mills and factories; all classes of steam fittings.

Russian firms have commenced to manufacture for themselves, but the articles required for high-pressure steam necessitating bodies of cast steel, are obtained in considerable quantities from Germany. Germany also sends the following amongst other material to Russia: —Papermakers' felts and wires; wire ropes, hemp and manila ropes, woven belting; leather belting of an inferior quality, but sufficiently good for the purpose for which it was used; electric lamps, and all kinds of steel goods, especially tool steel.

CANADIAN TRADE OUTLOOK IMPROVING.

WITH the development of evidence tending to show that financial and trade conditions are adjusting themselves in the United States and Great Britain, unmistakable signs are accumulating of an all round improvement in the commercial position of Canada. One of the most important of these is the statement of the Department of Trade and Commerce indicating an increase of \$65,000,000 in the export trade of the Dominion during the year ending August 31. The total trade of the country was \$1,063,908,233 and of this amount exports aggregated \$488,000,000 as against \$413,000,000 for the previous year. Imports during the same period declined from \$686,000,000 to \$549,000,000.

Analysis Showing.

An analysis of the statement shows that the increase in exports is of an all round nature and affords numerous reasons for congratulation among all classes of producers. The principal increase in exports were, animal produce from \$43,000,000 to \$61,000,000, agricultural products from \$159,000,000 to \$183,000,000, manufactures from \$48,000 000 to \$63,000,000. Imports from the West Indies increased from \$4,217,000 to \$5,598,000, while exports to the West Indies increased from \$4,368,000 to \$5,075,000. Imports from the United Kingdom fell from \$145,000,000 to \$114,000,000, but exports to the United Kingdom grew from \$185,000,000 to \$218,000,000. Imports from the United States fell from \$448,000,000 to \$373,000,000, while exports to the United States increased from \$175,000,000 to \$209,000,000.

Canada Establishing Credit.

Commercial men believe that with such an improvement in our position it should not be many years before this country is very much on the right side of the balance of trade. The establishment of credits at such a rate, not only in Great Britain, but in the United States, should help materially in tiding the Dominion over the period of war financing, when without such credits, borrowings would be extremely difficult to negotiate for not only municipal but for large industrial and public utility enterprises.

British and American Financial Relations.

A re-establishment of credit relationships between the United States and Great Britain will also, it is believed, have a pronounced effect upon the prosperity of the Dominion. The situation in this connection has improved considerably, and no less an authority than Sir George Paish is responsible for the statement that the outlook is now far brighter than it was a month ago. The big point of interest in the international situation is, of course, the success of Great Britain will make of the rather herculean problem involved in collecting her debts from all the nations of the world. The United States owes Great Britain something like half a billion dollars. Some of this will be paid in actual cash and a large part of it will be discharged in the form of credit balances abroad formed by means of exports. The necessity of maintaining free trade routes therefore becomes evident; also the matter of providing for the large cotton crop in the United States and the most profitable disposition of gold reserves, become of paramount interest.

World's Liabilities to Britain.

In connection with the international situation, Sir George Paish, in a recent interview, said:

"The liabilities of the world to Great Britain in respect of accounts due and bills of exchange have been estimated at some three hundred and fifty millions sterling, and whatever amount Great Britain realizes from this she will continue to pass along for the maintenance of world-wide trade, as well as whatever additional money is needed to maintain international commerce in a normal condition of activity. The attitude of her financiers towards the United States includes not only the plan by which the current indebtedness on account of trade and finance bills due by the United

States abroad can be liquidated, with as little export of gold as possible, but also arrangements whereby she may establish in New York credit or funds by means of which payment can be made for all goods purchased by the British people.

"The situation in the United States has improved greatly. There is now a feeling that the credit position has been saved. The bankers there have provided $80,000,000 for the purpose of reducing New York city bonds, and are establishing a gold fund of $100,000,000 against which exchange may be drawn, so that American debtors may find the means by which they can pay their debts to Britain: and these sums, together with the credit balance which Great Britain may leave in the United States, should effectively meet the exchange situation."

Facilitate Exchange Business.

Another matter of paramount interest in the adjustment of trade relationships is the official statement issued by the British Treasury, cabled a few days ago, giving the plan of the Government to facilitate stock exchange business and to prevent undue depreciation in investments by avoiding the necessity for forced realization.

The Government has arranged with the Bank of England to make advances to certain classes of lenders to enable them to continue their loans until after the end of the war. The scheme will be confined to "account to account" loans made to members of the Stock Exchange by lenders other than banks, to which currency facilities are open.

Won't Press Loans.

All such bankers have agreed not to press loans for payment or require a deposit of further margin until after the expiration of twelve months from the conclusion of peace. The Government will arrange with the Bank of England to advance to lenders 60 per cent. of the value of securities they hold against any loans they had outstanding on July 29. The interest will be payable fortnightly or at each settlement when the Stock Exchange is re-opened.

The bank will not press for the repayment of advances until a year has elapsed from the conclusion of peace. A Stock Exchange committee has undertaken to formulate rules to make the scheme as widely advantageous as possible. The committee will not open the Stock Exchange without first obtaining the consent of the Treasury.

Numerous reports received in Canada show that the war was quick to stimulate trade in England at the expense of Germany, and this will tend to improve the situation here in Canada.

The Canada Tool & Specialty Co., New Glasgow, N.S., have secured an order for thirty thousand sights to be fitted on the Ross rifles recently ordered by the British Government from the Ross Rifle Co., Quebec.

Canadian Commercial Intelligence Service

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS

Argentine Republic.

H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.

D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Cancoma.

British West Indies.

E. H. S. Flood, Bridgetown, Barbados, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.

J. W. Ross, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.

Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.

Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

Japan.

G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.

J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.

W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.

W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.

W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.

E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.

J. E. Ray, Central House, Birmingham. Cable address, Canadian.

Acting Trade Commissioner, North British Building, East Parade, Leeds. Cable address, Canadian.

F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.

Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Canacom.

Harrison Watson, 72 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.

Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Nassau, Bahamas.

Colombia.

A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.

C. E. Sontum, Grubbeged No. 4, Christiana, Norway. Cable address, Sontums.

South Africa.

D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.

E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.

W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Smith's Falls, Ont.—The Aluminum and Brass Foundry Co. will build a plant here.

Toronto, Ont.—Mr. G. Morgan, contractor, Palmerston Avenue, is in the market for a 2-ton hoist.

Fort William, Ont.—The Consolidated Elevator Co. will build a transformer house. Electrical equipment will be required.

Toronto, Ont.—The Humber Beach Machine Co.'s plant at Humber village, was destroyed by fire last Friday, the loss being estimated at $12,000.

New Westminster, B.C.—The Canadian Lock Co., East Burnaby will soon have their plant in operation. Some of the machinery has arrived and is being installed.

London, Ont.—Fire on October 29 completely destroyed a building owned and occupied by the Dominion Brass Corporation. The loss is estimated at $20,000, only a part of which is covered by insurance.

Kamsack, Sask.—At the regular meeting of the town council last week dissatisfaction was expressed by the members over the delay of the companies concerned in the delivery of pumps and other machinery required, at the new power house.

Welland, Ont.—Another large order for war supplies to be made in Welland has been received by the Billings-Spencer plant. This is a rush order for 100,000 Ross rifle parts. The firm will run day and night shifts for four months to turn out the order, which will require one and a half million forgings.

Brantford, Ont.—Within one month Brantford will have a plentiful supply of Tilbury gas purified, and therefore fit for use. That was the statement made recently by J. C. Macdonald, president of the Dominion Natural Gas Co., of Pittsburg, who was in the city in conference with Mayor Spence.

Owen Sound, Ont.—In his report of the proceedings of the Fire Chiefs' Convention, which comes before the Council shortly, Fire Chief Thomson strongly recommends the installation of a motor-driven combination hose and chemical truck. The cost of this equipment would be $6,500.

Ottawa, Ont.—The silver-lead industry in the Kootenay is likely to be substantially benefited by the fact that bullets for shrapnel shell now being manufactured in Canada will be made from Canadian lead. Hon. W. T. White, Finance Minister, has recently been taking up the matter with the committee placing orders for shells, and it has now been arranged to the satisfaction of the smelter people at Trail.

Windsor, Ont.—The Marshall foundry, which was completely destroyed by fire, is being rebuilt and is nearly completed. The plant is located on Assumption between Parent and Langlois. Mr. Marshall the owner is putting up a modern and fireproof plant. He has built up a general gray iron jobbing business, giving special attention to sewer and water pipe castings for municipal work.

St. Thomas, Ont.—The National Graphite Lubrication Co., of Scranton, Pa., has selected St. Thomas as a manufacturing place for its Canadian business. D. J. Lewis, a representative of the firm, has been in the city for several days, and has closed a deal with the St. Thomas Bronze & Brass Co., and H. Rayner & Sons, for the manufacturer of lubricators for the present.

St. Catharines, Ont.—Plans are now maturing for a project for further power development in Lincoln county, which are to be put into effect just as soon as considerable detail preparatory work can be completed. The plan is to establish a power house on the bank of the Sixteen-Mile Creek, using water for development purposes from the Chippewa creek, by means of an artificial channel six miles in length, constructed by rock cutting.

Harriston, Ont.—Mr. Buchanan, of Toronto, manager of the McColl Oil Co., has been in town completing arrangements for the rebuilding of the oil works here. The company will install two tanks on this property and erect a building suitable for refining, etc. The contract for the erection of the building has been awarded to George Gray & Son, of this town, and work will be commenced immediately. The buildings, when completed, will cost in the neighborhood of $20,000. Robert Reid is manager.

Hamilton, Ont.—F. J. Stewart, Willoughby Ellis and E. I. Sifton of the Hydro Development; Mayor Allan and City Engineer Macallum, after a conference to discuss the question of the Hydro assuming control of the city waterworks system, decided to secure the views of a number of engineers on the scheme, and later to obtain estimates of the cost of the construction of a mountain reservoir and other proposed changes, including probably a steam auxiliary plant.

Electrical

Fergus, Ont.—Hydro-electric power was turned on here on Oct. 24.

Dresden, Ont.—A Hydro-Electric system is being installed here at a cost of $10,000.

Newmarket, Ont.—A fire alarm system, estimated to cost about $4,000, is to be installed by the Town Council.

Point Grey, B.C.—It is understood that an extension will be made to the electric light system at Richmond. C. Rummell is manager of the B.C. Electric Railway Co., which is behind the project.

Rodney, Ont.—It is announced that hydro power will be delivered here. A separate line will be run on the hydro telephone poles from St. Thomas. A transformer station will be built at Dutton, and Glencoe will be served from there. Another transformer station will be built at West Lorne and Rodney. Providing the rates are satisfactory and the four villages decide to use hydro, it will still be several months before the current will be available.

Newmarket, Ont.—At a special meeting of the council last Thursday, a motion was passed instructing Town Clerk Anderson to write to F. A. Gaby, chief engineer of the Provincial Hydro-Electric Commission, and enquire if Newmarket could be supplied with hydro-electric power for street and house lighting.

Toronto, Ont.—Runnymede Liberal Conservative executive committee held a meeting on Oct. 26, to discuss the question of a hydro-electric service for the district. The township council was requested to sign an agreement with the commission for the issue of the necessary debentures and to pay for brackets and lamps. The commission would erect poles and wires and meter the houses at cost price. Power could be secured from Cooksville or Weston.

Turret Lathe and Vertical Boring Mill Practice

By Albert A. Dowd *

Beginning with our July 9 issue this year, there have appeared more or less frequently articles contributed by the author of this further series. To our readers who have followed what has already been published on the above subject, and more particularly to those recently added to our list of regular subscribers, it will be sufficient to state that the writer is a thorough master of his subject.

AUTOMOBILE PISTONS AND RINGS.—II.

IN the introductory article of this series which appeared in our November 5 issue, a variety of considerations to be noted in machining automobile pistons and rings were dealt with and discussed at length. In addition, the procedure to be observed relative to the first setting when machining a piston was described and illustrated.

Second Setting of the Piston.

In the second setting of the work, the end is to be faced, exterior turned and ring grooves cut, but previous to this the wrist pin hole is rough drilled in a jig locating from the bored end.

Fig. 3 shows the tool layout and holding device used in this setting, the piston itself being shown in section at A. The end which has been previously bored and faced locates the piston on a steel ring B, which is forced on to a prepared

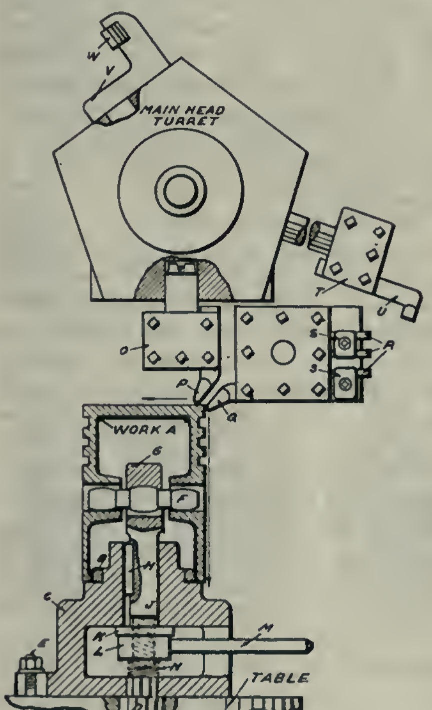


FIGURE 3.

portion of the fixture body C. This fixture in its turn is located by the plug D in the centre hole of the table and is held down by the bolts E, which enter the table tee-slots. The draw rod G is keyed at H to a sliding fit in the base and is threaded at J with a quadruple 4pi. Acme thread. The heavy threaded collar L fits the lower end and has a handle M which extends through an opening in the base, permitting all the movement necessary. A collar, K, is interposed between the base and the operating collar. The tempered steel pin F is convexed at both ends and in the middle, so that all strains are equalized.

In operation, the piston is first placed on the fixture and revolved until the holes are opposite each other. The pin F is then inserted and the draw rod pulled down by means of the handle M, after which the piece is ready for machining. The purpose of the spring N is merely to keep the draw rod up so that no trouble will be experienced in assembling.

Some of the tooling for this setting is regular and some is of special construction. Tool P is held in a regular tool holder O in the main turret head, and is used for facing the end of the piston, while the regular tool Q rough turns the outside. Tool U is used for finish turning the outside and is held in a special length holder, T. In the side-head is a special block carrying the three grooving tools, R, which are clamped in place by the straps S. A roller support is shown in the main turret head at V, the rollers W being two in number and set in the form of a vee, so as to relieve side strain as well as the pressure of the cut.

The second and third operations in this setting are shown in Figure 4. It will be seen that the finishing cut on the outside is started by the tool U in the long tool holder T before the roughing cut has been completed by the tool Q in the side head. This would ordinarily not be considered good practice, but in a case of this kind where the final finishing of the outside of the piston is done by grinding, there can be no possible objection to it and the saving in time is considerable. The finishing cut being very light, a coarser feed may be used, so that after the side head has been drawn back out of the way, a very little more time suffices for the remainder of the finishing. The operation of cutting the ring grooves is shown in the lower part of the illustration, the tools R in the side head being used for this purpose. Before starting the grooving cut, the roller support V is brought down until the rolls W are in contact with the outside of the piston, after which the side head is advanced at a fine feed until the proper depth has been reached. A final finishing cut is sometimes taken on these ring grooves, the piston being held on a lathe fixture during the operation.

Another Method of Handling An Automobile Piston:

In the method just described, the piston was located in the first setting by the cored interior surfaces but was not held by these surfaces during the process of machining. An improvement on the method hereinbefore mentioned is

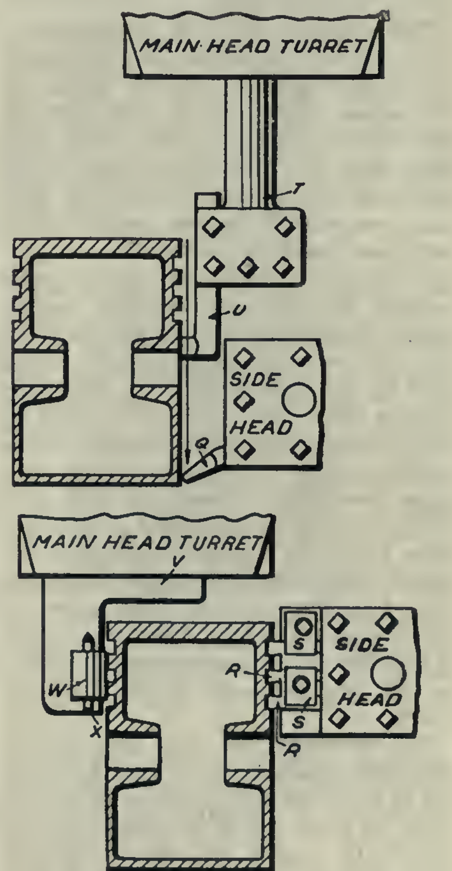


FIGURE 4.

shown in Fig. 5, in that the work is both located and held during the process of machining in the first setting, by the cored surfaces mentioned. An internal expanding pin chuck is used for the purpose of locating and holding the piston, and although the design of this

*Production Engineer, Bridgeport, Conn.

chuck may appear somewhat complicated, in reality there are no delicate parts subject to breakage if reasonable care is exercised in its use, nor is it liable to get out of order. As the writer has in the past ten years designed something over a hundred chucks of similar construction to this one, for many varieties of auto pistons, and as these chucks have been subjected to severe usage and more or less abuse, it follows that the design must be thoroughly practical, for were it otherwise, inherent faults would have shown themselves long since.

In the design of a chuck of this kind there are several important points which should be carefully noted. The chuck should be made as nearly dirt-proof as possible, for cast iron scale and fine particles of parting sand working their way into the mechanism do an immense amount of damage. Stop pins must be provided, so that damage will not result from forcing the pins beyond their normal limits when there is no piston in position on the chuck. Considerable allowance should be made when designing, to take care of variations in the size of the cored surfaces.

The piston A is shown in section in its position on the chuck body, B, which is centered on the table by means of the hollow stud L, and is held down by the three tee-bolts C, which enter the table tee-slots. There are six pins, H, in the body of the chuck, the lower pins being spaced 120 degrees apart, while the upper ones are as far apart as the spacing of the wrist pin bosses will permit, this distance varying considerably in different sizes of pistons. The pins are controlled in their radial movement by the cams D and E, in which are angular slots against which the ends of the pins bear. Attention is called to the leather washer Z on the top of the upper cam, which is kept well oiled and which protects the internal mechanism from dirt. The pins H have a shoulder against which the coil springs thrust so as to force the pins back when releasing. Pins are very carefully fitted and lapped in position in the cover plates Y which are let into the body of the chuck as shown.

The operating rod F is threaded in the upper cam with a right hand thread and in the lower with a left hand thread, while its lower end is cylindrical and is splined to receive the key M in the mitre gear J. The coil spring N supports the rod and cams and has no other purpose. The mitre gear J is ground to a running fit in the hollow stud L and is provided with a thrust washer as shown in the illustration. The other gear, K, has a solid stem which is also ground to a running fit in the body of the chuck and is squared up at R to receive the end of the socket wrench P by which the mechanism is operated. The stem of this socket wrench is also ground to a running fit in the body so that there will be no wobble when revolving the gears. The handle is bent at Q so that it can be used as a crank. Two stop pins, G, are provided in the body of the chuck in order to limit the movement of the cams. The hole through which the gears are assembled is fitted with a steel cover plate at O in order to keep out dirt and chips.

When the piston is placed on the chuck it is dropped down until it rests on the upper end of the chuck. The crank is then placed in position, and the gears are revolved until the pins H

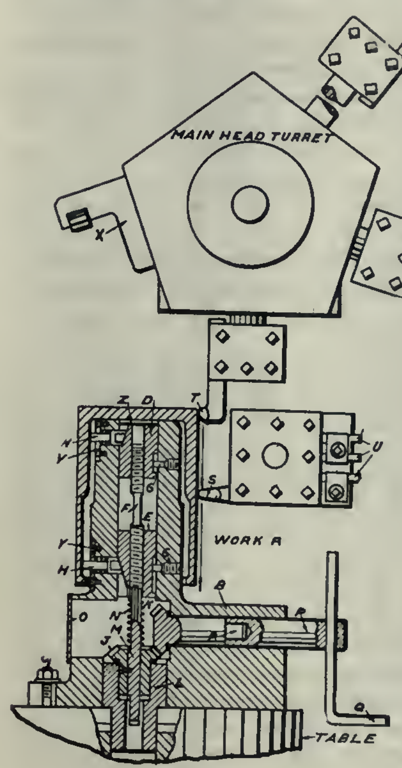


FIGURE 5.

bring up firmly against the inside of the piston, thus locating and holding it positively by the core. It will be seen that as the gears are revolved the rod F floats up and down in the lower gear so that an equalizing action takes place and gives an equal amount of pressure to both the upper and lower sets of pins, no matter how much variation there may be in the core. In order to act as a driver and therefore take the strain off from the pins, one side of the chuck body is milled out in such shape that it forms a shoulder against which one of the wrist pin bosses strikes. This is not shown in the illustration.

In order to save time in machining, the main head and side head are used simultaneously in turning the outside, the tool T being started at the top, while the tool S in the side head is started about half way down the piston. A rough facing cut with the tool V in the main head may be taken at this setting if desired, in order to gauge the thickness of the end from the inside, or it may simply be marked and finished in another setting. The tools U, V and W and the roller support X are used as in Fig. 4, the same fixture being used for holding as that shown in Fig. 3.

The second setting of the work is not shown as it is too simple to need illustration. The work is held in a set of soft jaws bored to the size of the roughly turned exterior and the tools shown in Fig. 2 are used to bore and face the open end.

INTERESTING LOCOMOTIVE CONVERSION.

PARTICULARS are given by the Railway Gazette of an interesting locomotive conversion on the Great Northern Railway. When engine No. 271 was built in July, 1902, it had four single expansion cylinders—two between and two outside the frames — all driving the leading coupled wheels. Stephenson valve gear operated from the crank-axle with rocking levers for the outside cylinders was fitted. In September, 1904, each cylinder was provided with its own valve motion, Walschaerts' gear being fitted to the outside cylinders and the Stephenson gear retained for the inside. In 1911, No. 271 was again altered by being changed to a two-inside-cylinder engine, the valve gear being of the Stephenson type with piston valves. It was at the same time fitted with a Schmidt superheater.

The weight in working order is now 131,376 pounds, of which 74,816 pounds is carried by the drivers. Formerly it weighed 138,880 pounds with 79,520 pounds, on the drivers. The heating surface is 1,164 square feet, as compared with 1,303 square feet, but to the former must be added 343 square feet for the superheater, and the working pressure has been reduced from 175 lb. per square inch to 160 lbs. The present two cylinders are each 18½ in. by 26 ins. stroke, as against 15 ins. by 20 ins. stroke in the four cylinders. In its altered state the engine is giving good results and has taken a load of 372 tons at 45 miles per hour up the Potters Bar bank.

Toronto, Ont.—The General Electric Co., Ltd., of London, Eng., has entered an action to recover $75,000 from Chapman & Walker of Toronto. The money claimed is an amount alleged to be due on six debentures. They also ask foreclosure and the appointment of a receiver and manager.

Care and Application of Slings for Hoisting Purposes*

The transportation of either heavy or light and delicate machinery from one location to another in factories and workshops calls for crane mechanism and operation which will at all times be effective and reliable. An accessory to these and of supreme importance is the sling feature. The writer of this article directs attention to the latter in its various aspects, and discusses in a thoroughly practical and easily intelligible manner the procedure that should be adopted by those responsible for the slinging of materials, whatever their nature and shape.

As a rule, altogether too little attention is paid to slings used in hoisting. They are often neglected or misunderstood, even when the main cables to which they are attached receive careful attention. The lives of workmen and others may be endangered by the failure of a sling, just as certainly as by the breaking of a cable; the slings should therefore be inspected frequently and thoroughly, and kept in first-class condition. Moreover, valuable machine castings and other objects may be seriously damaged or totally ruined, by falling even a few feet. The employer therefore has a large financial interest, in addition to the humanitarian duty that he owes to his men, in seeing that the slings in use about the workplace are maintained in good condition, and that they are adapted to the service to which they are put.

The method of attaching slings to the load and to the hook of the hoisting cable is of great importance; and this part of the work should be entrusted only to experienced and responsible persons. Loads may often be safely hoisted by the use of a single sling, but in other cases two or three slings may be required—the number depending not only upon the weight of the load but also upon its shape.

Sling Materials.

Wire cables, chains and manila ropes are all used for slings, their relative

FIGS. 1 TO 6. ILLUSTRATING THE OBLIQUITY OF SLINGS.

strengths, for similar diameters, varying in the order in which they are here named. For many reasons aside from its strength, a wire cable sling is to be preferred to a chain or to a fiber rope of any kind. Ordinarily, deterioration is easily detected in wire cables, as it is commonly indicated by broken strands that are readily discoverable by an experienced and qualified inspector. Chains, on the other hand, may sometimes be used almost up to the moment of failure with no manifest external evidence of weakness other than the existence of a few seemingly unimportant bruises, although a careful microscopic examination will often disclose a multitude of small cracks, showing that the metal has become "fatigued" by the heavy loads that have been lifted.

Wire-cable slings, on account of their pliability, are often bent at very sharp angles, not only while being adjusted to their loads, but also when under strain. Sharp bends of this kind should always be carefully avoided, not only because they are immediately dangerous, but also because, when taken in connection with the twisting and untwisting to which the strands of the cable are subjected while in use, they cause rapid deterioration of the sling. The damage may be more marked in the inner wires than in those at the surface and, as the weakened condition of the inner wires is likely to pass unnoticed under ordinary inspection, unless the outer wires show serious wear or poor condition, the sling is often continued in use long after it should be discarded. In making a thorough inspection of a wire-cable sling it is advisable to clamp the sling in two places, and partially untwist the intervening section so that the interior wires can be seen and examined.

In placing a sling about a load, it is important to see that the turns of the sling do not lie one over another, because an excessive strain is likely to be thrown upon one of them unless careful attention is given to this point. A sling composed of a single length of wire cable, with spliced eyes, should never be used for hoisting a heavy load, by hooking into only one of the eyes; because if this is done there will be a tendency for the load to revolve, thus unwinding the cable and permitting the splice to slip. On the other hand, when using a doubled sling with both ends engaged in the hoisting hook, it is important to adjust the sling so as to equalize the stress throughout the sling as nearly as possible, and to prevent it from becoming unduly localized or concentrated in certain parts. When placing chain slings about loads, carefully avoid twisting the chains, because if they are twisted an excessive load may be thrown upon some of the links.

All slings should be kept in good condition, and special attention should be paid to those used out-of-doors. Chain slings should be oiled to prevent rusting, and slings made of wire rope should be treated with oil, or preferably with special dressings prepared for this purpose, also to prevent rusting. The inner wires often become corroded through exposure to the weather, even when the outer ones remain in comparatively good condition.

Stresses on Slings.

The stresses thrown upon slings and ropes vary a great deal with conditions, and are often influenced to a marked degree by circumstances which the casual observer might consider trivial and unimportant. In particular, the inclination or obliquity of the sling, in those parts which lie between the supporting hook and the points at which the sling first touches the load, must be carefully considered, as it is a highly important feature in connection with safety. The men who have to deal with slings often know very little about this subject, and we therefore give a number of outline sketches, which may help to make it clear.

In order to fix the attention upon the effect that the obliquity of the sling has upon the intensity of the stress, and avoid the necessity of repeatedly qualifying our statements so as to make allowance for the stiffness of wire cables and for other circumstances, we shall assume that the sling is perfectly flexible in all the cases shown in the sketches, and also that the load is symmetrical in shape and symmetrically supported, and that the branches of the sling (between the hook and the load) are equal in length and equally inclined.

*From the Travellers Standard.

For simplicity we shall also assume that the total load to be supported is 2,000 pounds in each case, in the first five diagrams.

Under these conditions, if the ends of the sling are exactly vertical, as in Fig. 1, the stress on each one of them will evidently be 1,000 pounds. If the ends are inclined, however, as shown in Figs. 2, 3, 4 and 5, the stress upon each of them will be greater than 1,000 pounds in every case, and it will increase as the obliquity of the ends increases,—that is to say, as they become more and more inclined toward a horizontal position. We shall not undertake to explain this fact fully, because a proper understanding of it calls for a knowledge of the elements of theoretical mechanics, and readers who possess this knowledge will perceive the reason for the increased stress, without explanation. In brief, however, we may say that the stress on each of the inclined ends must have a vertical component equal to 1,000 pounds; and as there must also be a horizontal component whenever the sling stands obliquely, the total tension in each of the inclined ends must always exceed 1,000 pounds.

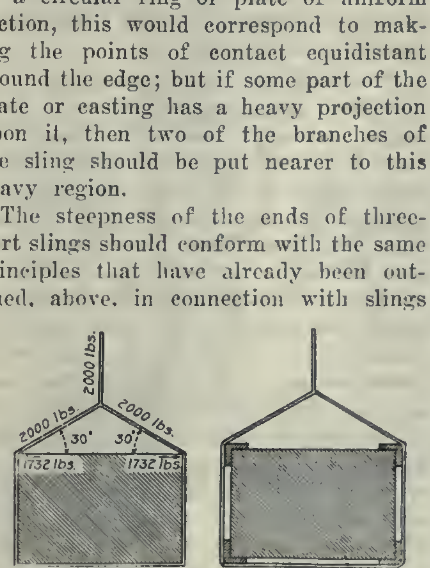
If the sling is of such a length that its ends, between the hook and the load, are inclined to the horizontal at an angle of 60 degrees, as indicated in Fig. 2, the stress on each end will be 15.5 per cent. greater than it would be if the ends were vertical, as in Fig. 1. That is, in Fig. 2, each end will be subject to a total stress of 1,155 pounds. If the ends of the sling make an angle of 45 degrees with the horizontal, as shown in Fig. 3, the tension on each of them will be 1,414 pounds; and if they lie at a still greater obliquity, so as to make an angle of 30 degrees with the horizontal as shown in Fig. 4, each of them will be subject to a stress of 2,000 pounds. If the obliquity increase still further, the stress will also continue to increase, but in a yet more rapid ratio; and when the ends of the sling approach the horizontal position quite closely, the stress upon them may become very great indeed. For example, if the sling were so short that its ends made an angle of only 5 degrees with the horizontal, as indicated in Fig. 5, each end would have to support a stress of 11,474 pounds.

These figures show very clearly the importance of giving careful attention to the inclination of the free ends of the sling. Men engaged in hoisting too often take it for granted that the tension on a sling is everywhere the same, and if the sling be strong enough to support the load in safety when the ends are vertical, they assume that it is safe to hook it around the load in any way whatever. It is plain, from what has been said above, that this is far from being the case. The sling should always be long enough to allow the ends to be at least as steep as shown in Fig. 3; or, in other words, the ends should never make an angle of less than 45 degrees with the ground.

Three Part Slings.

In lifting large plates of steel, or heavy castings of a circular shape, three-part slings are often used, as indicated in Fig. 6. In such a case, the three parts of the sling should be substantially equal in length, and the points at which the sling grips the load should be selected so that the strain will be the same on each of the three branches, so far as this can be judged by the man in charge of the operation. If the load consists of a circular ring or plate of uniform section, this would correspond to making the points of contact equidistant around the edge; but if some part of the plate or casting has a heavy projection upon it, then two of the branches of the sling should be put nearer to this heavy region.

The steepness of the ends of three-part slings should conform with the same principles that have already been outlined, above, in connection with slings



FIGS. 7 AND 8. ILLUSTRATING SLING PRESSURE AGAINST LOAD AND USE OF WOOD CORNER PIECES.

of the two-part or usual type. Thus if the load weighs 3,000 pounds, and the three branches of the sling are exactly vertical, each branch will be subject to a stress of 1,000 pounds; whereas if the load is still 3,000 pounds, and each branch of the sling makes an angle of 45 degrees with the horizontal, then the load on each branch will be 1,414 pounds, on account of the inclination. Similarly, if each branch of the sling make an inclination of 30 degrees with the horizontal, and the total load is 3,000 pounds, then each branch will be subject to a stress of 2,000 pounds; and under the same conditions, if each branch of the three-part sling make an angle of only 5 degrees with the horizontal, as in Fig. 5, then each will be subject to a stress of 11,474 pounds.

The accompanying table shows the way in which the stress changes in two-part and three-part slings, for various inclinations of the ends to the horizontal. The use of the table will be evident from what has already been said and from the illustrations which follow:—

Effect of the Obliquity of a Sling.

STRESS ON SLING, PER POUND OF TOTAL LOAD.

Angle Between Sling and Horizontal	Two-part Sling (Figs. 1 to 5)	Three-part Sling (Fig. 6.)
5°	5.737 lbs.	3.825 lbs.
10	2.879	1.920
15	1.932	1.288
20	1.462	0.975
30°	1.0000 lb.	0.6667 lb.
45	0.7071	0.4714
60	0.5774	0.3849
90	0.5000	0.3333

Example 1.—Total load, 2,000 pounds. Two-part sling, with ends making an angle of 5° with the horizontal.

Solution.—Opposite 5° in the first column, we find 5.737 in the second column; and multiplying this by total load to be supported, we have $5.737 \times 2{,}000 = 11{,}474$ lbs., which, as indicated in Fig. 5, is the stress on each end of the sling.

Example 2.—Total load, 3,000 pounds. Three-part sling, with ends making an angle of 45° with the horizontal, and adjusted so that each carries exactly one-third of the load.

Solution.—Opposite 45° in the first column, we find 0.4714 in the third column; and multiplying this by the total load to be supported, we have $0.4714 \times 3{,}000 = 1414.2$ lbs., which, to the nearest even pound, is the stress on each end of the sling as indicated in Fig. 6.

When the load to be lifted has sharp corners or edges, as is often the case with castings, and with structural steel and other similar objects, pads or wooden protective pieces should be applied at these corners, to prevent the slings from being abraded or otherwise damaged where they come in contact with the load. This is especially important when the slings consist of wire cable or fiber rope, though it should also be done even when they are made of chain.

Protecting Sharp Corners.

To show the importance of protecting sharp corners where slings run over them, reference may be made to Fig. 7. The total load is here supposed to be 2,000 pounds, and as the ends of the two-part sling make an angle of 30 degrees with the horizontal, each of these ends is also subject to a tension of 2,000 pounds. This tension is exerted partly to hold up the load, but it also tends to draw the sling horizontally against the load, at the points indicated by the arrows; and if the sling be pliable, and be placed about the load symmetrically as shown in the illustration, it will press against the load, under the assumed conditions, with a horizontal force of 1,732 pounds at each of the upper corners. This pressure may damage either the sling or the load, or both of them; and it is to prevent damage from this source, as well as from the direct weight, that the pads are recommended. Wooden corner-pieces are often provided, as shown in Fig. 8, for use in hoisting loads with sharp angles. If pads of burlap or other soft material are used, they should be thick and heavy enough to sustain the pressure well, and to distribute it over a considerable area, instead of allowing it to be concentrated directly at the edges of the object to be lifted.

Care of Slings.

Slings should always be kept in good condition, and when not in use they should be stored in a place specially provided for them, and locked up. They should be in charge of an experienced man, who should be held responsible for their condition. The man charged with the care of the slings should give them out as they are needed, and always with due regard to the use to which they are to be put. In this way it is possible to guard, effectively, against the workmen using slings of inadequate strength.

All slings should be promptly returned to the official custodian, when they are no longer needed for the work for which they were given out. As an additional precaution, every sling should be provided with a small metal identification tag, which should be firmly fastened to it. The tag should give the maximum stress that the sling can safely withstand in use, and in the case of a chain sling it should also give the date of the last annealing.

LOCOMOTIVE STAYBOLTS.

THE cost of repairing a broken staybolt, said C. A. Seley in a paper read before the New York Railway Club, even if the work can be combined with other necessary work, is not simply that of the labor and material employed, but also some portion of the value of the service of the engine which is lost thereby, and if the actual costs of staybolt maintenance and other matters incident thereto were closely computed, very good reasons for means of improvement would be manifest. Not that improvements have not been made. Makers have been diligent in producing special staybolt irons with more lasting qualities to stand the peculiar requirements of their service. By the use of special mixtures, and methods of piling and working, special brands of iron are produced which give very excellent results, but the breakage of solid staybolts has not been entirely stopped by such means.

With a well-designed and well-built boiler equipped with solid staybolts, there should not be serious staybolt trouble until about the third year of its use. In other words, the solid staybolt in modern well-designed boilers, is from 50 per cent. to 75 per cent. perfect, based on 100 per cent. being the life of the average firebox, which is now about five years.

Causes of Breakage.

Experiments have been made showing the relative expansions of the firebox and the outer boiler sheets when under pressure, proving they are not alike; therefore the staybolts, in addition to the tensile load imposed by the pressure, have also an angular strain due to these irregularities. It is these angular movements many times repeated that account for broken staybolts, for the direct pull is taken care of by a relatively high factor of safety.

In proof of the latter statement, assume staybolts with ⅞ in. diameter at smallest portion, spaced 4 in. by 4 in. in a boiler carrying 200 lbs. steam pressure. Each bolt supports 16 sq. in. and a consequent load of 3,200 lbs. The bolt area is .60132 sq. in. and the above load is therefore 5,320 lbs, per sq. in. As staybolt iron has generally not less than 48,000 lbs. ultimate tensile strength the factor of safety exceeds nine. This proves the undesirability of large staybolts, as with large sizes there is an increase of rigidity, whereas the desirable feature is flexibility.

It seems clear that they do not break on account of lack of strength of cross section, but on account of the overstressing of the outer fibre due to angular vibration, and it might be well to theorize as to when the initial check or break in the outer fibre occurs. Reference has been made to tests showing angular movements of sheets and staybolts under pressure, but it is likely that these do not produce the extreme movement which may account for the initial check or failure of the outer fibre, which progresses gradually inward and results finally in complete fracture.

In the matter of irregular temperature of the sheets, produced by rapid and uneven heating of the firebox in firing up, also in cooling down and washing, it is believed that then the angularity is greatest, and is accountable for the initial checks, although at these times there is no pull on the bolts. After water circulation is well started, undoubtedly the amount of angular movement is greatly reduced, although remaining in some degree, but the damage has been done, the check has started and in course of time evidenced by the complete fracture.

Remedying the Trouble.

Now, what is the remedy? More flexibility of the body of the bolt between the sheets to reduce the stress on the outer fibre so that the initial check will not occur, and also reduce their strength as levers to punish the firebox material, reduce the buckling and save the fireboxes. It is manifestly impossible to correct the handling of engines at terminals so that these irregular temperatures and stresses will be done away with. Availability of power is the first consideration and terminal forces are under extreme pressure to get engines turned in the shortest possible time, and those not in a hurry get the same treatment generally in respect to the matters which contribute to staybolt breakage and firebox cracking.

Recognizing the necessity of meeting the situation and demands for availability of power, many railroads have installed improvements in washing out which contribute materially to that phase of the question. Bright minds have also been at work on the staybolt structure and some very meritorious designs have been produced, but generally at considerable increase over the solid bolt, both as to first cost and application cost. The importance of the necessity for extension of staybolt life and increase of locomotive availability will, however, justify increased cost, the degree of the latter being dependent upon conditions.

Owing to staybolt breakages occurring generally close to the outside sheet, the earlier attempts to secure flexibility of the staybolt structure, were to change the outer end to a ball and socket form, which gave complete and absolute flexibility at that end. This idea originated on the Pennsylvania Railroad, and is in extensive use there and elsewhere at the present time and has served as the basis of subsequent modifications and improvements of the various staybolts of that type and which are generally and commercially known as flexible staybolts.

One of the more recent developments in the art aims directly to increase the flexibility of the body of the staybolt to eliminate breakage and also save the firebox sheets by the simple expedient of making staybolts with a body of two pieces of half-round iron, thus having two neutral axes, each much closer to the outer fibre than in the solid section; then by twisting the body there is ensured the greatest flexibility in every direction in which a lateral stress may come to it.

The ends of these bolts are larger than the body and take the usual staybolt thread and at the same cost as that of solid bolts. As they have a relative flexibility of body several times that of solid bolts of equivalent cross section, it is reasonable to believe that the outer fibre stresses have now been reduced so as to give such bolts a life of three, four or half a dozen times that of solid bolts, and it can be reasonably expected that these bolts will last the life or more of the average firebox.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

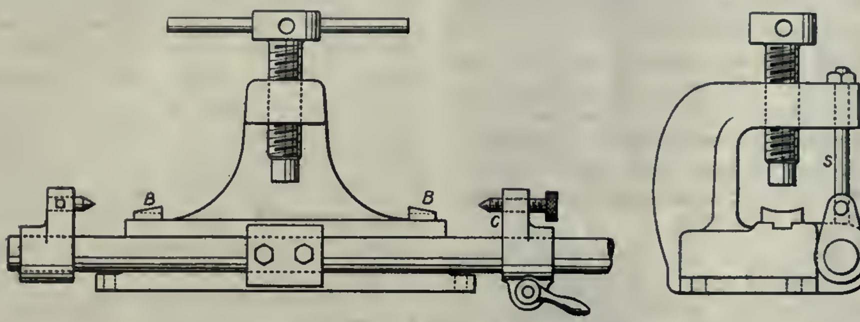
SHAFT-STRAIGHTENING PRESS.

By Armley Leeds.

THE general policy in the machine shop organization of relieving the higher class of workmen of the purely mechanical and laborious branches of the work has grown to be one of the essentials of successful operation. The effect of this has been to raise the wages of both the high and low-grade mechanics, and to vastly increase the efficiency of both.

One of the wasteful jobs in connection with lathe work is the preparation of shafting for turning. The cutting off, centering and straightening of shafting on the lathe is not only tedious and expensive, but is not attractive work for the ambitious machine hand. Of course, the straightening of arbors and spindles, particularly where no marking of the shafts is permitted, is an art in itself, and is a job of which, if successfully done, no mechanic need be ashamed. Nevertheless, a great deal can be saved by having as much as possible of the work done on a suitable machine by a lower grade of help.

The illustration shows a simple shaft straightening press that can be attached to or set up in close proximity to the centering machine. The body is of cast iron and is cast in a single piece. The screw is ¼ inch pitch, and works in a bronze nut which is pressed in from below by simply bringing the screw down into it against the bottom. The length of the fixture can be made as desired, but about 3 feet 6 inches has been found to be the most suitable. The shaft supporting the test centres is made to be conveniently moved in either direction to accommodate different lengths of shaft. The blocks BB can be moved back and forth to suit long and short kinks and, for heavy work, the holding down bolt shown in the end view is used. It has been found that, where much small work is done, the screw is better provided with a heavy hand wheel than the bar shown, and heavy work will be made much easier by providing two blocks of suitable size and shape, so that the shaft can be rolled from the straightening blocks to the test centres and vice versa.



SHAFT STRAIGHTENING DEVICE.

TOOLS FOR AN UNIQUE DRAWING OPERATION.

By L. E. Gehman.

IN the manufacture of typewriters, adding machines, and, in fact, all machines consisting of a multiplicity of parts, it is highly desirable to reduce the number as much as possible. The quality of steel that permits of its being readily drawn and formed renders parts made of this material remarkably well suited to perform a number of different offices usually performed by several different pieces. The adding machine part herein described, is an excellent example of this application of steel. It consists of a sheet metal crank arm with the hub drawn from the blank from which the piece is made. This method has been recently adopted in one of our most up-to-date factories and has resulted in an enormous saving in cost over the old process of making the arm and hub separately, and soldering, riveting or brazing them together, or swaging the hub.

The various steps in the process of manufacture are shown in Fig. I. The blank A is made from strips of soft cold-rolled steel stock, 1 11-16 inches wide and .050 inch thick. At B, the hub has been drawn and trimmed, and at C the process has been completed by the bending operation. The punch and die for the first operation are shown in Fig. 2 and are of a very useful progressive type. This principle has been described in connection with various articles in Canadian Machinery and therefore need only be mentioned here.

An elevation view of the piercing and blanking punches is shown at A, while B represents a plan and elevation view of the die. The stock is kept in position by the guide G, which is actuated by a formed flat spring. The spring stop S serves to gauge the feeding of the stock at each stroke of the press. The blank is, of course, made a sufficient amount larger than the finished part to allow for drawing and to prevent distortion.

The hole at the small end of the blank is pierced 0.107 inch in diameter and the one at the other end, 0.55 inch. The latter is reamed to 0.067 inch in diameter so as to produce smooth, even edges on the finished hub, and is used as a pilot hole in the drawing operation as well. The drawing die is shown in Fig. 3. The blank is laid on the die D and is located by the nest plate N. The tit on the end of the punch P engages with the reamed hole in the blank and draws the metal down into the cone shaped portion of the spring pad die R.

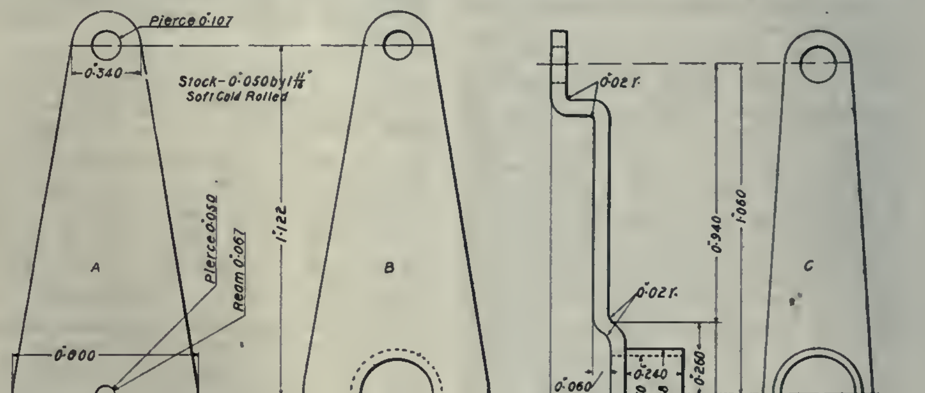


FIG. 1. STEPS IN ADDING MACHINE CRANK MANUFACTURE.

As the punch moves further down, the stock is securely held between the punch and the spring pad and, as the full diameter of the punch enters the stock, it is pressed out against the sides of the hole in the die to its full size. When the stroke is completed and the hub drawn to its full length, the spring pad serves to eject the part. The metal is thus drawn down at one stroke to nearly one-third its original thickness.

The next operation, after drawing, is the trimming of the blank to its finished size. The punch and die for this purpose must be very carefully made as its purpose is to give neat finished edges as well as correct size to the article. In this case, the male part of the die or punch is on the bottom and is shown at P. The drawn part is laid on the punch, being located by the pins M and N. The scrap is forced down over the punch and is cut in two by the knife edges K K as the die reaches the bottom of its stroke.

The trimmed part is carried up into the die J and is ejected by the stripper S which is actuated by the spring R. Being inclined, very much facilitates keeping the press clear.

The last operation consists of bending the crank arm to the shape shown at C, Fig. 1. This is done in the punch and die shown in Fig. 5. The part is located by the pin Q in the centre of the die B, which has the necessary steps cut in it to make the desired bends. The first bend is made by the spring punch W which forces the stock over the first step in the die. While, it is firmly held in this position, the punch X engages it, making the second bend and thus completing the part.

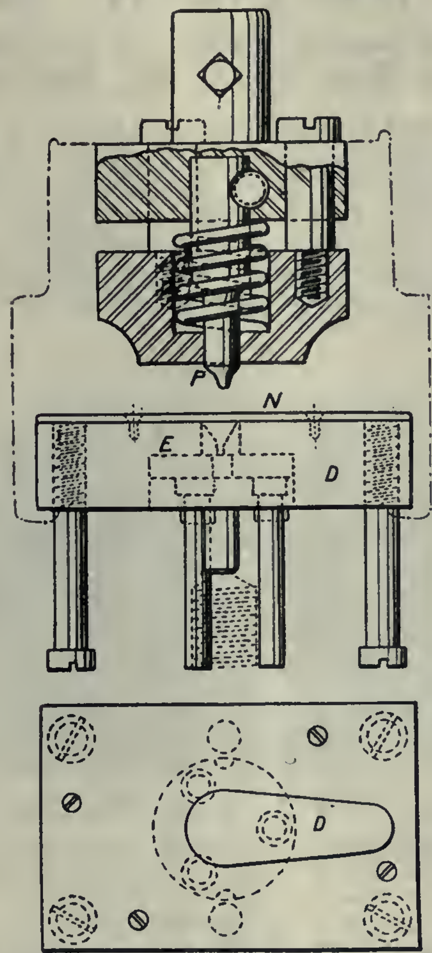


FIG. 3. PUNCH AND DIE FOR DRAWING OPERATION ON HUB.

The great saving in expense in the production of this part is easily evident. The drilling, pinning and sweating of the different elements in the old way would require very much more time and labor than the two simple press operations above explained. Again, in such machines as these, the gain in lightness, strength and cost of material is no small argument in its favor.

The engineer is he who, by art and science, makes the mechanical properties of matter serve the ends of man. In the widest sense, almost every man is more or less an engineer. The first man who bridged a torrent with a fallen tree had in him something of the engineer; the first man who dug a new channel for a brook—the first man who cleared a pathway in the forest had in him something of the engineer; but the title of engineer is more properly restricted to those who make the useful application of mechanical science their peculiar study and profession.—Rankine.

Sault Ste Marie, Ont.—The Algoma Steel Corporation, a subsidiary of the Lake Superior Corporation, has received orders for 20,000 tons of steel rails for January delivery.

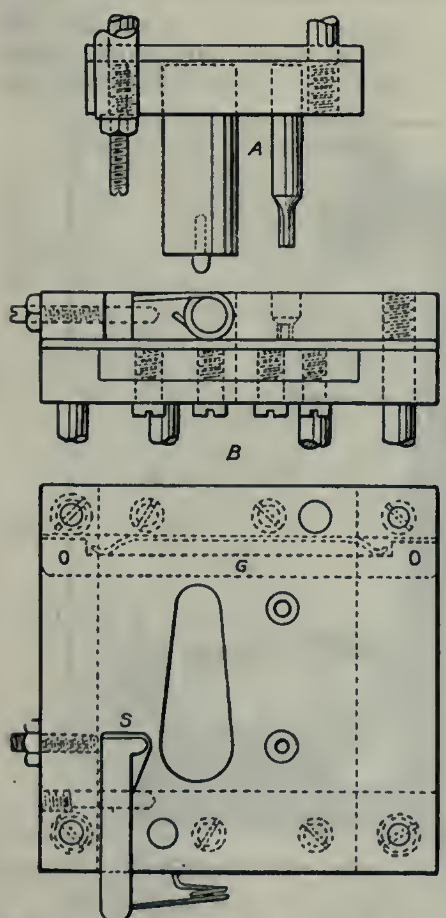
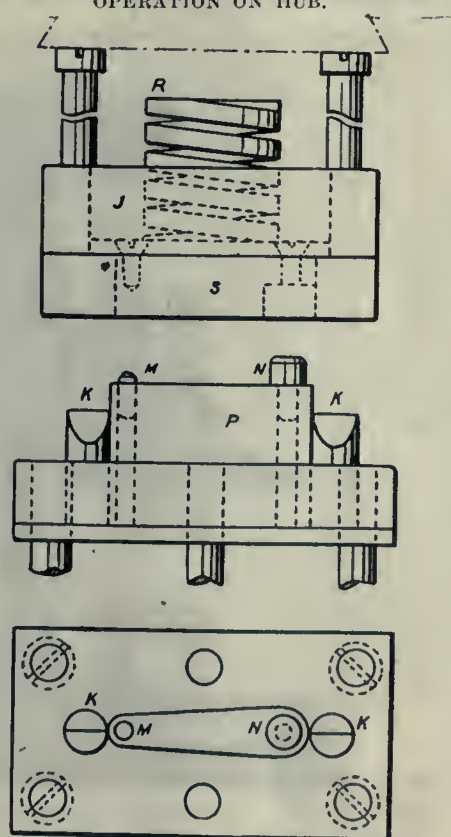
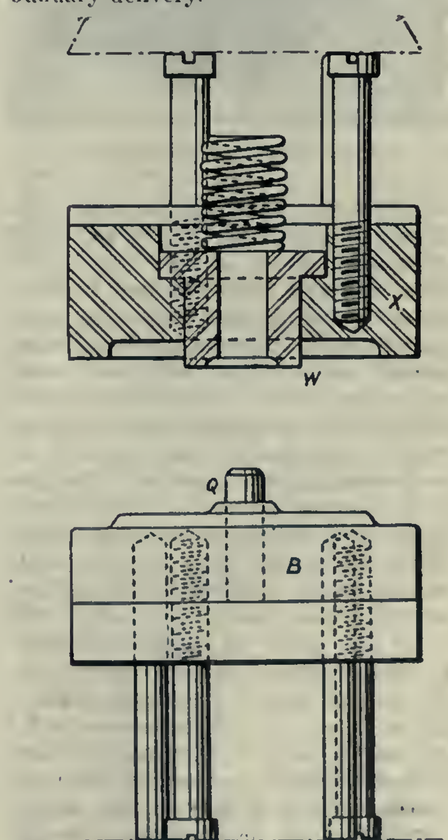


FIG. 2. PIERCING AND BLANKING DIE FOR FIRST OPERATION.





FIGS. 4 AND 5. TRIMMING TOOLS, PUNCH AND DIE FOR FORMING OPERATION.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

HEAVY BEADING MACHINE.

THE accompanying illustration shows a new machine of rigid and substantial construction designed by the Niagara Machine and Tool Works of Buffalo, N.Y. It is intended for beading, swaging and similar operations along the edges of sheet material in the manufacture of automobile parts, steel barrels, etc.

A novel feature of this machine consists in the belt-driven raising and lowering device for the upper main shaft. The clutch pulley F drives a worm and wheel by means of bevel and spur gears. The worm wheel is keyed to the shaft E, which carries on each end an eccentric and adjustable pitman; the latter being pivoted to the upper main shaft bearings. The motion of the attachment is controlled by the hand lever H, to enable the operator to start and stop the upper shaft in any position. This is a very important feature, as it is frequently necessary to engage the work gradually or to hold the upper shaft in a certain position while the beading and swaging operations take place. The worm runs in an oil chamber and anti-friction bearings are provided to take up the end thrust. The main shaft is driven from a clutch pulley controlled by foot treadle. Compensating gears always maintain the correct mesh between the gears of the two main shafts.

HEAVY BEADING MACHINE.

The operating lever for the shaft-raising device and the clutch treadle are located in front of the machine in convenient position for the operator. The main details of the machine are as follows:—Diameter of main shaft, 2½ ins.; minimum distance between shafts, 6 ins.; maximum distance between shafts, 8 ins.; ratio of gearing, 1.7½; weight about 1,600 lbs.

MULTIPLE SPINDLE DRILLS.

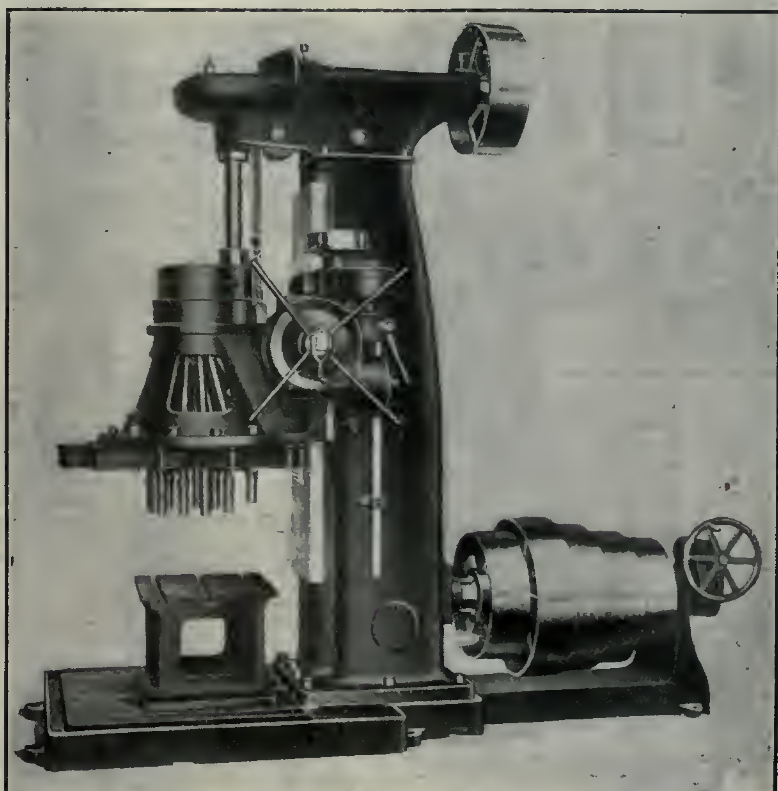
THE multiple spindle drills here described are a product of the Edwin Harrington Son & Co., Philadelphia, Pa., and are known as their No. 62A and 63A types. The former only is illustrated here.

Both machines have the same frame but heads of different size. They have a powerful drive and easily operated rack feed. Provision is made for the full rated number of spindle pinions so that, if purchased with less, the remainder can be added at any time. All spindle dimensions refer to regular equipment of 1 inch capacity, but lighter spindle units for smaller drills can be used, or the machine can be equipped with spindles of greater capacity than 1 inch, in a less number, depending on the size. The driving power is sufficient to handle the rated number of drills in cast iron at a peripheral drill speed of 65 feet per minute.

The head is a solid casting rigidly braced to prevent springing and is fully counterbalanced, being connected by two chains. The radius bars are of cast steel clamped to the head by bolts through the flange. Each spindle runs in a bronze bushing, and is driven by a heat treated pinion through two hardened universal joints and telescoping shaft with ball-thrust bearings. Quick vertical adjustment for different drill lengths is made in any layout without moving the radius arms.

The drive is by belt and bevel gears to the head, with a compact train of spur gears driving the spindles. The top shaft is mounted on roller bearings and provision for lubrication is very complete. Belt driven machines, with 7 ins. or wider belt, are provided with an eccentric sleeve within the lower cone for decreasing the centre distance when shifting the belt. In motor driven machines, a variable speed motor drives directly to the upper pulley. Belt drive can be provided through a change gear box when required.

The feed is driven by belt from the vertical shaft with three geared changes by sliding key. A strong planetary train



NO. 62A—MULTIPLE SPINDLE DRILL EQUIPPED WITH 12-1 In. SPINDLES.

of spur gears on the rack pinion shaft reduces the strain on the worm gear teeth. The worm has both hand and automatic trip besides a quick operating clutch for rapid hand movement of the head.

The frame of these machines is unusually heavy, while the base is heavily ribbed and provided with T-slots, oil gutter, and settling tank. An extension is bolted to the rear of the base for the cone bracket or motor as required. The table is of the open box type with large planed top surface and three T-slots. An oil pump with distributing piping can be provided and is driven by belt from the cone shaft.

The drilling capacity of the 62A machine in cast iron is twelve 1-inch holes, and of the 63A, sixteen 1-inch holes. For both machines, the spindle speeds range from 162 to 325 r.p.m., the range of feeds per revolution from either .005 to .015 or from .005 to .010 inches; the sizes of motor 25 h.p. and 35 h.p. respectively; and the motor speeds from 750 to 1,500 r.p.m.

The space occupied by each machine, belt-driven, is 11 ft. 6 ins. x 4 ft. 7 ins., and 11 ft. 11ins. x 4 ft. 7 ins. respectively, the corresponding dimensions for motor-drive being 11 ft. x 4 ft. 7 ins., and 11ft. 6 ins. x 4 ft. 7 ins. The weights range from 8,200 to 9,000 pounds, for the respective machines, dependent on the type of drive.

OIL BURNING LOCOMOTIVES.

THE Canadian Locomotive Co., Kingston, Ont., have completed two oil-burning locomotives for the new Pacific Great Eastern line. This is a road running out of Vancouver to connect up that city with the Grand Trunk Pacific Railway. One of these oil-burners was completed during this last week and was given a few preliminary runs around the yards of the shops.

Each locomotive has four driving axles and one leading axle, the drivers being 57 inches in diameter. The cylinders are 22 ins. diameter by 28 ins. stroke, and the total weight of each unit without the tender is 190,000 pounds, when in running order. The working steam pressure is 180 pounds per sq. inch, and a latest Schmidt type of superheater adds from 200° to 250° superheat. The draw-bar pull is 36,300 pounds. Walshaert valve gear is installed. The boiler staybolts are all of the flexible type and a radial buffer is fitted between the engine and tender. The head light is electric as are also the other lights, electricity being furnished by a turbo-generator set.

PACIFIC GREAT EASTERN RAILROAD OIL-FIRED LOCOMOTIVE BUILT BY THE KINGSTON LOCOMOTIVE CO., KINGSTON, ONT.

ENGINEER'S INVENTIVE FACULTY PARAMOUNT.

IN the course of his recent presidential address before the Manchester Association of Engineers, Edward G. Hiller made the statement that "testing and card indexing are good in their place, but they can be run to death, and sometimes there is rather too much of the testing regimen in our technical colleges; young men standing about with thermometers, indicators and the like and making notes—much like the card index and filing firms who set out to convince young men going into business that to ensure success they only need to purchase the complete card index and filing equipment.

"After all, testing is only registering what has been done, and although much is to be learned from it, it should not be exalted to the chief place in engineering. Engineers have to do things and to find the best way of doing them. The inventive faculty is the essential factor. The inventor, the man of mechanical capacity, is the foundation of the engineer."

The Engineer and the War.

Discussing the relation of the engineer to war, he pointed out that, although local engineering activities were mainly of a peaceful nature, yet there was little doubt that through the present struggle many of the local works would have their activities more or less transferred to the preparation of warlike material. Generally the development of weapons in war had followed to some extent the development of the use of tools in the more peaceful operations of life. In all directions the utilization of the improvements of engineering in the operations carried on was greatly increasing. At all times, almost the finest developments of the engineer's work had been for war, and a great stimulus to invention has proceeded from the desire of nations to make themselves strong.

Continuing, Mr. Hiller said that much has been made during the last few weeks of the relation of the engineer to the war in the matter of trade. The operations of trade are not of the nature of war. People come together to bargain only in an atmosphere of peace, and a sale and purchase is a mutual agreement which can be conducted only when the operations of war, as we know them, are absent. Some of the talk, therefore about trade war proceeds from a confusion of ideas.

The true trade war in the engineer's sphere is intellectual, and by it ultimately we stand or fall. If, owing to the war, currents of trade are diverted in our direction, this diversion may only be temporary unless, by advances in our invention, organization, production, or distribution, our engineers ensure that the product supplied is superior to that which it has replaced, both in suitability and price. In the ordinary course of the natural peaceful development of commerce, this result has already been obtained in many cases.

Although the present conditions give special opportunities, these are probably not so permanent or so good for the country as those of the ordinary peaceful commerce, but they may be regarded rather as some partial compensation for the inevitable loss all round which war brings.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

Question.—A drop weight for breaking iron weighs 900 pounds and has a fall of 30 feet. What would be its velocity when striking a blow?

Answer.—From formula

$v = \sqrt{2gh}$ we have $v = \sqrt{2 \times 32.16 \times 30}$

$= \sqrt{1829.60} = 42.77$ ft. per sec.

• • •

Question.—In the above problem, if the weight struck a bar of iron bending it ½ in., but not breaking it, what would be the force of the blow?

Answer.—The weight must be stopped in the space of ½ in. The work necessary to raise 900 lbs. 30 ft.$=900 \times 30$ foot pounds and this must be expended within ½ in.$=.5/12$ ft. The force of the blow then is

$$\frac{900 \times 30 \times 12}{.5} = 648000 \text{ pounds.}$$

• • •

Question. — Suppose the head of a steam hammer weighed 5,000 pounds and had a stroke of 4 ft., and the steam were cut off and exhaust opened at ¼ stroke which gave the hammer a velocity of 60 ft. per sec., what would be the force of the blow if the work were compressed 1 inch?

Answer.—The height to which a body would have to be raised to acquire a falling velocity of 60 ft. per sec. would be

$$h = \frac{v^2}{2g} \text{ or } h = \frac{60 \times 60}{2 \times 32.16} = 55.97 \text{ ft.}$$

The total force of the blow then would be equal to that of the hammer upon falling $55.97+3=58.97$ ft. or force of the blow $=$

$$\frac{58.9 \times 5000 \times 12}{7} = 3.543,000 \text{ pounds.}$$

• • •

Question.—A steel column 30 ft. high, 2 ft. cross section and weighing 4 tons, falls over on its side. What would be its kinetic energy?

Answer.—The centre of gravity of the column would fall 15—1=14 ft. Its average velocity then would be

$v = \sqrt{2gh}$, or $v = \sqrt{2 \times 32.16 \times 14} = 30$ ft. per sec.

Kinetic energy$=\frac{1}{2}mv^2$

Where $v =$ velocity in ft. per sec.

$m = \text{mass} = \frac{w}{g}$ where $w =$ weight.

and $g =$ force of gravity $= 32.16$.

Formula becomes energy $=$

$\frac{w}{2g}v^2$ 4 tons $= 8000$ lbs.

Kinetic energy upon striking the floor then is

$$\frac{8000}{2 \times 32.16} \times 30 \times 30 = 111,940.3 \text{ ft. lbs.}$$

• • •

Question.—What force would be required to punch a one and one-quarter inch hole in a steel plate one inch thick?

Answer.—Ultimate shearing strength is about 20,000 pounds per square inch. Shearing area is equal to the circumference of the hole multiplied by its depth.

Shearing area $= 1.25 \times 3.1416 \times 1 = 3.927$ sq. in.

Force required is $3.927 \times 70,000 = 274,890$ pounds or about 137½ tons.

• • •

Question.—A cast iron bar, whose cross section is in the form of an ellipse carries a tensile load of 180,000pounds. Its two diameters are 6 and 8 inches. what safety factor is employed?

Answer.—The area of an ellipse is half the long diameter multiplied by half the short diameter multiplied by 3.1416. Area $= 3 \times 4 \times 3.1416 = 37.699$.

Load per sq. inch$=$

$$\frac{180,000}{37.699} = 4774.6 \text{ pounds.}$$

Breaking tensile load of cast iron is 18,000 pounds per sq. in. Safety factor then is $\frac{18,000}{4774.6} = 3.77$.

• • •

Question.—Which is the stronger weight for weight, a bar of Georgia pine, or a bar of steel. The tensile strength of steel is 90,000 pounds per inch, the tensile strength of Georgia pine is 12,000 pounds and its specific gravity is .65.

Answer.—1 cubic inch of water weighs .0361 pounds 1 cubic inch of Georgia pine would weigh $.0361 \times .65 = .02346$ pound.

1 cubic inch of steel weighs .2816 pound.

Steel then is $\frac{.2816}{.02346} = 12$ times as heavy as the wood.

Strength of steel is 90,000 pounds per sq. in.

Strength of equal weight of pine $=12,000 \times 12 = 144,000$ pounds. Wood then is $\frac{144}{90} = 1.6$ times as strong.

• • •

Question.—A driving pulley is 64 inches in diameter, and a driven pulley which runs at 120 revolutions per minute is 2½ feet in diameter. What is the speed of the driving shaft?

Answer.—The r.p.m. of the driver multiplied by its diameter must equal the r.p.m. of the driver multiplied by its diameter.

Speed of driving shaft then is,

$$\frac{120 \times 30}{64} = 56.25 \text{ r.p.m.}$$

• • •

Question.—An emery wheel is to be set up to run at 1,200 r.p.m. The pulleys on the countershaft are 20 and 8 inches in diameter. The pulley on the wheel arbor is 6 inches in diameter and the line shaft runs at 180 r.p.m. What sized pulley should be put on the lineshaft.

Answer — $1,200 \times 6 \times 8 = 180 \times 20 \times$ diameter of line shaft pulley.

or diameter of lineshaft pulley

$$= \frac{1200 \times 6 \times 8}{180 \times 20} = 16 \text{ inches.}$$

• • •

Question.—A metal box 10 inches by 12 inches by 24 inches long inside is filled with 1 inch steel balls. How many quarts of oil would the box hold besides.

Answer.—The volume of the box is $10 \times 12 \times 24 = 2880$ cu. ins.

Number of balls$=2880$.

Space occupied by one ball$=1^3 \times .5236 = .5236$.

Total space occupied by balls$=2880 \times .5236 = 1507.968$ cubic inches.

Space filled with oil is $2880-1507.968 = 1372.032$ cubic inches.

$$\text{No. of quarts} = \frac{1372.032}{277.274} \times 4 = 19.9.$$

• • •

Question.—Allowing one gallon of paint to every 500 square feet of surface, how many gallons per ton would be required to paint 2-inch bar iron.

Answer.—The surface area for every foot of bar$=$

$$\frac{2 \times 3.1416 \times 12}{1728} = .04361 \text{ sq. ft.}$$

Weight per foot of bar$=2^2 \times .7854 \times 12 \times .283 = 10.67$ pounds.

1 ton of iron contains $\frac{.04361 \times 2000}{10.67}$

$=8.17$ sq. ft. neglecting ends of bars.

$$\text{Gallons per ton} = \frac{8.17}{500} = .0163 \text{ gallon.}$$

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Vol. XII. NOVEMBER 12, 1914 No. 20

PRINCIPAL CONTENTS:

THE POWER SOURCE IN FACTORIES.

WHILE much attention has been bestowed upon and consideration given to the perfecting of machines and raising the efficiency standard of their operators in order to secure higher degree quality and increased quantity of product with, shall we say, a proportionate distribution of the fruits of achievement, no very conspicuous effort has been made, and that only spasmodic at best, to deal with the question of power at its source. To some extent, and more perhaps than we care to specify, this condition of affairs has been largely due to the more or less uninterrupted and lengthened period of business prosperity that preceded the present depression. Then, it was more than anything else, simply a matter of ensuring that that the motive power did not fail, and questions of economy and efficiency had to give place to operation reliability. The latter feature is of course not only highly desirable, but may be termed a necessity at all times. To secure reliability, however, need not be excuse to sacrifice economy, and to obtain the former at the expense of the latter shows either a lack of appreciation of what can be accomplished by the intelligent operation of the factory power plant or a persistency to believe—ample evidences otherwise notwithstanding, that to keep going matters most.

In spite of all this, however, and whether our attitude be either of those above stated or other equivalent, this matter of economy with efficiency, or shall we say economy with reliability will come home to roost, and in nine cases out of ten, to be moderate in our estimate, we succumb, and the steam power plant, which by its reliability gave us, not what its capabilities were, but the much underestimated proportion of these we chose as a safe margin for continuous operation, is relegated to the scrap heap. We succumb, as has been said, by purchasing power instead of generating it, as was our wont, and we reach that stage wholly as a result of the mistaken idea that steam power cannot be generated by us to hold its own both from the economy and reliability standpoints, against that purchasable.

It is not our aim at this writing to discuss the question of factory motive power with the idea of making comparisons, rather is it our purpose to draw attention to the fact, that the slowing-down of the wheels of industry should be taken advantage of to look closely and thoughtfully into the subject, familiarizing ourselves not only with what research and investigation have proved in the manipulation of steam power plants but with the aptitude of the men who operate them.

An expert salesman in any line of business seldom fails to win out, and in the selling of power for manufacturing purposes he has not usually a too formidable task ahead. That such should be the case is not justifiable, and is certainly only attributable to lack of appreciation of what can be done to put on a competitive basis one's own power generating plant. It has been estimated that nine out of every ten steam power plants in connection with factories in the Province of Ontario alone can be at one and the same time increased in economy and efficiency for the most part by simply tuning-up and by bringing the operation feature into conformity with present-day, high-degree performance practice. Want of economy in the factory power plant is by no means an incurable disease, even although its symptoms be fairly widespread in the different unit ramifications; neither are the remedies to be applied to bring the whole to the equivalent efficiency basis of the particular product of the factory such as to warrant wholesale scrapping and substitution.

In an early issue of Canadian Machinery we will start publication of a short series of articles dealing with this question of steam power plant economy and efficiency, and as the subject matter will largely consist of a recital of actual existent, uneconomical and inefficient conditions of operation, the steps taken to remedy these, and the success achieved, the information will be so interesting and valuable both to factory managements and their power staffs as to make effective appeal and bring about an improved set of conditions with respect to this important yet much neglected department of manufacturing enterprise.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 40
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X	18 00	17 00
Victoria, No. 2 Plain	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.00
Steel bars, f.o.b., Toronto	2.00
Common bar iron, f.o.b., Montreal	2.00
Steel bars, f.o.b., Montreal	2.00
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.05
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.70
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

		Montreal.	Toronto.
Plates, ½ in. 100 lbs.		$2 20	$2 20
Heads, per 100 lbs.		2 55	2 55
Tank plates, 3-16 in.		2 50	2 50
Tubes, per 100 ft.,	1 inch	9 50	9 00
" "	1¼ in.	9 50	9 00
" "	1½ "	9 50	9 00
" "	1¾ "	9 50	9 00
" "	2 "	8 75	8 75
" "	2½ "	11 15	11 50
" "	3 "	12 10	12 50
" "	3½ "	14 15	14 50
" "	4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in.	75%
Finished Nuts over 1 in.	72%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75 & 5
Stove bolts	80 & 7½
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 50
Copper, crucible	10 00	9 50
Copper, unch-bled, heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	10 75	8 50
No. 1 compos'n turnings	8 50	8 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	72	62
7, 8, 10 in.	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

METALS.

	Montreal.	Toronto.
Lake copper, carload	$13 00	$13 00
Electrolytic copper	12 75	13 00
Castings copper	12 50	12 75
Spelter	5 50	5 50
Tin	36 00	35 50
Lead	4 50	4 50
Antimony	16 00	16 00
Aluminum	20 00	21 00

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	18½
Benzine, single bbls., per gal.	18½
Pure turpentine, single bbls.	0.67
Linseed oil, raw, single bbls.	0.54
Linseed oil, boiled, single bbl.	0.67
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Pure Manila rope	0.14
Lard Oil, per gal.	0.60

BELTING RUBBER.

Standard	50%
Best grades	30%

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50% & 10%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

CHAIN.

¼ inch	$5.65
5/16 inch	4.70
⅜ inch	4.00
7/16 inch	3.65
½ inch	3.45
9/16 inch	3.45
⅝ inch	3.35
¾ inch	3.25
⅞ inch	3.15
1 inch	3.05

Above quotations are per 100 lb. weight.

COLD DRAWN STEEL SHAFTING.

¾ inch	$ 4 95
1 inch	8 05
1¼ inch	12 65
1⅜ inch	15 30
1½ inch	16 50
1⅝ inch	19 40
1¾ inch	22 50
1⅞ inch	25 80
2 inch	29 30

Prices quoted are cents per foot.

CAST IRON PIPE.

6 inches and upwards	$32 00
4 inch	33 00
Specials per 100 lbs.	3 00

Quotations f.o.b. foundry.

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1½-in.	37.50	30.00	17.50
33/64 to ¾-in.	41.25	33.00	19.25
7/16 to ½-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, ordinary, 52 sheets	3 70	3 85
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (American)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 25
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	4 00	4 20

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Nov. 9, 1914.—Trade in general during the last week compares very favorably, indeed, with that of the immediately previous period. Most of the large firms state that they are entirely satisfied with the volume of their business at present. They take an excellent stand, and one that is highly commendable.

That "every cloud has a silver lining" is being demonstrated in many cases. Business had developed so rapidly with many firms that the increase in shop methods and economical means of production did not keep pace with it. As long as the good times lasted there never was any opportunity to adjust this state of affairs. Now the present low ebb is enabling many large factories to overhaul their equipment and replace any of antiquated type. New and better systems and methods of production are being inaugurated, with the result that manufacturing in Canada is quietly, yet none the less surely, being put on a more substantial basis.

The facts that fewer men are being employed or that the hours of labor have been shortened in any factory does not necessarily mean that the industry is dead. It means rather that when the awakening occurs and a new impetus in business arrives that Canadian manufacturing will be conducted on a higher efficiency. Products will be improved and the cost of production lessened. True, it may be that some institutions may fall by the wayside, and with them will go some who bid fair to have been the captains of industry, but we must pay the price for any new and great achievement.

The Steel Market.

The situation in the steel market can be termed generally as quiet and steady; nevertheless there are various fluctuations which from time to time occur. The feature of these fluctuations is business volume rather than prices. At the time of writing the market seems to be in the grip of one of the duller periods. Building has been conducted throughout the winter for many seasons past, and thus a market for structural steel has been available, but this year in Montreal, and the Province of Quebec generally, very little building is being planned. The machinery steel market has also been largely cut off, and these two broad markets being so much restricted have caused the present dull situation in the steel trade. The temporary nature of this present depression is not for a moment doubted, and optimism is being strongly manifested by all parties, although it must be confessed no immediate change is anticipated.

Machine Tools.

Dullness in the machine tool market is also an outstanding feature, yet there seems to be a fair amount of business moving all the time. Small orders continue to come in with persistent regularity, and have thereby enabled a great many houses to operate with moderate profits.

One new feature in evidence of late is that of repairs. Many firms are sending tools and machines to be rebuilt, or otherwise repaired, and quite a considerable amount of money is being spent in this way. For much of this old equipment the logical destination should be the scrap heap. Such money is poorly expended. The expenditure of any large amounts in the rejuvenating of old machines seems a short-sighted policy, and would often form a very substantial payment on a new article of more modern design. The decision of whether a tool is to be scrapped or repaired is an important one, and the merits of new tools should always be investigated first. The common instances of the above have occurred largely in connection with pneumatic and other small tools. The supply end of the business seems to have hit its stride. The same volume of business appears to keep coming in week after week.

Metals.

Business in metals is rather quiet. There are, however, many interesting little features which from time to time develop. Tin has taken a little upward jump. This change is likely to have arisen from the Eastern situation in naval matters and the anxiety for certain shipments afloat. Antimony is firm.

Orders may go down again on account of the new regulations with regard to "absolute contraband." However, this situation may be offset by the production being curtailed, as many producers do not find it profitable to operate when prices fall below a certain level.

Pig Iron.

In pig iron circles very little activity is being manifested. Only a small quantity of British ore is finding its way to Canada. Prices remain about the same.

Toronto, Ont., Nov. 10, 1914.—There is no change to be recorded in the general industrial situation this week, although it is satisfactory to note that there is no abatement in the optimistic feeling that has been gradually gaining ground for some weeks. A more settled conviction that Canada, as a whole, will benefit as the result of the war is becoming more manifest, and this helps to stimulate a feeling of confidence in business circles. Everything seems to indicate that a point has been reached where there will be little change in general conditions until the Allies have gained more decided supremacy over the hostile forces. This may be somewhat prolonged, but the issue is not in doubt and steady progress is being made against formidable opposition.

The large influx of orders for war equipment and supplies has come at an opportune moment and will help the industrial situation considerably by relieving distress caused by the war and placing large sums of money in circulation. Notwithstanding this, there are many unemployed, more especially in the larger manufacturing districts, in some of which public works are being started to relieve conditions as much as possible. Locally, the city has several works on hand and the Board of Education is arranging to go ahead with a number of new schools and extensions which call for a considerable expenditure of money, and will find employment for much labor.

With the exception of relief works in a few districts, practically no new work is being undertaken by municipalities, and in some cases operations have been stopped on work that was in progress. In consequence of this, few tenders are being called for material, which is adversely affecting manufacturers of iron and steel pipe; makers of power plant equipment are also affected. Although at this time of year there is usually curtailment of work, it is more pronounced this year on account of the difficulty which municipalities are experiencing in obtaining financial assistance. Private enterprises are being restricted for the same reason.

Steel Market.

The iron and steel markets are still very dull, although an improvement in some lines is noticeable. Business has reached a low level and the outlook for any substantial improvement this year is not particularly bright. Even if the demand increased, providing industrial conditions improved, it is doubtful whether Canadian mills could benefit to the full extent as prices are so low in the States. Canadian mills would have to meet these low prices with a resultant shrinkage in profits, making the business not very attractive. On the other hand, as far as it affects the consumer, the conditions are reversed, for with cheap materials, now is the time to buy if only the money market were easier to permit of building operations and other propositions being proceeded with.

Large orders for cars have been placed for the Canadian Government Railways. These orders will be welcomed by the car shops, which have been practically idle for several months. The Bloor street viaduct is the chief matter of interest locally in the steel trade; whether it shall be constructed of steel or concrete is the bone of contention. The former method of construction is generally favored and, if proceeded with, will require considerable steel.

Prices on bars, plates and shapes for Canadian consumption are weaker at 1.15c f.o.b. Pittsburgh. Prices in the United States have been generally sustained, although for large tonnages there has been some shading on bars, plates and shapes, further than is indicated above. The steel trade in the States is dull and there has been a further shrinkage in production. The scrap metal market in Toronto is dull and prices are unchanged.

Pig Iron.

There is no improvement in the pig iron situation, the market being very dull. Prices are steady, with the exception of Victoria pig, which is weaker, being quoted at $17 per ton.

Machine Tools.

Dealers report few sales of machine tools and inquiries are conspicuous by their absence. Buyers are waiting until the depression lifts and the money market is easier.

Supplies.

The market for supplies is quiet, a fair number of sales are being made, but the orders are small and just enough to satisfy immediate requirements. There has been no change in prices.

Metals.

The metal markets are all very dull and there is no improvement in business. Buying is light and only to fill actual requirements. Prices generally are unchanged, with the exception of tin, which is higher and is now being quoted at 35c to 36c per pound. In sympathy with tin, solders have advanced 1c per pound. Copper is quiet at unchanged quotations. Spelter is unchanged but weak, while lead is firm. The London Metal Exchange opened Nov. 5 and New York on Nov. 9, for trading in tin, lead and spelter.

St. John, N.B., Nov. 7, 1914—Splendid progress is being made on the new post office being built on Prince William street. The facade in front has been built to the third story, while in the rear the work is more advanced. Concrete floors have been laid throughout the greater part of the building, and the work of fitting at least the lower floors will be proceeded with during the winter.

Another new crib was sunk at West St. John this week by the contractor in charge, D. C. Clark. Two more large cribs are under construction and will be ready for placing when the berths are sufficiently dredged for them. The warehouse on the new Sand Point wharf is about completed, and will be ready before the first winter port steamer docks this season. Several local manufacturing houses are benefiting commercially through war contracts.

Lumber operators are expecting a curtailment of their cut this season in New Brunswick, owing to the uncertainty of the foreign market. The British market up to the present has been most encouraging. Reports concerning the possibilities of trade in pit props have been somewhat knocked because of the statements that prices here are not quite satisfactory to mine operators on the other side. Stocks of lumber this season were fairly large in St. John and other New Brunswick centres and as the prospects for next year are difficult to judge correctly, the reasons for the curtailment are obvious.

The two halves of the steel arch of the new bridge over the reversing falls at St. John, were put together this week by the Dominion Bridge Co. The arch is 565 feet in length. Record breaking progress has been made on the new bridge by the builders.

To a prominent St. John industrial head, James L. McAvity, proprietor of the McLean Holt Mfg. Co., manufacturers of castings, machinery, etc., has been given the distinctive honor of commanding the 26th New Brunswick and

P. E. Island battalion of infantry to be taken to the front for active service. The death of Charles Miller, well known as a lumber operator and proprietor of a lime-manufacturing industry, occurred this week at his home here. He was 55 years of age and had been practically all his life engaged in the lumber and lime business, operating a large saw and shingle plant and several lime kilns here.

MAGNITUDE OF THE KRUPP ENTERPRISE.

By Thos. Swinden, D.Met.

AS the train slowed up between the snow-covered platforms of Essen Station last New Year's Eve, I little thought that the year which was coming would witness the greatest tragedy of all time, or that this silent town would play so important a part in the titanic struggle. The almost empty train rumbled along mile after mile through white pasture land and snow-laden pine forests, looking ghostly enough in the moonless night.

The vast collieries and iron mines of the Ruhr district were closed, the rolling mills and steam-hammers silent, the blast furnaces hardly glowing with their banked fires, and the only sounds proceeding from the brilliantly lighted refreshment salon on the station and streets of the town were those of the riotous merriment of the German New Year's Eve. Here, however, and somewhere amongst the vast network of silent factories and machine shops, foundries and testing grounds, controlled by the Krupp concern, must have been the parts of those unprecedented siege guns whose mighty projectiles with their tremendous charge of metal and explosives have shattered the fortresses of Belgium and France.

Origin of the Business.

It is just one hundred and three years ago since the original Krupp built his first smelting furnace for the making of steel, but it was his son Alfred, who became head of the firm at the age of fifteen when his father died in 1826, who laid the real foundations of what has since become one of the greatest industrial enterprises the world has ever known. The main reason for the pre-eminence of this firm in steel constructional work connected with all branches of warfare was the years of persistent research which were spent in the time of Alfred Krupp in the casting of large masses of steel.

It has been said that the greater part of the profit which came to the firm through the inventions of the spoonroller, cast-steel axles, and solid forged railway tires was eaten up by these experiments, but it is an undoubted fact that this painstaking labor bore fruit, for the year 1843 saw the first cast-steel gun barrels made, and the first gun tubes followed only four years later. From this beginning, the firm proceeded with rapid strides in the increase and perfection of these death-dealing instruments, which culminated in the building of the celebrated 105-ton gun for the defences of Kronstadt..

Although the name of Krupp is no longer heard on the management board of the firm, the army of the Allies will not easily forget "the surprise for France" which the fertile brains of Essen have invented and secretly constructed.

The manufacture of armor plate for the protection of warships and fortresses is another great business resulting from the scientific researches of the earlier Krupp, as it was made possible by his introduction of the carburizing process for the impact face, which gives the surface a glass hardness and consequently shatters the projectile without there being any resultant cracking or flaking of the armor plate.

Development of the Business.

During the lifetime of Alfred Krupp his employees increased from nine in 1833 to nearly thirteen thousand at the time of his death in 1887, and during the presidency of his son, Frederick Alfred Krupp, and since his death, the firm, by absorbing collieries, iron mines, steelworks, docks, and kindred businesses of every description, has continued to expand so rapidly that the total number of employees controlled by this gigantic concern is said to have reached eighty thousand, or, together with their dependents, a number which must exceed a quarter of a million.

All these men have been excused military duty at the present time because of the urgency of their work, and the already great numbers employed are said to have been increased by additional men since the commencement of the war. If the Allies could penetrate far enough into Germany to secure and convert to their own purposes the gun yards and testing grounds at Essen, they would wound the German army in one of its most vital points, and, because of the large concentration of the German armament trade in this one centre, would greatly increase her difficulties in replenishing her stock of guns and artillery as these were lost or destroyed. Indeed, such a coup on the part of the Allies might considerably shorten this devastating war.

It is difficult to conceive a concern of the magnitude of the one which has grown out of the original Krupp steel works, and it is easier to think of this great amalgamation split up into its various units. These are said to include six collieries which produce the two and a half million tons of coal annually consumed by the firm; over five hundred iron mines in Germany, and an interest in others in Bilbao in Spain; cokeries without number, six iron and steel works and rolling mills, blast furnaces at Duisburg, Neuwied, Engers, and Rheinhausen, the famous cannon works in Essen, where the 16-in. howitzers have come into being; gun testing grounds stretching for fifteen miles at Meppen, and the colony for the workpeople between Essen and Meppen containing over six thousand dwelling houses.

Imagine the workshops with their six thousand machine tools in operation, the 150 steam hammers, the hydraulic presses in number between fifty and a hundred, some of which give a pressure of 7,000 tons, and the six or seven hundred steam engines giving a combined motive power of 50,000 horse-power. Add to all this a fleet of steamships on the Rhine with docks at Rotterdam and a wharf at Kiel, and then a fair idea will have been obtained of the magnitude of the Krupp concern.—Engineering Review.

EVIDENCE OF HOSTILE TRADING.

ATTENTION has been called to the fact that circular letters were being sent out from points outside of Canada in the interests of German firms, and that in this indirect way an attempt was being made to continue trading transactions, which had been prohibited.

Evidence has now come before the Department of Trade and Commerce, Ottawa, to the effect that German shipping and forwarding agents to compensate themselves for cessation of business in their home centres have transferred their offices to London and points in Canada. In this way they are attempting to retain their business connections in competition with British and other firms until peace enables them to re-establish themselves in Germany. In order to do this they offer rates that preclude British firms from doing business on a reasonable basis.

While it would be difficult to directly interfere with such practices as here indicated, it is nevertheless desirable for Canadians to discourage hostile activity of this kind by assuring themselves of the standing of the firms with which they may have occasion to transact business.

The Canadian Fairbanks-Morse Co., Ltd., Toronto, have secured an order for "Skefko" ball bearings for the entire transmission equipment at the new plant of T. R. Eaton & Sons., Ltd., Orillia, Ont.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

ONTARIO HYDRO-ELECTRIC FIGURES.

IF anything were needed to demonstrate the remarkable success of public ownership as exemplified by the Hydro-Electric System it is offered in the returns of the municipalities in the Hydro sphere for the first nine months of the year. The financial statements of 40 municipalities, made public in brief form showed an unbroken succession of surpluses, and this in spite of the prevailing depression, and the fact that the three months of heavy consumption—from October 1st to the year end—are not covered. The surpluses are evidence also that the Provincial Commission, in recommending general reductions in power rates at the beginning of the year were not giving the municipal systems too much of an impost to bear.

The Statement.

The following statement shows the net surplus, after allowing ample amounts for depreciation, interest, power charges, etc.

Municipality.	Gross surplus.	Depreciation.	Net surplus.
Ottawa	$28,144.05	$26,470.40	$ 1,673.65
Hamilton	28,213.73	16,000.00	12,213.73
London	48,289.16	21,222.00	27,067.16
Berlin	15,391.24	8,872.00	6,519.24
St. Thomas	19,344.64	5,319.00	14,025.64
Guelph	19,174.18	7,705.00	11,469.18
Stratford	9,813.58	4,074.00	5,739.58
Galt	15,325.64	6,945.00	8,380.64
Woodstock	8,891.41	4,014.00	4,877.41
Collingwood	4,009.12	1,983.00	2,026.12
Barrie	4,442.94	2,647.00	2,095.94
Ingersoll	5,797.41	2,587.00	3,210.00
Waterloo	5,366.58	2,616.00	2,750.58
Dundas	3,928.77	1,900.00	2,028.77
Preston	4,631.94	2,450.00	2,181.94
Penetang	1,632.04	1,449.00	183.04
St. Mary's	4,369.64	2,450.00	1,919.64
Brampton	4,097.69	2,250.00	1,847.69
Tillsonburg	2,408.07	1,380.00	1,026.07
Weston	2,845.92	1,050.00	1,795.92
Milton	5,332.78	750.00	4,582.78
Mitchell	1,954.17	900.00	1,054.17
Elmira (10 months)	1,070.60	563.00	507.60
Norwich	1,214.05	413.25	800.80
Georgetown	1,923.24	591.00	1,332.24
New Hamburg	2,564.15	675.00	1,889.15
Acton	546.99	415.00	181.99
Stayner	175.27	262.50	87.23
Hagersville	591.59	314.00	277.59
Baden	1,128.00	215.00	913.00
Caledonia	427.03	225.00	202.03
Coldwater	801.02	300.00	501.02
Pt. Stanley	2,122.04	507.00	1,615.24
Elmvale	457.83	255.00	202.83
Waterdown	689.33	304.50	384.83
Rockwood	821.34	210.00	611.34
Beachville	1,877.90	300.00	1,577.90
Port Credit	1,123.33	394.80	728.53
Thamesford	414.95	119.00	295.95

The statement given does not contain the figures of municipalities that have been operating, but a part of the nine months' period, and the Toronto returns are also missing. These have yet to be finally passed upon, and are the subject of discussion between the officials of the Toronto and Provincial Commissions.

The City of London makes the best showing of the list, a net surplus of $27,067 being reported for the nine months. St. Thomas, Guelph and Hamilton showed margins above the ten thousand mark.

DOMINION REVENUE.

THE financial statement of the Dominion for October and for the first seven months of the fiscal year shows, as may be expected, a continued serious falling-off in revenue. The October statement especially reflects the result of the war in cutting customs revenue. For the past month customs receipts totalled $5.331,508, a decrease of $3,713,337 as compared with October of last year. For the seven months of the fiscal year customs revenue has totalled $47.238,177, a drop of nearly twenty millions. The total revenue for the seven months has been $80,972,466, which is $20,130,848 less than for the corresponding period of last year. The October drop in total revenue was $3,584,344.

Expenditures for the ordinary expenses of administration show, on the other hand, a continued increase. For the seven months consolidated fund expenditure has been $65.211.703, an increase of $7,764,875. Capital expenditures show some curtailment this year. The comparative figures are $23,630,856 for the first seven months of this year as compared with $30,720.490 for the first seven months of 1913-1914.

The net debt of the Dominion is now considerably higher than it has ever been, although the war expenditures hardly begin to figure yet in the returns. At the end of October the net debt was $352,675,399, an increase of $51,547,862 as compared with October 31 of last year. During the past month the jump in the national debt was $9.288.814. Temporary loans now amount to $20.573,333, an increase of about eleven millions during the month.

Despite the increased excise taxation put on at the war session of Parliament, the excise revenue for the past month was only $1.613,641, or $322,057 less than for October of last year.

C.S.C.E. VISIT WELLAND SHIP CANAL.

AN interesting and highly-instructive visit was paid to the Welland Ship Canal Works on Oct. 31 by the members of the Toronto branch of the Society of Civil Engineers. Over 180 members made up the party, which consisted principally of engineering students from Toronto University, who are also student members of the C.S.C.E. Among other prominent members present were A. K. Stewart, chief engineer C.N.R.; G. M. Going and M. Hewson, of the G.T.R.; Professor Haultain and Dr. Ellis; J. S. Weller, chief engineer of the Welland Ship Canal, and staff.

Upon arrival of the party at Thorold, a move was first made to the site of lock 7 and the G.T.R., Welland branch, diversion. The sites for locks 6, 5 and 4 were then visited, all this work being in section 3, after which lunch was partaken of in the construction camp at Thorold. After lunch, the party were taken on cars along the line of the canal to Port Weller, on Lake Ontario, and the work in progress examined carefully, the engineering features being explained by the staff of canal engineers. This part of the work is included in sections 1 and 2, and several interesting engineering undertakings were to be seen, consisting of work on the excavation for the head of lock 2, the drag-line excavators at work in the canal prism, and the operation of the Western grading machine. Section 1 includes lock No. 1, where the reinforced concrete walls are being constructed. It also includes the building of the harbor and dredging of same. Wood trestles are run out into the lake, and all surplus material dumped on the trestles, the purpose being to form a harbor.

Considerable time was spent in this section, after which the party returned to St. Catharines, where dinner was served at the New Welland Hotel. This concluded a most interesting day, all of those present highly appreciating the efforts of Mr. Weller and his staff of engineers in explaining the work in progress.

C. G. S. GRENVILLE LAUNCHED.

A LARGE number of prominent people attended the launching of the new Government steamer "Grenville" from the yards of the Polson Iron Works, Toronto, on Saturday afternoon, November 7. The vessel, which was designed by the Department of Marine and Fisheries, will be used for lighthouse and buoy service along the shores of Lake Ontario and the St. Lawrence River. She is a handsome all-steel boat, 164 ft. 6 in. long, with a beam of 30 feet, a depth of

13 feet, and built to class 100 A1 at Lloyd's.

She will be fitted with triple expansion engines, jet condensing, having cylinders 14 in.-22½ in.-28 in. diameter by 24 in. stroke. The engines are capable of developing 900 i.h.p. The boilers are two in number, Scotch type, 10 feet diameter by 11 feet long, of 180 pounds working pressure. There will be a complete electric light plant installed, and the vessel will be fully equipped in every other respect. The plans were prepared under the supervision of Charles Duguid, naval constructor, for the Department of Marine and Fisheries, and the building and launching were under the supervision of William Newman, works manager of the Polson Iron Works.

The "Grenville" was christened by Mrs. Kemp, wife of Hon. A. E. Kemp, who represented the Government. At the conclusion of the ceremony Mrs. Kemp was presented with a handsome bouquet by Miss Margaret Miller.

The company held a reception in the offices, and among those present were: Lt.-Col. and Mrs. Peuchen, Mr. and Mrs. Grayson Burruss, Mrs. Taylor, Capt. and Mrs. Taylor, Marine Department, Prescott; Mr. and Mrs. R. R. Roane, Canadian Stewart Company; Mr. and Mrs. H. C. Chillas, Canadian Stewart Co.; Mrs. Osler Wade, Mrs. Chaplin Stevens, Miss Davies, Miss Taylor, E. Crooks, Canadian Inspection Company; T. B. Benson, Lloyd's, Toronto; W. H. Smith, Grand Trunk Railway; D. J. Brebner, Canadian Bitulithic Co.; M. Wilsher, inspector for Fisheries Department; J. Mancor, representing Lloyd's, New York; J. T. Matthews, E. A. Matthews, C. Duguid, naval constructor for the Fisheries Department, Ottawa; Controller Church, A. G. Webster, representing Marine Engineering of Canada; Ald. Ryding, A. M. Asling, W. B. Tindall, J. Sittzler, Col. J. B. Miller, and W. Newman and A. H. Jeffery representing the builders.

COMMISSION OF CONSERVATION. FIFTH ANNUAL REPORT.

THAT the conservation movement has made distinct progress during the past year is clearly indicated in the "Fifth Annual Report" of the Commission of Conservation, which has just been issued. In his annual address, the chairman of the Commission, Hon. Clifford Sifton, covered the Commission's activities with respect to waters and water-powers, minerals, public health, agriculture, fisheries, fur-bearing animals and forests, indicating clearly and succinctly a number of the problems that have been grappled with and the advances that had been made in their solution.

Water Powers and Minerals.

With respect to water-powers, lengthy reports are presented covering the work in connection with the water-power surveys carried out in Western Canada. Two volumes will be issued later giving the results of these surveys and will prove of great value to those who are interested in the development of the water-powers of Canada.

The Commission's Committee on Minerals has been further strengthened by selecting as chairman, Dr. Frank D. Adams of McGill University. Dr. Adams is an outstanding authority on the minerals of Canada, and his assistance will be of great value to the commission. The report contains an excellent review by W. J. Dick, mining engineer of the Commission, on the "Importance of Bore-hole Records and the Capping of Gas Wells."

Public Health and Agriculture.

Several aspects of the problems of public health are dealt with in the report by well-known authorities. Dr. Hodgetts in a brief address summarizes the work of the Committee on Public Health, and, in addition, presents reports on such vital problems as "Infant Mortality," "First Aid to the Injured," and the work of the City-planning Conferences held in Chicago and Boston in 1913. G. Frank Beer, president of the Toronto Housing Co., develops at some length the housing and city-planning question in Canada, with especial reference to the work of the Toronto Housing Co., and the legislative requirements for town-planning, are outlined by the late Col. J. H. Burland.

The work of the Committee on Lands is described by F. C. Nunnick, the Commission's Agriculturist, who pays especial attention to the progress of the experiments with the growing of alfalfa in Quebec. Mr. Nunnick also describes in detail the Commission's "Agricultural Survey" for 1913, showing in concise form the farming conditions in the several provinces as ascertained by the committee's investigators. Dr. James W. Robertson and John Fixter describe the work of the illustration farms on the Commission.

Birds, Beasts, Fishes and Forestry.

J. Walter Jones follows in detail the progress in fur farming in Canada during the past year. The work of the Committee on Fisheries was confined, during 1913, chiefly to the development of the oyster industry. Hon. A. E. Arsenault describes the new method of leasing oyster beds in Prince Edward Island. This method was advocated by the Commission two years ago and will do much to regenerate the oyster industry in the Maritime Provinces. An exceedingly interesting paper on the "Protection of Migratory Birds" is given by a leading American authority, W. S. Haskell, who urges Canada to join with the United States in providing sanctuaries for these birds.

Considerable advance has been made in the conservation of forests during the year. The Commission has co-operated with the Board of Railway Commissioners and the several Provincial and Federal forest services concerning the prevention of forest fires, with the result that much has been done to prevent forest fires along railway lines, especially in Western Canada. In addition to the report of the chief forester, Clyde Leavitt, there are addresses on forestry by Dr. B. E. Fernow and R. H. Campbell.

The report contains a number of splendid illustrations and gives in concise form much information that is of value to all Canadians interested in the conservation of our natural resources.

NEW ZEALAND MARKET FOR MOTOR CARS.

IN this market few complete motor vehicles of German origin appear to be imported, but in 1912 materials for motor vehicles were imported from Germany to the value of £28,760, imports from the United Kingdom being valued at £57,871.

"Cheap cars are largely sold on hire-purchase, and it is a question to what extent the purchasers are fully acquainted, before making the purchase, with the annual expense which is involved in the running and repairing cost plus the instalments of purchase. I am told that the hire-purchase system is not practised as regards high-priced cars.

"Since tar macadam, asphalt and wood-block paving were introduced it may be said that the principal towns at least give scope for the normal British models of cars. On the other hand apart from taxi-cabs, and delivery vans, most owners of cars use them for touring, or at least for going to considerable distances from town. In several important towns the gradients are very steep, necessitating high power. Of the main trunk roads again, some are very hilly though fairly well formed and not needing a very high clearance. In other parts are absolutely unformed and at some times of year may consist of a foot depth or more of loose sand or of mud. It is thus obvious that, in order to be suitable to all the conditions with which it may be expected to grapple, the ideal car for this country should be very strong, very powerfully engined, very light, with high clearance, and economical in running; it should be proof against inexpert handling; it should not be likely to suffer from not being kept clean—the ordinary garage tariff for cleaning being 5s.; it should have all the latest and most up-to-date appliances and accessories; the engine should be easily accessible for repair, and all parts should be so construed to standards so that spare parts can be stocked and be easily procurable.

"Cyclecars have not really been tested here for the different classes of roads, as, for instance, whether they would be of use on the unmetaled sand tracks of the country districts or only on good roads.

"Motor delivery vans are slowly coming into use. Some 22 motor cars in my returns are specified as vans, though there may be others not specified. These are chiefly British."—(British Trade Report.)

J. J. McNiven, B.Sc., of Vancouver, has been appointed assistant inspector of gas and electricity in that city.

Trade Gossip

C.P.R. Scholarships.—The regular entrance examination for the free scholarships in McGill University, in connection with the offer of free tuition by the C.P.R., will be held in June, 1915. These four years' tuition are in the Faculty of Applied Science, and are open to apprentices and others on the company's permanent staff under 21 years of age and to minor sons of employees. So far the new department has resulted in unqualified success. Those who have taken advantage of the opportunity are equipped in a double sense—they have the practical and the theoretical; and this duality makes for greater efficiency.

Grand Trunk Apprentices.—A correspondence course is to be one of the advantages enjoyed by Grand Trunk apprentices for the first time this winter. W. D. Robb, the general superintendent of motive power, has some 600 apprentices in his department of the railway work—the young fellows being trained in the various locomotive shops of the company at Montreal, Stratford, Battle Creek and other points. The benefits of the training are such that boys are sent from all parts of the American continent and even from Europe, to take their apprenticeship here. If they pass their entrance examination, they are given trials of from two to three months in the shops; and if satisfactory, are asked to sign indenture papers binding them for the period their trade calls for; machinists for five years; pattern and boiler makers for four years. During this apprenticeship the boy has to attend classes, arranged by the company, and is taught mechanical drawing and practical mechanics. Examinations are held periodically to test the knowledge of the boys, and at the end of the term a final examination is arranged for the whole system—marks being compiled, and the station having the highest percentage, receiving a cash prize, donated by the company. Individual prizes are also given to the boys.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Windsor, Ont—Thos. J. Lawson & Co. will probably build a plant for fabricating structural steel.

Hawkesbury, Ont.—The Hawkesbury Board and Paper Mills Co., are contemplating the construction of a paper and board mill next year.

Tillsonburg, Ont.—The Barkey Brothers' electrical plant was destroyed by fire on Nov. 3, with a loss of about $10,000.

London, Ont.—The City Council are considering the question of purchasing water turbines, pumps and electric motors. H. J. Glaubitz is manager of waterworks department.

Dutton, Ont. — The Hydro-Electric Commission is contemplating the purchase of equipment in connection with the running of a line from St. Thomas to Dutton and Glencoe. J. B. Blue is clerk of Dutton.

Stratford, Ont.—It is reported that the Bartlett Automobile Co. of Toronto, will take over either the Morlock or Diebel factory, and equip a plant for making automobiles. It is stated that a medium priced car will be made.

Brantford, Ont—The Massey-Harris Co. which closed down the day after war was declared, throwing 1,200 men out of work here, will start up again in a few days, employing 800 men five days a week. Married men will be given the preference.

Canora, Sask.—The Town Council has awarded a contract to Wm. Newman & Co., Winnipeg, for the supply and installation of machinery at a cost of $54.000, in connection with the municipal water system. Chipman & Power, Toronto and Winnipeg, are the consulting engineers.

Quebec, Que.—The C. E. Deakin Co., of Montreal, has been awarded the contract for a large extension to the Ross rifle factory. The new building will be 200 x 250 ft., and must be ready for the installation of machinery by December 1st. The machinery and equipment has been ordered in England, and is expected to arrive around that date.

Renfrew, Ont.—A large amount of new machinery for the Renfrew Knitting Co. which is increasing the capacity of its mill, has arrived from Worcester, Mass., by express. A special express car of large size was provided for the purpose. The cost of such transportation came high, but the time gained was worth the money. The mill is busy on heavy war orders.

Electrical

Flesherton, Ont.—A by-law authorizing the issue of $5,500 for installation of Hydro-Electric power was voted on here last Thursday, and carried by a unanimouse vote. Work of installation will be commenced as soon as possible.

London, Ont.—It is announced that the new rates for hydro power for lighting, cooking, etc., in London will be 1/8 cents net per k.w. with 2.7 cents net per 100 square feet floor space. Those who prefer to remain on a straight meter basis without floor space will be charged 4-5 cents per kilowatt net.

Chatham, Ont.—No definite action will be taken regarding the street lighting plans for Chatham until the citizens' committee has had an opportunity of consulting Engineer Jeffrey, of the hydro staff, and securing information regarding the cost of the various systems. An effort will be made to have Mr. Jeffrey return to Chatham as soon as possible to consult with the committee.

Hamilton, Ont—Although the Dominion Power and Transmission Co. has not yet commenced laying cable in the underground conduits, the Hydro Department at the City Hall expects all overhead construction in the centre of the city to be down by a year hence. At present there is practically no overhead wiring belonging to the Hydro in the underground district, other than that forming part of the conduit system.

Chatham, Ont.—The site for the local hydro-electric offices and substation has been definitely selected by the local public utilities commission. The property has a frontage of 62¾ feet on King street, and a depth—all good, high ground—of practically 150 feet. It is thus amply large enough for the purpose of a substation. The offices and show rooms of the commission will be located at the front, giving a frontage on Chatham's main business street for show room and display purposes.

Municipal

Chatham, Ont.—A by-law will be submitted to the ratepayers to grant aid to the Combined Casket & Vault Co., who propose establishing a plant here.

Galt, Ont.—The installation of a fire alarm system is under consideration by the council at an approximate cost of $12,000. Tenders will be called before a by-law is voted on.

Toronto, Ont.—A building permit was granted on Nov. 3 to William Cowlin & Son for the new water purification plant at the Island. It will be of concrete and brick construction, and cost $138,870.

Quebec, Que.—An action to recover the sum of $4,359.38 has been taken by the city of Quebec against theDorchester Electric Co. The action is one for debt, and covers the cost of water supplied the company for its plant by the city.

Oakville, Ont.—This town will probably have a new firehall. At the Town Council meeting last Monday the proposal was discussed at length. The chairman of the Public Buildings Committee recommended a $10,000 building. It was finally decided to let the matter rest until the next meeting.

Toronto, Ont—The Committee on Works last Friday, approved of Street Commissioner Wilson's plan to erect a new incinerator at the island to cost $15,300. This covers the building, furnace and chimney and dock equipment. The incinerator will be located about 300 feet north of the present incinerator site.

Toronto, Ont.—Consideration for the unemployed has influenced the Provincial Government to give assurance to the city that if the work of constructing the Bloor street west car line from Dundas street to Quebec avenue is gone on with legislation will be passed authorizing the issue of debentures for $150,000 to cover the cost of the work without a vote of the ratepayers.

St. Catharines, Ont.—The contract for the continuation of the Niagara Boulevard through Bridgeburg and Fort Erie, from the Bowen Road to the ferry landing, has been let to J. C. McNamara, of St. Catharines, whose bid was $32,000 for the work. His tender was the lowest of the five received. The cost of this roadway is to be divided between the municipalities of Bridgeburg and Fort Erie and the Park Commission. The cost to Bridgeburg will be about $7200 and to Fort Erie approximately $3,600.

Empress, Sask. — A meeting of the ratepayers was held on Oct. 30 in the office of Secretary Cusack for the purpose of a general discussion of the water works question and the incorporation of the village as a town. The cost of the proposed waterworks system as submitted by the John Galt Engineering Co., would be approximately $60,000 with the Red Deer river as the source of supply. The question was put to a vote of the ratepayers present and carried unanimously in favor of the proposition.

General Industrial

Hull, Que.—The city are in the market for a fire engine.

Lethbridge, Alta.—A soap factory has opened up here under the management of J. O. Jones.

Listowel, Ont.—The Perfect Knit Mills Co. will build an extension to their factory to cost $4,000.

Fort George, B.C.—A scheme is being considered to install a waterworks system at an estimated cost of $50,000.

Welland, Ont.—The Candied Fruits Confectionary Co., Ltd., which has a capital of $40,000, will build a factory here.

Harriston, Ont.—There is every prospect that on upholstery factory, financed by United States capital, will be running by the first of the year. The town is also after other concerns.

Dutton, Ont.—The Southwestern Ontario Gas Co. turned the gas into the Dutton mains for the first time on Nov. 4, and already a large number of citizens are using it for lighting and heating.

Edmonton, Alta.—A big flow of gas has been struck at Edmonton's municipal gas well at Viking, and is at present giving out over nine million feet of gas in twenty-four hours.

Orangeville, Ont. — In less than a month the Dods Knitting Co.'s mill will be in operation. The steamfitters are busy finishing their work, and as they get through the mill will be started.

Brampton, Ont.—The foundations for the new factory of the Lindners Ltd. are being laid. The erection of the building will be pushed forward with all possible speed, so that the company may commence operations early in the new year.

Redcliff, Alta.—Mr. Bonner, who has already erected a building here for the purpose of starting a knitting factory, states that he has been successful in making financial arrangements which will enable him to proceed with the installation of the necessary machinery for his factory.

Quebec, Que.—Fire breaking out, presumably from the boiler-room, gutted the entire east wing of Gale Brothers' shoe factory on Valier street, here, shortly after ten o'clock last Thursday. The damage, however, caused mostly by water, will easily reach $3,000, but is covered by insurance.

Brampton, Ont.—John McMurchy, who some time ago took over the old tannery property, has had the building thoroughly renovated and repaired and is this week installing machinery for the manufacture of woollen underwear and hosiery. The factory Mr. McMurchy expects, will be running with a fair number of hands within three weeks.

Calgary, Alta.—It is announced that the Western Canada Cordage Co., capitalized at a million dollars, with sufficient capacity to supply western farmers with 12,000,000 pounds of binder twine per year, will begin building operations at Calgary within the month. Arrangements for its organization, proceeding quietly in the city for some months, are now completed, and the plant will be in operation for next year's trade.

Contracts Awarded

Lauzon, Que.—The contract has been awarded by the Dominion Government to E. Leonard & Sons, Ltd., London, for the boilers in connection with the drydock here.

The Smart-Turner Machine Co., of Hamilton, Ont., has been awarded a contract by the Department of Railways and Canals, Ottawa, for pumps for the Intercolonial Railway.

Simcoe, Ont.—The contract has been awarded for the erection of the new Hydro-electric station, which must be completed by November 30. Poles are being erected and wires strung along the streets, and it is expected to have the current turned on and the service in operation before Christmas. R. E. Gunton was awarded the contract at $1,356.

Orders for Railway Equipment.—Two large equipment orders have just been placed by Canadian Government railways, one with the Eastern Car Co., New Glasgow, the other with the Nova Scotia Car Works, Halifax. The Eastern Car order is for 250 fifty-ton all steel freight cars for general service. The Nova Scotia order is for 200 all steel flat cars. Orders for some sleeping cars have also been placed with the Preston Car Co.

Toronto, Ont.—The following contracts have been awarded by the Board of Education in connection with addition to Roden Street School:—Masonry and reinforced concrete floors, G. T. Gayton, $12,200; carpentry, Wm. Williamson, $7,295; plastering, Geo. White, $2,600; painting, F. J. Cox, $799; wiring, A. R. Rice & Co., $182; heating and ventilating, Bennett & Wright, $777; plumbing, F. Armstrong Co., $3,388; roofing, Duthie & Son, $1,130; iron stairs, W. D. Beath & Son, $1,680; heat regulating, Johnson Temperature Regulating Co., $419.

Toronto, Ont.—The Board of Education has awarded the following contracts in connection with the construction of Ryerson School annex:—Masonry, Witchall & Son, $28,200; concrete floors, Ramsay Contracting Co., $1,092; carpentry, Hutchinson Woodworker and Contracting Co., $10,495; plastering, Beaver & Co., $3,798; painting, J. Cosey, $1,380; heating and ventilating, W. J. McGuire Co., $4,700; plumbing, W. J. McGuire Co., $4,300; iron stairs, W. D. Beath & Son, $2,755; wiring, A. R. Rice & Co., $334; heat regulating, Canadian Powers Regulating Co., $793.

Tenders

Galt, Ont.—Tenders for the installation of a Fire Alarm System will be received up till Monday, November 16, addressed to the undersigned. Parties tendering to submit specifications for a town of 12,000, with an area of approximately 1,600 acres. Joseph McCartney, town Clerk.

Toronto, Ont.—Tenders for Synchronous Converters, with their transformers and switchboard panels, will be received until Thursday, November 26, 1914. Address to the Chairman, Toronto Electric Commissioners. Specification and form of tender can be obtained at the office of the purchasing agent.

Toronto, Ont.—Tenders will be received up to **Tuesday, November 24th, 1914**, for the supplying and laying of a 72 inch steel conduit from the Mechanical Filtration Plant to the 72 inch and 84 inch steel conduits on Toronto island. Drawings, specifications and tender forms may be obtained upon application at the office of Mr. James Milne, Mechanical and Electrical Engineer. Department of Works, Room 16, City Hall, Toronto.

Turret Lathe and Vertical Boring Mill Practice

By Albert A. Dowd *

Beginning with our July 9 issue this year, there have appeared more or less frequently articles contributed by the author of this further series. To our readers who have followed what has already been published on the above subject, and more particularly to those recently added to our list of regular subscribers, it will be sufficient to state that the writer is a thorough master of his subject.

MACHINING PISTON RINGS.

Two types of piston or packing rings are in use on automatic engines, one of these types being concentric and the other eccentric. Illustrations of each type are shown in Fig. 6. A in the upper part of the figure is the concentric type which is less common than the eccentric type E in the lower part of the illustration. The rings are usually machined in the form of a pot or shell, then cut off to approximate width; a piece is next cut out and they are sprung together and re-machined. Sometimes the cut is made to produce a lap-joint, as at D, and in other instances the lap is formed as at H in the form of a bevel cut. When rings are concentric they are sometimes "peined" from B to C to give a better spring action to the metal. When the eccentric form is used, the rings are split at G or the thinnest part of the ring, the spring action being made more uniform

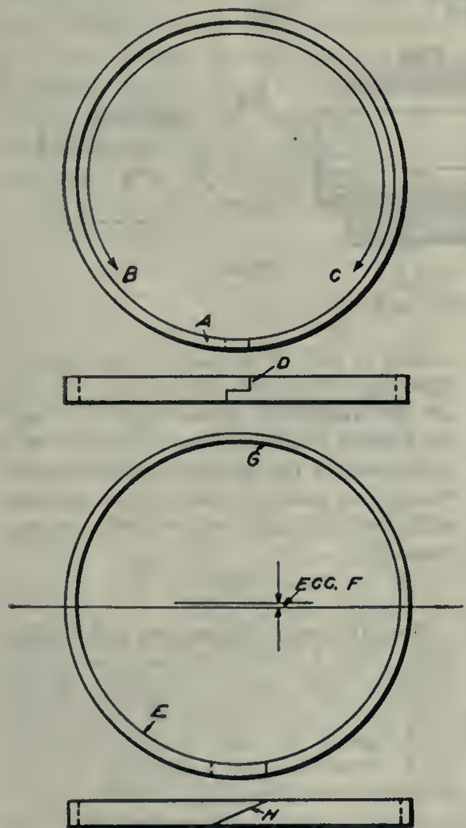


FIGURE 6.

by the eccentricity F. Naturally the concentric type of ring presents the fewest problems in machining.

*Production Engineer, Bridgeport, Conn.

In either case, there is one thing which causes more or less trouble and that is the fragile nature of the work, which

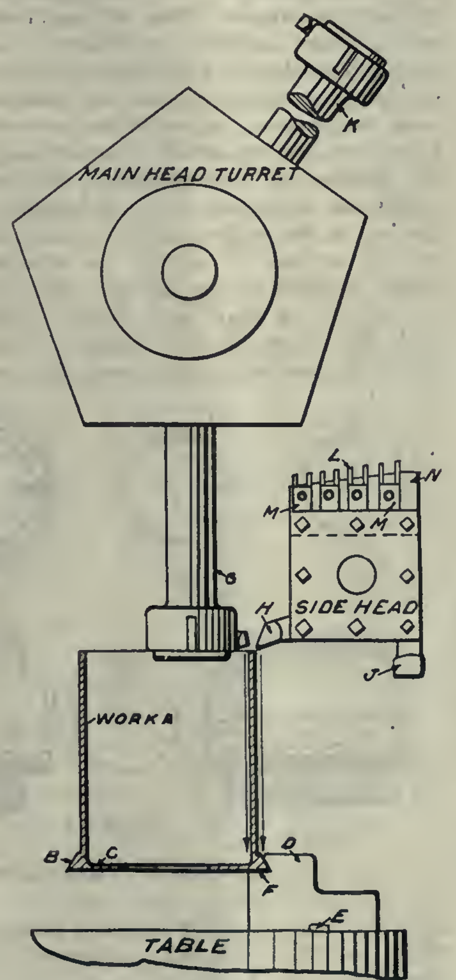


FIGURE 7.

makes it a difficult matter to hold it and machine without distortion. Fig. 7 shows the tool layout and method of holding a concentric ring pot on the vertical turret lathe, the work being shown at A in the illustration. The form of the pot is quite important, and it will be noted that an angular gripping flange is provided at B and that there is an internal web C to assist in preventing distortion. The jaws D in which the pot is held are of special form to fit the angular portion of the flange and are slightly grooved at F so that no trouble will be experienced with chips, dirt or "fins" on the casting. The jaws are keyed to the sub-jaws of the table in the usual manner at E.

The main head turret is provided with two boring bars G and K, the first of these being used for roughing while the second is used for finishing. These bars are of standard type with large heads and slip cutters, which feature may or may not be used in this setting. If the slip cutter feature is used, only one bar is required, the roughing and finishing tools being interchanged as desired. The side head is provided with roughing and finishing tools H and J, these being used simultaneously with the boring tools. Tools should be set opposite to each other, for the external and internal pressures of the cutting tools are neutralized by so doing and less distortion is apparent. The parting tools L are set in a special tool block N, which is held in the side head turret by the regular clamp screws. The double clamps, M, each hold two of the parting tools.

Fig. 8 shows the operation of cutting off the rings after the turning and boring have been accomplished. It will be seen that the tools L are arranged so that they operate progressively, being set so that a line passing through the ends of the tools forms an angle of about 5 degrees with the centre line of the spindle. By this arrangement the

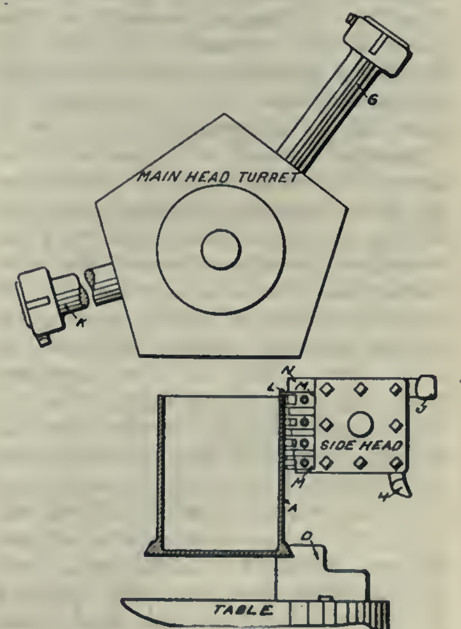


FIGURE 8.

rings come off clean cut and without broken edges, as there is strength enough on the unseparated ring just below the one being cut off to prevent its breaking off when the upper one is being cut off.

Eccentric Piston Rings.

When the rings are to be of the eccentric type, a fixture is necessary or else an eccentric turning device must be devised. A comparatively simple fixture which gives excellent results is shown in Fig. 9. The form of the ring pot is somewhat different from that previously described, being provided with three lugs which are jig drilled at B before the pot A is placed in position on the fixture. Its location is determined by steel studs which enter the holes B, the clamps C being used to hold it in place. Only one clamp is shown in the illustration, the others being removed to avoid confusion in the drawing.

KEYS AND KEYSEATING.

By Armley Leeds.

IT is regrettable that so many plants take upon themselves the responsibility of adopting key standards to suit their own local convenience and with no regard to standards adopted by the more authoritative and better informed bodies. While an adherence to standards is to be very strongly recommended, a study of the disadvantages of different types will not be amiss. The tendency is almost entirely towards the adoption of a rectangular key which is sunk in both shaft and hub except for special purposes. The thickness and depths in shaft and hub, however, are the points which are most at variance.

In defining the size of the key, two methods are adopted, as shown in Figs. 1 and 2. Whichever is used, the sizes given always represent the head or larger end of a tapered key. The amount of taper allowed is 1/8 in. vertically in every 12 in. horizontally.

Another method of keying is that known as staking. Four or more keys are fitted upon flats on the shaft, and all the driving work is done by pressure upon the wide surfaces of the keys; that is to say, when driving the wheel in a certain direction the keys are under driving pressure where indicated by short lines in Fig. 3. The important feature of this arrangement is that the driving pressure acts directly upon the inclined surface of the key, not along the straight sides and therefore, in tightening a key, the actual driving surfaces are brought into closer contact, and any slackness is eliminated. Keys of this description are better adapted for withstanding reversible loads than the ordinary sunk key, and they also provide a means of turning the wheel on the shaft.

The ordinary sunk key, Fig. 4, combines the properties of the flat key, Fig. 3, with those of a bar of metal in shear. Taking these two qualities separately, the key is relatively narrow (viewed as a flat key) and, since there are usually only one or two sunk keys, the pressure on the broad surface as indicated by short straight lines is severe.

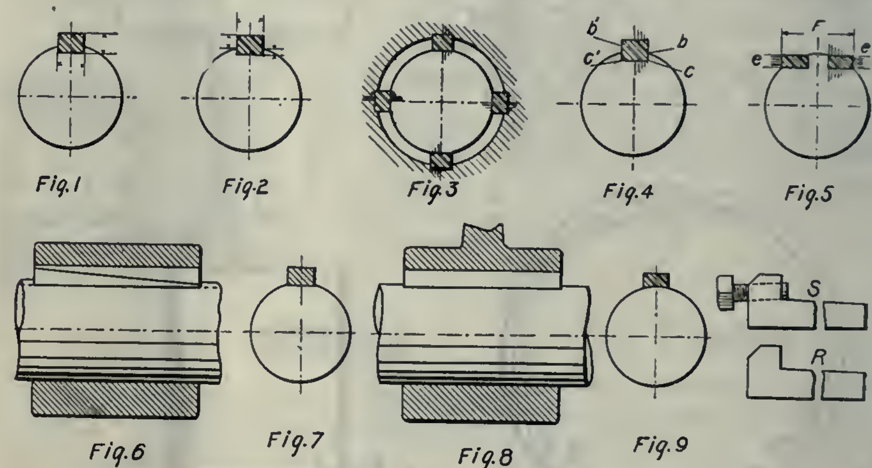
Regarded as a bar subjected to a shearing stress (presumably along the curved dotted lines), there is an objection that slackness resulting from driving pressure such as might be manifested at points C and B, Fig. 4, cannot be compensated for, because the sides of the key are parallel. This key combines some useful qualities, as follows: In cases where the drive is steady and not subject to sudden reversal or continuous alternations, the sunk key acts as a positive driving device in shear, and the broader or wedge-shaped surface fulfills the important duty of enabling the key to be wedged tight, so that its driving surfaces C^1 and B^1 are always closely applied to the driving sides of keyway in the shaft and wheel. The sunk key is useful for factory drives where the load acts continuously in one direction, but some other device is better where the drive is of an alternating character.

Where keys are subjected to stresses alternating in direction, a good type is shown in Fig. 5. The two opposed keys are tapered along their edges E and E^1. Their surfaces A and A^1 being flat, such keys may be said to combine the qualities of a flat key of width equal to the entire depth of the key. The sum of these properties offers a very lasting and substantial arrangement. With the driving shaft as shown in Fig 5, the driving pressure is divided between the two keys as indicated by the hatched lines, and vice versa when direction of rotation is changed. The pressure surface (e) is about equal in area to the equivalent driving sides of two ordinary sunk keys as shown in Fig. 4, and there is the advantage that, since the surface (e) is the inclined surface, slackness can be taken up as it arises. The driving surface afforded by the other key serves to tighten the load at (e). Keys of this description are locked tight against their driving seating, regardless of the direction in which the load is applied.

Folding keys, Fig. 6, are useful in cases where the key bed in the shaft cannot be allowed to extend beyond the hub of the wheel. One key is placed in its key seat in the shaft, the wedging being done with the other, which can be driven in or drifted out without coming in contact with the shaft. The keyway in the wheel is usually parallel, not inclined.

Flat keys, Fig. 7, are frequently used in place of sunk keys for light, steady running drives. The shaft is weakened less than is the case with sunk keys. For very light drives a key as shown, Fig. 8, is useful, especially where machine pulleys are likely to be moved from one place to another on the shafting when alterations are made.

Parallel keys are often adopted in electrical work. A typical case being shown in Fig. 9; set screws perform the function of tightening the key in lieu of the wedge formation. Any key may be formed with gib heads as at R or S which serves the purpose of withdrawal, where the point of the key is inaccessible, but this not not generally recommended.



KEYS AND KEYSEATING.

Foundrymen's Convention and Exhibition.—The American Foundrymen's Association and allied organizations will hold their next convention in Atlantic City, during the week of September 27. 1915. The Foundry & Machine Co. exhibition will be located on the steel pier, and the convention meetings will take place in rooms adjacent to it. The movement to affiliate the Associated Foundry Foremen with the American Foundrymen's Association is expected to be consummated early in 1915.

The Design and Service Application of Ball Bearings*

By C. H. Miller

The secret of the great advance in the direction of successful application of ball-bearings to a multitude of services a few years ago considered altogether impossible of attainment lies in the self-aligning feature, the capability of taking end thrust and the installation of two rows of balls instead of one.

THE application of ball bearings to all classes of machinery calls for the serious consideration of every engineer, not altogether on account of the saving of power effected, but as a means by which the weight and overall dimensions of machines can be considerably reduced, especially where internal bearings are necessary. Designs can be made neater, thus reducing pattern work and machining, but more important still, the speed of manufacture itself can be very much increased, which means a considerable reduction in the total cost.

It is therefore necessary to look at this subject in a practical manner, as this is the only side of the question which is of any commercial value to the average engineer. To do this it is necessary to briefly refer to the earlier designs, to point out their weaknesses and to compare, from a practical point of view, the advantages and disadvantages of modern designs for the purpose only of finding the true value of all, so that, when considering ball bearings for any particular application, these remarks may be of value in determining the best design of ball bearings for the purpose under consideration.

It is hardly necessary to mention the saving of power effected by fitting ball bearings as compared with those of any other type; it will be necessary to state that the total loss of power through friction with ordinary bearings may, at a conservative estimate, be taken at from 10 per cent. to 30 per cent. of the total power applied, in fact in many cases it amounts to 30, 40 and even 50 per cent, but when ball bearings are installed this loss is reduced by 75 to 90 per cent. Taking the total loss of power with plain bearings at the low estimate of 18 per cent., and the saving effected by ball bearings at 75 per cent. of this amount, we get a saving of 13.5 per cent., or a total frictional loss of 4.5 per cent. only. In cases where machines are constantly stopped and started, the saving of power is enormous, as the starting effort with ball bearings is practically the same as the running friction.

*From a paper read before the Birmingham Association of Mechanical Engineers.

Early Ball Bearing Types.

The type of ball bearing, known as the cone type, is one of the earliest forms, and is still used extensively for light radial and thrust duties, owing to the small cost at which it can be manufactured. The only point to be noted in favor of this type is that it has a two-point contact. Professor Stribeck proved beyond doubt that in a ball bearing the ball should only have a two-point contact, and M. Renouf proved the same thing.

In all ball bearings in which the balls touch the races at more than one point only, spinning of the balls takes place. Professor Stribeck and M. Renouf went deeply into the ill-effects of the so-called spinning of the balls, and its ill effects are more pronounced in large bearings than in small sizes. The spinning also causes ball bearings to run hot. Spinnning of the balls is not always the fault of the design, being often caused through dirt and grit getting into the bearing.

The shapes and modifications of the cone type ball bearings are innumerable, the principle defect being their adjustable feature, because the slightest turn with a spanner may enormously overload the bearing, or, on the other hand, the bearing may be adjusted too loosely, so that the balls will rattle and the result consequently be unsatisfactory. The prevalent idea that angular ball bearings can be adjusted to compensate for wear is erroneous. Besides, the races can never be made to adjust themselves truly parallel within anything like the degrees of accuracy of the balls themselves and, therefore, when adjusted as nearly perfect as possible, there must be one place where the balls are tighter than another, which means more wear in that particular place and, when adjusted again, the races will become tight in another position, and thus the balls become sealed and the whole bearing destroyed.

In the types of bearings known as "crammed," the balls are not separated by a ball cage, but revolve against each other.

Ball bearings having perfectly flat races are most efficient under test, but are not capable of carrying such heavy loads as the grooved races type. The modern type of ball bearing for radial duty is perfectly adjusted by the makers and therefore this very great advance in design has made it possible to fit ball bearings to every class of machinery, and for any duty without fear of overloading through bad adjustment. A properly designed ball bearing which is not overloaded will not wear and provision for adjustment is not only impracticable, but unnecessary.

Radial Type Ball Bearings.

There are only two types of radial ball bearings having standard overall dimensions—namely, the common single-row type, known as the single-row rigid radial bearing, and the Skefko S.K.F. self-aligning double-row type. Other types are not interchangeable with the common standard overall dimensions.

It will be noticed that there is one great difficulty in the manufacture of the first type, namely, filling in the balls. There are many ways of doing this. Each race must be in one piece, otherwise the hardened steel balls will cause the spliced hardened surface of the race to become chipped, which, of course, spells failure of the bearing.

It has been proved by Professors Stribeck and Goodman that a radial bearing having both races grooved will carry a considerably greater load than one with both its faces flat. When a ball bearing is under load, the balls are slightly flattened, and if the balls are rolling between two flat races the contact area on the balls is a circle; but, if the balls are running in a grooved race, the area of contact is then an ellipse of which the minor axis is equal to the diameter of the circle for an equal deformation of the ball. The area of the ellipse is greater than that of the circle, and the load-carrying capacity is therefore increased.

Now, in radial ball bearings, the races are curved in both directions, the inner being concave in one direction and the outer convex in the other. It is therefore obvious that, in an ordinary single-row bearing where the groove is similar in both races, the area of contact between the ball and the outer race will be greater than between the ball and the inner race. The effect of this is that in practice where wear takes place, it is always more marked in the inner race than in the outer. In the Skefko bearing, the outer race has been flattened out and care taken to avoid reducing the area of contact between it and the ball below, as compared with the area between the ball and the inner race.

From this it will be seen that the strength of the bearing due to the curvature of the outer race has not been in any way reduced; at the same time this design enables two rows of balls to be used, and in most cases a larger number of balls to be got into each row, so that there are twice as many balls carrying the load. The importance of this increased number of balls is appreciated when it is remembered that the carrying capacity of any radial bearing is directly proportional to the number of balls, if their size be the same in both bearings.

Ball Cage Feature.

There are three main objects for the use of a ball cage. Firstly, because it is impossible to so proportion races and balls, even of the full ball type bearing, that the latter exactly fit the circumference; secondly, to reduce noise; thirdly, to prevent wear.

If a full type bearing be set in motion under the usual vertical load, whenever a ball passes from the region of pressure it is snapped forward, striking forcibly the adjacent ball, causing considerable vibration, and before it comes to rest it is struck by the following ball, which in turn is subjected in turn to the same treatment. This, the chief cause of noise in ball bearings of this type, tends to get worse and worse. The second trouble that the cage overcomes is the wear of one ball on another. With the full type bearings it is not uncommon to find the balls having a groove worn around their circumberence, with a radius of curvature equal to that of the ball diameter. One cause of this is deflection. It is most important to keep all ball bearings properly aligned.

Ball cages were devised to keep the balls equally separated in the partly-filled type bearing. To reduce noise and to prevent certain forms of ball wear, a properly designed ball cage should be such that every ball is free in its own setting. It should be strong, if possible in one piece, elastic, and capable of retaining the maximum number of balls in the bearing. Thrust bearings, both of the single and double types, having flat races, should only be used for light loads on account of the difficulty in mounting.

Ball Thrust Bearings.

The stationary race or races and the revolving race must be mounted absolutely parallel with each other and, generally speaking, this is almost impossible, but even if parallelism were possible it cannot be maintained under the deflections due to the load, and it must also be remembered that initial errors or deflections of a thousandth part of an inch will cause the balls on one side to carry the entire load and therefore the margin of safety must be a big one when this type of bearing is used. It is therefore advisable to use a thrust bearing, having a self-aligning race. The race being ground spherical and mounted on a corresponding seating can adjust itself in such a way as to distribute the load equally over the entire number of balls in the bearing, thus making it impossible to overload any one ball. This self-aligning principle, both in radial bearings as well as thrusts, is undoubtedly the secret to the successful application of ball bearings.

Thrust bearings of light and medium types should not be run at speeds higher than 2,000 r.p.m., and heavy type thrust bearings saving large diameter balls should not be used for speeds higher than 500 r.p.m. owing to the centrifugal force acting on the balls. Thrust-bearing cages like those used in radial bearings, are in great variety. Those of the pressed type are worthy of particular note. They are made in one piece, and so designed as to take up any centrifugal action on the balls, thus keeping them in the centre of their races. This prevents excessive slipping and spinning of balls, which causes heating and failure of the bearing when running at high speed.

The "Skefko" radial bearing makes a most efficient thrust bearing for light loads at high speeds, but the amount must not exceed 25 per cent. of their radial load given for medium type bearings. The use of this bearing for light thrust loads running at very high speeds entirely overcomes the trouble caused by centrifugal force; they have been successfully used for speeds up to 30,000 r.p.m. This special feature of the "Skefko" radial bearing to take a considerable end thrust without overloading the balls is due to the inclination of the tangent to the curve of the outer race at the point of contact with the ball.

Radial bearings are capable of taking as much as 35 and 40 per cent. thrust duty, and this is a very important feature, as it is difficult to find a position on any machine where radial duty is not combined with a certain percentage of thrust duty. The more conical this type of bearing, the greater the safe thrust load will be in proportion to the radial load. Purely radial bearings—that is, those of the rigid type—are not calculated to resist any thrust load whatever, and when subjected to axial thrust, the makers rightly refuse to accept responsibility for failures.

With the rigid type of ball bearing, it is essential that extreme accuracy be observed in the alignment of the shaft and housing to which the bearings are to be fitted. Therefore, with this type of bearing it is necessary to fit a thrust bearing as well, which not only increases the cost, but also the difficulty of mounting satisfactory. In the self-aligning type of radial bearings, the necessity for this extreme accuracy is obviated, as owing to their construction they adjust themselves instantly and automatically through the rolling of the balls across the spherical face of the outer race to any deflection, thus ensuring equal distribution of the load over both rows of balls. When fitting a bearing of this description for radial as well as thrust duty, all that is necessary is to fix both races of one bearing axially, the inner race on the shaft and the outer race in its housing. Never more than one radial bearing on each independent shaft should be thus fixed; the other bearing or bearings must be allowed free axial movement in both directions in their housings or on their shaft.

Materials and Manufacture.

One of the most important points to consider in the manufacture of a ball bearing is the material used. The best ball bearings are made from the very best Swedish chrome cast steel obtainable. This steel is noted for its hardness, toughness, and high elastic limits. After the races have been turned to shape they are hardened throughout and carefully tempered. The greatest care must be exercised in this process, the exact degree of hardness having been decided after years of experience and tests. The temperature of each furnace should be automatically recorded once every minute, so that the works manager can at any time see exactly what the temperature was in any furnace at any time.

There are still some makers who use a low carbon steel and case-harden the surfaces. The main trouble with a case-hardened bearing is that the thin hard skin tends to flake away from the soft backing which results in the bearing becoming a total wreck, and it must be remembered the greater the area of ball race, the greater the thickness of soft backing, besides which, it is impossible when manufacturing large quantities to obtain a case-hardened surface of equal thickness. It is more difficult to manufacture ball bearings of hardened steel throughout, especially in the larger sizes, where the races are comparatively thin, owing to their tendency to warp during the hardening process. This means that a large amount must be left for grinding, which considerably increases the cost of manufacture, but such bearings are undoubtedly capable of standing a much greater duty than if made of a case-hardened material.

The instruments used for testing the hardness of ball-bearing races are the Scleroscope and the Brinell machines. The Scleroscope measures the hardness of a material by the height of the rebound of a small hammer falling from a definite height. This hammer has a diamond point and actually dents the material, so that its kinetic energy at the moment of striking is partly returned to the hammer as kinetic energy which raises it to a certain height in the glass tube, which is provided with a scale. The Brinell test is to force a hard steel ball of standard diameter into the material under test with a standard load, and then measure the diameter of the impression made. The Brinell test is the more accurate as being practically the same set of conditions as exist in the bearing in practice.

Lubrication.

The question whether a ball bearing requires lubrication has been much debated, but it has been proved conclusively that the friction of a properly designed ball bearing, when it is oiled, is never less and is sometimes greater than when it runs dry. Being made from extremely hard steel and highly polished, they are very liable to rust, and a ball bearing should never be run in a rusty condition, or else failure is inevitable. In actual practice it is found necessary to either pack the housing with a suitable grease for speeds up to about 1,000 r.p.m. or run them in an oil bath for higher speeds. The installation of ball bearings effects a saving of at least 90 per cent. of the lubrication required with plain bearings.

Generally speaking, the users of ball bearings endeavor to fit them accurately. Such great care is not needed, the main object being that under no conditions must the bearings be subjected to strains other than their legitimate duty, and every care must be exercised not to deform the ball races in any way. Parallel bearings should be fitted on the shaft with a light tapping fit, and held securely against a shoulder by means of a nut. A suitable shaft shoulder will be obtained if it is made 1.1 times the diameter of shaft, plus 5-32 in. The outer race should, of course, never be hammered when mounting a bearing on the shaft, a piece of hard wood held against the inner race and tapped gently being all that is necessary.

Ball bearings are now being universally used for line shafting purposes, in which case an adapter sleeve is used between the bearing and the shaft for fitting. One bearing only on each independent line of shafting must be fixed axially, for the purpose of keeping the shaft running in line, and the others free axially in their housings. Thrust bearings or collars are never needed on line shafting when Skefko bearings are fitted. Regarding the race which is made a sliding fit in its housing, many people try to fix them from revolving; this is a great mistake. It is good for this race to creep a little in its housing, as it distributes the load evenly all round the outer race, at the same time the amount of creep is so small that no appreciable wear takes place.

Ball Bearing Housings.

Referring to the design of housings for ball bearings, it is preferable to make them of the split type, and not all in one piece with an end cap, the principal advantages of the first type being that the bearings can be fitted more easily, and the shaft complete with all its mountings can be lifted into the lower part of the pedestal. With the other type, the mounting of the bearings has to be done more or less in the dark, and any slight errors in machining may put excessive end thrust on the bearings, which will probably be ruined before the cause is found out. Housings should be made as large as convenient, and every care should be taken to provide good protection for keeping the bearings free from dust and moisture.

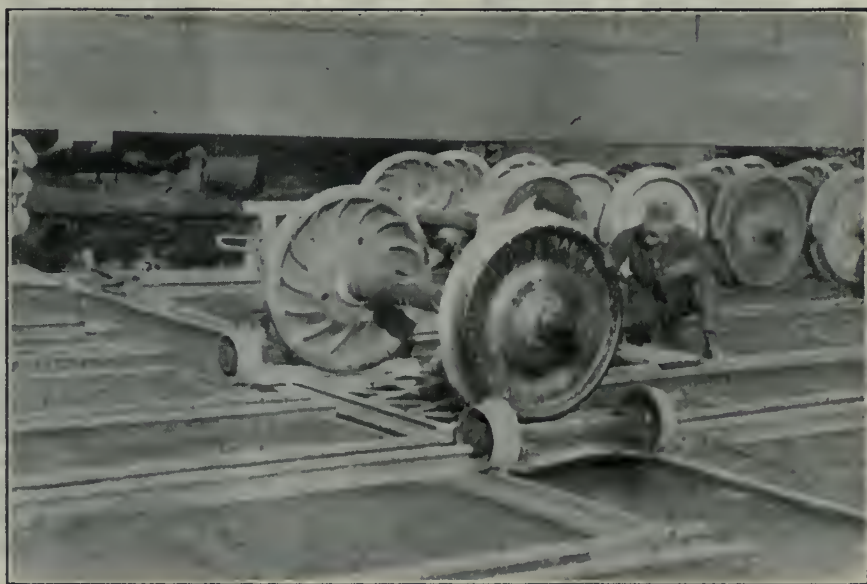
When special machines are to be fitted on ball bearings it is advisable to submit the designs, together with full particulars of the duty, to the ball-bearing makers, when they will suggest the best type and size of bearing for the duty and show same correctly mounted.

One of the most important points for both the designers and users of machinery fitted with ball bearings is to provide and use every care to keep the bearings clean. The result of dirt and grit in a ball bearing means short life; the particles, no matter how small, collect together and cause spinning of the balls. The balls also tend to mount these particles, with the result that either the races themselves burst or the balls become overloaded, but the usual effect is that the balls become sealed on their one hemisphere and the races worn in deep tracks. The ball cages also often fail owing to the skidding of the balls.

CAR WHEEL TRANSFER TRUCKS.

By G. A.

IN the wheel storage yard of the Pennsylvania Railroad, Columbus, Ohio, a transfer truck is in use that saves considerable time and trouble. This truck is shown in the accompanying half-tone runs on a cross-track, so that it can easily be placed opposite the ends of any storage track in the yard. On the body of the truck are two short pieces of rail, so that a set of wheels can be run onto the truck and transferred to any other track in the yard to be used or regrouped as desired.



CAR WHEEL TRANSFER TRUCKS.

Canadian Patents.—The following is a list of Canadian patents recently issued through the agency of Ridout & Maybee, 59 Yonge street, Toronto, from whom further particulars may be obtained: Charles W. Peters, threshing machine; August Vesterling, the filing of records, letters and other documents; George I. Ogden, thermostats; John Brier, fuel vaporizing for internal combustion engines; George A. More, apparatus for indicating and recording variations of water levels in steam boilers; William Say, automatic and folding man-catcher for mechanically propelled vehicles.

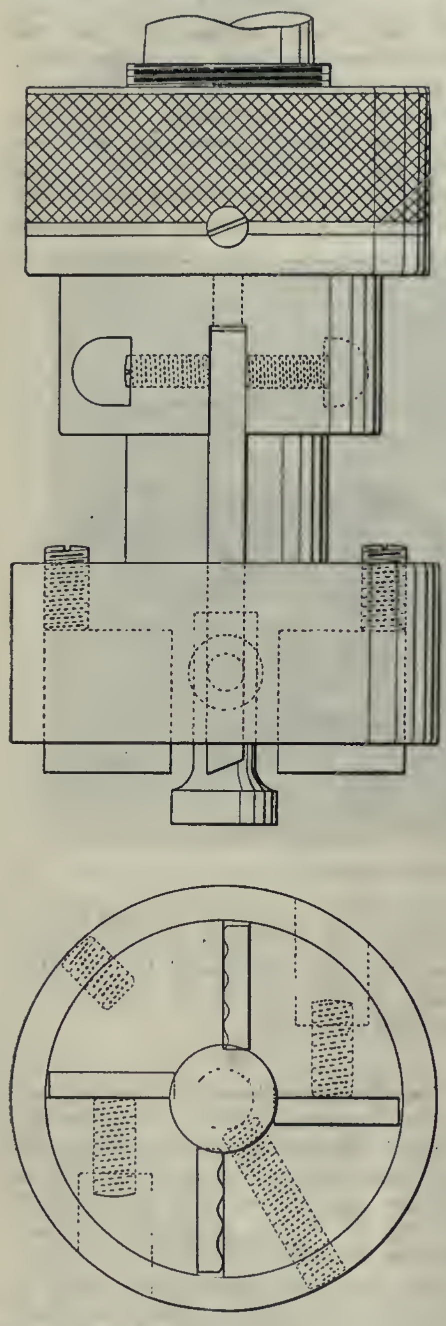
PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

COMPOUND BORING AND FACING TOOLS.

By H. Womersley.

THE counterboring and facing of rough castings uses up more or less expensive tools very rapidly. The tool in the accompanying illustration has shown itself to be a great saver of time and also of cutting tools. The roughing tools are first shaped on the top to a serrated face so that, in sharpening, it is only necessary to grind them on the ends which is an extremely simple operation. The finishing tools require much less grinding and are fastened in a more stationary way.



COMPOUND BORING AND FACING TOOL.

A main spindle passes through the entire tool and terminates in enlargements both top and bottom. In the bottom part are milled four slots, two for the finishing cutters and two for the roughing cutters as shown. These are so cut as to make the cutting edges of the tools radial and, after milling, a ring is shrunk on. The finishing cutters are fastened by locking and adjusting set screws so that adjustment can be made for wear and for equalizing the work.

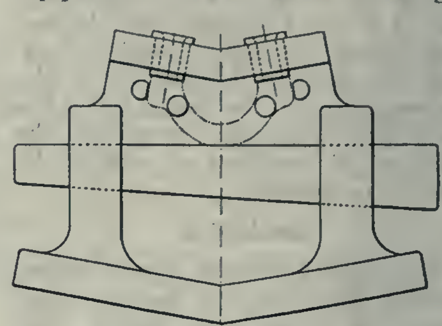
The lower end of the spindle is bored to receive a guide pin which is tapped in the end for a screw to permit the fastening of bushings for different sized holes. This pin is also held in place by set screws. The roughing cutters are movable in their slots and are held fast at their upper ends in the collar as shown by means of screws. These are provided with setting-up screws also, the adjusting nut on top being chambered to clear their heads. The vertical adjustment of the roughing cutters is accomplished by the knurled nut shown on top, and can be quickly and conveniently done. These roughing cutters serve to nick and break the scale, thereby taking the most wearing work off the finishing tools. It is also found much easier to feed the tools when used in conjunction with the breaking cutter, and very wide surfaces can be readily faced by hand with this help.

JIG FOR ANGULAR HOLES.

By James Moore.

A RECENT article in Canadian Machinery illustrating a fixture for drilling holes inclined to each other at different angles has prompted the writer to offer another simpler, if anything, than the one mentioned, but not so suitable in cases where a larger number of holes are to be drilled. The changing of the jig from the position for drilling one hole to that of the other is a very easy matter and, while the example shown represents an extremely simple case, the principle involved can be adopted in a very wide range of work.

The illustration requires no particular explanation. The body is made of cast iron. the two bases being provided with bearing strips and carefully planed to the required angle. The work in this instance. is a bearing cap and is located by the pins as shown, the whole being fastened by the key. There are two holes on each side, and the length of the cap makes it sufficiently stiff to resist any springing effect of the key. The work is placed in from the side, and considerable time can be saved by inserting a stop pin near the small end of the wedge to prevent its falling out each time it is loosened.

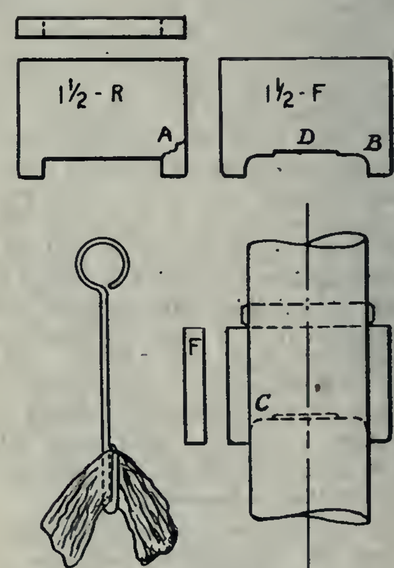


JIG FOR ANGULAR HOLES.

BORING OUT LINE HOLES.

By J. E. Cooley.

WHEN boring out line holes in frames, beds, etc., double-end flat cutters are generally used, as more accurate work is accomplished with this style of cutter than with the single-end type, which cut only on one side of the holes. The latter springs the boring bar and renders the holes out of line.



BORING OUT LINE HOLES.

The double-end flat cutter is considered an expensive tool for the reason that the teeth are easily broken off, the break occurring across the corner at A. If the cutter be rounded in the corners B, and also on the corners of the broach in the boring bar, as at C, the teeth will seldom break off.

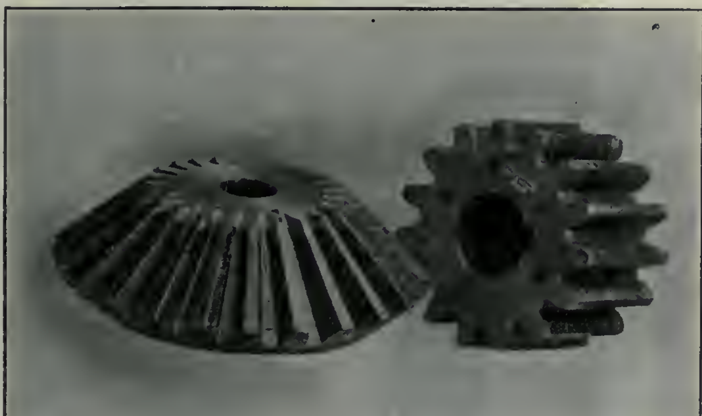
Two sets of cutters are used in boring operations: a roughing and finishing cutter ,designated by the letters R and F stamped on the front, as shown. Sometimes when the cutters have been fastened in the bar, a doubt exists as to which of them have been inserted. If the letters are stamped on the side, as F, they are then easily seen.

A clearance should be made on the cutter, as at D, in order to have it set square in the broach. The broach should be cleaned out each time before the cutter is inserted. A handy tool for this purpose is the swab, having a piece of waste or cloth fastened on the end, as shown.

RAWHIDE PINIONS.

By Chester Hamilton, Junr.*

RAWHIDE pinions are used in a great variety of drives where noise would be objectionable. Their commonest application is on electric motors, but they are also used on a wide range of other machinery. They will operate at much higher pitch-line velocities than all-metal gears.



RAWHIDE PINIONS.

The use of noiseless gear drives is increasing very rapidly. Formerly it seemed to be taken for granted that gears were essentially noisy and the only way to avoid the noise was to avoid the use of gears. This is all changed now. There are three principal ways of securing quietness aside from accuracy of workmanship:

First, by the selection of a fine pitch and providing sufficient strength by the use of high-grade material, such as heat treated alloy steel. Automobile gears are typical of this class, though in their case the very accurate gear cutting is also largely responsible for the quietness.

Second, by the use of helical or double helical gears in which there is a continuous rolling action.

Third, rawhide pinions, along with which are grouped those made of cotton, paper or compressed fibre. The quietness of this class is due to two reasons—the material, on account of its softness, does not transmit vibration or sound, but absorbs it, and the elasticity and slightly yielding nature of the material does not permit it to take up the load suddenly when it comes in contact with the mating tooth. The result is more evident in such a case as a rawhide pinion put to work with a worn-out gear with badly shaped teeth. The sound is in the nature of a throb where it would be a ringing blow if both were metal. When the tooth shape is correct, the rawhide pinion makes practically no noise at all.

First-class materials are essential for durability and strength. There are a number of grades of hide on the market, and some are not very good. Some first-class brands are much over-rated and over-valued by their makers and are accordingly not worth the price asked. The flanges of a rawhide pinion should be of red brass; there being little saved in using poor yellow brass. Steel would be all right, but the cost of machining, including cutting, runs up out of proportion to the value. Cast iron or steel are frequently used on very large pinions, but very seldom on small. The rivets should be of soft Norway or Swedish iron, and be a driving fit in the hole.

Rawhide pinions should be kept dry and free from oil. Most oils and even atmospheric dampness shorten the life of a pinion and reduce its strength. The pinion should be protected and at the same time lubricated with a thick paste made from linseed oil and flake graphite.

Pinions should be designed with flanges of full outside diameter. The omission of flanges or the use of flanges less than the outside diameter is not at all advisable. Such designs are not durable. Shrouds, that is plain flanges put on after the teeth are cut, are of no advantage, are expensive and sometimes cause trouble by interfering with the gear teeth, if gear or pinion becomes shifted sideways. Sometimes a third flange is placed in the middle of the pinion dividing the rawhide into two parts. The object is to increase the strength on heavy drives, but it is of doubtful value, and certainly makes a noisier pinion than plain rawhides. For quiet running, the flanges should never touch the gear, the face of the pinion being increased to twice the flange thickness greater than the face of the gear. If the pinion shaft is free to move endways a short distance, as on a motor, the face of the rawhide between the flanges should be increased by the amount of the travel. It is common to add 1/8 inch to these dimensions so that the flange always clears the gear by 1/16 inch. Pinions of very wide face sometimes have bolts instead of rivets. If the diameter of the pinion is large and the flanges relatively thin, an additional circle of rivets near the bore is occasionally used. In designing small diameter pinions with large bores, care must be taken that there is ample material between the root of the teeth and the rivets.

A rawhide or other built-up pinion should be driven with a key rather than a set screw. The latter applies the power directly to one flange only and causes a twisting of the pinion which tends to tear it apart. Rawhide pinions are generally figured as equal in strength to their cast iron mate; that is, they are a little better than a cast iron pinion. Good fibre is about half as strong.

*Manager, the Hamilton Gear & Machine Co., Toronto.

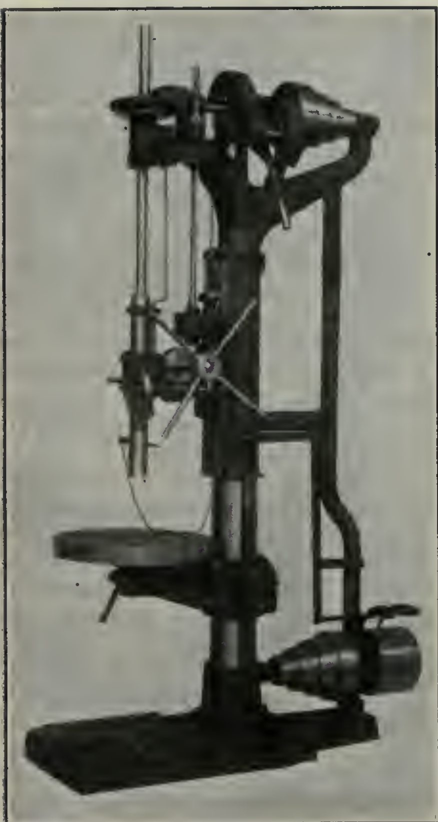
Fuel Economizers.—A paper on the counter current principle as applied to directly fired and to waste heat boilers appears in a recent number of the Journal of the Engineers' Society of Pennsylvania. It discusses at some length the conditions under which fuel economizers should be installed and those under which the use of waste heat boilers is economical. The conclusions drawn by the author, George H. Gibson, of the George H. Gibson Co., New York City, are that economizers can be used profitably regardless of the fuel price and load factor as, if an economizer be not used, the boiler must heat the water up to the evaporation point at a lower efficiency, since it contains water at the temperature of steam, while the economizer utilizes the low initial temperature of the water to increase the heat absorption. Waste heat boilers and turbines should be put in for as high steam pressures as are practical, in view of other considerations, and the boiler should be supplemented by an economizer to obtain the maximum amount of power from a given amount of gases.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

22-INCH SLIDING HEAD DRILL.

THE cut shows the Aurora 22-in. Sliding Head Drill, being a new design brought out by the Aurora Tool Works of Aurora, Indiana. This drill embodies a number of new and es-



22-INCH SLIDING HEAD DRILL.

sential features in drill press construction. The column and base are heavy and well ribbed, and the head, sliding on wide dove-tail ways, is raised and lowered by means of a rack and pinion. The head and spindle are counter weighted.

Back gears and spindle bevel gear are made of a special semi-steel which has a high percentage of manganese and carbon, making a strong gear to resist wear. The spindle is made of ground high carbon steel, and is furnished with a ball-thrust bearing. The table rests on a large flat bearing besides the usual pivot bearing. The spindle bevel gear is 7½ in. in diameter, and its ratio 3 to 1; the back gear ratio being 6 to 1.

The cone pulley carries a 2½ in. belt, and tight and loose pulleys carrying a 3-in. belt, run at 550 r.p.m. The maximum distance between spindle and base is 48 in., and between spindle and table 30 in. The spindle has a No. 4 Morse taper hole, and its traverse is 11 inches. The net weight of the machine is 1350 pounds.

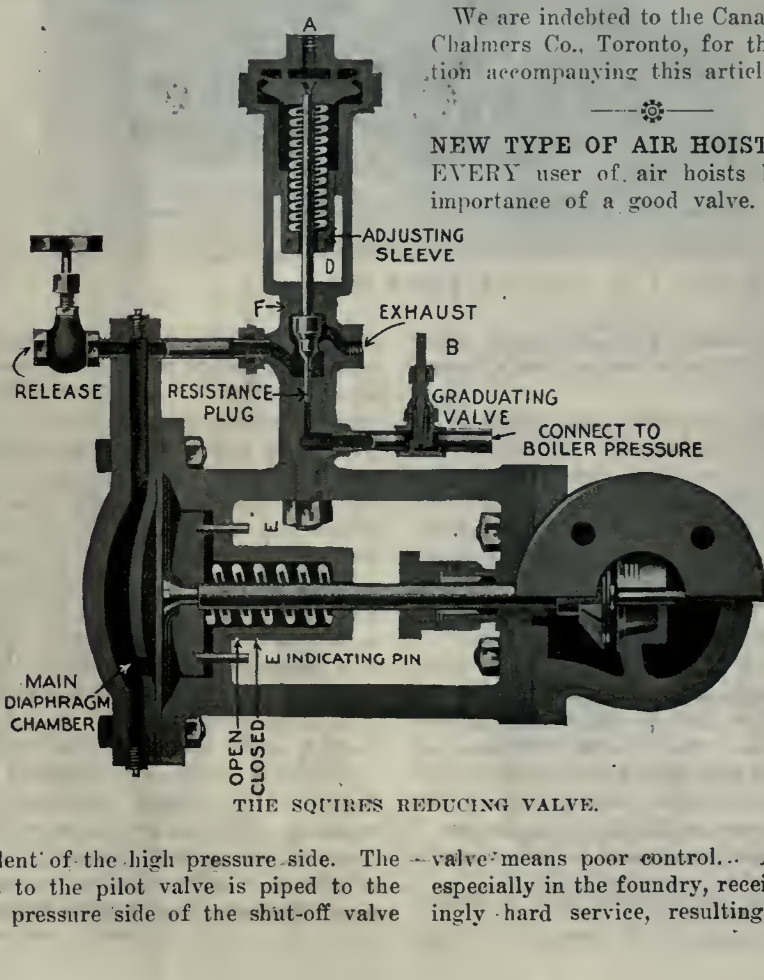
THE SQUIRES REDUCING VALVE.

THE Squires reducing valve, illustrated herewith, has been designed to fulfil any and all conditions required of such an apparatus. The wearing parts are reduced to a minimum, while the valve seats and discs are removable and accessible without disconnecting the body of the valve from the pipe line, by simply undoing the yoke. The valve has a bypass within itself, and by closing the steam inlet valve to the pilot and opening the release valve on the diaphragm chamber, the unit is wide open and bypassed. The main valve is operated by the initial pressure, and as 25 pounds is all that is necessary to entirely close it, there is a reserve that will positively insure against any danger of non-closing through corrosion or a tightly-packed stuffing box.

As shown by the cut, this reducing valve is controlled by a pilot valve and governed by the low pressure side; consequently the delivery pressure is independent of the high pressure side. The inlet to the pilot valve is piped to the high pressure side of the shut-off valve in the line where pressure is to be reduced. Outlet A at top of pilot valve is connected to reduced pressure side. By means of the interchangeable pilot valves, any boiler pressure may be reduced to any lower pressure in one reduction. The operation of the valve is as follows:

Reduced pressure acting on the diaphragm of the pilot valve is balanced by the tension of the spring, which tension is varied by an adjusting nut. If reduced pressure overcome the spring, the pilot valve is seated, steam seeps past the plug of the pilot valve, thereby increasing the pressure on the main diaphragm and decreasing the main valve opening. If reduced pressure be overcome by the spring, the pilot valve is lifted off the seat, and the exhaust port is opened; pressure is reduced on main diaphragm and main valve opens up, allowing more steam to enter the reduced pressure side. There will always be a slight exhaust from the pilot valve, showing that the valve is just off its seat, and a steady pressure maintained on the main diaphragm holds the valve open just enough to maintain the pressure desired.

We are indebted to the Canadian Allis-Chalmers Co., Toronto, for the illustration accompanying this article.



THE SQUIRES REDUCING VALVE.

NEW TYPE OF AIR HOIST VALVE.

EVERY user of air hoists knows the importance of a good valve. A poor valve means poor control. Air hoists, especially in the foundry, receive exceedingly hard service, resulting in leaky valves if not designed properly. With this in mind, the Whiting Foundry Equipment Co., Harvey, Ill., has recently developed a disc valve. Based on years of experience and observation in the manufacture and operation of air hoists, it has naturally proved very satisfactory in actual service.

NEW TYPE OF AIR HOIST VALVE.

The cut herewith shows all parts and also the valve assembled. Working parts consist of a brass disc operating on a cast iron body, the disc being held in place by air pressure and also by coil spring. The valve seat and disc are both ground, insuring an air-tight joint. The valve lever moves through an arc of 45° each way from the central position, making a total movement of 90°. The valve is so designed that the stem does not pass through the air chamber, thus eliminating leakage at this point. The valve cover and disc may be removed without disconnecting the piping, and no packing is used in the valve.

COMPOUND DRILL TABLE.

THE illustration and description refer to a compound table of new design built by the Aurora Tool Works of Aurora, Indiana. This style table can be furnished on 24-in., 26-in., 28-in., 32-in. and 36-in. Aurora drills. The design is unusually rigid, the table and saddle sliding on wide bearings. The working surface on the 24in. and 26-in. machine is 18 in. x 24 in. and has a lateral and longitudinal movement of 15 in. The 28-in. and 32-in. table has a working surface of 22 in. x 28 in., and longitudinal and lateral movement of 17 inches. The 36-in. table has a working surface of 24 in. x 30 in., and a longitudinal and lateral movement of 17 in. The height from top of base to top of table is 20 in. on all sizes.

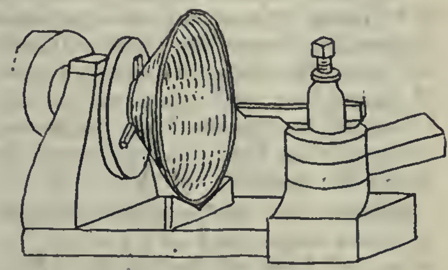

NEW DESIGN AURORA COMPOUND TABLE.

BORING A LARGE CONE.

By A. V. F.

ONE of the great difficulties in machining many pieces is the impossibility of properly supporting the metal against vibration under the action of the cutting tools. A case of this kind is shown in the accompanying illustration, in which a large cast iron funnel, possibly 48 inches across, was being turned out in a lathe which would barely swing it properly.

The only way of holding and driving this was by a flange on the small end, as shown, and it was one of the most uncomfortable jobs to handle that we have had recently. The only support we could give it was in the shape of a large wooden bearing at A, made from a piece of heavy planking, which was cut out into a sort of V of the proper size to help support the work. This not only helped to prevent the overhang working the funnel out of the chuck, but it also assisted greatly in reducing the vibration which interfered seriously with the work.


BORING A LARGE CONE.

It is not claimed that this simple device made it possible to do the best kind of a job, but it helped out when nothing else seemed to be available.

Trading With Enemy Regulations.—An order-in-council has been passed relaxing in a certain degree the regulations against trading with the enemy. It is provided that a transaction not clearly permissible under the recent proclamation would be in the public interest in the case of material necessary for the maintenance of Canadian industries, and that a license may be issued on behalf of his Majesty permitting such a transaction. It is recommended as an instance that the Minister of Customs be authorized to issue licenses permitting a manufacturer using magnetite to trade with enemy wherever it is established that the materials are necessary for the maintenance of such industries.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

Question.—A load of 1,600 pounds is to be raised by a wedge, which is pulled forward by a screw having four threads per inch. The wedge is 6 inches high by 12 inches long, and the screw is fitted with a handle 10 inches long. Neglecting friction, what force is required at the end of the handle?

Answer.—The wedge moving forward 12 inches raises the load 6 inches. The necessary force on the wedge is then

$$\frac{1600 \times 6}{12} = 800 \text{ pounds.}$$

The circumference of a circle whose radius is 10 inches = 62.832 inches. While the power moves through 62.832 inches, the load moves ¼ inch. The required power is therefore,

$$\frac{800}{62.832} \times \frac{1}{4} = 3.18 \text{ pounds.}$$

* * *

Question.—What pull would be required on a block and tackle containing one fixed and one movable double block in order to raise 820 pounds?

Answer.—The raising of the load one foot requires the shortening of four ropes by that amount, or the power moves four times as far as the load. The pull required, then, is

$$\frac{820}{4} = 205 \text{ pounds.}$$

* * *

Question.—In the above example, if the friction of the mechanism be assumed to be 24 per cent. of the load lifted, what will be the force required and what will be the efficiency?

Answer.—Friction load $= \frac{24}{100}$ of $820 =$ 196.8 pounds.

Total load = 820 + 196.8 = 1016.8 pounds.

Force required to lift this would be

$$\frac{1016.8}{4} = 254.2 \text{ pounds.}$$

Efficiency = ratio of power input to work output,

$$= \frac{205}{254.2} = 80.6 \text{ per cent.}$$

* * *

Question.—A boiler weighs 2½ tons, and contains 2½ tons of water. If the whole be raised from freezing to the boiling point, what amount of heat will be required? What per cent. of this will be required by the boiler alone?

Answer.—The specific heat of water is 1 und of steel .1165. The freezing temperature is 32 degs. and boiling temperature is 212 degs. Difference is 180 degs. British thermal units required to raise 5,000 pounds of water 180 degrees, $= 5{,}000 \times 180 \times 1 = 900{,}000$ B.T.U.

Heat units required to raise 5,000 pounds of steel 180 degrees $= 180 \times 5{,}000 \times .1165 = 104{,}850$.

Total heat required $= 900{,}000 + 104{,}850 = 1{,}004{,}850$ B.T.U.

The proportion of the heat required by the boiler is $\frac{104{,}850}{1{,}004{,}850} = 10.43\%$, or about one-tenth.

* * *

Question.—How many pounds of coal would be required to heat the air in a building 70×100×40 feet high from ten below zero to 70 degrees F., neglecting radiation?

Answer.—The number of cubic feet of air is $70 \times 100 \times 40 = 280{,}000$. This amount of air weighs $280{,}000 \times .083 =$ 23,240 pounds.

Specific heat of air under constant pressure is .2375.

Heat units required to raise 23,240 pounds of air 190 degrees $= 23{,}240 \times 190 \times .2375$.

$= 1{,}048{,}705$ B.T.U.

Average good coal will give 14,000 B.T.U. per pound.

Amount of coal required, then, is

$$\frac{1{,}048{,}705}{14{,}000} = 74.9 \text{ pounds.}$$

If the boiler efficiency were 60%, the actual coal required would be $\frac{74.9}{60} \times 100$ $= 124.8$ pounds.

* * *

Question.—A crane hook is fastened by a 1-inch pin, which passes through the eye. Assuming that the hook will give way by the shearing of the pin, what load could be lifted?

Answer.—Shearing area of a 1-inch steel bar is $1 \times 1 \times .7854 = .7854$ sq. in. Shearing strength of steel = 50,000 pounds per square inch.

As the pin is in double shear, the load necessary to rupture it would be $.7854 \times 50{,}000 \times 2$.

$= 78{,}540$ pounds, or about 39 tons.

* * *

Question.—The longitudinal seam of a boiler is double riveted with ¾-inch rivets spaced at 3 inches. The plate is ½-inch thick. What is the efficiency of a joint with double butt straps?

Answer.—A strip of plate ½ x 3 inches has an area of 1.5 square inches. This will sustain a tensile stress of $60{,}000 \times 1.5 = 90{,}000$ pounds. The space of 3 inches is sustained by 2 rivets. Shearing area of a ¾-inch rivet $= .75 \times .75 \times .7854 = .4418$ sq. in., or $.4418 \times 2 = .8836$ sq. in. for 2 rivets.

Shearing strength of mild steel = 50,000 pounds per sq. inch, and the rivets are in double shear. The strength, then, is $.8836 \times 50{,}000 \times 2 = 88{,}360$ pounds.

The efficiency of the joint as far as rivets are concerned would be $\frac{88{,}360}{90{,}000}$ $= 98$ per cent.

The plate, however, is weaker in another way. In every 3 inches, .75 inch is cut out for the rivet hole. This leaves 2.25 inch of good plate. The real efficiency, then, is

$$\frac{2.25}{3} = .75 \text{ per cent.}$$

* * *

Question.—A ten-inch solid steel shaft is fitted with a solid flanged coupling. The bolt circle is 18 inches in diameter and the bolts are 1½ inches in diameter. How many bolts would be required to sustain the full power of the shaft?

Answer.—The twisting moment, which may be sustained by a solid shaft is

$$M = \frac{3.1416 d^3 S}{16}$$

where S = the shearing strength of the material = 50,000 pounds per square inch. d = diameter = 10 inches.

$$M = \frac{3.1416 \times 1000 \times 50000}{16} = 9{,}817{,}500$$

inch pounds.

The radius of the bolt circle is $\frac{18}{2}$ $= 9$ inches.

Shearing strength required of the bolts then is $\frac{9{,}817{,}500}{9} = 1{,}090{,}833$ pounds.

Shearing area of a 1½-inch bolt is $1.5 \times 1.5 \times .7854 = 1.767$ sq. in. At 50,000 pounds per square inch, this represents 88,350 pounds.

The number of bolts required is,

$$\frac{1{,}090{,}833}{88{,}350} = 12.34, \text{ say, } 12 \text{ bolts.}$$

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Vol. XII. NOVEMBER 19, 1914 No. 21

PRINCIPAL CONTENTS:

DEVELOPING CANADIAN TRADE AT HOME AND ABROAD.

AMONG many other things we in Canada, as a result of this All-European War, have had most forcibly impressed upon us are the ramifications and the every individual magnitude of Germany's industrial and commercial enterprise. It seems to have been reserved to this time of tragedy and hellish destruction for business interests in their every feature to awaken to a realization of having assiduously cultivated a self-imposed contentment of effort in the matter both of developing home markets and in seeking a rightful portion of those available beyond their own borders.

Canada, of course, does not lack company in the present circumstances, and good company too, for have not both Great Britain and the United States been equally remiss. Germany has not only forestalled and largely supplanted all three of them in the world's markets, but has more or less succeeded in establishing herself as a competitor to be reckoned with for their domestic requirements. Statistics now being ground out from the mills of Government departmental officialdom are, it seems to us, likely to be of little real import and assistance in capturing even a trifle of that trade and commerce which they so realistically portray as having been acquired by Germany. Our own apple tree we can shake, even if the apples be out of reach, but to possess from the tree of statistics we must climb, and to the latter we are unaccustomed.

It has been urged that "the need of Canada to-day is a Kaiser who would insist on technical education and see that our people's efforts were intelligently inspired and directed." What is implied in this statement is not very clear; we think, however, it is a question of second thoughts being best, and one of those statements that had better been left unuttered. We in Canada neither need nor want a Kaiser to direct our education, our industry, our trade and our commerce, but we do need a broadening of the scope of the interests of our business and public men. To go a step further, all of us move too much within our own little world, with the result that the major portion of our nature and being and, more often than not, the best part of it, is in a state of total eclipse.

It may be claimed that this is a day of specialization and that whole-hearted concentration is necessary to insure success in what we undertake. This we do not dispute, but the specialization that so engrosses our attention as to make us operate as independent units can never be a factor in our national upbuilding. The architect, the bricklayer, the carpenter, etc., are each specialists working for their own welfare and well-being, but incidentally co-operating in the common purpose of rearing a structure not only creditable to themselves but to the community and to the nation in general.

Doesn't it strike you that this co-operative spirit is woefully lacking when it comes to fitting our particular specialty to the national structure? Isn't there too much of a disposition abroad for us to shake the tree of business opportunity or at best only to stretch ourselves in order to grasp what appears possible of being easily reached? There is neither lack in numbers nor lack in intelligence and pre-eminence of gifts among those who have organized and who direct the wide variety of industrial enterprises within our borders, but there is a lack of unity of purpose to foster and establish the demand for our products in other countries.

This failing is individual and personal, and although impregnable to technical education, let the latter be ever so desirable, it is amenable to reason and can therefore be overcome. We have been too long accustomed to the enjoyment of both national and individual freedom on this North American Continent, to take in anywise kindly to even a Canadian Kaiser dominating and intelligently inspiring and directing our efforts, however well-intentioned he might be.

Many doors of opportunity are reckoned as being available to our enterprise as a result of the European War, but, to avail ourselves of them, concerted action and concentration of purpose, national instead of individual, alone will ensure successful accomplishment. German statesmen, politicians, bankers and manufacturers put their country's development at home and influence abroad well ahead of every other consideration. What Germany achieved is also possible to Canada.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 40
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X......	18 00	17 00
Victoria, No. 2 Plain..	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal.	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 50
Copper, crucible	10 00	9 50
Copper, unch-bled, heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	10 75	8 50
No. 1 compos'n turnings	8 50	8 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings ...	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws....	75 & 5
Stove bolts	80 & 7½
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4½c per lb. off
Nuts, Hexagon, all sizes.	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh ...	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh..........	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload ..	$13 00	$13 00
Electrolytic copper	12 75	13 00
Castings copper	12 50	12 75
Spelter	5 60	5 50
Tin	36 00	35 50
Lead	4 60	4 50
Antimony	16 00	16 00
Aluminum	20 00	21 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	....
7 in	2.38	7 in	3.81	....	....
8 in	2.50	8 in	4.34	....	....
8 in	2.88	9 in	4.90	....	....
9 in	3.45	10 in	5.48	....	....
10 in	3.20	....	....	....	....
10 in	3.50	....	....	....	....
10 in	4.12	....	....	....	....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect July 2, 1914:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in...	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ..	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	18½
Benzine, single bbls., per gal.	18½
Pure turpentine, single bbls.	0.67
Linseed oil, raw, single bbls.	0.54
Linseed oil, boiled, single bbls.	0.57
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Dia. In.	Grade 1	Grade 2	Grade 3
49/64 to 1½-in.	37.50	30.00	17.50
33/64 to ¾-in.	41.25	33.00	19.25
7/16 to ½-in.	45.00	36.00	21.00
0.178 to 0.4218	56.25	45.00	26.25
0.125 to 0.175	62.25	49.80	29.05
0.101 to 0.120	67.50	54.00	31.50

Prices in cents per pound are quoted for the different grades.

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	65
Carbon over 1½ in.	25
High Speed	25
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50% & 10%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents.
XXX extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 08¾
X Press	0 07¾
COLORED.	
Lion	0 07
Standard	0 06¼
Popular	0 05½
Keen	0 05
PACKING.	
Arrow	0 15
Anchor	0 06
Anvil	0 07½
Axle	0 09
WASHED WIPERS.	
Select white	0 06
Light colored	0 06½
Dark colored	0 05

Prices per lb.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Nov. 16, 1914.—The general situation which is much the same as has existed for some time back, and very little change is anticipated while the war lasts. The present volume of business moving seems to be about an average of what can be expected with the winter ahead of us. The business policy of many of the large firms, of making use of the present dull period to improve their systems of production and to install new equipment to replace older machines, is a wise one. Many of our manufactured articles have been costing too much to produce and the remedy will no doubt result from the above action.

The Steel Market.

The situation in the steel market remains unchanged. The steel shells that the Government have on order throughout the country continue to furnish a certain amount of work for many plants. Prices of material have hardly changed.

Pig Iron.

Pig iron seems to be very dull indeed. There is very little demand for pig. The importation of British pig has fallen off greatly of late on account of the small amount of business moving. Until foundries begin to run on full time again and the improvement in business arrives, the pig iron trade will be undoubtedly small.

Machine Tools.

The volume of business in machine tools seems to be about the same. It is perhaps a trifle better than during the previous few weeks. A great deal of repair work is being done at the present time, the manufacturers taking advantage of the present quiet period to carry out these repairs, that the press of business had for so long delayed. The supply business is also holding out well. Small orders are, of course, in evidence, but they come frequently.

Metals.

In the metal market there have been many fluctuations, the governing factors constantly undergoing more or less change. Copper has a tendency to weaken, while lead appears to be a little stronger this week. The trade in spelter has increased some, and this has had a tendency to increase the price. Business in other metals is only nominal and prices have not changed; a rather small amount of business only passing.

Toronto, Ont., Nov. 17, 1914.—There is little change to be noted in industrial conditions this week, except perhaps that the outlook is brighter in consequence of the large orders for war equipment and supplies which continue to be placed by the British Government. People are becoming more accustomed to the "state of war" conditions and are less apprehensive of any further adverse effect on trade. The fact that so much new business has been given to Canadian factories has instilled a feeling of confidence in business circles and will, in addition, mean the distribution of considerable sums of money. The belief that Canada will eventually benefit by a large increase in manufacturing has also helped to allay fears of any serious setback to industrial progress of the Dominion. The present check will, when hostilities cease, give way to increased prosperity.

That the condition of the country is sound both financially and industrially, has been proved by recent events. If it had been otherwise, the crisis would not have been weathered in such a satisfactory manner. There is little evidence of any very serious dislocation in trade or finance. Money is still tight and some industries, particularly the steel trade and machinery manufacturers, are quiet. On the other hand, textile and knitting mills, pulp and paper mills and factories making leather products are all very busy, while, for the basic industry, agriculture, the outlook was never better. As the result of all this activity, millions of dollars will be added to the wealth of the country.

An interesting feature of recent date to be noted is the opening of the Massey-Harris plant at Brantford and a similar move on the part of the Canadian Furniture Manufacturers who are re-opening several of their plants in this province. The Massey-Harris Co., announce that their Toronto plant will be re-opened shortly. This is good news, as it indicates a revival in trade as well as giving employment to many hands.

Steel Market.

There is little, if any, improvement this week in the iron and steel trades. Business on the whole is dull and there seems to be little prospect of any betterment in the immediate future. The improvement noted in some industries may eventually benefit the steel trade in the event of plant extensions being found necessary; at present, however, there is no indication of such requirements. The building trade is dull and appears likely to remain in this condition for some months. The returns of building permits issued for the month of October show a marked decrease in value as compared with the corresponding month of last year.

There have been no price changes this week and the market in this respect is firm. Bars, plates and shapes are quoted as low as $1.10 f.o.b. Pittsburg, but locally $1.15 is nearer the figure, except perhaps for large tonnages, when this price would probably be shaded. A better feeling dominates the situation in the States, which is believed to indicate a gradual return to more prosperous conditions. The report that the British Government has placed an embargo on shipments of ferro-manganese has been confirmed. If this prohibition is of long duration, a difficult situation will result.

Pig Iron.

The pig iron market is quiet and prices are unchanged. The demand is light, as foundries and manufacturing interests are generally working on reduced capacity. The Steel Company of Canada announce that they will blow in a furnace at their Hamilton plant on November 20. This is welcome news and indicates a revival of business.

Machine Tools.

The machine tool market is still very quiet and dealers report few enquiries. The demand for new tools has fallen off considerably the last few months and it is hardly probable that there will be a resumption of buying until industrial conditions improve materially. There is a tendency to buy second-hand tools in preference to new machines, but even in this line there is not much activity. There is a light but steady demand for machine shop and mill supplies, orders being generally for small lots.

Metals.

There are no changes in the metal markets this week and business is quiet, consumers buying only to cover immediate requirements. Tin is firm but unchanged. Copper is steadier with an improved situation. Spelter and lead are steady and are showing a stronger tendency. The New York Metal Exchange opened on November 9 for trading in tin, lead and spelter.

Trade Gossip

Woodstock, Ont.—The Bain Wagon Co. has just completed the manufacture of 2,000 wagons for the British Army and the firm expect to make shipment this week.

Ontario Labor Conditions—Hon. T. W. Crothers, Minister of Labor, has received a report on labor conditions in Ontario, which is part of a Dominion-wide investigation which he has been conducting. The Ontario survey, which will be continued at intervals all winter, was made by E. W. Compton, fair wage officer for Ontario. The report is of an exceedingly encouraging nature and shows that outside of the larger industrial centres, such as Toronto and Hamilton, unemployment is slight; many smaller cities and towns report conditions normal. In most of the industrial towns of Ontario the situation is apparently no worse, if it is as bad, as during the depression of 1907. One encouraging feature of the situation is the manner in which the Ontario municipalities are self-reliantly preparing to meet the unemployment problem and to care for their own. There are no signs of downheartedness. Mr. Compton says that in Toronto there are eighteen thousand reported out of work and, of these, two thousand are carpenters, with another two thousand members of allied building trades. The remainder are largely factory employees. He reports some fifteen hundred Austrians and Germans out of work. Conditions in Toronto will be relieved by contemplated public works.

Electrical Firm Ordered Wound Up—An order winding up Chapman & Walker, dealers in electrical and gas fixtures and machinery, Richmond St., Toronto, was made by Mr. Justice Middleton at Osgoode Hall, Toronto on Nov. 10. The General Electric Co., of London, England, the petitioners upon whose application the order is made, claim £1,108 upon acceptance by Chapman & Walker payable to the petitioners, and £1,000 upon goods which have been made upon the order of Chapman & Walker, but which have not been shipped. The petitioners have also entered action to recover $76,100 alleged due upon seven debentures issued by Chapman & Walker to cover advances made by the General Electric Co. since March 23rd last. The Sterling Telephone & Electric Co., of London, England, is plaintiff in an action the Guarantee Company of North America to recover $10,000 alleged due under a guaranty of drafts and acceptances by Chapman & Walker for goods sold and delivered. The Northern Electric Co. has entered suit against Chapman & Walker to recover $1,415.25 alleged due for goods sold and delivered. The company, now placed in liquidation was incorporated in April, 1909, with a nominal capital of $50,000, which was increased later to $150,000. Its head office is in Toronto, and it has a branch in Vancouver. The company assigned on November 3rd to Malcolm Hugh Robinson, who will be the interim liquidator. There will be a reference to the Master-in-ordinary. Leave is given to other creditors to intervene if the liquidation proceedings are not carried on properly.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

CANADIAN TRADE RESTRICTED BY WAR.

STATISTICS of Canadian trade for September, as just published by the Department of Trade and Commerce, show the effect of war conditions in restricting both imports and exports. Imports of merchandise for the second month of the war totaled $36,567,572, a decrease of $17,772,985, or about 33 per cent., as compared with September of last year. Exports of Canadian produce for the month totaled $31,769,613, a decrease of $5,251,832, or about 15 per cent. Exports of foreign produce, however, which totaled $8,747,481, increased by nearly five millions, as compared with September of last year. The greatest falling off in exports was in agricultural produce, which totaled only $7,478,798 for the month.

Manufactures Exported Last Year.

As compared with $11,829,772 for the preceding September, exports of manufactures, despite the war, held to the level of last year, the totals being $5,188,314 for last September, and $5,041,465 for the corresponding month of last year.

Import of Bullion.

During the month $15,885,221 in coin and bullion was brought into Canada, the great bulk of it, of course, being for Bank of England account under the arrangement made for settling gold debts due the bank from the United States by transfer in trust to Ottawa.

While detailed figures of October trade are not yet available, it is understood that the percentage of decline in both imports and exports noted in September was maintained.

Year's Trade Below Billion.

The twelve months' figures, ending with October, show that the total trade of Canada has again got below the billion-dollar mark, which was passed on the up-grade some two years ago. The shrinkage in customs revenue during the past twelve months has been nearly thirty million dollars.

IRON MINES OF NEWFOUNDLAND.

By B. Bugden.

EIGHTEEN miles from St. John's, and a short distance from the mainland in Conception Bay, is situated Bell Island, which from point of mineral production ranks high among .the world's richest iron deposits. This island,, which is closely associated with two smaller ones, is six miles long by two miles wide, or, in other words, covers an area of about 12 square miles. Here is to be found Newfoundland's leading red hematite iron production centre.

A remarkable feature about the Bell Island mines is that their existence was discovered by accident rather than by design. Somewhere about twenty-three years ago, so the story runs, a fisherman in setting out in his smack for St. John's, ballasted his boat with lumps of reddish rock that lay on the strand of the island. When unloading these at a wharf in St. John's, an Englishman at the next pier saw that it seemed to be highly mineralized. He took a portion of it across the Atlantic with him and had its value determined. This was in 1891 and, for the property, the original owners are said to have received the insignificant sum of $120,000.

The Nova Scotia Steel and Coal Co. began operations in 1895, and four years later, holding the upper bed with contents of about 6,000,000 tons, sold the lower bed of about 28,000,000 tons to the Dominion Iron and Steel Co. for $1,000,000. Since that time both companies have vigorously operated, and each takes out fully 500,000 tons of ore every year.

The mineral is very cheaply mined and handled. By exploding small charges of dynamite, it is made free for loading into cars, carrying one ton each, while an endless steel cable conveys it to up-to-date shipping piers about eight furlongs distant, where enormous pockets receive the material and transfer it at the desired time to the holds of 10,000-ton ships which lie below, 24 feet of water prevailing at the pier head. So perfect also are the loading appliances that it is not uncommon for 7,000 tons of this ore to be put on board a steamer in four or five hours. Most of the Dominion Steel Co. ore goes to its smelters at Sydney, Cape Breton, while that of the Nova Scotia Steel and Coal Co. to various markets in Europe and America. The pig iron and steel produced at the Dominion Company's Sydney works is in large demand all over Canada.

The properties are known as the Wabana Iron Mines, and contain a number of seams of red hematite ore. The great seams all outcrop on the north of the island, and extensive prospecting has proved that the surface ore is but an infinitesimal portion of the great deposits which extend far under the sea. Stopes driven into these deposits have shown that they extend uninterruptedly for at least 7,000 feet from the shore, and experts who have gone over the properties have estimated that they contain hundreds of millions of tons of this high-class ore, which from point of benefit to mankind in his several necessities, constructive and otherwise, ranks among silver and gold.

The ore has a bright, metallic lustre. It is non-bessemer, and when dried containes 48 to 56 per cent. metallic iron, 8 to 15 per cent. silica, and 0.7 to 0.9 per cent .phosphorous. It possesses a remarkable rhombohedral cleavage, breaking into blocks about 5 inches square, therefore requiring very little crushing before use in the furnaces. Professor Howley has estimated that, including all the ore bands now known to exist on Bell Island, the entire deposit, submarine and above water ,contains the enormous total of 3,635,543,360 tons, observing at the same time that "the amount recoverable will largely depend upon the conditions met with, the engineering skill to cope with difficulties that may present themselves, and the adequacy of the machinery employed to keep the mine dry and fully ventilated."

It by no means follows that these deposits at Bell Island are the only ones of the kind in Newfoundland. On the contrary, some other very promising iron prospects are known to exist on the West Coast, but for various reasons their development has not been undertaken. Of late, the British Government has been keenly desirous of learning of the discovery of other similar ore beds in Newfoundland, as the iron ore resources of many parts of Europe are diminishing. The supply of hematite from the Spanish mines near Bilbao is falling off, and the deposits near Narvak, on the north of Sweden, are, it is feared, likely to fall into the hands of competitors of the British Empire. Under these circumstances, it looks as if there is a splendid opportunity now ahead for enterprising mining capitalists and prospectors to devote themselves to the iron ore resources of Newfoundland.

CANADIAN CAR & FOUNDRY CO.

OFFICIAL announcement of the deferring of the dividend on Canadian Car & Foundry Co.'s $7,000,000 preferred stock, as anticipated, has been made following a recent meeting of the board of directors. A statement of the reasons which prompted the action was issued by the board:

"The directors beg to inform the shareholders that the financial situation and business depression caused by the war make it necessary to defer paying dividends until conditions improve.

"When war was declared, the company was negotiating for the sale of a very large quantity of equipment, the work of which would have kept our plants busy for many months. We had reason to expect satisfactorily to complete the transactions. The war, however, not only prevented the railway companies from obtaining funds for capital expenditures, but has further depressed trade and, while this depression lasts, the purchases by the railways of new equipment in any large volume will be very uncertain.

"In view of these adverse conditions, the directors feel it their duty to conserve the company's resources by withholding the payment of dividends from previous surplus account, believing that any different action would be condemned by the shareholders.

"The directors call the attention of the preference shareholders to the fact that dividends on their shares are cumulative and must be fully paid before any further dividends can be paid on the common shares. They also inform the shareholders that the various plants of the company and its subsidiaries have been maintained, and are now, in a full state of efficiency, and will be kept properly prepared for any work which may develop."

TORONTO HARBOR IMPROVEMENTS.

ONE season's work by the Harbor Commission on their elaborate programme of harbor improvement on the water front shows satisfactory results. From the mouth of the Humber eastward over 2,700 feet of crib work has been laid and weighted with stone. All that is to be seen, however, is the framework sticking out of the water, but underneath is the foundation for the new seawall, which will extend practically along the whole waterfront. Next spring the commission expects to commence the work of filling in on the lake shore in readiness to complete the water lane for pleasure craft, and diverting the old Lake Shore road, allowing for an 86-foot radial entrance. From the east about one thousand feet of cribwork has been constructed, which means that approximately one-third of the foundations for the seawall is finished. The central section will be built into wharfages and further east reservations for parks are made. The Don diversion at the foot of Leslie street is practically completed. The work of reclaiming Ashbridge's Bay is also well underway. The powerful hydraulic dredge Cyclone being engaged in dredging commercial routes in the bay.

Work will continue right up till the bay is frozen over, after which it is the intention of the commissioners to proceed with the pick and shovel work as much as possible in order to help out the unemployed situation. It is expected 200 men will be kept going all winter.

CANADA'S WINTER PORTS.

ON account of the important part the ports of Halifax and St. John will play this winter in connection with Canada's military activities, special precautions are being taken by the Marine Department to ensure safety of navigation at these points. J. G. McPhail, commissioner of lights, left for Halifax on November 10, to see that lights, buoys and other navigation aids at the winter ports are kept in proper order. This work is generally left to the departments's agent at Halifax, but it is decided to take special precautions this season.

The Naval Service Department is chartering a number of sea-going tugs for patrol duty on the Atlantic coast during the winter months. Vessels of ten-knot speed and about 150 feet length are being advertised for.

MUCH POWER EXPORTED.

THAT more of the immense electrical development of Canada is exported from the country than is used at home is shown by figures just compiled by the Government dealing with electrical inspection. The production, export, and domestic supply of the principal companies on the basis of kilowatt hours are:

	For Export.	Home Use.
Can. Niagara Co.	400,214,908	11,420,020
Electrical Dev. Co.	42,154,000	191,885,670
Ontario Power Co.	282,123,004	412,597,896
Ontario Minn. Co.	21,649,327	868,856
Western Canada Co.	23,213,891	39,339,239

The total production of electrical power last year was 1,543,464,097 kilowatt hours, of which 772,597,049 was exported from and 770,867,048 used in Canada.

CONCERNING A DELIVERY PENALTY CLAUSE.

BECAUSE they failed to deliver certain machinery to the Canadian Rubber Co. by the time called in their contract, in which a penalty clause was inserted, the Canadian General Electric Co. have lost $14,500 by a judgment delivered in the Court of Review. The amount in question covers a delay of more than a year at $25 a day. In appealing to the Court of Review from the judgment given by Mr. Justice Charbonneau of the Superior Court, counsel for the Canadian General Electric Co., claimed the contract in question had been withheld from them until it was too late to fulfil its conditions, and that therefore Mr. Justice Charbonneau's judgment should be set aside by the Court of Review. Their Lordships Tellier, Greenshields and Delorimer, sitting in the latter court, upheld the decision given by Mr. Justice Charbonneau, adding that the acceptance of the contract by the Canadian Rubber Co. and their attempt to fulfil it implied acceptance of all its terms.

DOMINION STEEL CORPORATION EARNINGS.

NET earnings of $694,084, after allowance for depreciation, sinking funds, etc., and payment of fixed charges, are reported by Dominion Steel Corporation for the six months ended September 30.

The statement is the first half-yearly report to be submitted by the corporation, but comparisons are possible through the medium of the quarterly statements issued in 1913-14. In that year the corporation reported net available for dividends of $705,263 in the first quarter, and $843,640 in the second, or a total of $1,548,903, against the $694,084 shown in the half-yearly statement, covering the same period, now issued by the corporation. The decrease of $854,819, or about 55 per cent., may be taken as a fair index of the depression against which the steel manufacturers have been struggling.

While the corporation maintained the dividend on its own preference stock and on the preferred stock of the Dominion Coal Co., the preferred dividend of the Dominion Steel Company was deferred. In view of this, it is interesting to note that despite the poor showing in respect to earnings, the preferred dividend of the Steel Company was earned, if not paid.

The preference and preferred dividends in all require a sum of $490,000 for a half year, and earnings of $694,084 were, therefore, sufficient to have made all preferred stock payments and left a balance of $204,084. By withholding the preferred dividend of the Steel Company, the corporation was able to carry forward out of the half-year's earnings a sum of $379,084 to add to the previous balance at credit of profit and loss, bringing that account up to $1,175,991. That is, more was added to profit and loss than was paid out in dividends.

So far as the common stock is concerned, the statement, of course, cannot be considered in a very cheerful light. Had all the preferred dividends been paid, the balance remaining out of earnings; namely, $204,084, would have been equal to about .65 of 1 per cent. earned on the $32,000,000 common, or at the rate of 1.3 per cent. for a year.

The official statement of earnings, given below, is preceded by the following statement from the directors:

"The directors of the Dominion Steel Corporation, Limited, present the audited statement of the results of the operations for the half year ended September 30, 1914, of the corporation and its subsidiary companies. All inventories and accounts receivable have been carefully reviewed with reference to the financial and trade conditions now existing, and the special provisions which have been deemed necessary on account thereof have been charged against the operations of the half year."

The consolidated profit and loss account for the six months ended September 30, 1914, is as follows:

Net earnings, after deducting all manufacturing, selling and administrative expenses and special provisions against inventories and accounts receivable, but before charging provision for sinking funds and depreciation and interest		$2,106,771
Deduct—		
Provision for sinking funds, exhaustion of minerals and depreciation		484,704
		$1,622,066
Deduct also—		
Interest on bonds and loans	$853,290	
Proportion of discount on bonds and notes sold	74,691	
		927,982
Net earnings		$ 694,084
Add—		
Balance at April 1, 1914		796,907
		$1,490,991
Less—Dividends paid—		
On preference shares	$210,000	
On preferred stock of Coal Company	105,000	
		315,000
Balance Sept. 30, 1914		$1,175,991

Newfoundland.—All railway traffic going east or west was tied up for a couple of days recently due to a landslide of earth, trees and rock which piled to a considerable depth for four rails length at a point three miles east of Humbermouth, Bay of Islands. This particular section of the road runs below towering precipices, and it was fortunate no train was passing at the time, otherwise an accident would have occurred, for at this period of the year large quantities of freight and many passengers are being conveyed to and from the City of St. John's previous to the close of navigation. It took 100 men upwards of twenty-four hours to clear away the debris. Heavy rains were the cause.

Canadian Commercial Intelligence Service

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS

Argentine Republic.

H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.

D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Cancoma.

British West Indies.

E. H. S. Flood, Bridgetown, Barbados, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.

J. W. Ross, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.

Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.

Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

Japan.

G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.

J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.

W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.

W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.

W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.

E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.

J. E. Ray, Central House, Birmingham. Cable address, Canadian.

Acting Trade Commissioner, North British Building, East Parade, Leeds. Cable address, Canadian.

F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.

Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Canacom.

Harrison Watson, 72 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.

Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Nassau, Bahamas.

Colombia.

A. E. Beckwith, c-o Tracey Hmoa, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.

C. E. Sontum, Grubbeged No. 4, Christiana, Norway. Cable address, Sontums.

South Africa.

D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.

E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.

W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Montreal, Que.—The Ogdensburg Coal & Towing Co. will erect a large steel and concrete pocket at Westmount.

Medicine Hat, Alta.—The Alberta Linseed Oil Mills Co., are in the market for machinery for their linseed oil plant.

Quebec, Que.—The Quebec Railway, Light, Heat & Power Co. have plans under consideration for the development of additional power.

Edmonton, Alta. — The Edmonton, Dunvegan & B. C. Railway Co., are contemplating the construction of a power house and machine shop at St. Albert's Trail, at an estimated cost of $8,000.

Wallaceburg, Ont.—The Dominion Glass Co. are installing a new 3-cylinder horizontal gas engine in their factory. It was supplied by the Premier Gas Engine Co., of Sandiacre, England.

Fort George, B.C.—The Main Hotel was destroyed by fire on Nov. 14, and the power plant of the hotel which supplied the town with light and power was badly damaged. The loss is estimated at $150,000.

New Westminster, B.C.—A large machine and repair shop, 411 ft. in length by 234 ft. in width, and two stories in height, is being constructed by the Heaps Engineering Co., on Lulu Island under the supervision of H. Mansfield.

Schumacher, Ont.—J. Houston, manager of the Schumacher Mines, has received instructions from the Columbus owners of this property to prepare plans and specifications for a 150-ton mill. The mill will treat ore with cyanide and will embody the latest practice.

Sarnia, Ont.—There is now nearing completion at the works of the Imperial Oil Co. a new four-storey steel and concrete building, which will be used as a candle works in connection with the wax department of the plant. The building is fire-proof and strictly modern. The cost of construction is about $60,000.

Hamilton, Ont.—The National Gas Co., which last fall was given a city franchise to lay mains throughout the streets, will be in a position to offer a service to several west-end residents in a few months, according to an official of the company. The company will, as soon as tenders are accepted, commence construction on sixteen miles of the main artery from Blackheath to Hamilton, and will lay seven and one-half miles of pipe in the city.

Municipal

Guelph, Ont.—It is proposed to make improvements to the sewage disposal plant.

Lethbridge, Alta.—Work on the extensions to the high pressure water system, has been commenced.

Edmonton, Alta.—The city is considering the installation of a sewage disposal plant. A. J. Latornell, city engineer.

Winnipeg, Man.—The waterworks administration board has let contracts amounting to $5,196,695 for the great waterway project.

Port Dalhousie, Ont.—The Board of Trade has prepared a by-law to submit to the ratepayers next January to authorize the construction of a water works system for the town.

Belmont, Ont.—A by-law will be submitted to the ratepayers on November 25, to authorize the laying of gas mains in the village. Geo. Riddell, Wilton Grove P. O., is the clerk.

Montreal, Que.—A municipal ferry will probably be operated between here and St. Helen's Island. If the proposal goes into effect, two ferry boats will be required. The R. & O. franchise expires in the spring.

Hamilton, Ont.—There was a conference last Friday of representatives of the city and the Township of Barton with reference to a water supply for the township. Th meeting decided to leave the question to the city and township engineers and solicitors, who will prepare a draft agreement, which will be considered at another conference.

Mimico, Ont.—The first step towards the construction of a water and sewage system for Mimico village was taken on Nov. 9, by the Mimico Council, which ordered its solicitor to prepare a by-law, authorizing the undertaking in accordance with the vote of the people on Jan. 5th last in favor of the expenditure of $125,000. The plans for the proposed sewage and water system, which have been prepared by A. E. James, village engineer, will be submitted to the Provincial Board of Health along with the by-law. The work of construction will be commenced as soon as possible.

Welland, Ont.—It has been decided to install ornamental lighting standards at the north and south ends of the city. The system will cost about $11,000. Tenders will be called shortly.

Montreal, Que.—Mayor Martin proposes that the city shall give the Montreal Tramways Co. an extension of franchise for twenty-two years, on condition that the new franchise shall cover all the existing franchises with the various sections of the city which have been annexed since the original franchise was granted. These are numerous, and some of them are for fifty years or more, while one is in perpetuity. The main franchise has eight years to run yet, so the extension advised by the Mayor is practically for thirty years. The company asked for a forty-year extension.

Saskatoon, Sask.—Work on the construction of the water main which is being laid across the river is progressing very satisfactorily. This 24-inch main, when completed, will provide better pressure on the south side and will remove the danger of this portion of the city having its water supply absolutely cut off, as would happen at the present time were anything to go amiss with the 8-inch main at the traffic bridge, which is the only source of supply. For the last four weeks there have been approximately 35 men at work and they will probably be employed on this piece of construction during the greater part of the winter.

Ottawa, Ont.—To the demand of Engineer Haycock that they immediately make repairs to the 40-inch intake pipe in accordance with the requirements of his recent report, Contractors Loomis, McBean and Williams have replied that the work which Mr. Haycock says is defective was not part of their contract work, but additional work ordered by the city engineer, and that therefore they are not responsible for it, as it was carried out according to the instructions of the engineer and passed by him upon completion. The crib work around the pipe is referred to. The contractors say, however, in a letter to the city council, that they will undertake to do whatever Mr. Haycock wants done on a basis of cost plus 15 per cent.

New Wire and Cable Plant, Northern Electric Co., Montrea

The ever-widening scope of application of electricity for domestic, industrial, mineral development and agricultural purposes and the establishment of hydro-electric generating plants over a more or less scattered area has given impetus in extraordinary degree to the manufacture of transmission equipment. To keep pace with all of this electrical progress has been policy of the Northern Electric Co., Montreal.

THE new wire and cable plant of the Northern Electric Co., Ltd., now nearing completion, occupies an area of 178,000 sq. ft. (over four acres), bounded by St. Patrick, Shearer and Richardson Streets, in the City of Montreal. The old plant located at the corner of Guy and St. James Streets, being entirely inadequate to cope with the ever increasing demand for the high-class wire and cable products of this well-known company, has necessitated the erection of an enormous new structure which, when completed, will be the largest single plant in America for the exclusive manufacture of wires and cables.

Building Features.

The E. G. M. Cape Co., Montreal, have the general contract for the building, the foundations for walls and columns of which are composed of plain and reinforced concrete. In the main building and some of the one-storey portions, the columns rest on Raymond concrete piles, of which over 4,000 have been driven with an average length of 12 ft. On each group of piles rests a reinforced concrete cap, on which bases for the building columns are placed. The 6,500 tons of structural steel required for the superstructure were supplied and erected by the Dominion Bridge Co., Montreal, and Bethlehem H columns, girders and beams were used almost exclusively throughout.

The most modern fireproof construction has been used throughout the entire building, all interior columns being encased in 4¾ inches of hollow terra-cotta, and beams in 2⅜ inches of same. The floors are composed of hollow terra-cotta segmental arches with a span of 6 ft. 8 in., and are suitable for a live load of 288 lbs. on the second to seventh floors, and 150 lbs .on the eighth floors. A stone concrete fill is poured over the arches, in which wooden sleepers are embedded, and the underflooring is nailed to these sleepers. Over this, the final maple flooring is laid at right angles. The National Fireproofing Co. supplied all the fireproofing terra-cotta, amounting to 11,000 tons.

The walls are built of Laprairie plastic brick, about seven millions of which were used. All the lintels in the courts and on the street sides, together with the architectural ornaments and copings on the street sides were supplied by the Atlantic Terra-cotta Co., of Tottenville.

The main buildings, shaped like the letter E have two main courts, which serve to provide ample lighting facilities for the 500,000 sq. ft. (over 12 acres) of floor space from the interior, in addition to the exposed sides on the streets. These courts have sloping roofs of book tile, with large skylights. The G. T. R. and C. P. R. steam tracks run into one court, which has large platforms for shipping and receiving purposes. Each track is provided with a 150-ton Canadian Fairbanks-Morse track scale.

Crane Equipment.

There are four traveling electric cranes—one 50-ton one 20-ton, one 20-ton with 5-ton auxiliary hoist, and one 10-ton, all made by the Case Crane Co. The 50-ton crane will be used for handling reels of armored cable, the 20-ton for the lead covering department, and the 20-ton with 5-ton auxiliary for the turbine room, and the 10-ton for impregnating tank room. The two 20-ton cranes are arranged so that they can pass material to the 50-ton, which will convey it over the railway tracks or vice-versa.

Sectional Division of Buildings.

Fire walls with automatic steel fire doors on both sides divide the building into various sections. Each section has a fire and smoke-proof stair tower, with iron stairs at both ends, thus providing ample and safe means of exit in case of fire on any floor. The fire doors for the whole building were supplied by the Architectural Bronze and Iron Works, and the iron stairs by John Watson & Son, Ltd. All windows throughout the building have steel frames with wire glass. Pivoted sections of these windows can be opened with operating chains equipped with fusible links, thus making them self-closing in case of fire. The 95,000 sq. ft. of steel sash required for the factory was supplied by the Trussed Concrete Steel Co., and the casement sash for the offices by Henry Hope & Son, Ltd.

Sprinkler System.

All drains and underground sprinkler mains are being installed by James Bal-

NEW WIRE AND CABLE PLANT, NORTHERN ELECTRIC CO., MONTREAL.

lantyne. The sprinkler and fire hose systems above the first floor level are supplied by H. G. Vogel Co. (Canada), Ltd., and consist of 6,000 sprinkler heads and fire hose located at convenient points in the building. These systems are supplied with water from the city mains, steamer connections on the street, and a 1,500-gallon Worthington underwriters' fire pump, which is connected to a 100,000-gallon concrete reservoir and the canal.

Elevators.

Five 6,000 and one 15,000 lb. freight elevators, with a travel of 100 ft. and 25 ft. per minute respectively will be used to handle the transfer of material for manufacturing, and two high-speed passenger elevators traveling at 350 ft. per minute will be used to serve the general offices of the company, which are situated on the eighth floor of the building. They are being supplied by the Otis-Fensom Elevator Co This floor has no columns, the roof being supported by steel trusses with large skylights. The absence of columns afford splendid facilities for the laying out of offices to suit the requirements. A unique point in the design of the building is the storage space secured on the roof of one section by means of paving bricks. This roof is served by means of one of the 6,000 lb. freight elevators. Large intake pipes from the canal supply the reservoir and the water used for condensing purposes, while an automobile garage and a wagon court, with platforms facing St. Patrick Street, are so arranged that the material can be readily loaded for city delivery without having to cross the railroad tracks.

Heating Arrangements.

The building will be heated by a forced circulation hot water heating system. Exhaust steam from one of the main turbines will be passed through closed heaters, while the water will be circulated by means of a 4,000-gallon Alberger single stage volute pump directly connected to an Alberger-Curtis steam turbine. The vapors and condensate from the exhaust steam will be carried from the heaters by means of an Edwards air pump with tail pump. This makes a very flexible system to suit the changes in the outside temperature, as the vacuum can be increased in warm weather, thereby creating a lower temperature of the exhaust steam and decreasing the amount of steam required by the turbine as the vacuum increases. In extremely cold weather, the turbine can exhaust into the heater at atmospheric pressure, and thus increase the quantity and temperature of the steam. When running two turbo-generator units in parallel, one turbine can run condensing, while the other exhausts into the heating system, and its load can be varied to suit the amount of steam required for heating purposes. The power plant equipment for this heating system is in duplicate, either one of the units being large enough to take care of the whole system. The enclosed heaters mentioned above were built by the John McDougall Caledonian Iron Works Co., Montreal

The water required for the house service system and for manufacturing purposes will be pumped from the 42-in. intake pipe, mentioned above, by means of Deane motor-driven, single-acting, helical-geared triplex pumps, supplied by the John McDougall Caledonian Iron Works Co.

The Canadian Ingersoll Rand Co. are supplying two steam-driven air compressors, which have a combined capacity of 1,200 cu. ft. per minute.

Power Plant.

The power plant is of the most modern design. Coal can be stored in large quantities, and will be transferred to the storage bins over the front of the boilers by means of a Telpher car and clam shell bucket Ash-handling equipment takes the ashes directly from ash chutes under the boilers and delivers them into ash storage bins, which in turn deliver them into railroad cars or carts for disposal. Ashes can also be handled by means of small cars on an industrial railway running in the basement of the boiler room. The Telpher car will raise the body of each of these cars off the truck through a hatchway in the main boiler room floor, and will carry them over to the ash storage bin. This method of ash handling will only be used when it is necessary to overhaul and repair the regular ash handling equipment.

Boiler Room.

A 225-foot chimney, built by the Alphons Custodis Chimney Construction Co., serves four Babcock & Wilcox boilers, nominally rated at 650 horse-power, but which will be forced to deliver 1,000 horse-power when necessary. These boilers are fitted with B. & W. chain grate stokers and superheaters. The exhaust steam and condensate from the heaters, turbines, condensers and steam driven auxiliaries is brought to a Warren & Webster feed water heater, which is capable of raising 107,000 lbs. of water per hour to 210°. From this heater the water is returned to the boilers by means of two Weir boiler feed pumps, each with a capacity of 6,000 Imperial gallons per hour. General Electric-Curtis horizontal turbines form the motive power for the generators, and are placed on structural steel stands directly over the Alberger condensers, thus ensuring a high vacuum. The condensers are located over two 42-in. pipes leading to the canal. From one of these pipes the water is drawn by a turbo-volute turbine-driven pump, and after having passed through the condenser is discharged into the other pipe. Tunnels leading from the turbine and pump room are used to run the power and lighting circuits, the flow and return pipes of the forced hot water heating system, the house service water lines and the high pressure steam lines for manufacturing purposes.

Turbine Room.

The turbine room has been laid out for two 2,000 k.w. and two 1,000 k.w. turbo-generators; two 460 k.w. rotary converters, and two 75 k.w. turbo-driven exciters. Of the foregoing, the two exciters, one 1,000 k.w., one 2,000 k.w. turbo-generators and two rotary converters will be installed now. The generators are three-phase, 60-cycles, 440-volt star wound with neutral connection brought out to the switchboard. The exciters are of 125 volts, and generator voltage will be controlled by Terrill regulator .

Air for the ventilation of the generators will be taken from a duct in the foundations of the generators and forced through the windings and air passages by fans integral with rotors. Screens will be provided to exclude dust, etc.

Horse Power.

The horse power of connected load will be approximately 550 h.p. direct current at 115 volts, and 4,000 h.p. alternating current at 440 volts. For the supply of the former, two 460 k.v.a. rotary converters, with necessary transformers and starting switches, will be installed, the neutral being brought out from each transformer bank for the neutral of a 115/230 volt, 3-wire direct current system.

Switchboard.

The switchboard for the control and distribution of the power will consist of a main board of twenty-five Blue Vermont Marble panels on the turbine room floor. On this board will be mounted the meters for measurement of outputs of generators and loads of the feeders, also the direct current bus-bars both for exciters and direct current factory load and control equipment for twenty-five solenoid operated feeder switches for alternating current distribution. These switches will be mounted on Honson slate panels on a mezzanine floor under the turbine room floor. The alternating current, 440-volt bus-bars and generator switches will also be located here.

Generator switches will be non-automatic with bell-ringing attachment and feeder switches automatic, as mentioned above. All feeders will leave the turbine room in a tunnel, from which they will branch off to the various buildings in three-inch fibre conduits. These fibre conduits will lead to cable pits, from which risers of three-inch conduit will be carried to distributing panels. All alternating current cables will be three conductor paper insulated, leaded; direct current cables being single conductor leaded. For lighting factory area, four-light clusters, wired series parallel, will be used. As mentioned above, the neutral point of generator windings will be brought out. The lead sheath of the lighting feeder cables will be bonded to the neutral bus, and lighting circuits will connect one wire to one of the three conductors, the other to the sheath, giving approximately 266 volts across two lamps in series. Lighting feeder cables will lead to distributing boxes on the third floor of each section, from which circuits will run to the panel boxes on the different floors. Power feeders will run to distributing boxes on the third and fifth floors, from which circuits will run to power loops on each floor. All wiring except that in general offices will be open conduit. The general offices will have outlets for fans, dictographs, annunciator and telephones, all wiring being concealed in conduit.

A large number of 3-phase, 60-cycle motors will be used for direct connected, belt and group drives. L. K. Comstock & Co. have the contract for wiring the lighting and power circuits.

An artesian well is being drilled by Wallace Bell Co., and will be used for drinking water and for manufacturing purposes.

In addition to the fire protection system, a regular watchman's service system will be installed, so that the building will be patrolled at all times outside of the regular working hours. For the convenience of watchmen and to avoid the use of oil lanterns in the plant, a certain number of electric lights will be kept burning all night to form a pilot system so that in cases of emergency the workmen in the building can easily locate the fire apparatus and also the exits. The following features in connection with the building are of interest:—

The total excavation amounts to some 50,000 cubic yards. Over 14,000 cubic yards of concrete have been used for foundations, while 1,500 carloads of building material have been received up to the present time; 100,000 square feet of glazing has been used, and approximately 100,000 square feet hot water radiation service will be required.

The work has been carried on under the direct supervision of E. F. Sise, president of the Northern Electric Co.; J. D. Hathaway, general superintendent; J. S. Cameron, plant engineer; and W. J. Carmichael, architect.

Approved Safety Rules Relative to Cranes

Approval has been given by the Conference Board on Safety and Sanitation, which is composed of the National Founders' Association, the National Association of Manufacturers, the National Metal Trades' Association, and the National Electric Light Association, to the following safety rules relative to cranes.

TRAVELING cranes which are operated from a cage attached to the crane bridge are liable to cause more frequent and more serious injuries than other types because the former usually carry heavy loads at considerable speed over great areas of floor upon which employees are engaged in work. Most cage-operated cranes are electrically driven. The rules suggested in this bulletin, therefore, are especially designed for electrically-driven, cage-operated traveling cranes. Satisfactory crane rules are in effect in many plants, yet they differ in language and in details. A number of these have been gathered and studied, while close observation of crane hazards in all kinds of plants has suggested others. Out of this study has grown "The Fifty Crane Rules" herein suggested.

Not all of these rules, however, are ap-

NEW WIRE AND CABLE PLANT, NORTHERN ELECTRIC CO., MONTREAL.

plicable to every cage-operated, electrically driven crane in every plant, because of the great variety of such cranes in service and the many different conditions under which they must operate. These rules, if not adopted in their entirety, may nevertheless be used as a foundation upon which a set of rules may be formulated for each plant to suit local conditions; they may even suggest rules for operation of other types of cranes as well.

It is recommended that the rules be printed and copies posted conspicuously in each operator's crane cage and placed in the hands of all cranemen. When once adopted, the rules should be rigidly enforced.

General Rules.

1.—Cranes must be operated only by regular crane operators, authorized substitutes, crane repairmen or inspectors; no one else should enter crane cage.

2.—Access to and exit from the crane cage should always be by stationary ladders, stairways or platforms provided for the purpose. Cranemen must keep their hands free when going up and down ladders.

3.—Articles which are too large to go into cranemen's pockets or belts should be lifted to or lowered from crane by hand line kept in cage for such use.

4.—Cages should be kept free of clothing and other personal belongings. Tools, extra fuses, oil cans, waste and other articles necessary in the crane cage should be stored in a tool box, and not left loose on or about crane.

5.—A pail filled with sand should be carried in the crane cage for use in case of fire.

Rules for Operators.

6.—Operator should familiarize himself fully with all crane rules and with the crane mechanism and its proper care. He must not tamper with any mechanical or electrical adjustment, but if adjustments are necessary, he should report the same at once to foreman or repairman.

7.—Operator must not eat, smoke or read while on duty nor operate crane when he is in poor physical condition.

8.—Operator must be constantly alert in watching crane and floor operations, and workmen under or near the load.

.—Operator or some one especially designated by the foreman must daily oil all working parts of crane including sheave blocks, fill empty grease cups, turn down others and make sure that oil passages are not clogged. Hoist chains and cables must be lubricated regularly as directed by foreman.

10.—Operator must examine crane daily for loose parts or defects and report same immediately to foreman or repairman.

11.—Operator must clean crane weekly or oftener as directed.

12.—Operator must test foot brake and limit switch at beginning of each working period.

13.—Operator must avoid, as far as possible, carrying loads over workmen; it must be absolutely avoided when carrying molten metal.

14.—Operator must lift loads only high enough to clear safely all men and obstacles upon the floor.

15.—Whenever loads are to be carried over a long distance to a high position, they should be carried as close to floor as feasible until final location is reached; load should then be lifted to desired height.

16.—Operator must never go or allow any one else to go on crane bridge without first opening main switch; if crane is provided with an emergency switch, that also must be opened. Preferably, switch must be locked open, or warning sign placed and kept upon it, while any person remains on the bridge.

17.—Whenever operator finds main or emergency switch open, he must not close it, even when starting on regular duty, until he has made sure that no one is on or about the bridge or runway.

18—Before closing main switch operator must make sure that all controllers are in off position.

19.—Operator must move controllers slowly from point to point to gradually increase speed of motors, and must restrict speed until slack in chain or cable has been taken up.

20.—In case of electrical short circuit or if a controller should stick, operator must immediately throw all controllers, except the one that sticks, into off position, then open main switch with a rapid motion and notify foreman or repairman.

21.—If power goes off, operator must immediately throw all controllers to off position until power is again available.

22.—Operator must not run more than two motors at one time; when handling molten metal it is advisable to run only one motor at a time.

23.—Operator must not reverse a motor until it has come to a full stop, except to avoid accidents.

24.—Operator must pay special attention to the block when long hitches are made, to avoid tripping limit switch or running block upon the drum. When it is necessary to hoist beyond limit switch, operator must first secure foreman's approval.

25.—Operator must not lift or suspend a load when there are less than two full wraps of cable or chain upon the drum.

26.—Operator must recognize signals only from the one man who is supervising the lift. Operating signals should follow an approved standard; they should be manual, never verbal. Whistle signals may be used where one crane only is in operation.

27.—Before starting to hoist, operator must place trolley directly over load to avoid swinging it when being hoisted. This precaution is especially important when handling molten metal.

28.—Operator must not make side pulls with crane except when especially instructed by foreman.

29.—Except on order of foreman, operator must not lift load when operation of controller shows that load is excessively heavy.

30.—When handling maximum loads, particularly ladles of molten metal, operator must test hoist brakes after load has been lifted a few inches; if brakes do not hold, load should be lowered at once and the brakes adjusted or repaired.

31.—If hoist brakes refuse to hold while crane is handling molten metal, it may be necessary, in order not to interrupt the pouring operation, to sustain load by short upward movements of hoist, to counteract settling of load.

32.—Bumping into runaway stops or other cranes must be avoided. When operator is ordered to engage with or push other cranes, he must do so with special care for safety of persons and cranes.

33.—When two or more cranes are used in combination to lift one load, the several operators must be careful to lift load evenly.

34.—When lowering a load, operator must proceed carefully and make sure that he has load under safe control at all times.

35.—When leaving cage, operator must throw all controllers to off position and open main switch.

36.—If crane is located outdoors, operator must also lock crane in secure position to prevent it from being blown off or along the track by severe wind.

37.—In all doubtful cases operator should consult foreman or inspector.

Rules for Floormen.

38.—Floorman shall give all signals to the operator in accordance with approved standards.

39.—Floorman shall be responsible for the condition and selection of all hoisting accessories and for all hitches.

40.—Before operator moves crane upon which empty chain slings are hanging, floorman must hook both ends of slings to block.

41.—Floorman shall whenever possible walk ahead of moving load and warn people to keep clear of it. He shall see to it that load is carried high enough to clear all obstructions.

42.—Floorman must notify the foreman in advance when an extra heavy load is to be handled.

43.—Floorman should not himself ride or allow others to ride on hook or load except on authority of foreman.

Rules for Repairmen.

44.—Repairmen should have crane that is to be repaired run to a location where the repair work will least interfere with other cranes and with operations on floor.

45.—Before starting repairs, repairman must see that all controllers are thrown to off position, that main switch and emergency switch are opened and that, except for short time repairs, all fuses are removed.

46.—Repairman should immediately place red flags or out of order signs on crane to be repaired and approved warning signs on floor beneath. Where feasible, space under crane should be roped off. If other cranes are operated on the same runway, he must also place rail stops at a safe distance.

47.—Before removing any part which may release hoist block, repairman must run block to floor, or if this is not possible, he must wedge the gearing to prevent drum from unwinding.

48.—When repairing runways, repairman should place rail stops and red flags at both ends of section to be repaired.

49.—Repairman must take care of prevent loose parts from falling or being thrown upon floor beneath.

50.—Upon completion of repairs, craneman must remove all blocking and all loose parts, bolts and tools, and put the crane in operating condition. He must then remove rail stops, red flags and warning signs and turn the crane over to operator.

Personal Caution is after all the greatest safeguard.

Crystallization and Annealing of Soft Steel

By J. L. Douglass *

It is only of late years that the electric pyrometer has come into its own and, by its use, have high temperatures been accurately determined and, if required, automatically registered for the practical heat treatment of various products.

MELTING points of metals as well as high temperatures for many other uses have been established many years, but the laboratory methods employed require such great care and delicate precision that they could never become of practical value in the trades where absolute simplicity of operation with a fool-proof apparatus is of the utmost importance.

There are to-day several makes of pyrometers on the market which are giving perfect satisfaction in various trades for accuracy and durability. The following temperatures have been compiled from some two thousand experiments made with different types of pyrometers, which were thoroughly tested from time to time for the closest accuracy. The writer is aware that these temperatures will be disputed, but the results of so many tests prove conclusively that they are reliable.

This article deals only with low carbon steel, particularly soft basic open hearth and Bessemer rods from which are manufactured the majority of all sizes of wire and wire products such as fence wire, nails, and cold made rivets. These two grades of steel show an average chemical analysis as follows:

Basic.

Carbon .09%.
Manganese .40%.
Phosphorus .011%.
Sulphur .023%.
A trace of silicon.

*42 Wilcox Street, Toronto.

Bessemer.

Carbon by combustion .066%.
Carbon by color .09%.
Manganese .46%.
Phosphorus .104%.
Sulphur .048%.
Silicon 023%.

Soft steel with analysis similar to the above, unlike harder steel which may become coarse grained by constant strain in everyday use, crystallizes only through certain degrees of heat treatment. Authorities on the metallurgy of iron and steel differ as to whether steel can become coarse grained through constant torsion, tension or compression. Some claim that the failure of structural steel, shafting, etc., is due to imperfections in the steel which existed from the time of manufacture. The manufacturer, on the other hand, is inclined to blame steel failure on the excessive strain to which it has been subjected, and which in some cases causes the coarse grain to appear.

Reducing the Crystallization.

To go back to the statement that soft steel becomes crystallized only through certain degrees of heat treatment. There are two ways of curing, refining or reclaiming this condition of the steel; one by continuous working, bending or hammering, known as the mechanical cure, and the other by heat treatment. In either case, a molecular reconstruction takes place which eliminates the brittleness that exists with crystallization. This brittleness or weakening of soft steel is very considerable, sometimes amounting to 50 per cent. of its refined state, and depends upon the size of the grains which in turn are dependent primarily upon the heat it has been subjected to and, in conjunction with that, the amount of work that has been put upon it.

Size of Crystals.

The size of crystals in soft steel rods depends upon the diameter of the rod and the temperature at which the rods have been finished in the rolling. Other conditions being equal, the larger the diameter of the rod, the larger the grains, as less work has been put on one size of rod than the size smaller. Again, if the rods are not finished from the billet at the correct temperature, crystallization has a tendency to creep in. The finishing temperature varies with the carbon content of the steel, but should be in all cases the minimum temperature at which crystallization appears, and to be on the safe side it should be less.

Crystallization After Annealing.

Crystals often appear in the rod or wire drawn from the rod, after annealing, in which case their size depends only upon the temperature of the annealing.

As noted before, other conditions being equal, the larger the diameter of a rod the larger will be its crystals, but all sizes smaller than 1/4-in. are never coarse grained under any circumstances, the rods and wire at these small sizes being of a more homogeneous character where there is no further molecular rearrangement possible at any temperature. It naturally follows that rods 1/4-in. in diameter and smaller can be finished at any temperature consistent with practice.

Molecular Re-arrangement.

The phenomenon of the molecular rearrangement of steel has never been satisfactorily explained, particularly in the mechanical action, but we do know what outside influences cause it and how it can be avoided or remedied.

As an example of the process of mechanicaly curing or refining, we will consider coarse grained rods 7-16-in. in diameter being given three drafts to 5-16-in. in diameter. If the crystals are not too coarse, they will during this process of reduction be reclaimed by the crushing process. The steel has, of course, in this process become much harder and tougher, the tensile strength increasing from 50 to 60 per cent.

Further, if this steel is subjected to certain temperatures, the crystals will reappear with the resultant weakening of the steel. A still higher temperature will again reclaim the steel to its maximum strength.

As noted above, the drawing process, besides crushing the grains until, if carried far enough, they entirely disappear, also increases the tensile strength to a remarkable degree, and perhaps the limit for stiffening and strengthening by the mechanical process is reached in the process of forming large heads on nails and rivets with one quick blow. In such cases, the steel becomes so hard and brittle that the heads will fly off with the least hammering.

Burnt or Overheated Steel.

The term burnt or overheated steel, as sometimes applied to crystallized soft steel, is a misnomer, since a burning or melting temperature occurs long after the grains disappear. However, with harder steels, this term is applicable, as the melting temperature is that at which the coarsest grain size appears. The temperature governing the above conditions are the following:

At 1,025° Fahrenheit soft steel, such as we are considering, becomes fully annealed and, except where crystallization creeps in, it cannot be made softer at any higher temperature .

Between 1,025° and 1,160° no physical change takes place.

Between 1,160° and 1,570° it becomes more or less crystallized, but from 1,475° the crystals begin to disappear, until at 1,570° they are entirely gone and do not return at any higher temperature.

Annealing Soft Steel Rods.

Since over 95 per cent. of all steel is either wrought or annealed, these processes become very important in the manufacture of the innumerable products made from steel, and the annealing of soft steel rods and their products, which, of course, cannot be wrought, presents very interesting features.

There are two methods in common use where large quantities are annealed at one time.

1.—Open annealing.

2.—Closed annealing.

By open annealing, the so-called muffle annealing is referred to, and in this process the flame and products of combustion come in direct contact with the work.

Closed annealing refers to all processes which do not permit the smoke and flame to come in contact with whatever is being annealed. The most common of this type is the pot or kettle annealing.

Both methods of annealing have their advantages, but where uniform results with no discoloration and scale are required, kettle or pot annealing is superior to any other methods, and with very little attention will give satisfactory results.

Natural Gas Furnaces.

Natural gas, if its price is not prohibitive, should be the best fuel for such furnaces. Although the writer has never seen it tried out with the so-called muffle furnaces, he can see no reason why it should not be best there also.

Annealing with natural gas at 15c per M. can be accomplished for .03c per 100 lbs. of steel annealed, while coal costs from .023c to .035c per 100 lbs. of steel annealed, which does not include the cost of labor required in firing, cleaning, and removing the ashes. Then there is a great saving in the life of the furnace when using gas, as there is no constant stoking and cleaning of fires, which shortens considerably the life of any furnace where high heat requires the use of soft fire brick. Again, the heat can be regulated more readily and, of course, requires no attention between starting and stopping.

Changing From Coal to Gas.

Very little expense is necessary in changing a furnace from coal to gas. The flues remain the same, and the grate bars are simply covered with a floor of fire brick and sand. A Gwynn burner is inserted through the fire door or through a brick wall built up to replace the fire door. The size of the burner will depend upon the size of the furnace, but as a burner can be replaced in a few minutes without changing the furnace, there is very little trouble experienced in determining the best size to use.

The draft necessary for a coal furnace should suffice for the gas, but if not, the flues under the kettle can be made larger or smaller as required. The pressure of the gas is a very important consideration, and should never be more than nine ounces. Eight to nine ounces gives the best results with ordinary draft.

For determining the temperature of the furnace at any time, the pyrometer is, of course, the most accurate method, but the final temperature can easily be gauged by the eye looking through a 1-in. gas pipe, which extends through the hood and the top plate of the kettle .

With the use of gas, the time required for annealing can be determined after a few tests and within a few minutes, thereby eliminating any attention between starting and finishing.

There are erroneous ideas concerning the time required in annealing. As far as the annealing itself is concerned, it may be done as quickly or as slowly as possible, and after it is accomplished the temperature may be dropped as fast or as slowly as desired either in the kettle or furnace or by exposure to the air .

In all cases the degree of softness will be the same, providing, of course, the annealing temperature has been reached. Soaking or slow cooling has absolutely no effect on the softness, and, of course, represents a higher cost. Just as soon as 1,025° F. is reached (and this is a dark red color), annealing is complete, and the steel cannot be made softer by annealing at any higher temperature, except the crystallizing and that, of course, is to be avoided.

The Temperature Feature.

In conclusion, it is necessary to realize that the temperatures given above are the exact temperatures and not the safe working temperatures. Sufficient leeway should be allowed to offset any error in the pyrometer and the chances of unequal temperatures existing in the kettle, which latter condition often prevails to the extent of a few degrees. It may happen that the temperature at the fire end is slightly higher than in other portions of the kettle. It is, therefore, of importance to allow for a factor of safety which may be governed by the conditions existing in each individual case.

METAL FILAMENT LAMPS.

THE new metal filament lamps of high candle-power are likely to take the place of arc lamps for outside lighting in many cases, and one of these is for the lighting of railway yards.

A good example is a large freight depot and yard on the continent which was thus lighted last autumn. Current at 6,000 volts comes from an outside electric plant into a transformer house where it is reduced to 200 volts. For the lighting which is needed for loading and unloading of freight there are used twenty-four iron work poles, each 26 ft. high and carrying a 300 candle power metal filament lamp, while the lighting equipment of the outer tracks comprises fourteen similar poles 40 ft. high with the same lamps. In other places 50 candle-power lamps are employed. A suitable device allows of lowering the lamps from the poles when they are burned out, but ordinarily they require no trimming as in the case of arc lamps. A small winch and steel cable lowers the lamp in very much the same way as an arc lamp, so that a new lamp can be readily put in.

Offers of Sites for Belgian Factory.—Colonel Pelletier, Agent-General for the Province of Quebec, in London, has now received 25 offers from municipalities or firms in the province offering free sites, electricity and other facilities to the Belgian manufacturer who suggested establishing a factory in Canada. All these have been placed before the manufacturer in question who, so far, has not decided upon his action in the matter.

PRODUCTION METHODS AND DEVICES

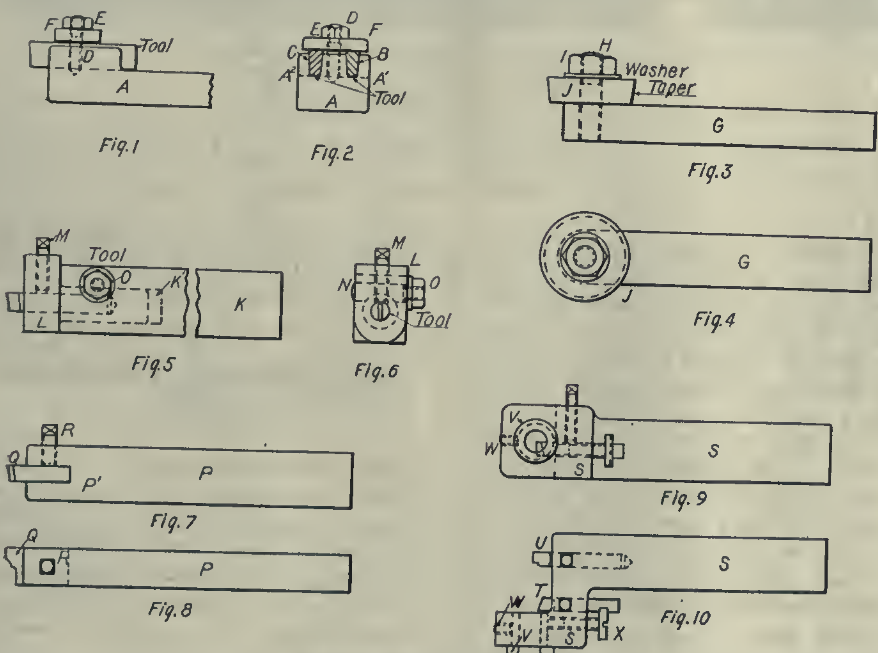
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

USEFUL SLIDE REST TOOLS.

By W. C.

THE tool holders here illustrated are of simple construction, their object being more particularly for use with tools of the detachable type.

Figs. 1 and 2 are front and side elevation respectively of a grooving tool holder for turning ring grooves in motor engine pistons and such like. It will be readily seen that a tool of very similar construction would be used for cutting off and facing rings for the said pistons, the only difference being that the tools would have to be brought in closer, in order to suit the thickness. Further, it would be necessary to have the outer tool slightly in advance of the inner (nearer the lathe centre) in order that the facing tool complete its operation before the work is finally cut off the bar.



USEFUL SLIDE REST TOOLS.

The holder A is made from a piece of rectangular mild steel, and is provided at its extreme end with an enlarged projection, in which are formed two taper grooves, A^1 and A^2, for carrying the grooving tools B and C. These tools are made from steel of taper section, the advantage being that they can be held more rigidly than those made from metal of rectangular section. Again, it is only necessary to grind them at the extreme ends when they become dull, the side clearance being already formed. The stud D, nut E and clamping plate F are all made from mild steel, the plate and nut being preferably case-hardened to protect them from rough usage.

Figs. 3 and 4 are elevation and plan of a flat circular form tool and holder. Part G is the holder body. This is constructed from a rectangular mild steel bar provided at one end with a tapped hole for the purpose of receiving the clamping stud H and nut I for securing the radius tool J; the latter consisting of a tool steel blank, having in the centre a hole for securing it to the holder as shown. The sides of the said tool are slightly tapered in order to provide the necessary clearance for cutting. This tool will be found useful for finishing accurate radii, as it is only necessary when one part of the cutting edge becomes dull to slacken off the nut and turn the tool slightly in order to bring into operation the unused part, without in any way unsetting the arrangement.

Figs. 5 and 6 are side and front views respectively of an improved form of holder for use with tools of circular section. Its primary object is the cutting of worms and screws of coarse pitch, which necessitates the tool being set over at an angle for the purpose of clearance. The tool shank K is made from mild steel bar, and is provided at one end with a hole for receiving the circular end or shank of the tool holder.

The latter is made from a rectangular mild steel block, and is provided with a reduced circular stem part as shown, through the centre of which is bored a hole for receiving the tool, which is secured to the holder by means of the pin M. The tool block is finally secured to the tool shank K by the clamping pin N and the nut O. The pin N is made from a piece of circular mild steel bar, one end being reduced and screwed to receive the clamping nut O. It is cut away near the centre and of corresponding shape to that of the periphery of the tool block shank. It will be readily seen that the tool block L can be swivelled to any desired angle by slackening off the nut O and, further, grinding is facilitated by the removal of the tool and holder en bloc, thus providing a more convenient means for handling the tool during the operation.

Figs. 7 and 8 are elevation and plan of a small form tool holder. The holder P is made from a bar of mild steel, having formed at one end an open sided rectangular slot P^1 for the purpose of receiving the form tool Q; the latter being secured by means of the set pin R. A holder of this type will be found of service when using small high-speed form tools for the production of repetition work in small quantities, which otherwise would not warrant the outlay of a more expensive tool of the solid type.

Figs. 9 and 10 are elevation and plan respectively of an improved form of tool holder for producing small repetition work from bright drawn stock. The body S consists of a rectangular mild steel forging, having an enlarged cranked end S^1 for the purpose of carrying the turning and end figure tools T and U. It is further provided at its extreme end with a hole at right angles with the said tools for carrying the steady bush V. This is made from best cast steel, and should be carefully hardened and ground. It is prevented from rotating by the grub screw W. The cutting tools are secured by means of set screws, as shown. The adjustment of the turning tool is carried out by the cheese-headed screw X engaging with the slot formed in the side of the tool. It will be seen that the tool lends itself readily to the machining of various diameters, by simply removing the bush and re-inserting another of the required diameter, the setting of the turning and end facing tools being a comparatively easy operation.

UNUSUAL MILLING JOB.

By F. Scriber.

IT is difficult to teach a man how to handle odd shaped work as every new piece will necessitate the exercise of his ingenuity more than his knowledge of previous jobs. Nevertheless, accounts of successful pieces of work can be so studied as to add materially to one's experience.

The piece shown by the accompanying drawing is known as a top flat roll bracket shoe and is used on a cotton carding engine. The work consisted of milling the radial seat shown by the finish marks on a milling machine fitted with a radial milling attachment. This is very much quicker than employing a boring machine for the operation.

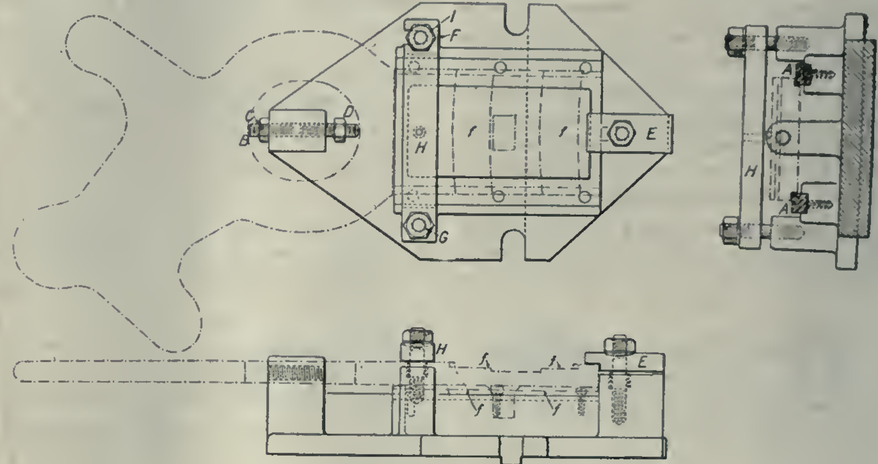
Previous to this operation, the seat marked X had been milled on a plain machine and, as the radial seat must run concentric with this, it was used as a locating point both horizontally and sideways by the steel strips AA of the jig which fit over the boss as shown.

The next point to be determined was the endwise location. As the use of external points for this purpose would require a very large fixture and as the holes in the center of the castings are very uniform they were used for locating purposes by the use of the boss and screws as per sketch. The screw B is set and locked in place by the nut C while D is a special screw which may be adjusted to suit the work.

To fasten the work in place, a simple clamp E is used at the end. This clamp is supported by a spring to prevent it from falling while the work is being removed.

Across the middle of the work, the swinging clamp F is used which is also supported by a spring and swings about the stud G.

The fixture is provided with a tongue on its base which locates in one of the radial slots of the circular plate of the radial milling attachment. The work is simply clamped in place and the cut started and as many as desired can be done with the same setting.



UNUSUAL MILLING JOB.

MACHINING ECCENTRIC PISTON RINGS.

By Albert A. Dowd.

WHEN the rings are to be of the eccentric type, a fixture is necessary or else an eccentric turning device must be devised. A comparatively simple fixture which gives excellent results is shown in Fig. 9. The form of the ring pot is somewhat different from that previously described, being provided with three lugs which are jig drilled at B before the pot A is placed in position on the fixture. Its location is determined by steel studs which enter the holes B, the calmps C being used to hold it in place. Only one clamp is shown in the illustration, the others being removed to avoid confusion in the drawing.

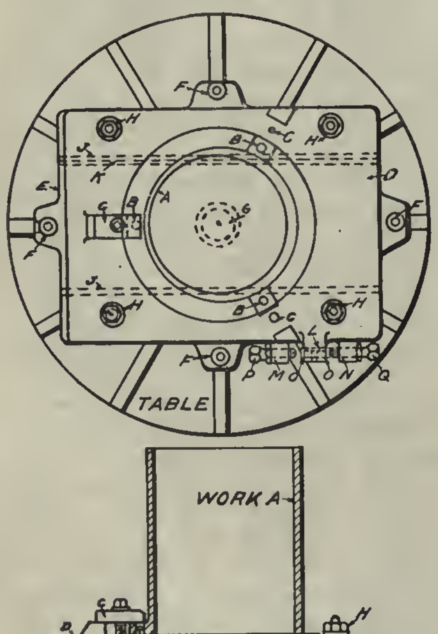


FIGURE 9.

The base, E, of the fixture is centered on the table by a plug in the usual manner, and it is held down by the four bolts F, which enter the table tee-slots. The slide D is dovetailed at J and provided with a taper gib K, so that adjustment for wear can be readily made. The studs H are set into the base and the slide is provided with elongated holes at these points to take care of the movement necessary when setting over the slide for the eccentric turning. The elongation of the holes is not great as movement required is very slight.

The arrangement for obtaining the proper amount of "throw" to the slide is somewhat out of the ordinary and is clearly shown in the illustration. The base is provided with two lugs M and N which are tapped to receive the setscrews P and Q, both of which are furnished with check nuts so that they can be positively locked in any desired position. The slide has an overhanging lug L, in which are set two hardened steel studs O, against which the ends of the screws strike when setting over the slide for the eccentric. It will be seen that this arrangement is practically dirtproof, as any dirt falling down at these points will not interfere with the correct indexing of the fixture.

The tooling arrangements are the same as those shown in Fig. 7, but the operation of boring takes place alone and, after this has been done, the fixture is set over and the eccentric turning and cutting off is done with the fixture in this position.

LARGE TURBINE RUNNER CASTINGS .

By C. A. C.

THE Calgary Power Co. of Calgary, Alta., has recently put into operation a second power plant at Kananaskis Falls on the Bow River. This consists of two Canadian Allis-Chalmers 6,000 h.p. single vertical turbines driving vertical umbrella type a.c. generators operating under 70 feet head and delivering power at a speed of 164 r.p.m. One of the most interesting parts of these turbines from the manufacturing point of view is the runner, which is shown in the accompanying photos, taken in the foundry of the manufacturer.

This runner is cast in one piece and weighs approximately 17,000 lbs. It is 80 inches diameter at its entrance and the largest discharge diameter is almost 100 inches. The total height is approximately $5\frac{1}{2}$ feet. Each of the moulds consists of 18 dry sand cores which are made from a wooden core box. Figs. 1 and 2 show clearly the method of setting the baked cores together and holding them in proper position by means of cast iron heavy foundation plates and top holding plate.

Each core is made of dry sand and heavily reinforced by means of cast iron plates and soft steel bent into proper shape and cast into the supporting plate. With this method, the possibility of expansion and breaking of cores is entirely eliminated, and no filing is necessary to make the core come true when being assembled. These round steel reinforcing rods are joined together on top and are held together by a heavy placed and bolted into position. It is next necessary to remove the eight cores bolted to the half plate, also the first core that was set. This has to be marked to insure being put back in the same place after the last two cores are in position. The half plate with cores is then put back to the seating on the whole circular plate and all points are filled and dried. The appearance then is that of one big core.

SETTING CORE OF 68 IN. SOLID CAST IRON RUNNERS IN FOUNDRY OF CAN. ALLIS-CHALMERS, LTD.

eyebolt so as to facilitate handling. The vent is taken from each core by means of three lengths of ⅜-in. wax taper carried off the back of each core at the same height, so that they are easily connected by coke vent running around the mould to a pipe, making only one vent to take care of instead of eighteen. To assemble the cores it is necessary to use two bottom plates, one of circular shape and the other of semi-circular shape, owing to the convex and concave sides of the cores.

The circular plate is loamed up half way across to form a flat surface for the half plate to rest upon. The whole base is then built up to the level of the half plate. The first core is set on the full plate with concave side towards the half plate and, to that core, fifteen others are

The lower ring of the runner is formed by a brick casing built in halves to the required diameter. The hub is moulded in a top plate through which the gates and risers are made. The whole mould is set into a pit lined with cylindrical shaped steel plates, and four stout cast iron beams with heavy weights on top are placed upon the closed mould. Eight gates were provided to pour the mould on circumference and on top, while a 20-ton crane was used to lift the ladle which contained the melted metal.

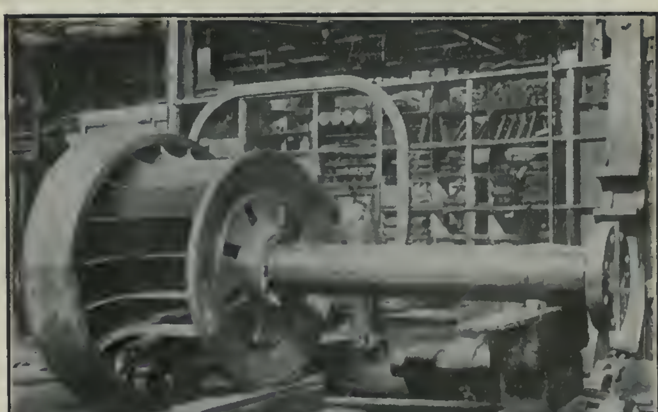
The actual pouring lasted but one minute and the casting was left four days in the sand. The hub being very much heavier than the buckets of the runner, it was necessary to remove the centre core as soon as possible after the cast, to allow that part to cool quickly and contract along with the lighter parts of the casting, thus preventing shrinkage stresses.

FRICTIONLESS RAILS.

AN interesting development in railway track construction is a so-called "frictionless" rail designed to be used on the inside of curves. Its special feature is a very narrow head, and its purpose is to reduce the slip of the inside wheel which takes place in compensating for the greater length of travel of the wheel on the outside rail.

It is claimed that there is a diminution of friction and resultant wear to both the outer and inner—frictionless—rails and the wheel flanges; while the reduced friction gives a freer and smoother passage of the wheels, with a reduction in power required to handle a given tonnage. The Southern Pacific Railway has ordered 5,000 tons of the frictionless rail, using a 90 lb. section as a companion to the standard 90 lb. A. R. A. (A) type section.

The rail has not been in service for a sufficient time to enable a definite statement to be made as to its performance.



68 IN. SOLID CAST IRON TURBINE RUNNER MOUNTED ON SHAFT.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

It will be found by those who have followed the previous lessons and profited by them that the various practical applications can now be easily observed, applied and appreciated.

CAPACITY.

CAPACITY is the extent of room or space occupied within the confines of the three **dimensions**; length, breadth and thickness.

To find the capacity or volume of anything, these three conditions are necessary, as nothing can occupy space with less than three dimensions.

A surface cannot take up room, as it has no thickness.

A circle cannot occupy space, but a disc will have volume as it must have thickness.

In the mensuration of surfaces, the units of area are the sq. in., sq. ft., etc., and in the calculation of volumes or capacity, similar units are necessary.

The unit of volume is usually the cubic inch or the cubic foot, and that of capacity in liquid measure is ordinarily the gallon, which may be subdivided or multiplied to suit the problem in hand.

In Chart 42 is shown a tank, the dimensions being 15 ft. x 8 ft. x 7 ft. What is the volume in cu. ft. and the capacity in U. S. gallons, if one cu. ft. contain 7.48 gallons?

Volume = length $\times$ breadth $\times$ depth $= 15 \times 8 \times 7 = 840$ cu. ft.

Capacity = vol. in cu. ft. $\times$ 7.48 $= 840 \times 7.48 = 6283.2$ gallons.

What would be the weight of water if tank were full?

One cu. ft. of water weights nearly 62.5 lbs., then $62.5 \times 840 = 52500$ lb., or $26\frac{1}{4}$ tons.

If the above tank were emptied from two one-inch pipes in four hours, in what time would it be emptied from a $1\frac{3}{4}$-in. pipe, friction being neglected?

The areas of circles vary as the squares of their diameters, therefore the time will vary inversely as the area of the openings.

Let x = the required time, then

$$1^2 + 1^2 : 1.75^2 = x : 4, \text{ or}$$

$$x = \frac{(1^2+1^2)\times 4}{1.75^2} = \frac{2\times 4}{1.75\times 1.75} = 2.6 \text{ hrs.,}$$

or 2 hrs. 36 min.

A large hollow sphere, Chart 42, 4 ft. in diameter, made of steel, is required to sink half its depth when placed in water; what must be the approximate thickness of the plate?

Volume of sphere $= .5236\ D^3 = .5236 \times 4 \times 4 \times 4 = 33.5104$ cu. ft.

Volume of water displaced $= 33.5104 \div 2 = 16.7552$ cu. ft.

Weight of water displaced = vol. $\times$ $62.5 = 16.7552 \times 62.5 = 1047.2$ lb. = weight of the steel in the sphere.

Volume of steel in sphere = weight $\div .28 = 1047.2 \div .28 = 3740$ cu. in.; .28 being the weight of one cu. in. of steel.

Surface area of sphere $= 3.1416\ D^2 = 3.1416\times4\times4\times144 = 7238$ sq. in.

Thicknes of plate $= 3740 \div 7238 = .5167$ in., or approximately $\frac{1}{2}$ inch.

In Chart 43 is shown a cylindrical tank, 7 ft. in diameter, and 10 ft. long, partly filled with oil to a depth of 5 ft.; what is the value of the oil at $8\frac{1}{2}$ cents a U. S. gallon?

Area of cylinder end $= .7854\ D^2 = .7854 \times 7^2 = 38.48$ sq. ft.

Volume of cylinder $= A \times l = 38.48 \times 10 = 384.8$ cu. ft.

For length of chord g h, we have

$$e\,c : c\,g = c\,g : c\,f, \text{ or}$$

$$c\,g = \sqrt{(ec \times cf)} = \sqrt{2\times5} = \sqrt{10} = 3.162,$$ then chord g h $= 3.162 \times 2 = 6.324$ ft.

Sine of angle c o g $= \frac{c\,g}{o\,g} = \frac{3.162}{3.5'} = .90343.$

Corresponding angle $= 64°\ 37'$.

Area of sector e g o h : A = ang. g o h : 360.

Area of sector : 38.48 = 129.25 : 360

$$\text{or } a = \frac{38.48\times129.25}{360} = 13.81 \text{ sq. ft.}$$

$$\text{Area of triangle g o h c} = \frac{g\,h\times c\,o}{2} = \frac{3.162\times1.5}{2} = 2.37 \text{ sq. ft.}$$

Area of segment e g c h = 13.81 sq. ft. — 2.37 sq. ft. = 11.44 sq. ft.

Area of end of contents = 38.48 — 11.44 = 27.04 sq. ft.

Vol. of contents $= 27.04 \times 10 = 270.4$ cu. ft.

Capacity in U. S. gals. = vol. in cu. ft. $\times 7.48 = 270.4 \times 7.48 = 2022.6$ gallons.

Value $= 8.5 \times 2022.6 = \$171.92$.

If resold at \$3.50 a barrel, what would be the profit?

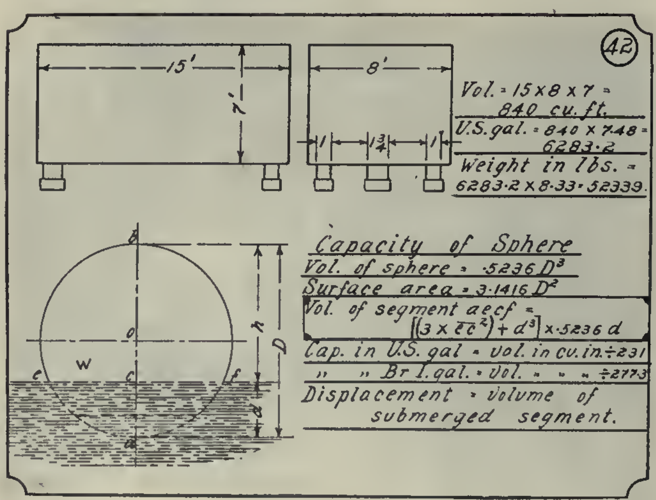
A bbl. contains $31\frac{1}{2}$ gal., and number of bbls. $= 2022.6 \div 31.5 = 64.2$.

Selling price $= \$3.50\times64.2 = \$224.70$.

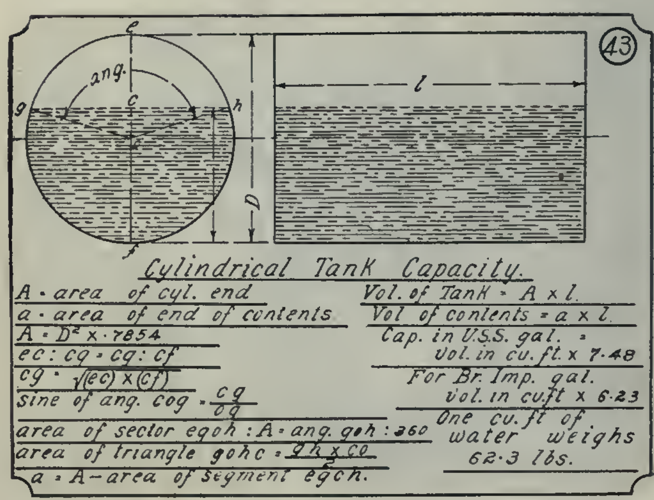
Profit = \$224.70—\$171.92 = \$52.78.

READERS' QUERIES.

Question.—A pipe six inches in diameter and 100 feet high is full of water and closed at both top and bottom. What



ARITHMETIC CHART 42.



ARITHMETIC CHART 43.

pressure per square inch would be produced on the outside of the pipe at the top by opening it at the bottom? Could the vacuum pressure be equal to the static weight of the water which, in this case, would be 43.4 pounds per square inch?—A. C. Rioux, Clavesholm, Alta.

Answer.—Taking for granted that no air is allowed to enter the pipe when the bottom is opend, the external pressure would depend upon the hight of the barometer or the atmospheric pressure which varies according to the altitude of the place at which experiment is carried out.

At the sea level the average barometer reading is 30 inches which corresponds to an atmospheric pressure of 14.701 pounds per square inch. Upon opening the bottom, the water would fall in the pipe until the weight of the remaining water would exactly equal the pressure of the atmosphere; that is, it would stand at 33.9095 feet. The upper 66.05 feet of pipe would be subjected to the atmospheric pressure of 14.701 pounds per square inch which would tend to collapse it.

In the province of Alberta, the average height of the barometer is about 26.3 inches, which corresponds to an atmospheric pressure of 12.926 pounds per square inch. The water in this case, would fall to a height of 29.853 feet. The space in the upper 70.147 feet would be practically a vacuum and would therefore be subject to an external pressure of 12.926 pounds per square inch.

ROLLING MILL MOTOR CONTROLLERS.

IN a paper read before the American Association of Iron and Steel Electrical Engineers, W. Sykes and G. E. Stotz made plea for simpler controllers on rolling mill motors. The motors themselves have been so perfected that trouble with them arises only under extraordinary circumstances, but, to reduce the risk of overloading the machines while accelerating the heavy rotating parts of the mill drive, complicated automatic controllers have been introduced which not infrequently introduce more maintenance troubles than they remove. Interlocks and a multiplicity of contacts and relays should be avoided, as far as possible in favor of manual operation by proper attendants.

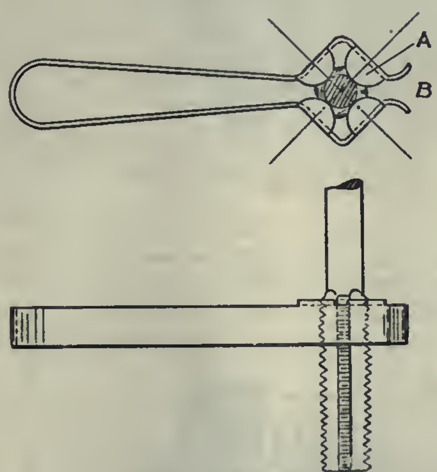
Rolling mill motors necessarily carry high momentary peak loads, hence it is difficult to protect them against long continued moderate overloads. Ordinarily, the speed drop of an induction motor from light to full load is only 2 or 3 per cent., which does not permit a fly-wheel to relieve appreciably peak loads on the driving motor. A liquid slip regulator, providing 10 to 15 per cent., or greater speed drop on full load, permits the fly-wheel to become usefully operative, and maintains more uniform load on the motor than is possible where step-by-step grid resistances and switches are used.

As compared with a controller and fixed slip arrangement, a liquid slip regulator effects very important reductions in the maximum power required for rolling; this saving becoming more considerable the smaller the fixed slip, and in a particular case the use of a liquid slip regulator reduced the maximum demand 30 per cent. and 40 per cent., as compared with the demand when rolling with 11 per cent. and 6 per cent. fixed slip respectively.

A TAP CLEANER.

By J. E. Cooley.

EACH time a hole is tapped out it is necessary to clean the chips from the tap, before it can be put into another hole. The oil used on the tap causes the chips to adhere to the grooves.



A TAP CLEANER.

The usual method for cleaning a tap is by means of a brush or a piece of waste, wiping off each groove separately. In the enclosed sketch is shown a handy tap cleaner, which cleans the chips from all the grooves at the same time, at one quick stroke.

It is made from a strip of sheet steel, having four ears, as A, bent over to fit in the tap grooves as shown. The cleaner is slipped on the tap-shank through the opening B, then pushed down on the grooves, the ears, A, cleaning off the chips.

Detinning Process.—A new method of removing tin from coated metals has been invented by Wallace Savage, Piedmont, Alabama. The inventor has discovered that at a temperature below 68 deg. F. and preferably at 32 deg. F., a coating of white tin can be changed to the non-adherent gray tin by the catalytic action of gray tin, applied in the form of a slimy mixture with a solution of tin ammonium chloride. A mixture of about 2,500 lb. of gray tin is used with a solution of 10 lb. of tin ammonium chloride in 100 gals. of water. Agitation may be employed, or the coated material may be merely moved through this slime.

P. R. R. TESTING PLANT AND LABORATORY.

THE Pennsylvania Railway Co. has just completed a concrete building to contain the testing plant and electrical laboratory for its shops at Altoona, Pa. The machinery for the testing of couplers, brakes, steel bars, and heavy material is placed in the basement and on the first floor. One machine is capable of crushing at a pressure of 1,000,000 lb. This machine is also used for determining the lifting strength of connections. In the electrical department is a large electric light globe testing plant with which 960 bulbs can be tested at one time. Explosives will be stored in an explosion-proof department in the basement.

The walls are of concrete and 2 ft. thick, while the floors of the building are an experiment. On a 5 in. layer of sawdust has been placed a ½ in. covering of red cement. The process was discovered in and the materials were imported from Greece. It deadens sound and is more comfortable for those who do their work standing.

CORLISS ENGINE DASHPOTS.

DASHPOTS on a Corliss engine, says a U.S. contemporary, should receive as much attention as the governing mechanism, for the latter will have little or no effect on the speed, and the steam economy will be low if the dashpot pistons do not close quickly. If the dashpots are sluggish in action, the engine may even run away. A little oil dropped in the dashpots now and then will prevent leakage between the piston and cylinder and will also prevent scoring which may give rise to trouble later. Indicator cards will show whether the governing mechanism or dashpots are the cause of poor speed regulation or high steam consumption.

If the admission curve drops off gradually before the expansion curve starts in, it shows that the admission valve is not closed quickly enough and that the steam is being "wire-drawn." If this be the case, the dashpot pistons may be too snug or they may be worn and leak air. In either event, the trouble should be remedied to get the full advantage of automatic cut-off.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Marine Engineering Product Achievements

BRIDGE REAMER MILLING MACHINE.

THE description and illustration refer to a bridge reamer milling machine recently put on the market by the Hendey Machine Co., Torrington, Conn. The equipment includes a double or elevating table with the top section pivoted at the rear end, and rising and falling between substantial guides cast with the lever half or slide on the front. Provision is made to bolt suitable cams or forms to the side of the table, which engage with a roller carried by a bracket bolted to face of saddle; these cams being so formed and applied as to allow for continuous fluting of reamers having both initial and secondary tapers or with taper start and straight body. The eight spindle centres shown mounted on the table of the machine index in unison, and the combined equipment makes a very efficient machine for the class of work intended.

The swing of these centres is 1½ in. and the spindles in the headstock are fitted with centres and coupling drivers, adapted for the tangs of taper shanks conforming to the Morse Nos. 2 and 3 standards. The feed index plate, which is of the ratchet type, is regularly drilled for 12 holes to provide 2, 3, 4, 6 and 12 divisions, but if desired, other rows of holes for different divisions can be supplied. Spring tension and lever release

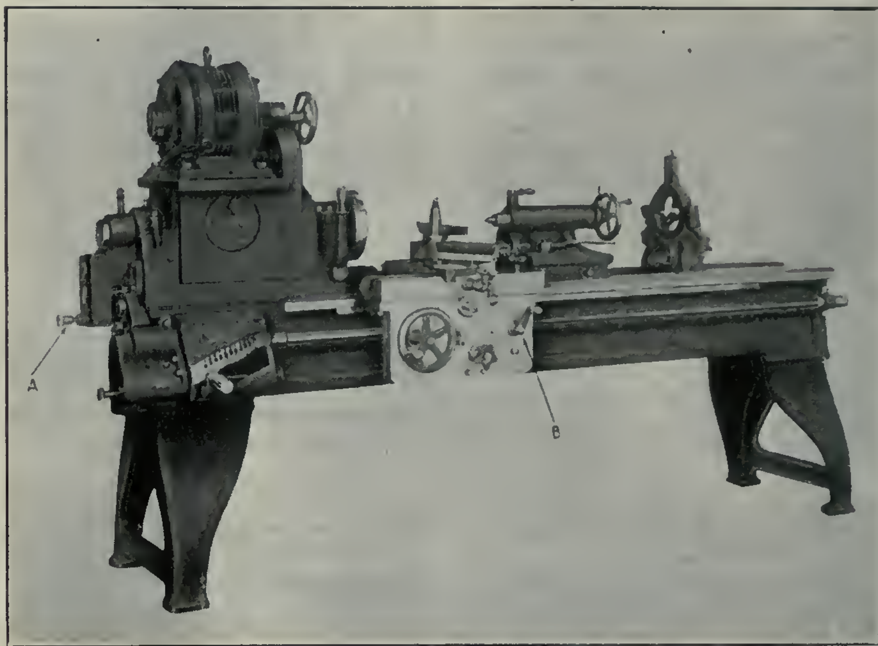
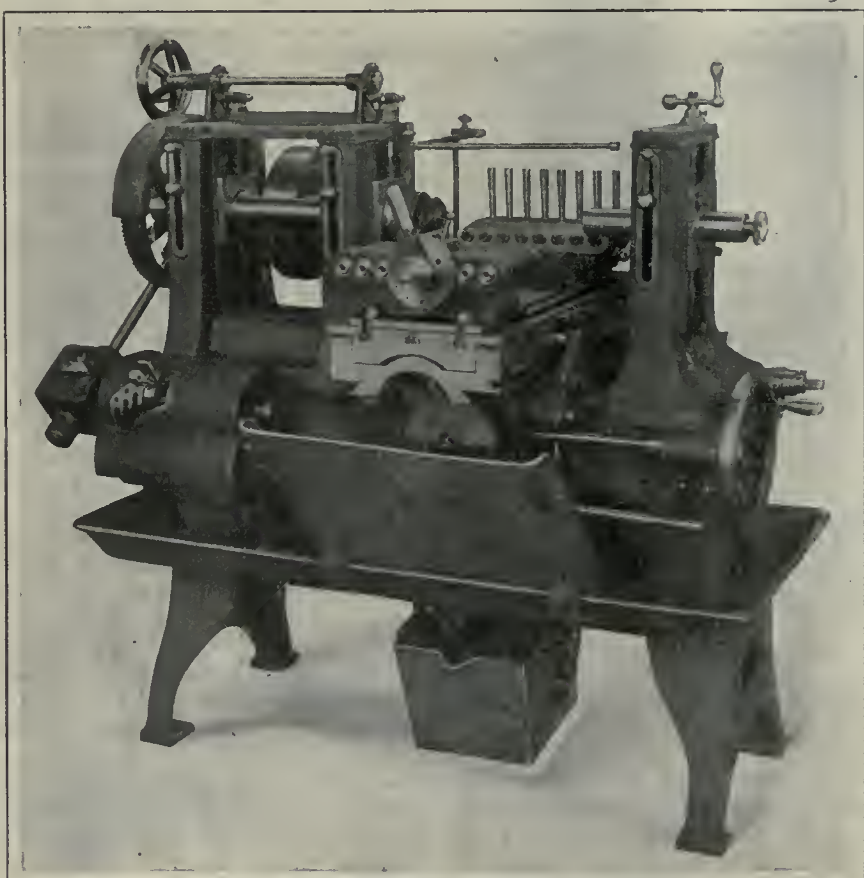


FIG. 1. MOTOR-DRIVEN ENGINE LATHE.

are provided for the footstock centres, and the binding plugs are operated by two handles, one on either side of the block.

In addition to the spindle centres illustrated, spring chuck equipment can also be supplied for centering and holding the ends of pinion shafts and similar work, which can be milled in unison. The maximum capacity of these chucks is ⅞ in. and a draw-in rod, two of which have to be operated by a key passed through a ratchet index plate, is relied upon to hold them in position. This type of head-stock is fitted with special binding plugs, controlled by two levers, each one binding fur spindles through two plugs and connecting compression block.



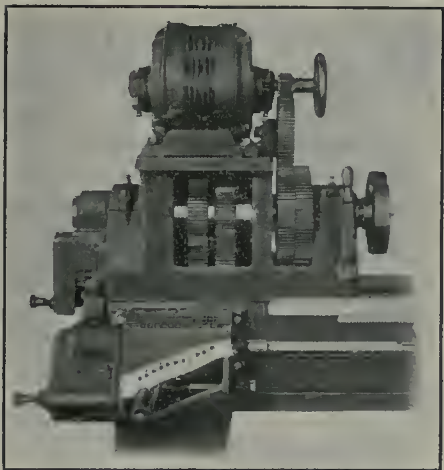
BRIDGE REAMER MILLING MACHINE.

MOTOR-DRIVEN ENGINE LATHE.

FIG. I. shows a 16 x 8 motor-driven Cisco engine lathe, which will be shipped to San Francisco for the Panama Pacific Exposition, together with a 14 x 8 and an 18 x 10, by the Cincinnati Iron and Steel Co., Cincinnati, Ohio.

Two small improvements have been made on the lathe. At the point A, a pull pin is arranged so that, when at neutral, the lathe can be run at high speed and all gears from the first compound thrown out, this being especially desirable for filing and work of that kind. At the point B, the lock on half nut is arranged so that the lead screw cannot be clamped too tightly.

The beds of these lathes are being made deeper and heavier, and in the future will all be of semi-steel. A number of other small improvements have been made, such as higher nuts on the tail stock, etc. ,



MOTOR DRIVE "CISCO" ENGINE LATHE.

Fig. 2 shows the motor drive arrangement; this requiring a 2½ or 3 h.p. motor, either d.c. or a.c., variable speed or constant. The head itself has three speeds, two controlled by a lever in front to a friction on the inside, and one an open speed obtained through the face gear. To use the open speed, it is necessary to have the lever on front of head in neutral position. There are two bearings on the main shaft with a raw hide pinion drive on the motor. The head is open both front and back. The illustration shows a constant speed, Westinghouse motor, of 3 h.p., 1,100 r.p.m., for a.c. current. A new arrangement has been worked out in the change gear box, in the matter of guides for the tumbler, so that the operator can obtain his various ranges and changes without difficulty.

FIG. 3. TYPE OF CUTTER.

GEAR PLANER.

WHAT is known as the "Sunderland" Gear Planer is being introduced to the Canadian market by the Dominion Machinery Co., 82 Adelaide street East, Toronto. It is manufactured by J. Parkinson & Son, Shipley, England, and among the claims made on its behalf are those of large producing capacity, low cost of cutters, and first class finish to any work on which it may be employed.

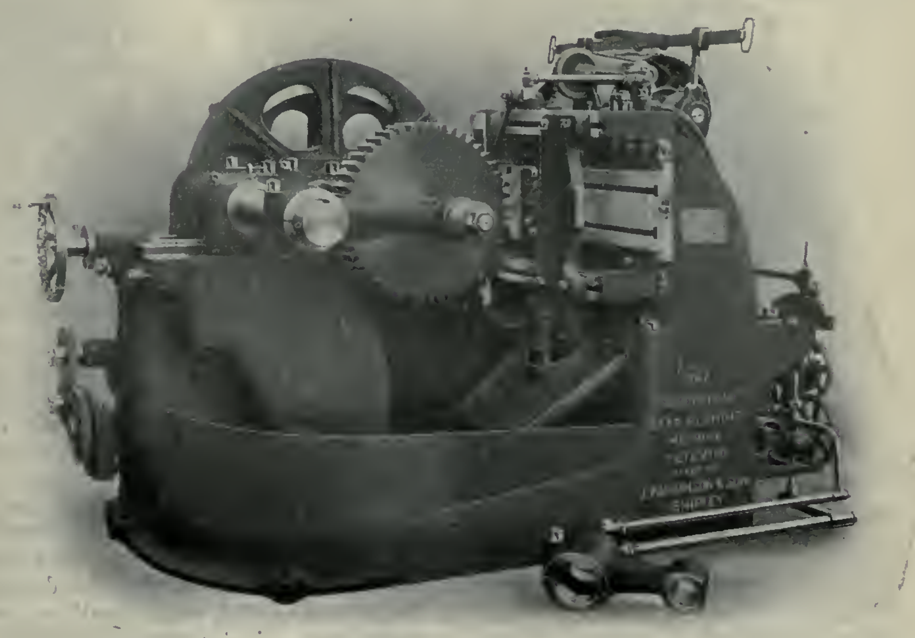


FIG. 1. CUTTING ORDINARY SPUR GEARS

Fig. 1 shows the machine cutting ordinary spur gears with cutter making the actual cut. The spindle is hollow, thus enabling gears that are solid with their shafts to be cut. Ordinary gear blanks are mounted on an arbor secured in the spindle socket.

The operation of this gear planer is as follows: The feed motion driving through one shaft, causes simultaneously and in unison the rotary motion of the blank and the travel of the cutter for a distance of one, two or more pitches according to circumstances, whereupon the gear blank withdraws from the cutter which returns to its original position, in order to operate on the next or succeeding segment of the gear blank, which then re-engages the cutter. These movements repeated complete the gear being cut. The feed operates intermit-

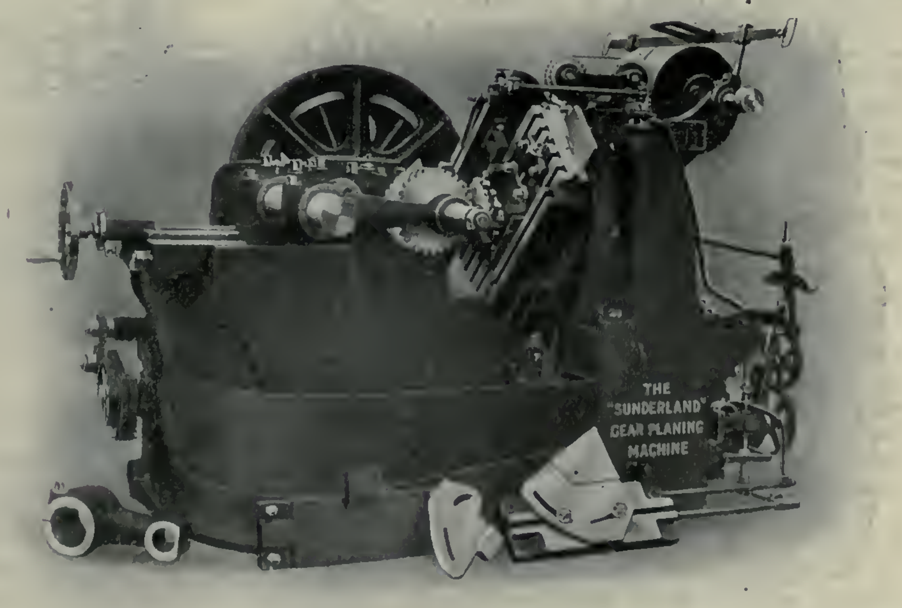


FIG. 2. CUTTING SPIRAL GEARS.

tently, and during the cutting stroke, the dividing wheel and worm are at rest and not wearing. The rate of feed may be varied while running by a conveniently placed quick-change lever.

Fig. 2 shows the machine cutting spiral gear, of which class up to 40 in. diameter may be cut if the angle does not exceed 30 degrees.

FIG. 4. RACK AND GEAR PRINCIPLE OF CUTTER OPERATION.

Fig. 3 shows the type of cutter employed, these being easily sharpened without alteration of size or form of tooth, and one cutter only per pitch is required.

METALLIC SPRAYING.

By R. Morcom.

In a paper read before the Institute of Metals at Portsmouth, the author described a method of producing uniform metallic deposits by a spraying process. The exact theory of the process is, he said, complex, and at present not completely understood. The spraying may be accomplished in various ways, and practical experience is demonstrating how apparatus of increasing technical convenience for the purpose may be made.

In the earliest attempts, the metal was melted in a pot, forced through a fine nozzle under high pressure, and sprayed with steam or a gas upon a surface. Improved results were achieved by driving metallic powders at high velocity against the body to be coated by means of gaseous jets expanded from considerable pressure. For producing the metallic powders, the metal had to be subjected to one of the known pulverising processes, such as distillation, grinding, or spraying, and it occurred to Schoop, the inventor of the two processes referred to above, that the pulverisation and deposition could be combined in one apparatus.

Construction of the Apparatus.

The essential parts of the machine, or "pistol," are a combined melting and spraying jet, and a feed mechanism. The metal, in the form of rod or wire, is fed to the melting flame by a small pneumatic motor, driven by the spraying medium either in series or parallel with the main jet. The flame may be formed by coal gas, water gas, acetylene, hydrogen, etc., burning in air or oxygen, according to the metal used. The gases are supplied at such pressures as to prevent blowing-out and to ensure a highly deoxidising flame. The spraying jet may be of carbon dioxide, nitrogen, air, steam, etc., and is fed at such a pressure as to produce a sufficiently high velocity for successful coating. The various pressures must be carefully kept constant by accurate gauges and reducing valves. The dimensions of the wire, nozzle, and feed mechanism vary with the different metals, and the nozzles and feed mechanism are so designed as to be readily interchangeable. For small work, hand operation is sufficient; but, probably, when large work is undertaken, it will prove convenient to have mechanical traverse and control.

To obtain the best adhesion, the surface upon which the metal is sprayed must be thoroughly clean and of an open nature to give a key for the deposit. Sand-blasting with sharp sand has been found best. Shot gives too polished a surface. Such surfaces as fabrics, wood, unglazed earthenware, and asbestos require only freedom from grease, as their surfaces give a natural key. Celluloid, and even explosives, can be safely metal-sprayed.

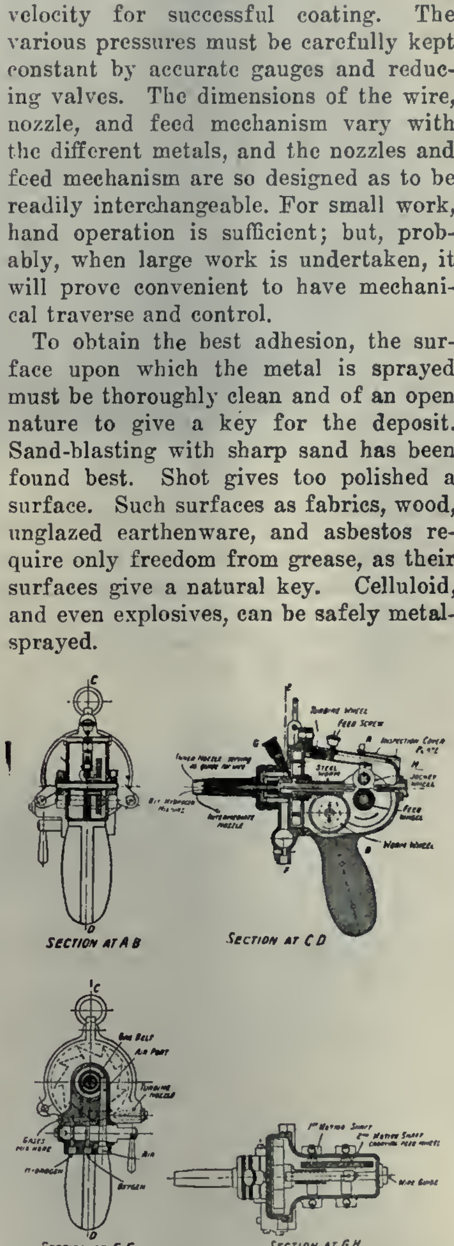


FIG. 1—SECTIONAL DRAWINGS OF THE SPRAYING MACHINE OR PISTOL.

Theory of the Process.

The melting jet is focused at A on the tip of the wire. The spraying jet, cold from expansion, strongly draws forward the products of combustion in the centre of its cone, and by its draught drags off minute particles of metal, either in the plastic or molten state. The central cone, therefore, consists of metal particles, some cooled to solidity, some molten, and some perhaps gaseous, surrounded by a protective reducing atmosphere. This cone is hurled forward with great velocity upon the object to be coated, B, C, by the outer jet. There is a most definite economical quantity of gas which should be used in the pistol, this quantity being about 1.5 cu. ft. of hydrogen per minute, and 0.5 cu. ft. of oxygen, or about 0.8 cu. ft. of coal gas to 0.65 cu. ft. of oxygen for present standard designs.

The outer jet keeps the nozzles and wire cool, cools the object, and produces the requisite velocity. In addition, it has to atomise the molten metal and accelerate the particles up to its own velocity. For this, a certain mass of air is required. As at present constructed,

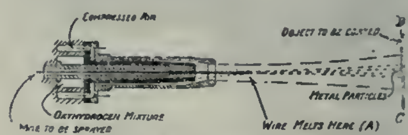


FIG. 2—MELTING AND SPRAYING JETS IN ACTION.

the standard pistol uses about 0.55 to 0.6 cu. ft. per minute for every 1 lb. per sq. in. air pressure, so that with an air supply at 80 lb. per sq. in., which is a very suitable figure for ordinary spraying, the air consumption will be from 45 to 50 cu. ft. per minute. The mass of this will be from 830 to 920 grammes, and the mass of metal sprayed by this air will vary from about eight grammes in the case of iron to about 200 grammes in the case of lead. The effectiveness of the cooling is shown by the fact that the hand can be held in the jet, so as to receive a coating of metal, without inconvenience.

The action of deposition is probably a complex one. The minute particles of solid metal are driven with such force against the object that, in some cases, they fuse, but, owing to their small relative size, are promptly chilled by the object to which they adhere. If any of the particles are molten or gaseous they will adhere. In addition, the suddenly chilled particles are possibly, or even probably, in the state of unstable equilibrium found in "Prince Rupert's Drops," and act like so many minute bombs, bursting on impact into almost molecular dimensions, and penetrating the smallest cracks and fissures of the object.

Some care is required in manipulation as, by varying the conditions, it is possible to spray porous or non-porous coatings and, with some metals, anything from a pure metal to a pure oxide. With care, however, non-porous, oxide-free, adherent coatings can be procured of almost any metal on almost any solid.

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Vol. XII. NOVEMBER 26, 1914 No. 22

PRINCIPAL CONTENTS:

PROGRESS WORTH WHILE!

IN these days when industries are being driven countrywards by exorbitant taxation and when both capital and labor are assessing production for all it is worth, it is refreshing to make note of successful achievements in the other and opposite direction.

The city of Winnipeg, Man., is to be congratulated upon possessing not only the cheapest electrical energy in Canada, but on having attained that pre-eminence without lowering wages or curtailing reasonable profits. The cost of labor and material in this Western city are decidedly high, hence the achievement is all the more a triumph of careful business methods and honorable public service. The city of Galt, Ont., comes a close second, but comparison is difficult on account of the different methods adopted for fixing the service rate, the flat rate plan of the latter city distinctly favoring the small householder.

The beneficial effects of thus cheapening such a necessary commodity cannot be over-estimated as there are so many other industries that will be directly or indirectly stimulated by increased adoption. A little reasoning will also show that the wage-earner is much better off than if he had received a raise in pay to offset a proportionate increase in the cost of what are to him almost absolute necessities. As it is, he is richer by a commodity that tends to make him a better man and a higher type of mechanic.

The short-sighted policy of lowering costs by cutting wages is but temporary in its effects and is in no way an advance in the science of management. The reduction of costs by improved methods of manufacture and the co-operation of satisfied employees is of individual and national importance and worthy of the united effort of all concerned.

THE SECURING OF DEPARTMENT HEADS.

FEW men who have ambitions of filling a position higher up realize the difficulties which beset him who is required to make the selection. It is not often that such positions can be filled from the rank and file of the plant and, in most instances where this procedure has been closely followed, the men have been chosen chiefly upon merits which are by no means the most satisfactory. In any case, the system of choosing department heads from among the workmen cannot help but cause more or less dissatisfaction among those who have devoted themselves diligently to, it may be, other equally essential qualifications for the position.

The department head should, first of all, be a tactician and, secondly, be master of his business; a very rare combination. The most valuable qualities therefore, cannot be developed in men by confining their educaton to a single institution any more than a college education can make a master mechanic. The system of developing factory heads directly has, nevertheless, been strongly advocated by men who have themselves achieved advancement, and it certainly possesses some advantages.

Several firms of our acquaintance have scored decidedly by employing as many apprentices as convenient and encouraging them to leave for other fields as soon as their time was served. A careful record is made of each young man's likely qualifications during his period of employment and those showing particular aptitude in handling men are closely followed up after leaving. The period of apprenticeship is usually amply sufficient to establish the character and reliability of the proposed candidate and, if this can be coupled with a successful and varied subsequent education outside the particular institution, the choosing of a department head is shorn of a large part of the guess-work usually attached to it.

The men also recognize their new foreman as one of themselves, although with all the added qualifications of an outsider. There is thus removed the most prolific causes of discontent and lack of co-operation and cordiality between those who direct and those who take direction.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 40
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	Toronto.
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X	18 00	17 00
Victoria, No. 2 Plain	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	Cents.
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	Cents.
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 50
Copper, crucible	10 00	9 50
Copper, unch-bled, heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	8 50	8 50
No. 1 compos'n turnings	8 50	8 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75 & 5
Stove bolts	80
Plate washers	45
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Fillister head	25 per cent.
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. & Hex. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%
Nipples	75%

METALS.

	Montreal	Toronto.
Lake copper, carload	$13 50	$13 50
Electrolytic copper	13 25	13 25
Castings copper	13 00	13 00
Spelter	5 75	5 60
Tin	35 00	35 50
Lead	4 85	4 60
Antimony	16 00	16 00
Aluminum	21 00	21 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	.1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect July 2, 1914:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	72	62
7, 8, 10 in.	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	18½
Benzine, single bbls., per gal.	18½
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.56
Linseed oil, boiled, single bbls.	0.59
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50% & 10%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents.
XXX extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 08¾
X Press	0 07¾
COLORED.	
Lion	0 07
Standard	0 06¼
Popular	0 05½
Keen	0 05
PACKING.	
Arrow	0 15
Anchor	0 06
Anvil	0 07½
Axle	0 09
WASHED WIPERS.	
Select white	0 06
Light colored	0 06½
Dark colored	0 05

Prices per lb.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Nov. 23, 1914.—The outstanding feature of trade conditions can best be described as "very quiet." This circumstance, however, is not one at which to become at all alarmed, because the very soundness of the financial foundation upon which our manufacturing institutions are built is surely evidenced by the remarkably good condition we find them in to-day. Machine shops and various other manufacturing establishments are in most cases operating and are able to so distribute the work that has come their way so as to give employment to the largest number of employees possible. In times of great prosperity petty troubles have often caused serious disagreement between labor and capital, but it is gratifying to note how, under the influence of a common depression, each side has done and is still doing its utmost to assist the other. Furthermore, a greater spirit of loyalty has been instilled into all classes, and with that loyalty there has been aroused a spirit of national pride.

The importation of steel and iron has dropped off to a large extent, and trade along these lines is very dull. In the metal market, and among its many fluctuations, copper seems to have been the most active. The machine tool market continues dull. The liberal distribution of orders for munitions of war and for their supplies to Canadian firms has relieved a great deal of the pressure in many instances. Much money is being kept in circulation through these orders and conditions as a whole are beginning to wear a more optimistic hue. Underlying this, of course, is the well defined feeling that Canada is due for a wave of wonderful prosperity when conditions once more become normal in Europe.

The Steel Market.

The situation in steel is very much the same as has been prevailing for some time past. Prices do not fluctuate to any extent. This is rather remarkable, because the natural tendency would have been a decline. It is perhaps due to the United States Steel Corporation that these prices have been maintained, the policy of such large corporations having the tendency to keep the market more or less steady. A nominal amount of machinery steel is being sold, but the business in structural steel is very quiet.

Pig Iron.

Little business has been moving in pig iron circles. Lately, however, the number of inquiries have been on the increase. No real improvement in business has been noted, but it shows that the market conditions are keenly watched and, as soon as there is the slightest provocation, business will again be resumed. A little flurry in pig iron circles was caused by a firm in Buffalo offering pig for $12, with delivery during the first six months of 1915. This exceedingly low price caused the list of inquiries to be enlarged, and considerable business was placed. It is understood, however, that this quotation has been recalled. Pig iron is worth more than $12, and thus the price would naturally rise.

Machine Tools.

The machine tool trade is still very dull, and no great improvement can meantime be expected. Of course, there are from time to time small orders reported which tend to total up to a fair figure. Orders for supplies continue to come in regularly, although mostly in small lots.

Metals.

There are numerous small changes in the metal markets to report. Copper is stiffening in price considerably, due to the fact that the price had dropped away below normal on account of this metal being declared absolute contraband by Britain. Shipments from America were curtailed, and the price will thus stiffen. Lead, too, shows a decidedly stronger tone. Business continues to be fair.

Toronto, Ont., Nov. 24, 1914.—Generally speaking, industrial conditions are much the same as have prevailed during the past few weeks. The situation is gradually improving and a more confident spirit prevails in business circles, although a return to real normal conditions is still some way off. The bright prospects for the agricultural industry and the large orders for war supplies have been largely responsible for the improvement in the outlook and in preventing a more serious decline. The effect of these Government orders will not so much make conditions that are usually regarded as normal, but rather tend to keep business at a level which, under the circumstances might be called satisfactory. It is hardly probable that any pronounced improvement will be experienced for some months, but more likely conditions will remain very much as at present. More decided progress by the allied forces would relieve the situation considerably, but indications point to a prolonged struggle.

An interesting situation has been disclosed through the publication of a comparative statement of exports and imports for October. The returns show a decided improvement, the growth of trade in that month being almost equal to the decrease in the total for the seven months of the fiscal year. Exports of manufactured products increased by over two million dollars in October and over eight million dollars in the seven months. The statement is considered highly satisfactory under existing conditions. With regard to the export trade for this month, difficulties have arisen in the way of scarcity of tonnage eastbound from St. Lawrence ports. It appears that large quantities of freight have accumulated at Montreal, which should be shipped before the close of navigation, due in a few days. The trouble has been caused on account of the number of regular liners which have been taken off that route as transports for the British Government.

Steel Markets.

Considerable dullness still exists in the iron and steel trades, conditions generally showing little, if any, improvement. The demand for structural shapes is light as the building trade is extremely quiet, and few factory extensions are being made. The money market is still too unfavorable to allow of any important developments in this direction, although money conditions are more satisfactory. Consumers are sending out inquiries for next year's requirements for regular tonnages, deliveries in many cases to be made in January.

Representatives of Canadian mills are in England looking over the situation with a view to possible business. The Algoma Steel Corporation has received an order for 20,000 tons of steel rails for January delivery. The city of Toronto recently placed orders for cast iron pipe with the National Iron Works and Canadian Allis-Chalmers, Ltd.

Reports from the United States show that the improvement in the steel trade, as stated last week, has been maintained and that a more hopeful feeling exists. There has been no change in prices, although there is a weaker tendency for large tonnages. The market in Toronto is steady and prices firm. There has been no change in scrap metals, business generally being quiet.

Pig Iron.

The pig iron market is dull and seems destined to remain in this condition for some time. Few foundries are working at anything approaching capacity and consumers generally are holding off. Prices are unchanged, although the market is weak.

Machine Tools.

There is little business moving in machine tools. Dealers report few sales and no very interesting inquiries have been received. The Canadian Kodak Co. have purchased two Bignell & Keeler pipe-threading machines for their new factory at Mount Denis, near here. The machine shop supply business is quiet, with prices steady.

Metals.

With few exceptions the metal markets are comparatively steady, and business is quiet. Tin is unchanged but is showing a weaker tendency. Copper has hardened since the metal exchanges opened and the situation has improved, quotations being about 25c higher. Lead is stronger and has advanced slightly, being now quoted at $4.60. Spelter has also advanced to $5.60. Antimony and aluminum are quiet and prices are unchanged.

Trade Gossip

Oil Regulations Relaxed.—An Order-in-Council has been passed relaxing the regulations for the disposal of petroleum and natural gas rights on account of the financial stringency prevailing as a result of the war. An extension of time for a year from October 15, 1914, within which to pay the rental for such rights which were due at the time and within which to instal machinery and equipment on the locations leased, has been authorized.

Dominion Steel Corporation.—C. S. Martin, superintendent of the Dominion Steel Corporation, is reported as stating that there are 2,000 men employed at the plant, more than half of the full staff. The plant is rolling a ten-thousand ton order of rails for South Africa. Rod, nail, wire, and billet mills, etc., have for some time been working to capacity. Further cargoes of barbed wire have been shipped to England, and others will follow.

Grain Rates Advanced.—An advance of about one cent per hundred pounds in the rates on grain and grain products from Chicago, Minneapolis, Duluth and other grain-shipping territory to points in the East, as well as for export, has been decided upon by American railways. It is understood that the Canadian railways will make a similar advance, effective about the first of the year. Increased expenses is given as an explanation for the raise.

Ottawa, Ont.—Tenders for the supply of motor trucks for the second Canadian contingent have been received, and will be dealt with by Order-in-Council within the next few days. These tenders, which call for trucks of great power and capacity, are under consideration by a committee appointed by the Minister of Militia, consisting of Honorary Colonels the Hon. George Taylor, John Eaton and W. K. McNaught, Honorary Major MacQuarrie, Messrs. Owen Thomas and T. A. Russell, Col. Hurdman and Quartermaster-General Macdonald.

F. H. Hopkins & Co., railway and contractors' supplies, Montreal, have dissolved. as. J. Rosevear has retired. Frank H. Hopkins and Robert A. C. McNally will continue the business under the old name.

M. Beatty & Sons, Ltd., Welland, Ont., has opened a district sales office in the Builders' Exchange, 154 Simcoe street, Toronto. K. M. McKee, formerly of Welland, will be in charge.

Ottawa, Ont.—The scarcity of tonnage eastward on the St. Lawrence is seriously hampering the movement of food and equipment from Canada to Great Britain and Europe, and the approaching close of navigation from Montreal promises new difficulties. Large quantities of freight have accumulated in Montreal for shipment, and room must be found for it within the next few days, or it must be carried to another port. Deputy Minister O'Hara, of the Department of Trade and Commerce, is in Montreal in connection with the problem.

Winding-up Order. — Mr. Justice Latchford at Osgoode Hall, Toronto, on November 20, granted T. H. Roy's petition for the winding up of the Rock & Power Machinery Co., Ltd., of Toronto. The firm was capitalized at $500,000.

Toronto, Ont.—An order for the winding up of the Marine Construction Co., of Toronto, was granted at Osgoode Hall on Nov. 17, by Mr. Justice Latchford. It will not issue till after a meeting of the creditors of the company. J. P. Langley is named as interim liquidator with a reference to the Master-in-Ordinary. The company was incorporated in October, 1910, with a nominal capital of $40,000, in $10 shares. The application was made on the application of J. G. Robinson, a director, who makes a claim for $5,000 for money advanced. The assets of the company are placed at $14,000 and the liabilities at $17,000.

Patents Secured.—Following is a list of patents recently secured through the agency of Marion & Marion, patent attorneys, Montreal and Washington: Fernand Cumont, Paris, controller for electric motors; Donald McLaren, Fort William, canoe motor frame; Dr. Abraham Wijnberg, Amsterdam, process of regenerating decolorizing carbon; James W. T. Cadett, Ashtead, carburettor for internal combustion engine; Pierre Dansereau, Montreal, wheel axle; Camille Duquenne, Paris, means for raising liquids and for pumping fluids of any kind; Napoleon Guillemette, Three Rivers, floor oiler; Edmond Lanhoffer, Poissy, France, method of and apparatus for moulding objects by pressure.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

CANADIAN TRADE IS NOW IMPROVING.

A MATERIAL improvement in the total volume of Canadian trade is shown by a comparative statement of exports and imports issued for the month of October. The increase for October is almost equal to the total decrease shown in the figures for the seven months of the fiscal year.

The October trade amounted in value to $139,537, 008, an increase of $24,974,093, while the total for the seven months' period was $640,171,607, a decrease of $25,993,741. Even allowing for the heavy increase in imports of coin and bullion, which do not benefit the revenue, the statement is considered to be far from discouraging under existing conditions.

October exports, domestic and foreign, amounted to $51,844,559, a decrease of $9,295,326, but an increase of $128,903 is shown in the statement of exports for the seven months, the amount for the present fiscal year up to October 31 being $272,141,330.

Imports increased by $34,269,419 in October, reaching a total of $87,692,449. They decreased by $26,122,644 in the seven months, the total imports for this year's period being $368,030,277. Imports of coin and bullion amounted to $52,578,669 in October and $81,228,410 in the seven months, an increase of $51,536,944 in one case and of $77,620,266 in the other.

Exports of domestic products gained considerably under some heads and lost only slightly under others. Exports of manufactured products increased by $2,098,837 in October and $8,011,278 in the seven months. Exports of agricultural products dropped by $14,338,761 in October and by $33,447,946 in the seven months, the heaviest decrease in the list. Under animals and their products, there is an increase of $1,949,694 for October and $10,635,151 for the seven months. Under fisheries, the decreases are $747,754 and $1,406,415; under mines, $697,684 and $2,561,795, while under forest products decreased by $170,377 in the seven months and increased by $430,648 in October.

CANADIAN NICKEL EXPORT.

THE Dominion Government has made an investigation into the destination of Canadian nickel exported from Canada to the United States for the International Nickel Company, of New Jersey, with a view to seeing that none of it reaches Germany.

It is now announced officially that communications have passed between the British and Canadian Governments in respect to the matter. The company claim that since the outbreak of war it has employed effective and successful measures to prevent any nickel manufactured by it from reaching Germany. The company invited investigation, and recently an expert accountant of great experience was sent by the Canadian Government to New York to go into the matter thoroughly.

He made a prolonged and careful investigation, and his report has been submitted to the British Government for consideration as to the sufficiency of the safeguards which are employed by the company for the purpose. It is understood that these are regarded as satisfactory.

The Government recently prohibited the export of nickel from Canada to European countries, save the allies, and has an undertaking from the International Nickel Co. that none of it shall reach Germany by any indirect route. To prevent the export from Canada entirely would be to throw 20,000 men out of employment.

FRENCH MOTOR CAR TRADE.

ONE of the consequences of the war to France is that it has resulted in the almost entire closing down of many motor factories and the complete cessation of all exports. The foreign trade has long been the principal mainstay of French motor car manufacturers, and although latterly foreign competition has been making inroads on their business, it is still one of the biggest branches of industry in France, a fact that may be gathered from the figures just to hand, which show that the shipments during the six months ending with June last attained a value of $20,457,360 as compared with $24,001,260 in the corresponding half of 1913. The principal market for French cars is the United Kingdom, whose purchases have, however, declined from $5,950,560 to $5,669,220. There were also decreases in the shipments to Austria, the United States, Russia, Brazil, Italy, the Argentine Republic, Algeria, and Belgium. On the other hand, those to Turkey, Morocco, Germany, Spain, and Switzerland show an increase.

BRITISH MEASURES FOR RELIEF OF TRADE.

THE London Times in its issue of November 4 gives particulars with reference to the British Treasury's scheme for the relief of trades having debts outstanding abroad. It is announced that a committee, consisting of representatives of the Treasury, the Bank of England, the Joint Stock Banks, and the Association of Chambers of Commerce of the United Kingdom have been formed to whom is delegated the authorization of advances in approved cases to British traders carrying on an export business in despect of debts outstanding in foreign countries and the Colonies, including unpaid foreign and colonial acceptances, which cannot be collected for the time being.

The object in view is to assist traders by removing obstacles to the steady flow of business which have arisen through the temporary interruption of the ordinary channels of collection. The assistance to be given is intended to provide solvent traders with funds to continue their business and to pay their commercial debts to other trades or manufacturers. The banks have agreed that no part of the advances under this scheme shall be applied to paying off or reducing loans or bank overdrafts or meeting unpaid foreign and colonial acceptances held by the trader's own bankers.

Relief Conditions.

The committee will have absolute discretion to decide whether an advance is to be made in any particular case and, if they decide to make an advance, such will not exceed 50 per cent. of the outstandings. Full particulars must be scheduled and lodged with the committee, supported by a statutory declaration of the trader and supplemented by a report from the manager of the bank with whom the trader keeps an account or through whom the advance is to be obtained. The banker may call upon the trader to submit to him audited accounts of his business or such other information as he deems desirable. The necessary forms will be issued by the banks, through whom all applications for advances should be made.

The committee will be prepared at an early date to consider applications and will authorize the bankers of the trader to provide facilities which will take the form of a six months' bill drawn by the trader, accepted by the bank, and certi-

The Waste Feature in Hiring and Discharging Employees*

By Magnus W. Alexander**

The elimination of waste is no new propaganda, although heretofore attention has in large measure been directed to its more visible or tangible and material side. The subject matter of this article deals with an aspect of the question which has in the past been entirely overlooked, due largely, we believe, to the general impression—now clearly erroneous, that hiring and firing exemplified efficiency virtues, the more full and unrestricted were their display.

EVERY employer knows how disheartening it is in industrial life to be obliged occasionally to dismiss employees as a result of business conditions and not through any fault of the employees themselves. Disregarding, however, the personal and the human aspects of this problem, it becomes at once clear that there must be a great waste involved in hiring and discharging. Business concerns have recognized the general truth of this, and have established employment departments which have in time come to be placed on a high plane with expensive and efficient men in charge.

Haphazard Action Doesn't Pay.

Modern business recognizes that it does not pay to hire and discharge at haphazard; but, as far as I have observed, the practice does not seem to indicate that there is as yet a recognition of the practical truth of the matter sufficient to carrq it beyond the theoretical stage. It costs money to train a man—even a skilled man—in the special modes, practices and "tricks-of-trade" that are peculiar to a given concern, and when we let such a man go, we have spent the money for his training in vain, as we will have to take someone else and start the process all over again.

My observations have been directed to a great number of concerns, both large and small, in the United States, embracing what we might call "mechanical industries." During the summer of 1913, while in Europe, I also took occasion to make similar investigations in various factories in Austria, Germany, France and England; and I have some statistics from these indicating that the problem which I am to present to you is not only national but international. It is surprising, therefore, how little serious attention it has received from sagacious business men on this and the other side of the Atlantic.

Uncontrollable Factors.

If you take a factory with 1,000 employees at the beginning of the year, and increase its permanent force to 1,100 at the end of the year, then theoretically under ideal conditions only 100 people should have been hired; but conditions are not ideal, and as business men we cannot expect theoretical conditions to surround our business, so immediately we must make allowance for certain items, viz.:

1.—Men die, and they must be replaced.

2.—Men fall sick, and are laid off for a longer or shorter period of time, at the end of which time, failing to return, they are discharged, and their places filled by others.

3.—Men might be hired under proper conditions, with the proper judgment exercised in their selection, yet of their own accord they may not find it possible to remain in their positions, whether because of climatic conditions, domestic affairs, or other causes which necessitate their removing from the locality.

4.—We must make a certain allowance for less than 100 per cent. of efficiency in the hiring department.

I believe, however, that it must be assumed that only about 1 per cent. of the force of employees die; that about 5 per cent. leave the employ on account of sickness of more than two weeks' duration; that about 10 per cent. withdraw from the service or are eliminated from the service for whatsoever reason; and finally, I have assumed only 75 per cent. of efficiency for the hiring department, because it is a specialized department in the hands of one or a few which can be more easily brought to a higher degree of efficiency than a large department or one that has to be in the keeping of a great many.

As to the 1 per cent. allowance for those who die, I have had recourse to insurance statistics and actuarial figures. Insurance figures also show that less than 10 per cent. of the average factory employees are sick annually for more than two weeks. I have assumed only a 5 per cent. rate because I know that usually, with respect to employees of some length of service, it is customary in factories to keep them on the payroll, even without giving them any wage for a considerably longer period than two weeks.

No reliable experience is available to show how many people withdraw during the year from whatsoever reason, or are asked to withdraw; in fact, the only information that I could find is contained in the United States civil service reports, wherein it is stated that 8 per cent. of all employees in the government civil service are separated from the service annually, and for reasons, including sickness and discharge; or, excluding sickness, the figure is somewhere around 4 or 5 per cent. Realizing that the governmental conditions are different from conditions in industrial establishments, I have, therefore, doubled the figure, and have taken 10 per cent. as the withdrawals by discharge, whether voluntary or involuntary.

It is thus shown that you have to add 16 per cent., or 160 men to the 1,000 in the factory at the beginning of the year in order to show an increase of 100 at the end of the year. Then, again, taking into consideration that the efficiency of your hiring department is 75 per cent., that would furthermore increase the number of those taken on by about 40. The facts show, however, that about 635 were actually engaged, and there appears to be no valid reason why 635 people were brought into this factory as strangers to the plant and had to be broken into the ways of the plant in order to increase the force permanently by only 100. It is obvious that a considerable expenditure of money, effort and care must have been wasted in this respect.

Facts Which Startle.

I took a certain group of factories and endeavored to arrive at a financial valuation, for that purpose dividing the employees into different classes.

I placed in a class (a) all highly skilled machanics who have practiced their trade for a number of years, having acquired it through apprenticeship with more or less regularity.

Under class (b) I included mechanics of lesser skill and experience who very likely could within one year acquire an average degree of efficiency.

In class (c) were included operatives who without any skill or experience soon acquired a sufficient degree of practical knowledge to do the work; such as piece workers whose time on probation is understood to be anywhere from 1 to 3 months.

Class (d) takes in all unskilled productive laborers who can be let go today and replaced by others to-morrow without great loss in the efficiency of the work.

In class (e) I put clerks, shop officers,

*From a recent address before the National Machine Tool Builders' Association.
**General Electric Co., Lynn, Mass.

shop room and labor department and cost accounting officers. The managers of the various factories were good enough to furnish me this information; and I classified the whole number, which covered more than 42,000, in that way.

I found that the increase between January 1 and December 31 had been 6,697, and that the total number who had been engaged for that purpose was 42,571. Applying the percentages which I mentioned before, and also the 75 per cent. efficiency of the hiring department, I found that only 17,596 should have been engaged; but even further allowing in the neighborhood of 3,000 discharges or additional men hired merely due to conditions of production over which no one could have any control, I have by hook or crook brought the figure up to 20,350, which shows that in order to hire 6,697 people they took on in these plants 42,570, although the hiring of at least 22,220 could have been avoided if proper methods and means had been applied.

Allocating the Economic Loss.

I think the economic loss involved in the hiring and discharge of employees may be grouped under the following five reads:

1.—The clerical work of hiring.

2.—The instruction of new employees by the foremen and assistants.

3.—Increased wear and tear of and damage to machinery and tools by new men.

4.—Decreased rate of production during the early period of productivity of the new men.

5.—Increased amount of spoiled work by new employees.

Clerical Work of Hiring.

Taking these five items and analyzing them as to financial value, I find that the clerical work in hiring labor is without doubt the smallest item. It includes interviewing the applicant, who may apply at the plant or department; also, the cost of sending the hiring clerk into the field to find people, incurring thereby the expense of traveling and, often in addition, expense of advertising. When interviewed and engaged the name of the employee is put on the pay-roll book. Various papers have to be made out when he leaves to make room for somebody else who of necessity has to be put in his place, and the whole process has to be gone over again. In addition, the man who leaves has to be taken off the pay-roll book, etc., and I think I am conservative in placing this item at 50 cents per employee.

Instruction Expense.

This is very largely in amount dependent upon the nature of the work and the skill and experience of the new employee. If you will bear in mind the classification of employees, this instruction expense will naturally be lowest in class (d), the unskilled productive laborer, where the expense will be $1 or $2 each. It may be said that perhaps $7.50 per employee will apply to class (a), highly skilled mechanics who have had many years of experience behind them, and it surely will double, or amount to $15, per employee for class (b), and for (c), including mechanics of lesser skill, such as piece workers; the less skilled they are the less they have capacity for, and you must therefore expend correspondingly more labor or cost in instructing them in the particular work for which you require them. We will put this cost at $20. For class (e), which includes clerks in the cost accounting department, stock room, office and the like, it may be a surprise, but it is nevertheless true, that the cost of instruction will be as high as for class (a).

Value of Wear and Tear.

The value of the increased wear and tear and damage to machinery and tools is very difficult to estimate. It will be very small for the clerks in class (e), and for the unproductive unskilled labor in class (d), and relatively small also for the highly skilled mechanics, but class (b), mechanics of lesser skill, and particularly class (c), piece workers, contribute very largely to the expense account of the factory in wear and tear of machinery and tools. To assign a value, I have taken $1 for the first class mentioned and only $10 for the last class mentioned.

Productive Feature.

The loss due to reduced production, of course, is entirely dependent on the value of the produced article, its particular nature and the experience and skill required. My guess, based on some investigation is, that unproductive labor may entail a loss in this direction of $5 per new employee, and the class of clerks in the various departments may entail a loss of $10 per new employee. The highly skilled men may have a reduced productivity throughout the first few weeks amounting to about $20 per employee; and the large class of piece workers may cost a loss of somewhere in the neighborhood of about $20 each, which for their generally less wage means a higher percentage of reduced productivity during the whole period.

Spoiled Material.

The expense due to the increased amount of spoiled work again depends entirely upon the value of the material and the work of the department. I cannot be very far amiss if I assign generally a value of $5 to the last three classes and a value of $15 to the first two classes.

On this basis then I find that the expense for clerical labor is 50 cents throughout; the expense for instruction, taking classes (a), (b), (c), (d) and (e) at $7.50, $15, $20, $2 and $7.50 respectively; for wear and tear, at $10 in classes (b) and (c), respectively, and $1 in classes (a), (d) and (e), respectively; for loss of production at $15 in class (a), $20 in classes (b) and (c), respectively, and $5 in classes (d) and (e) respectively; and for spoiled material at $5 in class (a), the highly skilled class, at $15 in classes (b) and (c), respectively, and nothing for unproductive labor and clerks. This gives me a total of about $37 loss per highly skilled mechanic in new employment; about $60 loss for mechanics of lesser skill, and about $65 for the average piece worker, $8.50 for the unproductive laborer, and $20 for the clerk.

Average Loss $35 per Man Engaged.

Before carrying out the multiplication, in order to be as fair as possible, I have reduced the figures in all these classes to about one-quarter to one-half the values above given, and in multiplying now the number of people in each grade by the financial value here assigned I have the astonishing result that the 22,220 employees, who after making all kinds of allowances were unnecessarily engaged, meant an average loss through their engagement of somewhat over $35 per man to this group of factories, or an actual loss of $750,000 in one year, all of which could have been eliminated, and which amount represents a very considerable percentage of the profits of the various concerns.

To Reduce the Loss.

Assuming that these figures are fairly correct, we are immediately faced with this question: How can this loss of three-quarters of a million dollars be avoided, if not entirely, at least in part? To this question I think five answers present themselves:

First.—A careful study of current employment statistics should be made and an analysis of the reasons for the discharges.

Second.—We need a far higher grade of men in charge of the hiring and firing of men than we have had heretofore in the persons of employment clerks.

Third.—While it is important to exercise proper care, thought and study in the hiring of employees, it seems vastly more important to apply the proper methods in initiating new employees in the work, and to treat them properly.

Fourth.—We ought to have effective systems of apprenticeship, factory schools, special training courses, or whatever name you may call them, so that we may not be dependent only on the grown up men as they float around the country, but that we may effectively take hold of the youth of the country and train them in the ways of our industry, and in loyalty and intelligence.

Finally, so far as it can be done, we ought to be able to regulate a little more the commercial requirements as they come to the factory.

Conditions in England and Germany

This main problem strikes at a very vital feature of our business, not only because competition at home is growing keener and keener, but because our competition from foreign markets will be found to be just as keen or even keener than in the past. It may, therefore, be reassuring to tell you that the problem seems to be of a somewhat international character. Let me give you a few illustrations drawn from factory experience in Germany and England in respect to this question:

A factory which had 13,556 employees at the beginning of the year and 16,450 at the end of the year, or an increase of 2,894, or 21 1-3 per cent., engaged 9,530 people in order to secure 2,894, or in other words, 3 times as many.

Another factory started with 9,165, and increased in the year to 12,032, an increase of 2,867, representing 31¼ per cent., to accomplish which it engaged 10,982 people, or we will ay about 3½ times the increase in the force.

Coming down to a smaller factory still, at the beginning of the year they had 4,636 people, at the end of the year 5,270, an increase of 634, or 13.75 per cent. This required the engaging of 4,845 employees, or 7 2-3 times the increase in the force at the end of the year.

A factory which increased from 365 employees at the beginning of the year to 470 at the end of the year, an increase of 105, or nearly 29 per cent., engaged 637 to gain the increase of 105, or a little over six times the final increase in the force.

A large German factory at the beginning of the year had 10,998 employees; at the end of the year, 11,914, an increase of 916, or say 8.5 per cent.; and it engaged 17,059 employees, or 18½ times the increase; a figure so astonishing for a concern priding itself upon its fine organization that I got permission from the president of the company to go over the books myself and checked it to the very last figure, finding the above correct.

An English factory which stands high among English manufacturing concerns, at the beginning of the year had 3,158 people employed, at the end of the year they had 3,149, or nine less than they started with; yet 2,148 people were required to be taken on to obtain this minus result. I have not yet had time to figure out what percentage that was.

You cannot take quicksand and knead it into a substantial mass; neither can you take a body of transitory employees and knit them into a homogeneous, intelligent, conscientious group of workers. Many of the efforts which we are making through so-called industrial betterment and pension schemes, seem almost wasted, unless we are first able to correct the condition which I have endeavored to point out.

COMPRESSED AIR STORAGE VESSELS.

THE dangers that may lurk in vessels used for storing compressed air and which are often employed at colliers for operating drills and coal-cutting machines or in connection with the starting of gas engines have been repeatedly called attention to. The danger arises from the fact that air is greatly heated by the work spent upon it during compression, and this tends to promote a process of spontaneous ignition amongst any accumulation of oily deposit which may have collected in the receiver or its connections.

Such deposits are very liable to be formed in an air compressing plant, and are derived from the oil used for lubrication, coupled with carbonaceous dust, e.g., coal dust which often exists in the neighborhood of collieries, and thus gets down into the compressor and is afterwards deposited in the receiver and its connections. This danger is greater than many people using these air receivers think, and the only way of avoiding it is by periodical inspection and scrupulous removal, at proper intervals, of any deposit that may be found.

During the past month, particulars of a disastrous explosion of a vessel of this kind has come under our notice, says Vulcan. The receiver was about 3 ft. in diameter by 10 ft. in length, and made of about ⅜ in. plates. The ends were made of about ⅜ in. plates. The ends were made of ½ in. plates, one of them being dished inwards and the other dished outwards to about the same radius, namely, 3 ft. 6 in. The explosion was destructive, though fortunately unattended with injury to life or limb. It is interesting to note that the end which was dished inwards was the one that was blown out, which supports the view that when a cylindrical vessel subject to internal pressure is fitted with dished ends, it is better for the camber to be so placed that the pressure acts on the concave and not on the convex side; in other words, for the camber to be outwards and not inwards.

TECHNICAL MEN AND MANAGEMENT.

THERE is always room for argument as to the practical and the impractical, says Edwin S. Jackman in the Iron Age. President Harrison did a practical act for American trainmen when he urged Congress to pass the automatic coupler bill. Charles Dickens was a practical man when he wrote the "Christmas Carol" to pay his pressing debt; when he created Tiny Tim for old men to read to children.

The men whose knowledge of facts is merely incidental to strength of character and high purpose are the most useful men in trade or shops. Directors of companies do not weigh what a man knows, but they consider his completeness as a man for the work he has to do; and if a technical man is selected, the choice is for other and better reasons than his knowledge of undisputed facts.

Men for heavy burdens need self-control and wisdom more than knowledge of scientific discoveries or mechanical improvements. There is no short cut to real success in building commerce or in building character. Permanency in a nation's trade or in individual success is supported by something greater than the facts of chemistry, of astronomy, or of mechanics.

If a technical man fails as a salesman, his failure is not owing to his education or his training, but to the fact that he was not a salesman and could not love the work. If a technical man succeeds as a general manager his success is due more to his love of the work than to his knowledge of mathematics. A lawyer may fill the highest position in commerce or manufacturing, but his success is only incidentally through legal knowledge; and comes directly through judgment and his insight into human nature. Character is not made up of the material or the seen realities, but of struggles with disappointment and opposition, for out of tribulation grow faith, confidence and honor.

Facts alone cannot be trusted. Facts and science will drift man to all corners of the universe; from doubt to doubt and from error to error. They are good tools, but cannot teach man duty or take the place of faith. Man has discovered some of nature's laws, but all facts and all of man's discoveries are insufficient for his victory without the thumps of life's reverses, by which we learn that logic may be false; faith may be right; force may fail; kindness may succeed.

Quebec, Que.—The Rock City Cigar Co. factory was burned down recently. The damage, estimated at $25,000, is covered by insurance.

PRODUCTION METHODS AND DEVICES

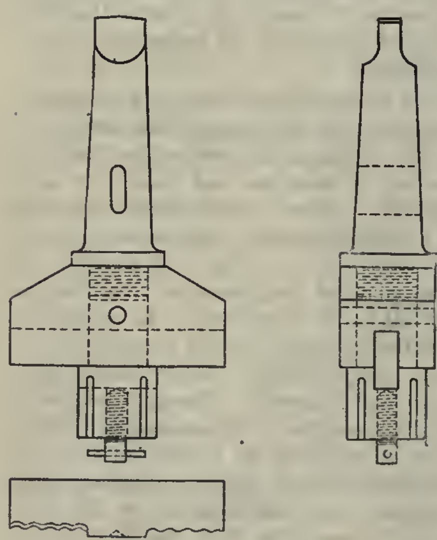
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

A FACING TOOL.

By C. Hulin.

IN boring mills having a centre boring head and doing such work as fly-wheels, it is almost necessary to face the ends of the hub with the centre spindle, although some of the mills are fitted with a third head so that the hub may be faced by hand.

The tool shown in the cut was made in three parts, the shank, body and pilot. The body was threaded and shrunk on the threaded ends of the shank, which was fitted with a No. 5 Morse taper. The body was bored out 1½ inch to take the various sizes of pilots, these being held in place by a No. 6 taper pin. The body was milled out to use ⅝-in. x 1½-in. high speed steel blades, these blades extending through the pilot, and being held and located centrally by means of the hardened screw in the pilot. The blade shown was used for roughing, the teeth of one side corresponding to the grooves on the other, leaving a fairly smooth surface; this being afterwards finished with a smooth blade.

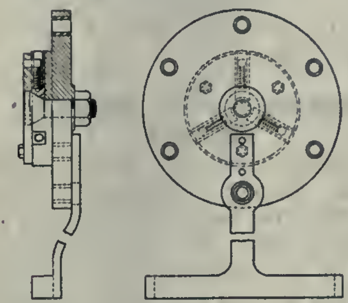


A FACING TOOL.

A CYLINDER DRILL JIG.

By D. O. Barrett.

NOT being supplied with reamers for the various sizes of our gas engine cylinders, it was almost impossible to maintain these at an absolute standard size, and the consequence was we experienced a great deal of trouble with our drill jigs for the cylinder head studs, the pilots which located these not lining up centrally. The jig shown was designed with a T-arm which lined the jig up centrally with the top of the hopper. To centralize the fixture, the three square plugs were expanded by means of the central tapered bolt. These plugs were of ⅝ square cold-drawn steel drilled out to accommodate the spiral spring shown. The plate covering the slots carried pins which project down into the drilled holes of the plugs, and act as stops for the springs. The whole arrangement worked out very satisfactorily, it being impossible for the operator to make any mistake in locating the jig.

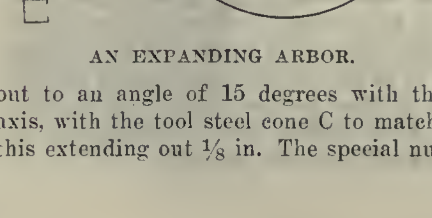


CYLINDER DRILL JIG.

AN EXPANDING ARBOR.

By D. S. Mann.

THE arbor shown in the accompanying drawing was used on an 18 in. Libby turret lathe for re-turning gear blanks, collars, etc., which had previously been bored and faced on one side, being held by chucking. The plate B was bolted to the face of the regular chuck, being centered by the projection on the back which was an enlarged part of the arbor A, the arbor being made a press fit in B, and being further held by means of a stud tapped half in the casting B and half in the arbor A. The arbor was extended a sufficient distance to hold the longest piece to be machined and was split with a 1-16 in. cut in four places. It was bored out to an angle of 15 degrees with the axis, with the tool steel cone C to match, this extending out ⅛ in. The special nut N was extended through the cone C and was provided with a left-hand thread on the inner end on to which was threaded the smaller nut M, this screwing up against a shoulder to prevent squeezing the cone. When the nut N is screwed out on the stud or loosened, the smaller nut on the inner end will draw out the cone. On some of the first of these arbors made, a heavy spring was placed on the inside and an ordinary nut used to force in the expanding cone. The cone would, however, stick at certain times, making it impossible to remove the work. The arrangement shown makes the movement of the cone C positive in both directions.

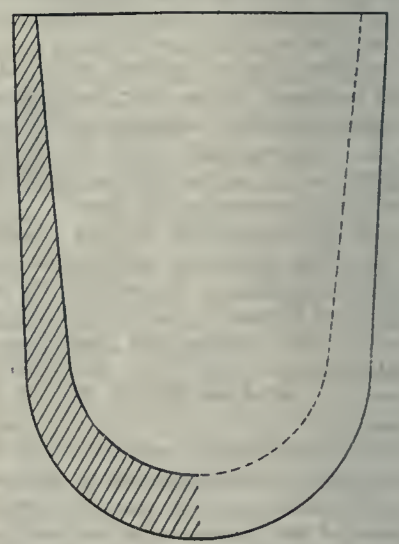


AN EXPANDING ARBOR.

BABBITT MELTING POT.

By A. L. Loy.

FOR melting babbitt and cyanide, we use a cast iron pot of the shape shown in the sketch, the bottom being thick and rounded, as we find they do not burn out as rapidly either from the inside of from the outside. These pots are 13 in. in height and 9 in. in diameter at the top, with the bottom about 1½ in. thick. They are fitted with handles to correspond to the style of furnace used for heating.



BABBITT MELTING POT.

PUNCH AND DIE FOR SHEET RUBBER.

By R. G. Dickens.

SOME time ago, while working as a toolmaker in a small plant at Niagara Falls, operated by two young graduates of the Massachusetts Institute of Technology, the writer had a proposition in the way of a punch and die which he still regards as a test for one's mechanical skill, considering the equipment at hand. The punch and die was required to punch sheet rubber about 1-16 in. in thickness for screens in a pea viner, and was practically as shown in the assembled drawing. The limits of accuracy in spacing was .0005 in any direction, and the number of holes was, as I remember it, about 70, all punched at one stroke.

In order that the reader may understand some of the difficulties involved, I will state that the only equipment I had to use was worn out in an automobile factory before being purchased by the present owners, and consisted of a large pond radial press, an 18-in. Lodge & Shipley all-geared, heavy duty lathe, a Gould & Eberhardt 18-in. shaper, and a Brown & Sharpe universal miller. As neither the shaper nor milling machine were large enough to finish the body plates in one setting, it was necessary to use eight settings in the shaper, as they were made from ¼-inch stock and finished to ⅞-inch thick, but were finally finished to within (.002) two thousandths of parallel in length, width and thickness.

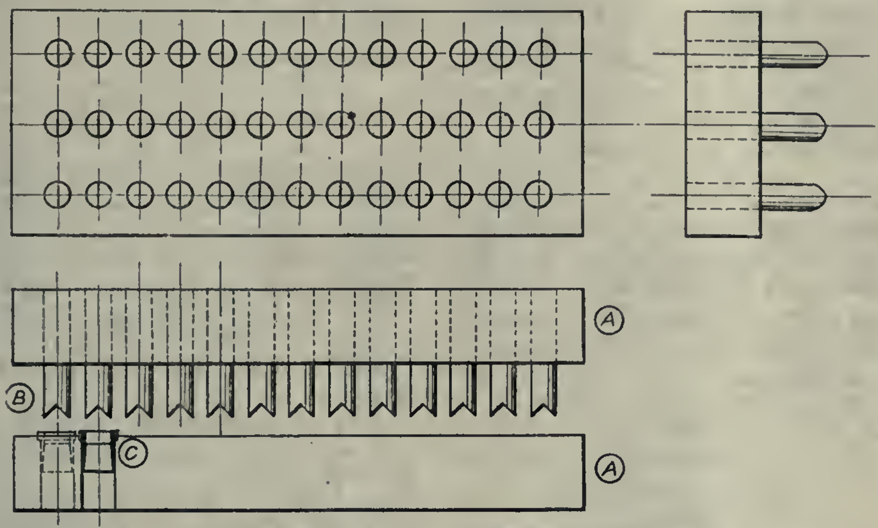
The construction of the finished tool is shown in the drawing, and consists of the following parts:—Top and bottom plates A, punch B, and die C. The punch and die were pressed into their respective plates, and not otherwise fastened, having been made on contract by one of the leading tool manufacturing concerns of New England, and coming all ready to assemble with a clearance of .0002 between punch and die. The method I used was substantially as follows:—

After finishing the two plates to the required limits, I drilled, countersunk and tapped the plates so that they could be bolted together, and not leave any projecting bolt heads. I then put a dowel in each end to avoid all chance of the plates moving while working, and laid off the holes with dividers to the spacing given on the tool drawing. I found that "Mr. Tech" had made an error in his figures and got one too many holes in each row. "Mr. Tech" made the drawing, because as he expressed it: "Toolmakers are fools and can't make anything right without a drawing." He was also responsible for the absurd limits required, as the only accurate work needed was in the clearance of the punch and die, and the alignment of same, because an error of 1-16 in. in the spacing would have cut no figure, as the subject was only a sieve for separating peas from the shells and vines after thrashing.

After laying out the holes and checking with scale for total length of centres, I located and clamped plates on the milling machine table as accurately as possible with a needle indicator, and drilled the first hole. Having previously taken up all possible slack in the machine by using lead screw dial, I drilled and reamed the holes in both plates the size for punch, and found that I was within the limits required. Taking the plates apart, I finished up the die plate as required by using the holes previously reamed as pilot holes for a counterbore of correct size for dies to be pressed in.

After everything was finished, the only trouble I had was with one punch pulling out, and this we remedied with a set screw.

The peculiar shape of the punch interested me, and I was told on enquiring that this had been adopted after quite a few experiments, as being the most suitable of all, and it certainly worked very nicely, as the entire sheet was punched at one stroke without any perceptible jar.



PUNCH AND DIE FOR SHEET RUBBER.

Mount Brydges, Ont.—The village of Mount Brydges, Middlesex County, carried a Hydro-Electric power by-law on Nov. 23, by a vote of 73 to 3.

A NEW MANGANESE STEEL.

AN improvement in manganese steel alloys is announced in a recent patent (U.S. 1,113,539—October, 13, 1914) granted to William Campbell, John H. Hall and Henry M. Howe. It offers a new class of such alloys, said to possess the characteristic hardness of the regular manganese steel but containing a lower amount of manganese. This is claimed to render production cheaper and afford practical advantages in certain other respects. Commercial manganese steel contains from 11 to 14 per cent. of manganese, and hitherto any attempts to produce a steel lower in manganese than 10 to 11 per cent. has tended to make a metal nearly as brittle as glass and unfit for commercial use.

The invention is based on the discovery, made by the inventors, that a certain critical relation exists between the percentage of manganese and the percentage of carbon employed with it in the alloy, and that by proportioning the carbon ingredients in accordance with this relation, a steel may be obtained containing from 6 to 9 per cent. of manganese or as low as 5 per cent., and "possessing to a very valuable degree the characteristic combination of ductility with hardness and the other important properties of the richer alloys."

It is believed that there is a practical limit, around 5 per cent., for the diminution of the manganese, according to the invention. For practical resons, the limits of this relation have been narrowed by the inventors so that in its preferred form, the product having in its composition an amount of manganese less than 9 per cent., and somewhat more than 5 per cent., contains carbon, other than graphite, between or not materially exceeding the following narrower limits, viz. 1.075—.04 of the percentage of manganese as one limit, and 1,075 + 1/3 of the percentage of manganese as the other limit, the percentages being taken with reference to the whole.

For example, for an 8 per cent. manganese steel, the preferable limits for the carbon are $(1.075 - .04 \times 8) = 0.755$ per cent. and $(1.075 + 1/3 \times 8) = 1.342$ per cent., the particular amount of carbon present being controlled within these limits and according to the degree of ductility required in the product. The ingredients of the product are preferably brought together in a molten state, as is usually the custom with manganese steel alloys and in the above proportions. After casting, the metal is properly water-toughened. The new alloy is a poor conductor of heat and practically nonmagnetic.

The patent has been assigned to the Taylor-Wharton Iron and Steel Co., High Bridge, N.J.—Iron Age.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

It will be found by those who have followed the previous lessons and profited by them that the various practical applications can now be easily observed, applied and appreciated.

CAPACITY.—II.

THE present article is a continuation of that which appeared in our November 26 issue, on which occasion the volumes or capacities of rectangular and cylindrical tanks and those of a sphere were the features discussed.

Chart 44 shows the ratio of volumes between similar shaped solids.

The volume varies as the cube of their sides or diameters, or $v : V = s^3 : S^3$.

A large cube of lead measuring 14 inches a side is reduced to a molten state and cast into small cubes $1\frac{3}{8}$ in. square. How many will be cast, allowing a loss of $\frac{1}{2}$ per cent.?

By formula, $v : V = s^3 : S^3$. Let x = desired quantity + loss, then

$$x = \frac{S^3}{s^3} = \frac{14^3}{1.375^3} = 1451.8.$$

Number cast $= 1451.8 \times .995 = 1444.5$.

If a number 1 in., 2 in., 3 in. 4 in., 5 in. and 6 in. spheres were united and made into one large sphere, what would be its diameter?

By formula Chart 44,

D = cube root of $(d^3 + d^3_2 + d^3_3 + d^3_4 + d^3_5 + d^3_6)$ = cube root of $(1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3)$ = cube root of 441 = 7.59 in. dia.

If cast into balls of $1\frac{1}{4}$ in. diameter, what would be the number?

$$x : 1 = 7.59^3 : 1.25^3, \text{ or } x = \frac{7.59^3}{1.25^3}$$

= 223.7 balls of $1\frac{1}{4}$ in. dia.

A billet of steel 5 inches in dia. and 14 inches long is heated and rolled into a $1\frac{1}{4}$-in. round bar. What will be the length, allowing a loss of 2%?

By formula $L : l = 1\frac{1}{4}^2 : 5^2$, where L = length of billet and l = length of bar + loss, then

$$l = \frac{5^2 \times 14}{1.25^2} = 224 \text{ in. or 18 ft. 8 in.}$$

Length of bar = 18 ft. 8 in. $\times$ .98 = 18 ft. 4 in., nearly.

In Chart 45 is shown a number of sketches where the area of two or more openings are made to equal that of one large opening or vice versa.

In a heating system, the large pipe with diameter D, Fig. 1, is required to branch off with three pipes of equal size, the three having the same total area as the large one. If the large pipe has a dia. of 16 in., what must be the dia. of the small openings?

By formula:

$$D = \sqrt{(d^2 + d^2 + d^2)} = \sqrt{3d^2},$$

$$D = 3d^2,\ d^2 = \frac{D^2}{3},$$

$$d = \sqrt{\frac{D^2}{3}} = \sqrt{\frac{16^2}{3}} = \sqrt{85.3} = 9.23 \text{ in.,}$$

or $9\frac{1}{4}$ inches.

In the branch piece, Fig. 2, Chart 45, the large diameter D is 20 in., and one of the smaller ones 16 in. diameter. What must be the diameter of the second branch so that the two branches d and d will have the same total area as the main pipe D?

By formula:

$D = \sqrt{(d^2 + d^2)}$, or $d = \sqrt{(D^2 - d^2)} = \sqrt{(20^2 - 16^2)} = \sqrt{(400 - 256)} = \sqrt{144} =$ 12 in. diameter.

In Fig. 3 is shown a round pipe branching off into two equal ones of the shape shown. If the diameter D be 12 inches and the dia. d needs be 6 in., what will be the length l so that the two branch areas will total the same as the main pipe D?

Suppose that the two branches were of circular form, then by formula:

$D = \sqrt{d^2 + d^2}$, or

$$d = \sqrt{\frac{D^2}{2}} = \sqrt{\frac{12^2}{2}} = \sqrt{72} = 8.485 \text{ in.,}$$

but as the width must only be 6 inches, we must resolve this dimension, 8.485 in. into two others, one of a circle (or two semi-circles) of 6 in. diameter and a parallelogram, one dimension being 6 in.

Area of circle whose dia. is 8.485 in. $= 8.485^2 \times .7854 = 56.545$ sq. in.

Area of 6 in. circle $= 6^2 \times .7854 =$ 28.274 sq. in.

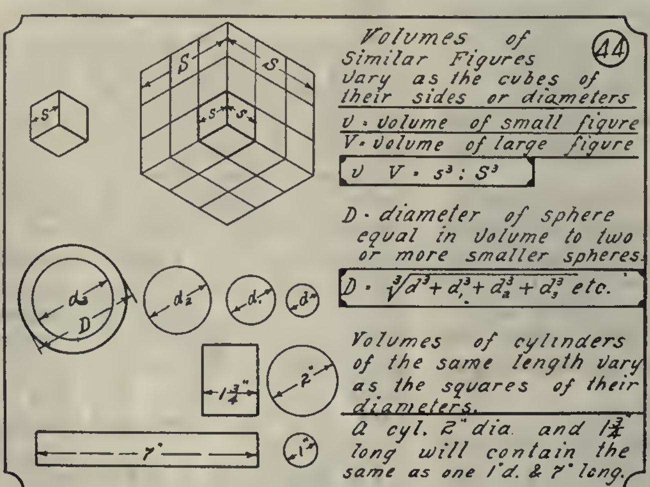
Area of parallelogram between the two semicircular ends $= 56.545 - 28.274 = 28.271$ sq. in.

Flat side of opening $= 28.271 \div 6 = 4.712$ in., then length $l = 6 + 4.712 = 10.712$ inches.

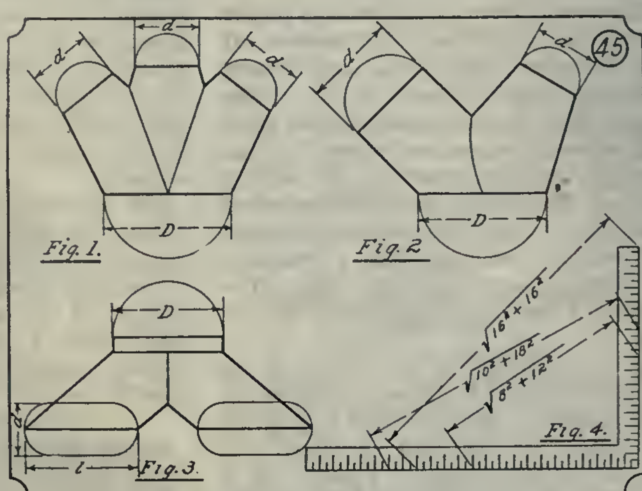
QUESTIONS AND ANSWERS FOR MECHANICS.

Question.—A load of 1,200 pounds is supported by two cables, so that these lines stand at an angle of 30 degrees with the vertical. What would be the stress in the cables?

Answer.—The force resisted by one cable may be resolved into two components, the vertical and the horizontal. If the vertical component is 600 pounds, the stress in the line must be proportional to the hypotenuse of the triangle.



ARITHMETIC CHART 44.



ARITHMETIC CHART 45.

The hypotenuse is

$$\frac{\text{side opposite}}{\text{Cosine } 60^\circ} = \frac{600}{.86603} = 692.6 \text{ pounds.}$$

* * *

Question. — What internal pressure would be sufficient to burst a steel sphere whose walls are 5/8 in. thick and its outside diameter is 8 inches? What would be the difference if the diameter were doubled?

Answer.—Inside diameter $= 8 - 1\frac{1}{4} = 6\frac{3}{4} = 6.75$ in.

Area of inside cross-section, $6.75 \times 6.75 \times .7854 = 35.785$ sq. in., which is the area upon which the pressure acts.

Area of outer cross-section $= 8 \times 8 \times .7854 = 50.265$ sq. in.

Difference $= 50,265 - 35.785 = 14.480$ sq. in., which is the area of metal resisting the internal pressure.

The tensile strength of steel is 80,000 pounds per sq. inch. Total resisting power of the shell would be $14.48 \times 80,000 = 1,158,400$ pounds.

The pressure per square inch is

$$\frac{1,158,400}{35.785} = 32,371 \text{ pounds.}$$

If the shell diameter be doubled, the metal area becomes twice as great, while cross-sectional area becomes four times as great.

The internal bursting pressure would, therefore, be four times, or as the square of the diameter.

* * *

Question.—It is proposed to raise a sunken steel boat of 500 tons displacement by means of attaching two cylinders, which may be filled with air as the water is pumped out. The depth is 40 feet and the diameter of the cylinders is 6 feet. What should be the length of the cylinders if they be both the same? Neglect weight of cylinders.

Answer. — One cubic foot of steel weighs 490 pounds; one cubic foot of steel under water weighs $490 - 62.5 = 428.5$ pounds, or it loses $\frac{62.5}{490} = 12.75$ per cent. of its weight.

500 tons under water, therefore, weighs $500 \times .8725 = 436.25$ tons.

Weight of 1 cu. ft. of air under 40 ft. of water $= .1839$ pounds. Net lifting power, then, is $62.43 - .1834 = 62.2466$.

Cubic feet necessary to lift 436.25 tons

$$= \frac{436.25 \times 2000}{62.246} = 14,001.6$$

Area of 6 ft. circle $= 28.274$ sq. ft.

The length of the two cylinders required is $\frac{14,001.6}{28.274 \times 2} = 247.9$ feet.

* * *

Question.—If the average yearly rainfall in a certain district where a power house is located is 3.4 inches; if the roof of the building be 90×170 feet and the available tank diameter be 16 feet, how high should a cylindrical tank be to take care of half this amount of water?

Answer.—Each square foot of roof area gives $\frac{144 \times 3.4}{1728} = \frac{3.4}{12}$ cu. ft. water.

Total amount of water is $\frac{3.4}{12} \times 90 \times 170 = 4335$ cubic feet.

Half of this is 2167.5 cu. ft.

Area of 16 ft. circle $= 201.06$ sq. ft.

Necessary height of tank is $\frac{2167.5}{201.06} = 10.77$ ft.

* * *

Question.—Neglecting friction, what draw-bar pull would be required to move a 2,000-ton train up a 3 per cent. grade?

Answer.—The power in this case moves 100 feet, while the load moves 3 feet vertically. The power multiplied by the distance through which it acts is equal to the load multiplied by the distance through which it acts.

Or $2,000 \times 3 = \text{Force} \times 100$

$$\text{or Force} = \frac{2,000 \times 3}{100} = 60 \text{ lbs.}$$

* * *

Question.—A direct acting pump is required to raise water against a head of 200 feet. The plunger is 6 inches, and the steam piston is 8 inches in diameter. Taking friction at 20 per cent. of the load, what steam pressure should be used.

Answer.—Pressure due to head of water $= 200 \times .433 = 86.6$ pounds per sq. in.

Total load on plunger $= \text{Area} \times \text{water pressure} = 28.274 \times 86.6 = 2448.5$.

Adding 20 per cent. for friction, this becomes $\frac{120}{100} \times 2448.5 = 2938.2$ pounds.

Area of steam piston $= 8^2 \times .7854 = 50.266$ sq. in.

Steam pressure required $= \frac{2938.2}{50.266} = 56.4$ pounds per sq. inch. Pressure carried should be about 60 pounds.

* * *

Question.—A pump rod, 2 inches in diameter, is to be changed from steel to gun metal. What size should the brass rod be?

Answer.—Area of 2-inch circle $= 3.1416$ sq. in. Ultimate strength of steel $= 60,000$, and of gun metal, 32,000 pounds per square inch. Area required, then, is

$$\frac{3.1416 \times 60}{32} = 5.89$$

Diameter would be $\sqrt{\left(\frac{5.89}{.7854}\right)} = \sqrt{7.5} = 2.74$ say, $2\frac{1}{2}$-inch rod.

* * *

Question.—A pneumatic tool clamp is operated with air at 70 pounds. The cylinder is 2 inches in diameter; the stroke is 4 inches; the throw of the cam is 1/2 inch, and this acts upon a lever whose long arm is 10 inches, and whose short arm is 2 inches. What is the pressure on the tool?

Answer.—Area of piston $= 2^2 \times .7854 = 3.1416$.

Total pressure $= 3.1416 \times 70 = 219.912$ pounds.

The piston moves 4 inches, while the cam raises 5/8 inch. Pressure on lever then is

$$\frac{219.912 \times 4}{.625} = 1407.4 \text{ pounds.}$$

This force operating on the lever would give a pressure on the tool of $\frac{10 \times 1407.4}{2} = 7,037$ pounds, or $3\frac{1}{2}$ tons.

* * *

Question.—What part of an Imperial gallon is a U. S. standard gallon?

Answer.—One Imperial gallon contains 277.274 cubic inches; 1 U. S. standard gallon contains 231 cubic inches.

A U. S. gallon is, therefore $\frac{231}{277.274} = .833$ of an Imperial gallon.

An Imperial gallon $= \frac{277.274}{231} = 1.2$, or 1 1-5 U. S. gallons.

MAMMOTH STITCHED COTTON DUCK BELT.

ONE of the largest rolls of stitched cotton duck belting ever made was recently turned out by the Gandy Belting Co., Baltimore, Md. The roll is 712 ft. long, 36 in. wide and weighs 6,000 lbs. The belt is of the maker's standard type and is manufactured of a special weave of heavy weight cotton duck stitched with a heavy sewing cord on patented machines to give an imbedded stitch that leaves the surface of the belt smooth, the stitching being done while the belt is under tension from end to end. A special width of belt was woven in this case, as as is the regular practice of the Gandy Co., to give a selvage and even strain on both edges.

In common with all the belts produced by this company, it was subjected to a special oil process, with a view to rendering it water, oil, steam, heat and dirt proof, as well as keeping it pliable and adding to its life.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

HIGH SPEED MULTIPLE DRILL.

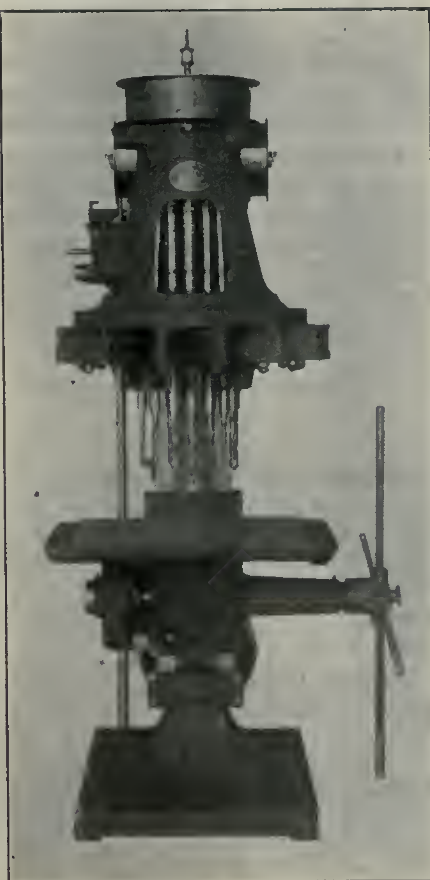
THE National Automatic Tool Co., Richmond, Int., has recently added to its line the No. 22 high speed multiple drill shown in the accompany illustration. This machine embodies many productive features of great value and was brought out to meet the demand for powerful machines capable of drilling up to ¾ in. holes in cast iron under heavy feeds. It is a very rigid, powerful machine designed especially for the use of high speed drills. The spindles are adjustable to any layout within the range of the heads with a vertical adjustment for drills of uneven lengths. The drive is by means of a two-step or three-step cone of large diameter and wide face. Both the driving cones and idler pulleys are mounted on Hyatt roller bearings which with a continuous belt drive insures a high transmission efficiency.

The column is of heavy box section, the metal being so distributed as to insure a maximum of strength and rigidity. It has a wide face giving ample bearing to the table knee. The steel rack of coarse pitch in which meshes the hardened steel pinions for elevating table are securely fastened in face of column. Ample room is provided within column to take care of counterweights for balancing table. A flange is cast around outer edge of base to prevent oil from reaching the floor.

The No. 22 drill is built with various sizes of round and rectangular heads which may be equipped with from 2 to 16 adjustable spindles. The head is tongue-grooved and securely bolted to column. The driving gears and pinions are made of high grade steel hardened and ground, and run in oil. All bearings are phosphor-bronze bushed. The wide flange around head provides a rigid support to the adjustable arms. The different sizes of heads may be equipped with various combinations of adjustable arms or cluster boxes.

The table knee has an extended top providing a support where it is needed most. The knee itself is of box section heavily ribbed, which insures a stiff support to the work. The table is counterbalanced, all weights being contained within column. A large oil channel for catching overflow of lubricant is provided and is arranged with T bolt slots at both ends for clamping jigs on table. A screen oil pocket prevents chips from choking up the drain pipe.

A table is operated by the adjustable hand lever or pilot on right hand side, or by the power feed lever beneath the table on the left hand side. Pulling up on power feed lever engages, while pulling down disengages the feed. The rack pinion shaft is made of crucible steel with the rack pinion cut integral and hardened. This construction insures maximum strength and durability. The power feed which is simple and positive may be tripped by hand or automatically



HIGH SPEED MULTIPLE DRILL.

at any point by means of an adjustable trip. The table returns automatically after being tripped to a position determined by the spring bumper below the knee which may be moved up or down depending upon height of work. An automatic drop table gives the decided advantage of permitting the operator to run two or more machines, or to load another set of jigs while one machine is drilling.

The feed box giving three changes of positive gear feeds is located on the left hand slide near top of column. It is driven upon the idler pulley by means of a Morse silent chain. The feed gears are made of high grade steel, hardened and run at moderate speeds in a bath of oil. The three changes of feed are made while the machine is running. All bearings are phosphor-bronze bushed. The feed worm gear is made of phosphor-bronze, the worm being provided with an extra heavy ball thrust. The machine permits of a wide range in speeds and feeds making it adaptable to a varied line of work.

The drill spindles made of crucible steel, hardened and ground are provided with ball thrust bearings and lock nuts at upper end to take up any end wear. Spindles are bored for standard Morse tapers, or are furnished with collets for using straight shank drills. The spindle bearings are of phosphor-bronze securely fastened to the semi-steel adjustable arm of I beam section by patented construction which permits the drill spindle to be easily and quickly adjustable for drills of different lengths. It is only necessary to tighten or loosen the hex. nut on the lower stud to get this vertical adjustment. This hex. nut is always accessible no matter how closely or in what position the spindles may be grouped. The patented arm construction permits the drill spindle to be adjusted vertically for different lengths of drills without disturbing the position of the adjusting arm.

The universal joints used on the machine are composed of only five parts, and each part is milled from the solid, all friction surfaces being hardened. The driving pinions on the centre block are milled integral with the block. No inserted pins or screws are used. The maximum angle for operating levers should not exceed 30°. These joints are guaranteed for two years. The weight of the drill is approximately 2,350 lbs. to 2,500 lbs, depending upon the equipment.

VERTICAL CENTRIFUGAL PUMP.

THE accompanying illustration shows a vertical centrifugal pump, built by the Smart-Turner Machine Co., Hamilton, Ont., for use in office buildings, and other places where the basement is below the sewer. They build this design of pump direct connected by flexible coupling to electric motor, for handling either sewage or drips which come to these low places. The equipment consists of a specially designed centrifugal pump; a vertical motor direct connected by flexible coupling; a float; a float switch; and where necessary an automatic starter. The cast iron floor plate is made of such diameter as to cover

VERTICAL CENTRIFUGAL PUMP.

either a cement catch-basin or a cast iron tank. The apparatus is built for direct and alternating current, and makes a compact and convenient arrangement.

AUTOMATIC DRILL FOR RAPID WORK.

THE illustration shows a new type of drilling machine, brought out to handle work at its maximum rapidity under the conditions of high-speed drilling.

Builders of high-speed drilling machines have been aware for a considerable period that the maximum time taken in drilling small holes in a given piece of material is not that consumed by the tool piercing the material, but by the operator in placing the work in position, advancing the tool to the work through the jig bushing or clearance space, engaging the feed, withdrawing the tool, and removing the work. The actual drilling time for a ¾-inch drill through a piece of cast-iron ¾-inch thick, with high-speed drills, should be about four seconds, but the average time taken, including changing work, etc., comes nearer being thirty seconds.

After a long period of study and experimenting, Baker Bros., Toledo, Ohio, have developed a machine to perform these operations automatically, and consuming the minimum of time. At the same time, the machine is simple in its construction and changes for different classes of work are quickly made.

The 1-inch automatic will, it is claimed, drill eight of these holes per minute, including chucking, for constant production. The feed of the machine is secured by means of cams, thereby giving an extremely powerful feed with quick return feature. It also gives a feed with a dowell at the end, which enables it to be used for facing work, facing to an exact depth, and giving in addition a feed on which the correct lead can be secured for threading.

Two types of tables are provided — plain table and automatic indexing table. On the plain-table machine, the operator places the work under the drilling spindle and trips the machine with a foot lever, the same as he would a punch press. The spindle advances quickly to the work; cutting tool passes through the work, withdraws, and the feed stops. The operator removes the finished piece of work, places another in position, and trips the foot lever. This enables him to use both hands, thereby securing rapid production.

The revolving table is provided with automatic indexing motion which, at the instant the spindle is withdrawn, advances the table to the next position and brings a new piece of stock under the working tool. The period occupied by the withdrawal of the working tool and the indexing of the table is from one to three seconds. In using this machine for chuck work, from six to eight chucks are usually provided on the table, and all that the operator is required to do is to chuck and remove the work, and see that the tools are kept sharp. Should a drill break, the machine can be instantly stopped at any point. Should it be desirable, the machine can be made to index, skipping any number of chucks that may be desired. The drill is driven by a 7½ h.p. adjustable speed Westinghouse electric motor.

AUTOMATIC DRILL FOR RAPID WORK.

GRINDING AND POLISHING MACHINERY.

GRINDING and polishing machinery was discussed at the second annual conference on industrial welfare and efficiency at Harrisburg, Pa., by Charles G. Smith, president and general manager of the Pittsburg Emery Wheel Co. The conference was called by the Department of Labor and Industry of Pennsylvania with the co-operation of the Engineers' Society of Pennsylvania.

About fifteen years ago, said the author, the taper on the sides of tapered wheels was ½ in. to the foot on each side of the wheel and the flanges were made of grey iron castings, but when it was learned that about 30 per cent. higher speed than was commonly understood and recognized as a reasonably safe speed for emery wheels would give so much greater and more economical production, there were several instances where the flange has broken. We then, about ten years ago, changed this taper to ¾ in. to the foot on each side and increased the thickness of these flanges. Since then there have been practically no serious accidents. Nearly all accidents that have happened were because flanges were too small in diameter, leaving too much of the wheel exposed beyond the rim of the flanges.

Very recently there has been a strong movement demanding the removal of the dust from all grinding and polishing machines. There are now some manufacturers working on designs of devices for taking care of this feature in addition to the aforementioned features and there are already some machines on the market with all these provisions.

The National Association of Abrasive Wheel Manufacturers has a safety committee. This committee proposes to submit standards to the commissioners of labor of the various manufacturing states, insurance companies, various trades bodies, such as the National Metal Trades Association, National Association of Manufacturers, etc., as well as to the users of grinding and polishing machinery in an effort to get co-operation along these standards. In the enforcement of any law along the use of safety devices with grinding wheels, it must always be recognized there are certain operations that will prohibit the use of any protecting device and it will be impossible to make the application apply to every case. There are many special cases and in these the machine should be kept in good repair to minimize the liability of accidents and judgment should be used in such cases.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

RADIUS OF SPHERE CALCULATION

By J. H. R.

ON page 378, **Canadian Machinery** issue of October 22, there appears at the top of the centre column the following question:—

"In the above example, what radius should the pattern-maker use to draw his templet by; or, in other words, what would be the radius of the circle or sphere of which the segment forms a part?" The question referred to is that at the bottom of the first column on the same page, and is illustrated in the accompanying sketch . The answer given is, in my opinion, somewhat misleading, and the formula used has undoubtedly been a mistake, as I hope to make clear.

Briefly, the height of the segment is to half the chord, as half the chord is to the diameter minus the height of segment, or

$$ec : ae = ae : ed,$$

$$\text{then } ed = \frac{ae \times ae}{ec} = \frac{15 \times 15}{12} = 18.75 \text{ in.}$$

Diameter = the height of segment plus the diameter minus the height, or

$$12 + 18.75 = 30.75 \text{ in.}$$

$$\text{Radius} = 30.75 \div 2 = 15.375 \text{ inches.}$$

BOOST THE MOULDING CRAFT.

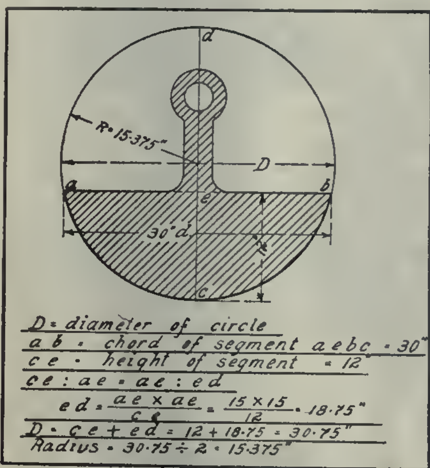
By R. Micks.

EVERY mechanic should respect the trade that he has chosen to follow and do all in his power to put it in the front rank, but it is necessary that he should like his work and take a deep interest in it and try and master its every detail, otherwise he cannot expect to rise to the top.

For some reason or other, the moulding craft has never received its just dues from the manufacturing world and in a lot of cases moulders have themselves to blame for these conditions, as the only interest they seem to have in their work is to slam it up and get it out of the shop as soon as possible. Some of the travelling moulders also have helped to give the trade a hard name, their limits being pay-day, a spree and away. Many people judge the trade by such examples, although in reality there are some of the finest men and first-class mechanics serving at moulding who regard their work as an art and do their best to make it so. Every thinking man knows that the foundry is the foundation of all manufacturing business and it is therefore up to each moulder to boost his trade and not only respect it himself but make others do so.

There are many ways in which he can help himself to gain a greater knowledge of all branches of the foundry business, and thereby find out that it is not only a question of ramming sand but a business that takes a goodly amount of study if one wishes to understand both the practical and technical end of it. Many mechanics smile at the idea of learning your trade from a book, but it makes no difference how good you may be as an operator, you can never expect to work up to the position of foreman or superintendent if you have no technical training in the trade you follow.

Another danger to the moulding trade is that of too many specialty men, who, if taken off the class of work they are on, are useless in another shop and have to learn all over again, which is a waste of time and money for both them and their employer. This in time is going to bring on a serious condition in machinery and jobbing shops as very few are learning the trade in all its branches and sooner or later the jobbing and machinery moulder will be at a premium.



RADIUS OF SPHERE CALCULATION.

Foundrymen should try and make the conditions as pleasant as possible in their foundries, for no man or boy likes to be regarded as a machine, but likes to know that his best efforts are appreciated. A word of encouragement to a man who is doing well goes a long way towards making him feel satisfied with his work and surroundings.

It is the duty of all foundrymen to make the trade as attractive as possible so that a boy who is considering becoming a craftsman can see something ahead of him outside of hard work and a hump on his back in a few years. Make him feel that he is a part of the organization, and is just as necessary as the biggest man in the plant, and that the more energy and study he gives to his trade the better chance he has to rise to the top. If these points were explained to boys who are considering taking up a trade, I don't think there would be so much difficulty in securing good, intelligent apprentices for the moulding shop or other allied department.

PLACING THE RESPONSIBILITY.

IF the motor industry in this country cannot hold its own against foreign competition, says a writer in the "Autocar," referring to England, it is entirely the manufacturer's own fault, for there is no dearth of highly trained engineers who are unremittingly devoting themselves to the study of the science and practice of their profession in all branches of the engineering trade who never can have a chance of proving their abilities. The fiat of those placed in authority by our manufacturers is — human machines and not brains required. It is fatal to the average man's interest, without influence in the concern, to show that he possesses above average smartness or intelligence, much less a scientific imagination, for he is invariably treated with contempt for having such aspirations, and is at once labelled dangerous and deliberately and persistently held back. Otherwise somebody might eventually have to stand aside for him.

Efficiency in design means a machine in which every part can be made in the quickest and most accurate way by the least skilled men; a machine which will sell itself with the minimum of boosting and which will produce the maximum of accurate work in the factory where it, in turn, will be operated by the cheapest man the owner dares to put on the job.

Pattern Wax.—The United Compound Co., Buffalo, N.Y., is offering a new and novel idea in the line of pattern wax made in two grades, the soft grade being about the same as beeswax, and the other hard, for use in filling defects in either wood or metal patterns. The distinguishing feature of this latter is the extra hard surface left on the pattern. Either grade will melt at about 150 degrees, and may be applied with a hot tool or melted and applied with a brush.

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Vol. XII. DECEMBER 3, 1914 No. 23

PRINCIPAL CONTENTS:

THE EXPENSE OF TECHNICAL EDUCATION.

WHILE a certain amount of opposition to the spending of money for technical schools was to be expected, objections still come from unforeseen quarters. True it is that it may be easily possible to waste money by mismanagement, even in the cause of education but too much education itself, of the right kind, is impossible.

A canvass was recently made of an average Toronto machine shop employing twenty-four mechanics to determine educational standing. Of these men it was found that thirteen could work multiplication and division of simple decimals and fractions; nine were able to determine the volume of a cylinder in gallons; seven knew how to find the centre of gravity of a compound body and three only understood cube root.

It would appear from this that considerable money could be spent before the waste point is reached.

VAGARIES OF EMPLOYMENT.

A PAPER recently read before one of our foremost engineering bodies will serve to open the eyes of manufacturers in general to the enormous aggregate losses entailed by the removal of one set of employees and the hiring and training of new ones. The loss of course, is in all cases, proportional to the rating of each individual man and to the care with which his efficiency has been developed and maintained. Although the paper evoked wide general interest and brought forth a most interesting discussion, the subject is by no means a new one, for a number of prominent industrial institutions have, for some time now, adopted the policy of discharging a man only as a last resort, after having tried him out thoroughly in every possible capacity.

From a strictly utilitarian standpoint, however, this plan is of doubtful value unless the class of work for which the employee is adapted be obvious. Experimenting with a man who has shown unfitness for one or more branches of a firm's work is less likely to be productive of results than with a new man who may be chosen for past experience in the work required of him. In any case, men are more often a non-success because of tactlessness and lack of interest on the part of their supervisors, than by reason of incapacity for the particular duties required.

One of the most prolific causes of the loss of valuable men is a dissatisfaction developed by tall stories told of better wages and conditions in other plants, and by an inflated idea of one's own indispensability, the latter of which asserts itself at some time or other in the breasts of most men. Such employees give up their jobs to find, in nine cases out of ten, that they have not, on the whole, improved their condition.

A method of dealing with such cases has been adopted by a prominent machine shop superintendent with considerable success. A careful study of other plants is continuously and systematically made and local conditions are so planned that the men, by close application, can do fully as well in the plant in question as in any other. Upon anyone beginning to show signs of discontent or lack of interest in his work, a vacation of such duration as will be sufficient to impress upon him the advantages of steady work in his own plant is promptly given. This is usually all that is required, but in severe cases of the complaint, the plan of forcible suspension is adopted, and this seldom fails.

In this particular plant, a man is rarely discharged except for incompetency and, being free to honorably return at a certain time, he nearly always does. The training of more than one man for every position where possible, not only greatly facilitates the above plan, but makes many occasions of the vacation or suspension application almost unnecessary.

The paper referred to in the opening paragraph appears in part in our present issue and both on account of the many interesting facts recorded, and its high degree importance in the matter of organization efficiency, it is worthy of careful perusal and study.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 40
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	Toronto.
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X......	18 00	17 00
Victoria, No. 2 Plain..	18 00	17 00
Hamilton, No. 1.......	18 00	17 00
Hamilton, No. 2.......	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal.	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	Cents.
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	Cents.
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 50
Copper, crucible	10 00	9 50
Copper, unch-bled, heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	8 50	8 50
No. 1 compos'n turnings	8 50	8 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings ...	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws....	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....4½c per lb. off	
Nuts, Hexagon, all sizes.4¾c per lb. off	
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger.	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright ......85, 10, 7½, 10, 5 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off	

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh ...	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh..........	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in. ..	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in. ..	70%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake copper, carload ..	$13 50	$13 50
Electrolytic copper	13 25	13 25
Castings copper	13 00	13 00
Spelter	5 75	5 75
Tin	35 50	36 00
Lead	4 85	5 00
Antimony	16 00	18 00
Aluminum	21 00	22 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	.1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect July 2, 1914:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in...	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ..	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	18½
Benzine, single bbls., per gal.	18½
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.56
Linseed oil, boiled, single bbls.	0.59
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents.
XXX extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 08¾
X Press	0 07¾
COLORED.	
Lion	0 07
Standard	0 06¼
Popular	0 05½
Keen	0 05
PACKING.	
Arrow	0 15
Anchor	0 06
Anvil	0 07½
Axle	0 09
WASHED WIPERS.	
Select white	0 06
Light colored	0 06½
Dark colored	0 05

Prices per lb.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Nov. 30, 1914.—A general betterment in the iron and steel trade during the past month has been quite noticeable. The pig iron market has improved, and prices have stiffened a little. In machine tools also there has been a decidedly increased demand as compared with October. The improvement has been gradual, of course, and consequently of a more permanent nature. The admirable calmness displayed in British financial circles has been reflected here in Canada. The confidence of the whole Empire seems to be growing each week, and with it an increase in business. Many large manufacturing plants are still idle, but such a situation is meantime unavoidable.

The month of November has shown that there is an undercurrent of security in evidence, and this is having the effect of teaching the more timid that the only way to bring back a normal situation is to keep as much business moving as is possible.

The Steel Trade.

In this branch of the metal business no changes of moment can be expected until the beginning of the year. The building trade will, no doubt, be rather dull this winter, and as a result the structural steel demand will be light. The improvement in general machinery lines of steel is gradual, and further marked progress is anticipated in the New Year. There is, of course, a certain amount of business moving all the time, but this is largely with those factories who have been able to keep going throughout the present depression.

Pig Iron.

Locally the pig iron trade remains rather quiet, but recent events in the United States will, no doubt, have more or less of an influence here. Several furnaces in the States reduced their prices to $12 for delivery during first six months, 1915, and this resulted in the last few weeks in business of nearly a quarter of a million tons. This buying forced the price up, until quotations are now around $13 for delivery not later than the end of the first quarter of 1915. Canadian furnaces never reached the extremely low price limit of the American furnaces ,but nevertheless the general buying in the United States caused business to brighten up for them. Inquiries, too, have become much more in evidence. The price of Canadian pig will, no doubt, be advanced somewhat to keep pace with the American advance. Manufacturing firms, too, are gradually exhausting their pig supply, and will soon have to be in the market. The prospect, therefore, is that business will continue to increase at gradually stiffening prices.

Machine Tools.

The last few weeks saw a decided improvement in the machine tool business. There, of course, have not been any large orders placed, but travelers throughout the province have been able to secure orders which will amount in the aggregate to a very fair total. The supply business continues to hold it own, and perhaps has improved somewhat. Generally the tone is everywhere stronger, and the outlook good.

Metals.

In the metal markets the past week has been quiet. The amount of business moving has remained about the same, and prices have not changed. The influencing factors in the metal trade have not been operating for a few days. Tin is expected to keep more steady, and copper has a slight tendency to strengthen.

Toronto, Ont., Dec. 1, 1914.—There is no perceptible change in the industrial situation this week and a general quietness continues in commercial circles. With the exception of those industries stimulated by the war there is comparatively little activity. The orders for war supplies are, however, considerable and will represent, in the aggregate, a large amount of money, tending to keep industrial conditions at a higher level than would otherwise be the case. An index of the general condition of trade is furnished by the railway traffic returns, which show heavy decreases in earnings and a corresponding restriction in the trade of the country.

Concerning those industries which are active on account of the war, it has been said that the possibilities of obtaining Government orders have not been fully realized and that full advantage has not been taken of the opportunity. It is claimed that Canadian manufacturers have, in many cases, waited for orders to come to them instead of directly soliciting the Governments who are placing the orders. A change, however, is fortunately coming over the situation, as two trade associations have already been formed and representatives sent to Europe to make a bid for business. There appears to be no doubt that if progressive and energetic methods of obtaining business are adopted, the trade of this country will benefit to a much greater extent than is the case at the present time. An instance of progressive methods may be cited in the case of a local firm of carpet manufacturers who have adapted their plants to make army blankets.

A general feeling of confidence prevails regarding the ultimate prosperity of the Dominion. Although no great improvement can be expected until the war is over, it is anticipated that when that day arrives, there will be such a marked revival in business that industrial conditions will be better than they ever have been.

Steel Market.

There are signs of a partial revival in the steel industry. The Steel Company of Canada which resumed operations last week, with one of its blast furnaces at Hamilton, announce a better demand for steel and pig iron. The Dominion Steel Corporation has started its rail mill to fill an order for ten thousand tons of rails for shipment to South Africa. The rod, nail, wire and billet mills are working to capacity and further cargoes of barbed wire are being shipped to the Old Country.

Although trade is improving, it can hardly, generally speaking, be called brisk. There is, however, a distinct spirit of optimism prevailing in business circles, based on a belief in the ultimate benefits that will accrue to the steel industry at the termination of the war. Some orders have already been placed for war materials and there is a possibility of further developments in this direction. Up to the present, however, the steel industry has not derived much benefit. The new business placed has not by any means made up for the adverse effect which the war has had. The inactivity among manufacturers using steel products and the decline in the building trade are very noticeable. In both cases any great improvement can hardly be expected for many months. The money market is firm, but until the general situation improves, loans will not be easy to obtain for any extensive propositions.

There has been no change in prices and the market is steady. The situation in the steel trade in the States shows some improvement, largely on account of foreign buying.

Pig Iron.

There has been considerable activity in the pig iron market in Buffalo recently which has stiffened the market here. The demand shows some improvement and prices are firm.

Machine Tools.

There is nothing of importance to note with regard to machine tools, the situation generally being unchanged. A few orders for single tools have been placed, but no very interesting enquiries have been received by local dealers. The demand for machine shop supplies is steady, but orders booked are generally small.

Metal Market.

There is some improvement in the general situation this week with a little better demand. Copper had a rise during the week but is now back at the original figure. Tin is quiet but is a little higher because of scarcity of spot supplies. Lead has advanced but the market is less active. Spelter continues a quiet advance with better inquiry. Antimony is stronger, being 2c per pound higher. The strength is created by a demand for this metal to be used in the manufacture of bullets. Aluminum has advanced 1c per pound.

PANAMA CANAL NOTICES.

THE following notices relative to navigation and other matters connected with the administration of the Panama Canal have been recently issued. Familiarity with the contents which follow herewith will tend to the elimination of delay and inconvenience on the part of vessels making use of the waterway.

Notice to Steamship Lines.

1.—The attention of the Canal authorities has been called to the fact that several of the firms whose vessels have been using the Panama Canal have seen fit to employ agents on the Isthmus, to take care of the interests of their vessels in regard to the payment of tolls and minor charges.

2.—This is not only unnecessary, but frequently results in delays which might otherwise be avoided were their business done direct with the Panama Canal.

3.—Ship-owners are informed that provision has been made in accordance with Canal regulations, by which deposits to cover tolls can be made with any of the assistant treasurers of the United States, who are to be found in larger seaports, or with the assistant auditor of the Panama Canal at Washington, D.C. As soon as these deposits are made cable information is sent to the Panama Canal.

4.—In case a vessel should desire to purchase coal or supplies at either terminal port, or contract a bill for pilotage or towage, deposits to cover these expenses can be made in the same way as for tolls.

5.—The price of coal at Cristobal is $5.40 per ton, and at Balboa $6.40 per ton. Tug service is at the rate of $15 per hour. The probabilities are that unless a vessel be over 15,000 gross tonnage there will be no charge for tug service; nor will there be any charge for pilotage for a vessel in transit through the Canal unless she takes on or discharges freight or passengers in a terminal port.

6.—It is advisable that deposits be made somewhat in excess of the tolls, cost of supplies, and charges for services, so that there will be sufficient funds available to cover bills not anticipated, since all bills are payable in advance before a vessel is allowed to enter the Canal or clear from Canal waters.

7.—Vessels that require answers to cables should prepay them or else deposit sufficient funds to cover in the same way as for tolls.

Rates for Miscellaneous Services.

The rates quoted below are effective for the following services furnished individuals, companies and others:

1.—For service of a diver, his assistants, and apparatus, for the first four hours or fraction thereof, from time of arrival at point of diving..... $60.00
For each succeeding hour or fraction thereof 10.00

2.—Compressed air, per 1,000 cubic feet .... .12

3.—For giving cable notice of deposits with the treasurer or assistant treasurers of the United States to be applied in payment of tolls, material, supplies and services 5.00

Canal Pilotage.

The regulations concerning charges for pilotage are so far amended that in future when vessels enter for the purpose of passing through the Canal, and do not take on or discharge freight or passengers, but do take coal or supplies, they will not be charged for pilotage.

PANAMA CANAL TRADE.

IN the two months from August 15 to October 15, during which the Panama Canal has been open, 113 vessels carrying in the aggregate 583,949 tons of cargo have passed through the waterway. This is about what was expected of the early period of the canal's use. Among other things it is suggested that the canal traffic is considerably affected by the war in Europe.

The heaviest traffic, it is said, has been between the Atlantic and Pacific ports of the United States, a trade in which only Americans vessels can engage, as they have a monopoly of the coastwise traffic of the United States. Manufactured goods and general merchandise have been carried through the canal in great variety chiefly from the port of New York and secondarily from Boston, Philadelphia and New Orleans to California and Puget Sound ports and also to Honolulu.

Traffic from the Pacific ports of the United States and Southwest Canada, mostly in grain, is regarded as largely seasonal, owing to the wheat harvest. Ten vessels have gone through eastbound on this route with grain.

Canadian Commercial Intelligence Service

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS

Argentine Republic.
H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.
D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Cancoma.

British West Indies.
E H. S. Flood, Bridgetown, Barbados, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.
J. W. Ross, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.
Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.
Philippe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

Japan.
G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.
J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.
W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.
W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.
W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.
E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.
J. E. Ray, Central House, Birmingham. Cable address, Canadian.
Acting Trade Commissioner, North British Building, East Parade, Leeds. Cable address, Canadian.
F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.
Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Canacom.
Harrison Watson, 72 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.
Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.
R. H. Curry, Nassau, Bahamas.

Colombia.
A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.
C. E. Sontum, Grubbeged No. 4, Christiana, Norway. Cable address, Sontums.

South Africa.
D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.
E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.
W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

MONTREAL HARBOR ELEVATORS.

THE elevators of the Montreal Harbor Commission have been filled with grain and emptied again twelve or thirteen times since the opening of navigation. The total amount of grain received up to Saturday night, November 21, was 61,675,181 bushels, over seventeen million bushels more than during last season, and the total deliveries up to the same time were 58,953,055 bushels, nearly fifteen millions more that during the entire season last year. The few more boats arriving before the close of the season will make a certain amount of difference in the receipts of grain, but the deliveries to the ocean vessels awaiting grain are expected to be much larger.

Elevator Capacity.

The elevator capacity of the two elevators belonging to the commission is placed at five million bushels, but ten per cent. has to be taken from this on account of the funnel shaped bottom of the bins, and the inverted-funnel way in which the grain rests in the bins at the top. Then it is often difficult to utilize an entire bin with grain of the same grade, because the requisite amount is not always available, and some waste space is thus occasioned. The harbor authorities have managed, however, during the summer to get into the two elevators as much as 4,500,000 bushels at a time, and this is regarded as a remarkable utilization of every scrap of space in the elevators to its full value. The capacity of the shipping bins, which have to be kept clear in order to accommodate the boats wanting cargoes, is also included in the capacity of the elevators.

Elevator No. 1 Addition.

The new $800,000 addition to elevator No. 1 will be urgently needed by the time it is finished. It is not thought that it will be finished in time to get any of the grain coming down from the Great Lakes during 1915, but the intention is to have it ready in the spring of 1916 for whatever comes forward.

Various Elevator Receipts.

The receipts in the various elevators up to Saturday night, November 21, were as follows:

No. 1 elevator	28,477,151
No. 2 elevator	28,802,275
Floating elevator	4,395,755
Grand total	61,675,181

The deliveries from the various elevators were:

No. 1 elevator	26,721,143
No. 2 elevator	27,836,157
Floating elevator	4,395,755
Grand total	58,953,055

The figures for the week previous to the above date indicate how the deliveries are beginning to exceed the receipts, in one case doubling them. The recipts in No. 1 elevator, for instance, were 284,773 bushels, while the deliveries were 585,444 bushels. In No. 2 elevator the receipts were 480,634 bushels as compared with deliveries of 595,429 bushels. The floating elevators, where there is no storage capacity at all, the receipts and deliveries are alike and total 94,558 bushels. In these elevators it is simply a matter of taking the grain out of one vessel, weighing it in transit, and dropping it into another.

LOCOMOTIVE ORDERS.

ORDERS for locomotives in 1914 have totaled as follows, according to the Railway Age Gazette:

January	43
February	139
March	167
April	127
May	121
June	50
July	99
August	45
September	17
Total, nine months, 1914	813

The total for the year at this rate would be about 1100, but the last quarter gives no promise of the average being maintained so that the total may not be above 900 or 1000. The annual average of locomotive purchases in 1901 to 1913, inclusive, was 3,798. The greatest number ordered was 6,265 in 1905 and the lowest 2,538 in 1904. The next lowest was 2,850 in 1911. Orders in 1912 were 4,515 while in 1913 the downward tendency was indicated in a total of 3,467.

BRIDGE REBUILDING IN FRANCE AND BELGIUM.

THE rehabilitation of hundreds of railroad bridges in Belgium and France which have been destroyed as a result of the military operations was understood to be the object of a conference in Toronto last week between representatives of the C. P. R., G. T. R., C. N. R., and the Allan, C. P. R. and C. N. R. steamship lines. Those who took part in the conference were: J. L. Perron, solicitor of the C.P.R. and Montreal Tramways Co.; William Lyall of the P. Lyall Co.; Timothy Foley, E. T. Foley and O. W. Swenson of the St. Paul firm of contractors, who helped build the Grand Trunk Pacific; W. F. Tye, civil engineer, Montreal, who was engineer of the Ottawa Terminal Co.; Patrick Dubee, a Montreal railroad man, and several others.

It was explained that the meeting was held to consider the problem of restoring railway communication in Belgium and France. Despatches from the war zone have pointed out the enormous task facing European engineers of replacing bridges in the briefest period, and bridge builders are of opinion that this cannot be done quickly enough by rebuilding from the ground up. The procedure suggested is to transport whole sections of steel bridges from other sections of the country. The Canadian and American roads have on hand numbers of "released" steel bridges which, it is thought could be utilized in the war zone.

FREIGHT CAR DEVELOPMENT.

AT the meeting of the Railway Development Association held in Chicago, November 10 and 11, E. W. Abbott, land commissioner of the Boyne City, Gaylord & Alpena Railroad, predicted the nearby advent of freight cars with two and one-half times the capacity of present equipment. In this type of car can be found the only solution, he said, for the increasing congestion on the trunk lines of the country. This will involve the adoption of an auxiliary 6-ft. standard road-bed in conjunction with the present track of 4 ft. 8½ in. gauge, the former to be obtained by laying an extra rail 1 ft. 3½ in. outside of one of the present rails. "The mammoth box car will be used for the vast bulk of carload freight," Mr. Abbott said. "It will save on handling, switching and hauling. It will be used only for freight destined to the big centres on the 6-ft. trunk lines. The operation of these cars will not interfere with the operation of the present standard car, which may be coupled up in the trains just the same, running on the 4 ft. 8½ in. track, which will be left where it is."

IMPORTANT JUDICIAL DECISION.

THE decision by Mr. Justice Sargeant in Morris v. Saxelby draws attention to a well-established principle of English law. Morris employed and trained Saxelby as a draughtsman and engineer. An agreement was made when Saxelby was 21 years of age that on leaving their employ he would (1) not disclose confidential information, and (2) would not engage in similar engineering work within the United Kingdom for seven years after he left Morris. Saxelby was sued for breach of agreement, and Mr. Justice Sargeant found that there was no proof that he had disclosed confidential information, and dismissed the case on the second point on the ground that the agreement was against public policy and, therefore, invalid. Agreements on point (2) used to be very common in many businesses, and always failed when tested in the courts. If restricted in time and area within narrow limits they may hold good, but when they practically bar a man from using his labor power in future they are invalid.

As the judge pointed out, Saxelby might as well have been excluded for life; if he could not practice his skill for seven years he would be out of touch with his business altogether. The skill that a man acquires by experience in the exercise of his labor power is not the property of his employer. The employer only buys the value created hour by hour by the power of labor. Any mental or physical development of the laborer that arises out of the work is something that belongs to the laborer.

It is regrettable, says an English contemporary, that such actions should be brought, or that any employer should suggest or seek to enforce such a limitation. Happily they are very rare in engineering.

CANADA'S TRADE DECLINE.

STATISTICS of Canadian trade for August, September and October, the first three months of the war, show that the imports of merchandise have fallen off nearly thirty per cent., and exports of Canadian products by about sixteen per cent., as compared with the corresponding three months of last year.

The imports for the three months of this year totalled $116.071.955, as compared with $164.663,971 for August, September and October of last year, a decrease of $48,592,016. Exports of Canadian products for the three months totalled $109.190,767, as compared with $128.368.662 for the corresponding period of last year, a decrease of $19.177,895.

For the first seven months of the present fiscal year, the aggregate trade in merchandise has been $555,175.449, a decrease of about one hundred millions, as compared with the first seven months of the last fiscal year.

Drop in Custome Revenue.

Corresponding to the drop in imports accentuated since the war began, there has been a corresponding drop in customs revenue. For August, September and October, the customs revenue has been $20,078,425, as compared with $29,-230.226 for the corresponding period of last year. For the seven months of the fiscal year the drop in customs revenue has been nearly twenty millions.

An interesting feature of the statistics of the past three months is the immense amount of coin and bullion brought into the country. The total for the three months is $79,916,609. The November figures, not yet available, will bring this total well over $100.000,000. For October the imports of coin and bullion totalled $52,578,669. This great influx of gold is, of course, due to the arrangement made between the Finance Department and the Bank of England for payment in Ottawa of gold balances due the bank by the United States clearing houses.

RECOVERY OF WASTE OIL.

IN a paper read before the Graduates' Association of the Institution of Mechanical Engineers. G. H. Ayres dealt with methods of recovering waste oils and greases from materials like cotton waste and rags used for cleaning machinery, and for rendering the materials fit for use again. The author said that until recently no process was in existence which could deal with such materials so effectively as to make their reclamation remunerative, but in many cases it is found that the materials which were formerly thrown away after first use are of greater value than the cost of new materials, owing to the oil contained in them.

Oil Extraction.

A convenient machine for extracting the oil is a turbine centrifugal separator. The rags are put in a perforated cage which is rotated at a peripheral speed of 6,000 to 7,000 ft. a minute by means of a steam-turbine incorporated in the machine. Thus no mechanical drive is required, and the exhaust steam from the turbine also serves to heat and liquefy the oil and grease. The separated oil may be filtered and purified in settling tanks, by means of filters of the filter-pad, gravity or similar types, or, when large quantities have to be dealt with, by a turbine centrifugal oil filter, which, like the separator, is self-contained and needs only a supply of steam at a pressure of 20 lbs. per square inch and upwards.

The rags or other materials from which the oil has been extracted are ready for further use as they come from the separator if they have been used only for mopping up oil or for comparatively clean work such as wiping down engines, but if they have been used for dirtier work they require washing. The machine used for this purpose resembles the ordinary laundry washing machine, but it embodies certain special features, such as a sludge chamber at the bottom of the cylinder casing in which the heavy dirt and grit may accumulate, an overflow trough at the horizontal centre line for the removal of suspended matter loosened during the process, and a removable section opposite the ordinary door in the revolving cylinder to permit the casing and sludge chamber to be easily washed out. After being washed, the wet material may be returned to the turbine centrifugal separator or passed on to an ordinary hydro-extractor, the final drying being effected in cabinets or automatic drying machines.

The Lancashire and Yorkshire Railway Co., who discarded cotton waste some years ago, use approximately 6½ millions of sponge cloths annually for cleaning purposes. These cloths, which are soaked with ordinary lubricating heavy cylinder, petroleum, and rape oils, with a small amount of tallow and yellow grease, yield from 1 to 1¼ gallons of crude oil per gross.

Oil Recovery From Metal Turnings.

Waste of oil again occurs when screwings and turnings are thrown upon the scrap-heap after very casual draining by which only about 30 per cent. of the oil is recovered. The loss may be avoided by treating the screwings or turnings in one of the centrifugal machines already described or in a machine specially designed for the purpose. In the latter type the swarf is put into a pressed steel pan which revolves at a high speed about a vertical axis. The oil driven off from the charge is expelled between the top edge of the revolving pan and its cover, and is thrown against the vertical filtering medium, through which it is pressed by centrifugal force.

The economy of this process may be judged from the fact that in the Wolseley motor-car works by means of turbine centrifugal machines, 1,200 gallons of cutting oil are recovered weekly to be used over again, the fresh oil needed to make up wastage being only 10 per cent. of the total amount required. One firm of manufacturers of cycles and cycle parts treated in six months 834 cwt. of metal turnings, 8 cwt. of rags, and 134 gross of sponge cloths, and recovered a total of 2,440 gallons of oil.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Glencoe, Ont.—H. F. McAlpine will equip a machine shop and garage here.

Aylmer, Ont.—The town will install a filtration plant. Mr. Le Blanc is engineer.

Reston, Man.—It is proposed to install a power plant. A. P. Power is engineer.

New Denver, B.C.—The New Denver Light & Power Co. will erect a new power plant and extend their transmission system.

Moose Jaw, Sask.—The Saskatchewan Iron & Bridge Co. will probably erect a large extension to their plant. George Harrison is manager.

St. Stephen, N.B.—The Sprague Falls Mfg. Co. will probably construct a dam, power house and power canal on the St. Croix River, near Grand Falls, Charlotte County, N.B.

Ottawa, Ont.—Fire on November 25 destroyed five motor trucks and a machine shop belonging to Harry Low, 92 Dufferin Avenue. The loss is estimated at $12,000, part of which is covered by insurance.

Toronto, Ont.—At a meeting held on Nov. 26, the Board of Control decided to call equipment tenders for the new Technical School. It is estimated that the equipment will cost about $284,000, of which $50,000 has already been received. The total cost of building and equipment will be $1,927,000. It is proposed to have the building ready by May 1. Rhys D. Fairbairn is chairman of the Board of Education.

Electrical

Mount Forest, Ont.—A by-law to authorize the installation of hydro power will be voted on by the ratepayers in January. W. C. Perry, town clerk.

Hamilton, Ont.—Council have decided to install a hydro lighting system in Dundurn Park, ornamental standards to be used. Estimated cost of installation $2,200, and of annual maintenance $250.

Magrath, Alta.—The town has decided to install a system of electric lighting. Power will be purchased from the Ellison Milling Co.. who offer to install a generator, providing the council will undertake the construction of the lines.

London, Ont.—The Board of Control has recommended to the City Council that the Dominion Railway Commission be asked to compel the placing under ground of all wires in the downtown section of the city.

London, Ont.—Sir Adam Beck announced recently that a reduction in power rates throughout the entire Hydro Electric zone will go into effect shortly. Between sixty and seventy municipalities will profit thereby.

Kingston, Ont.—F. A. Gaby, chief engineer of the Hydro-Electric Commission, has reported to the Kingston Public Utilities Commission that unless the present power arrangement between the city and the Street Railway Co. is changed it would not be profitable for the Commission to accept an offer of J. M. Campbell, who has developed power at Kingston Mills.

Municipal

Elburne, B.C.—The municipality has purchased a fire engine from the American La France Co., at a cost of $12,200.

Cranbrook, B.C.—Extensions will be made to the waterworks system. An appropriation of $100,000 has been made for the purpose.

Rainy River, Ont.—Extensions are proposed to the waterworks and sewerage systems, to cost $5,000. The by-law has been passed.

Ottawa, Ont.—W. T. Francis and F. D. Brown, engineers of Montreal, have issued a writ against the city for the sum of $3,271, as payment for professional services in connection with the proposed mechanical filtration plant.

Ottawa, Ont.—The Railway Board last Friday refused the application of the City of Montreal for interim exparte orders on the application for the temporary extension of Girouard and Regent Avenues over the right of way of the C.P.R., in Notre Dame de Grace.

Toronto, Ont.—The recommendation of the Board of Control to hold up the establishment of an incinerator plant on the Don roadway site until the people have voted on the question of garbage disposal on January 1, is declared to be legal.

Newmarket, Ont.—At the meeting of the Town Council on Nov. 25, it was decided to submit a by-law to the electors on Jan. 14th to authorize the issuance of $15,000 debentures for the construction of Hydro power into the municipality.

Dundas, Ont.—Extensions are proposed to the waterworks distributing system. Cast iron pipe will be required.

Cranbrook, B.C.—Hotson, Leader & Goode, of Lethbridge, Alta., are the general contractors for the extensions to the waterworks system.

Toronto, Ont.—The Board of Control has recommended to Council that the following by-laws totalling $577,000 be submitted to the ratepayers in January: Lansdowne line, $105,000; North Toronto line, $320,000; York Radial Scarboro division, $52,000; Motor buses, $100,000; total, $577,000.

Toronto, Ont.—The Board of Control on November 24, decided to recommend to the City Council the submission to the ratepayers on New Year's day of a bylaw to raise $105,000 for the construction of a civic car line on Lansdowne avenue, south from the city line on St. Clair avenue to the C. P. R. tracks.

Toronto, Ont.—The $100,000 by-law that the controllers have recommended be sent to the electors on New Year's Day will be sufficient to buy about ten motor-busses, as the average price of the machines, which in all probability will be single deckers, is $8,000. There will be $20,000 left for a garage and for the purchase of duplicate parts of the machines.

Toronto, Ont.—Among the many bylaws which will likely be submitted to the electors on the first of January for ratification is one for the acquiring of the Scarboro division of the Toronto and York Radial Co. It is understood that this matter will be cleared up in time to submit a by-law for about $50,000, which, it is said, is the price agreed upon by the arbitrators.

Mimico, Ont.—Engineer Lowe, of Aird, Murray & Lowes, consulting engineers, Toronto, and his staff are now busy and will be for at least three weeks more surveying the village for the purpose of preparing plans for the water system which it is proposed to install in Mimico. When the plans are prepared, they will be submitted to the Mimico council and, if they are approved, work may be started in the spring.

The Human Element, the Key to Our Economic Problems

A timely, interesting and valuable contribution to the science of business efficiency, and one which in its subject matter pierces to the very core of industrial organization. Particular stress in this respect is laid on the need for an individual enterprise being on a large scale, its suggested ideal constitution, the value of what is termed a "human report, and the business rating from an investors standpoint due to the latter feature.

PRESIDENT JAMES HARTNESS, in his address at the recent Annual Meeting of The American Society of Mechanical Engineers upon "The Human Element—the Key to Economic Problems," points out that the world of mechanism has become so intricate and complex that it has gone beyond the capacity of any single individual; that each one must be content to comprehend only a small part, and that it is only by selecting the character and limiting the amount of material that is taken into our individual minds that we can hope to accomplish the best results.

Under ordinary conditions the mind receives impressions from all directions, which, if unguided, may result in an undesirable trend in our personality and ability. On the other hand, by concentrating on those things which are of the greatest use to us, keeping in mind the laws of psychology, we may make a better use of our mental energy. The engineer should devote a part of his time to the care and study of his thinking machine instead of devoting it all to the machine created by that thinking machine. We should not overload our minds with data to the exclusion of thoughts of an initiative character. Man is a creature of habit to an extent that renders this characteristic a dominant one, and the most efficient use of mind and body demands a scheme of life that permits each one to take advantage of this fact.

Large Organizations Essential.

Specialization and repetition, by which habit is formed, are both essential to success. Carrying the principles of the individual into the realm of organized industry, it is a fact that large organizations are essential as affording an opportunity for the most complete sub-division of work and the greatest degree of specialization, both of which lead to the most effective employment of human energy.

A most important element of the large manufacturing plant is its organization. Without this, the buildings and equipment are of little value. Antagonism to the large organizations should be directed against corrupt practices, and not against the organization itself, which involves the workers' interest. The greatest good to the greatest number requires that we take into consideration each human being, his desires and his needs in finding the work for which he is best endowed.

Granting that the large organization is essential in this age, not only in bringing out the best in the individual but in mantaining the supremacy of our industry against foreign competition, may it not be that we may approach the ideal which we may assume to be somewhat as follows for a large industrial plant:

The Ideal Constitution.

It should have a capital equal to or as large as any competing organization. If possible it should have a small harmonious board of directors with an able leader, but if the directors merely represent the monied interests without special knowledge of the industry, then it would be sufficient if they were capable of appointing an able staff of officers, the chief executive of which should combine a knowledge of the technical and business side of the industry with the fullest possible conception of the human element. He should stand firmly for the cardinal principles of industrial economics as based on the human characteristics. Each officer should possess some special knowledge essential to the organization, so that the combined staff would have a general knowledge of all the various branches.

The chief executive should make it known that long continuity in service of each man in office will be given the first place in the scheme of management, and this should not only include the officers, but it should be the key to the management of the entire organization. The period of years of service of each man in the organization in a given task or in a given office should compare favorably with that in a competing organization.

It should be the aim of the executives to fill each position throughout the entire organization with someone who considers that position the best place in the world for him. Each officer and each workman should have a live interest in his part of the work, and each one should by specialization become the most efficient in his particular work. The interest of the officer or worker should be maintained by some fitting stimulus, and each one should be protected so far as possible from influences calculated to induce discontent.

Each man should be treated in a respectful manner. Needless direction or heartless correction by an over-bearing executive should not be permitted. Criticism or reprimand should not be uttered in the presence of others, for the best control of the organization comes from contact with the better side of man and that side is not reached by one who rides rough-shod over man's self-respect.

Personal dignity and self-respect is an important characteristic in everyone. It is not the exclusive quality of those whose self-respect is very apparent, nor is it limited to those whose natural conduct and bearing indicate their high regard of the esteem of others. It is to be found in the entire human family, and he who fails to see it, even in an apparently careless person, is blind to a very important part of the human spectrum.

Value of a Human Report.

As these truths become known will it not be possible to formulate general rules of management of industrial organizations and the promoter? With such rules, the investor could see to what extent an organization conforms to success standards. There would be in addition to the regular treasurer's report a human report.

The human report would begin with a description of the directors and go through the entire organization. This report would contain a statement regarding the elements of harmony of organization; of length of service of manager and workers; the frequency of change of methods or article manufactured; intelligence of executives in the management of men; the degree of contentment of each member; the extent to which each man in the organization approaches the best position for which he is endowed and how nearly he obtains the best remuneration for which he is qualified; the extent to which the management recognizes the inertia of habit of both mind and body; the degree in which the various men of the organization approximate the condition of highest efficiency; the extent to which the management goes in expression of appreciation; the degree of its knowledge of the most important characteristics of man as indicated by his inner motives and desires, and the condition of his mind as he goes to his home at night.

Organization Rating.

No mention is made here of the conditions of buildings from the point of sanitation and comfort, for such conditions are now closely scanned; but mention has been made of a few of those other conditions that must some day be measured just as we now measure power and other less vital things. All of these elements should be carefully appraised and the average should be the rating of the company. The investor who considers this human rating with the treasurer's statement will seldom make a mistake in estimating the true worth of an industrial organization. May we not hope that tabulations of these various elements taken from a variety of industries will lead to establishing a standard that will be a guide to both the manager and the investor.

Surely the investor should look with distrust upon a management that is always changing officers, changing men, changing models, changing methods without regard to the inertia of habit and the human element which is the life blood of every organization. He would also look with doubt on any scheme of management that allows the careless employment and discharge of men without due regard to the loss involved by such changes, for the perpetual changing of men is equivalent to the change of character of work in its handicap to industrial efficiency.

CONCERNING FOUNDRY COSTS.

By "Melter."

THE problem of how to keep uniform foundry costs with a maximum efficiency at a minimum of time and expense is a difficulty experienced by all founders, and, while no two systems are identical in all details, the same basic principles are involved.

There are in all five distinct divisions into which costs may be divided, namely: materials, productive labor, unproductive labor, commercial, overhead.

These divisions are again subdivided into:

1.—Materials, consisting of metals used, alloys, lime, coke, sands, gravels, facings, core room supplies, chaplets, lumber for flasks.

2.—Labor, productive, consisting of moulding, moulders' helpers, cupola labor, core makers, core makers' helpers, cleaners, clippers.

3.—Labor, unproductive, consisting of salaries of superintendents and foremen, chemists, clerks, pattern makers, carpenters, blacksmiths, electricians, crane men, yard labor.

4.—Commercial, consisting of sales, administration.

5.—Overhead, consisting of interest on capital value, lighting and heating, fire insurance, compressed air, cost of painting, cleaning, repairs, maintenance of machines and equipment, rates and taxes.

Two convenient forms are shown which involve the above classification and give at a glance the main factors.

Summary of all Expenses.

Labor.	Per Cent.	Amount
Molding		Form No. 1.
Melting		
Cores		
Chipping room		
Foremen		
Clerks		
General labor		
Overhead expense		
Total		
Materials.		
Metals		
Coke and cupola material		
Molding		
Cores		
General		
Poor castings		
Total		
Grand total		
Castings.		
Machine made		
Green sand		
Dry sand		
Miscellaneous		
Total		

In order that all this information may be accurately preserved, it is necessary to have distinct record books; one for the mixture which gives the percentages of pig iron, cast scrap, steel scrap, alloys, the way in which they are charged into the cupola and the coke charges. Another book would give the information relating to the output and would be divided into columns giving the drawing number, total quantity, number of good and bad castings with their weights and to what cause the defective castings may be attributed. A further book should give the order number, invoice number, description of casting, pattern number, average weight, total weight, number ordered and number shipped.

In connection with the order book, an order card should be employed. This card is filled in (with number required, etc.), and affixed to the pattern with a tack and placed in the rack where in due time it is put on the floor and filled in daily by the contract clerk, assisted by the molder. The card gives all information in connection with the particular casting in question and does away with all arguments between moulders and clerks.

Material. Date......

Material.	Quantity	Price	Amount
Melting			Form No. 2
Total			
Molding			
Total			
Core room			
Total			
Sundry expenses			
Total			
Output			
Total			
Summary.			
Metals			
Melting			
Cores			
Moulding			
Sundry expenses			
Total			
Average cost per 100 pounds	Material Labor Total		

The fourth book is the time record.

There should be a page for every man, covering a month's work, and the facts which should be enumerated are: Name of workman, clock number, time record, total hours, rate, total value, amount contract, amount wages, balance; checked, initials.

Order Card. Date......

Order Number.	Pattern Number.	Number Wanted.	Date Required.	Date Finished.
Price Per Mold.	Number of Cores Per Casting.			

Date	Number Molds Pored	Number Castings Good	Broken	Bad	Number Hours		Amount

To what order the castings are to be charged, description of work, number of operations, number of pieces, price each and amount of work is written in.

If it be desired to find the cost of an individual casting, the weight in pounds must be multiplied by the cost of metals used per pound, to which is added the percentage of non-production, the productive labor charges, proportion of commercial and overhead charges, all of which information is readily available if the above cited facts are recorded.

STRENGTHENING SPUR PINION TEETH.

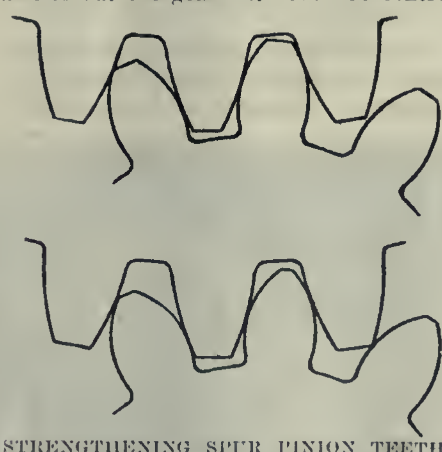
THE trouble which is perhaps most frequently met with by users of spur gears is the breaking of the teeth in the pinions. This invariably occurs at the roots of the teeth which are considerably weakened by "undercut." By this we mean that the width of the tooth is not so great at the bottom as it is a little higher up.

Regarding the tooth as a beam supported at the roots, and having the load applied at some point on the flank, it will be seen that the strength of the teeth varies as the square of the thickness at the weakest point, so that a good method of securing thicker root is somewhat valuable. The writer has had gears cut with a certain amount of "correction" to eliminate the undercutting, and gears so cut have been found to give good service where the standard gears have broken.

The upper figures shows the standard gears as cut with a hob on a generating machine, and it will be noticed that the flanks are badly undercut. The lower figure shows the gears cut with a certain amount of correction by the same hob and on the same machine.

The lower gears will work just as smoothly and at the same centres as the upper, and it will be seen that the second pair are not so badly undercut.

To accomplish the result shown in actual practice, it is only necessary to have the pinion blank large in diameter, and to cut the gear with the hob centre further from the pinion centre than for cutting the standard pinion. When cutting the wheel, the blank must be the same amount small as the pinion blank was large, and the hob must be just as much "close" as it was "wide" when cutting the pinion.



STRENGTHENING SPUR PINION TEETH.

The most successful way of determining the amount of correction is first to set up a cast-iron blank slightly larger than the pinion is expected to be and gradually run the hob closer in (topping the teeth all the time) until the desired shape is obtained. Then use the same setting for the pinion and when cutting the wheel make the same allowance.—Pages Weekly.

NICKEL SILVER.

SINCE the war began, states the Ironmonger, people interested in the electroplate trade have ceased to describe their base metal as "German silver," and have substituted for it the term "nickel silver." The change is not likely to cause inconvenience, because many of the makers, workmen and distributors of electro-plate have long used the latter term. The best quality of this metal for plating purposes at the present time is an admixture of 65 per cent. copper, 20 per cent. zinc, and 15 per cent. nickel. In his "History of Old Sheffield Plate," Frederick Bradbury states that the term "German silver" dates from the year 1830, when a Mr. Guitike, of Berlin, brought to Sheffield the first sample of this compound metal which was seen in that town. The alloy came originally from China, where its composition had been known from time immemorial, and it has been generally used as the basis of electro-plated ware in this country since about the year 1845.

ROLLING STOCK ORDERS.

NOTWITHSTANDING hard times, the various railway companies continue to add to their rolling stock, and among the orders placed recently were: Canadian Pacific, at the Angus shops, for 23 steel built flat cars, and 205 steel frame box cars; Intercolonial, from the Canada Car Co., six first-class cars; 200 standard flat cars of steel construction and of 80,000 pounds capacity, from the Nova Scotia Car Works; 250 freight cars of 50 tons capacity, from the Eastern Car Co., and from the National Steel Car Co., eight sleeping cars, 73½ feet in length, 10 feet in width over eaves, and 14 feet 2 inches from rail to roof top.

Recent deliveries of rolling stock includes from the Angus Shops to the C. P. R. one class D4 locomotive; eight steel built first-class cars, 88 steel box cars and 2 refrigerator cars; to the Grand Trunk Company, 12 first-class cars from the Canada Car Co., and two suburban locomotives from the Montreal Locomotive Works; and to the Canadian Northern, 11 Colonial type cars from the Canada Car Co., 10 from the Crossen Co., and one consolidation locomotive from Canada Allis-Chalmers, Ltd.

James Bayliss, chief engineer of the Bell Telephone Co., died on Dec. 7, in Montreal.

Training and Developing Leaders in Foundry Practice*

By E. A. Johnson **

The growth and development of any industry depends on the two-fold requirement of the intelligence, ability and supply of the rank and file workers, and on the like qualifications with the addition of that of leadership on the part of those who control and direct. This latter feature is here considered and an account given of the steps being taken towards its systematic accomplishment.

THE leader in the modern foundry has a great variety of responsibilities. His position is a complex one. It includes getting business, managing men, the upkeep of complicated mechanical equipment, the developing of improved methods of foundry practice, the improvement of quality of product and the decreasing of costs. All of these things are important and it is worth while to stop to consider what qualifications he must have in order to succeed in each.

FOUNDRY LABORATORY, WENTWORTH INSTITUTE.

Mechanical Skill Required.

He should have mechanical skill and ability to use his own hands in all the different kinds of work that come in the line of business which his foundry is doing or in its natural growth and extension may do. He must be able to judge what is a fair day's work, and be a teacher who can develop men to do better than they are doing in his competitors' shops. If he has not the comprehension of the elements of mechanical skill that enter into those jobs, his competitors are going to have the advantage over him.

Technical Knowledge Necessary.

The foundry leader must have technical knowledge of the kind that will enable him to organize the work in the shop; ability to judge what jobs may be done on machines with profit, what machines to use in each case and how best to mount the patterns; the size and shape of the flask to be used; the depth of copes and drags required, the method of gating, etc., all in order to get the maximum production in the shortest possible time and with the least possible losses through misrun castings and other causes. He must also have ability to plan match plates and match work of the varius kinds used in connection with molding machines, or otherwise, to effect saving in time and increased output, and in a thousand and one other ways he must have accurate, detailed, technical knowledge in each branch of his business.

The leader in the modern foundry should know how to determine rapidly and accurately the amount of metal required to run different kinds of castings; the proper pouring temperature of the metal which will produce the best results for every grade; the kinds and qualities of sand best suited for each variety of work, and the proper facings to be used. He must also understand the cupola in all its functions. He must be thoroughly familiar with up-to-date methods of mixing, of charging, and of melting; and he must know the effects on the metal when the conditions of melting are varied. He must know the relations of pressure and volume of blast, of depth of bed, height of melting zone, tuyere openings and time—all as applied to the melting of metal in the cupola.

It is not necessary for everyone in the foundry industry to have this kind of technical knowledge, but somewhere in every plant there should be a leader, at least one who has mastered these technical details and who can solve such problems as daily arise.

The Engineering Requirement.

The leader, too, has got to have an engineering appreciation of the generation of steam, power transmission, applied electricity, compressed air, ventilation, etc., subjects covering nearly the whole field of what is now regarded as the profession of engineering. He must also have a sufficient mastery of the pattern-maker's art to enable him to de-

FOUNDRY FLOOR, WENTWORTH INSTITUTE.

*From a paper read at the recent American Foundrymen's Convention in Chicago.
**Wentworth Institute, Boston, Mass.

termine when savings may be effected by altering patterns to simplify moulding. The man in charge should always be ready to devise changes that will effect economy not only for his own plant but also for his customers' plants.

The core room and cleaning department each offers its problems, and the whole fields of chemical and metallurgical engineering with their problems of temperature, heat values, combustion, and the relationships between the chemical and physical properties of foundry materials and foundry practise are also matters that must come within the accurate appreciation of the modern foundry leader.

Speaking generally, manufacturers everywhere appreciate the importance of what is here outlined and recognize the advantage to be derived from their adoption. They understand the value of scientific control of foundry operation. While this is true, there is still a large percentage of foundries where old methods of operations are still being employed. Foundrymen everywhere are familiar with this fact, but they are forced to continue operation in the old way simply because of their inability to get men with the training and with the leadership required to carry on the work in accordance with the best accepted standards of the trade.

It is not necessary to argue this point, for it is self-evident that the apprenticeship system as it has been carried on in foundries does not produce men who have the proper training to succeed in managing a plant in accordance with the ideas that we all are now prepared to accept. It is also self-evident that practical experience alone is no longer sufficient, and "rule of thumb" methods will not solve the problems.

Wentworth Institute Course.

Wentworth Institute, realizing conditions as they exist, has determined to offer a new two-year course designed to train men to fill the need who will be capable of grappling with just the sort of problems here outlined. This course is intended to train young men exclusively for the advanced positions in the foundry industry, those positions which require a combination of skill, intelligence and technical knowledge. It is planned to give both a broader practical training and a more thorough comprehension of the scientific principles that underlie modern foundry practice than can be obtained through practical experience in commercial shops to-day. The work of the new course, which we call Foundry Management and Operation, is divided into seven general headings.

Shop Experience.

Three-eights of the entire time during both of the two years is given to gaining experience in bench and floor moulding for iron, brass and other alloys and in machine moulding, core making, finishing, and in cupola management. The plan is to include all the common types of work that are met with in the best modern foundries. By carefully economizing the men's time and by seeing that there is no wasted effort through repetition and doing unnecessary kinds of work from which little benefit would be derived, it is confidently believed that in two years more practical skill and experience can be given than young men would get in a commercial shop in a four or five year apprenticeship.

EXAMPLE OF STUDENTS' WORK.

Text Book Study, Talks, Lectures.

A great deal of information can be successfully and rapidly imparted through reading and study and by lectures and practical experiments and demonstrations given to a class of mature and earnest students by an experienced teacher. The plan includes a systematic course of this kind extending all the way through each of the two years of this course.

Drafting and Design.

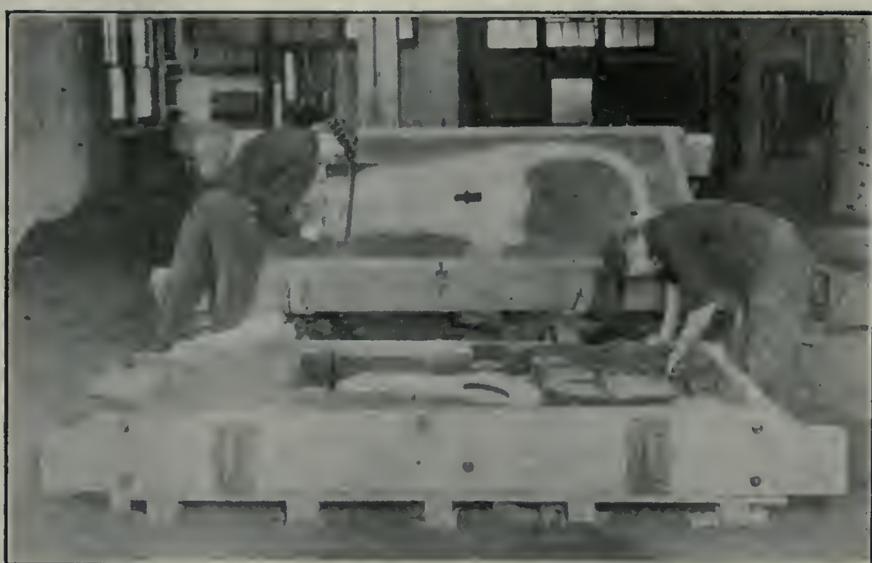
The third important sub-division of the course includes a variety of training given on the drawing board. There are many problems that can be solved better with drawings than in any other way, and a foundry leader must have facility with his lead pencil and ability to express his ideas on paper, to sketch the things that he wants done, and to design the details of foundry appliances and foundry equipment, if he is to get the best results.

Estimates and Quantities.

Rapid and accurate computations of a great many kinds enter into the foundry business. These include not only estimating of cost and quantities of material, but also a great variety of practical computations involving the use of formulae and more or less advanced mathematics. A systematic course of instruction is therefore planned involving computations of just this kind, including such branches of mathematics as are essential.

The Engineering Feature.

The fifth principal subdivision of the course is planned to cover all those principles of applied science which enter into the foundry industry and those general principles of engineering such as steam generation, power transmission, application of electricity and compressed air, strength and stiffness of materials, etc., which every foundry manager must understand if he is to



FINISHING A GREEN SAND MOLD FOR A BAND SAW FRAME. MOLD COMPLETE AND READY FOR POURING REPRESENTS ONE DAY'S WORK OF TWO STUDENTS.

become a leader. A special laboratory is equipped for this kind of work.

Foundry Chemistry.

Perhaps the most original part of the work, so far as school practice is concerned, is the instruction that is planned in foundry chemistry and chemical and metallurgical engineering including, of course, the questions of combustion and the effects of temperature. Two laboratories are especially devoted to this part of the work and a third is planned.

Initiative, Resourcefulness, Self Reliance.

Leadership can be developed, like any other quality, through practice. Students in this course have, therefore, opportunity to obtain systematic experience both in planning work and in directing the work of others. They are expected to act as foremen supervising at first small operations, and as they gain experience assuming larger and larger responsibilities. Experience in other courses has demonstrated that this kind of foremanship training does develop the quality of initiative, the qualities of resourcefulness, of courage and self-confidence which, taken together, may be called leadership.

DIE-CASTING PRACTICE.—I.

By Chas. Pack.**

DIE-CASTINGS may be defined as finished castings, the metal having been poured and allowed to solidify in permanent metallic molds. This definition would include a number of casting processes, the products of which are not commercially recognized as die-castings, such as the casting of cheap lead figures, lead battery plates, dental appliances, etc. Here the molten metal is poured from an iron ladle into a permanent metallic mold, filling the mold by its own gravity and using no external pressure. To exclude these processes, die-castings must be defined as "finished castings made by pouring molten metal under pressure into a metallic mold."

The process of die-casting consists essentially in melting the die-casting alloy in a suitable container and forcing it, under pressure, into a metallic mold or die, producing smooth finished castings requiring little or no machining, and being ready for buffing or plating without any grinding or cutting down. The process is best adapted to small intricate parts where accuracy and uniformity are essential. The process is limited to a group of alloys having a tensile strength not exceeding 20,000 lb. per sq. in., which limits the application of this process to machine parts not subject to severe strain or shock. It is, however, possible by a careful study of the service conditions to re-design castings, either by the addition of ribs, webs, fillets, etc., or by the insertion of steel or bronze inserts to so strengthen die-cast parts that they may successfully displace the stronger alloys of copper and iron.

Although the principles of die-casting have been known and practised for many years, the advent of successful die-casting as an individual industry dates back to a period of no more than fifteen years. By careful study and experiment it has become possible to enlarge the area of its application, and at the present time the manufacture of die-castings forms an important branch of the non-ferrous metal industry.

Die-castings are now used extensively for both useful and ornamental purposes. They constitute the vital parts of various types of automatic vending machines, photographing machines, typewriters, cash registers, magnetos, motor starting devices, time controlling devices, counting machines, water circulating and force feed pumps, player pianos, roller and ball bearings, connecting rod and crank shaft bearings for internal combustion motors, gas meters, electrical measuring devices, mechanical and electrical horns, phonographs, and for many other purposes too numerous to mention here.

ROLL-OVER MACHINE PATTERN MOUNTING INSTRUCTION.

Die-Casting Processes.

The processes in use for the manufacture of die-castings may be divided into two groups, viz.: Air machines and plunger machines. In the former type of casting machine, the metal is melted in a suitable iron pot fitted with air-tight cover. The air valve is opened to admit air, which forces metal upward into the die. Although there are a number of air machines where metal is poured downward with gravity, the greater number called to the attention of the writer force the metal upward and against gravity.

The plunger type of casting machines, although open to a number of objections, have proved more successful in practice and are used to a much larger extent than the air machines. The writer will confine himself to the machine and process patented by H. H. Doehler in 1907. This process, which is undoubtedly the best of either type, is now being successfully used in all parts of the United States, as well as in Canada, Great Britain, Germany, Austria and Hungary.

Construction of Dies.

Dies are constructed from model or blueprint furnished. The design and construction of the dies constitutes one of the most vital factors in the successful operation of the process. The designer of the die must find the proper location for the gate, which is a very important factor, far more so than in foundry practice. A machine part often pronounced a casting impossibility may be made a possibility by the ingenuity of the die designer.

A better understanding of the importance of the die construction may be gained by a consideration of the die cost. Dies for simple parts may cost from $25 to $100; for more intricate parts from $100 to $500, and for very complicated parts die cost may run as high as $1,000. Although the latter figure seems high, die-castings made from such die still show big savings, since otherwise there would be no demand for such dies.

The predominating features of die-castings are their high degree of accuracy and uniformity. Die-castings can be made to specifications of plus or minus 0.005 in., and when necessary, if conditions permit, to specifications of plus or minus 0.0005 in. These conditions depend upon the alloy to be used and construction of die. Generally, specifications of plus or minus 0.0005 in. can only be had on castings whose dimensions do not exceed 1 in. either way. It must, however, be understood that closer specifications require more careful die work and consequently higher die cost. Limitations should, therefore, be made as liberally as requirements will permit. From the foregoing it will readily be seen that in the construction of dies only high skilled mechanics can be employed. The employment of inferior labor in this department would be a false economy, since a single misstep may ruin weeks of good work.

*From a paper presented before the American Institute of Metals, Chicago, September 8.
†Doehler Die-Casting Co., Brooklyn, N.Y.

Alexander Harvey, secy.-treas., the Detrick & Harvey Machine Co., died on Sunday, November 22 last.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

REAMERS AND REAMER HOLDING.—I.

By Spring Craig.

As each machine in a manufacturing plant represents an outlay of money on which interest has to be earned and allowance made for depreciation, and as the purchase of new machinery must often be put off until the amount of the firm's business warrants the extra outlay, the machines on hand should be made use of, to the fullest extent, by their proper equipment with special tools and fixtures.

In most shops there are ways and means of keeping the men on the jump, but the equipment of the machines is often neglected. A few fixtures and special high-speed cutters for the millers, some special jaws for the shaper vises, a few jigs, high-speed drills and tapping attachments for the drilling machines and, last but not least, special chucks, chuck jaws, work-holding devices for the lathes, will often more than double the quantity and improve the quality of the work turned out.

It is the purpose of this article to discuss a few of the little appliances for lathes in a general shop, or tool room; namely, reamers, holding devices and boring tools which help more than driving the men to increase the output.

Boring Tools.

As there are a great many different kinds of special boring tools, a few types only will be dealt with. These are such as can be adopted in most any shop for a great variety of work.

For a lathe of between fourteen and twenty-inch swing, the writer has not seen or used in his experience a more universal or compact and satisfactory boring tool holder than the one here illustrated in Fig. 1. To be sure, there are other tool holders that are quite as satisfactory, but most of these are for special purposes. It is composed of a body A, which is knurled top and bottom as in the illustration, and is parted in the centre so that, by tightening nut G, any one of the three different sized boring bars, D, B or C, can be securely clamped in the holes D, E or F, to which it belongs. At H, a little can be turned off or some packing put in to bring the bar up to the centre of the hole to be bored. There is one wrench with this holder that fits nut G and all three boring bars. The bars shown are those furnished by the Armstrong Tool Holder Co., of Chicago, Ill.

In Fig. 2 is shown a boring bar E, or, more properly speaking, a reamer which has some valuable features that are not as well known or made use of as much as they should be. The body is made of machine steel with a flat at b for seating a set screw.

At F a slot is milled and a hole drilled in the centre of the shaft in which a plunger and spring are fitted. M is a

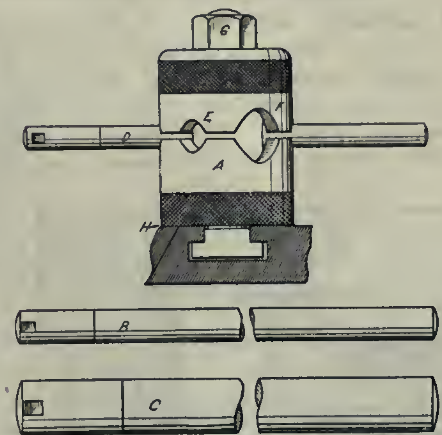


FIG. 1. BORING BAR FOR SMALL LATHE.

cap turned as illustrated and fastened on by two flat-headed screws. The cap and slot are case-hardened.

Below the bar at F is the cutter, made preferably of high-speed steel, of which F is a side view and (e) an end view. It is countersunk at d. This cutter is made a nice working fit in the slot in bar and the end of the plunger entering the countersink is all that holds it in place. In fact, it has all the advantages of a floating cutter.

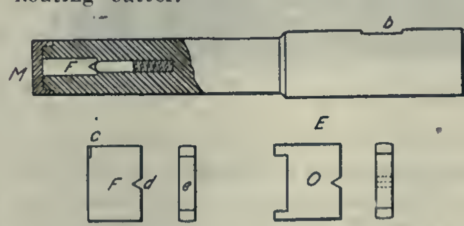


FIG. 2. SIZING CUTTERS AND BAR.

This plunger is often not used, but it helps to centre the cutter in the hole. The cutting is done on the front face, very little radius being used on the corners. The clearance towards the back is very small and, on the ends also, it is just enough to prevent the cutter from freezing. The clinging of particles to the sides must also be prevented, as this will make a rough hole, or the cutter will be forced to one side and bore large. The cutter shown at O is for holes that bottom. The hole is first bored within, say, a quarter of an inch of the finished diameter and two cutters are used; one, a roughing cutter to bore the hole within a sixty-fourth, and a finishing or sizing cutter. Once the finishing cutter is made to bore the hole to size, it will, with good care, bore holes four or five inches long perfectly parallel and straight to fit a gauge. It is always used in a horizontal position, and the only way it can bore large is by the moving of the bar above or below the centre.

A HANDY INDICATOR.

By A. S. Toy.

FOR accurately locating holes for drilling or boring in either the drill press or milling machine the indicator shown in the accompanying drawing is very useful and accurate. It consists of a tool steel pointer fastened in a steel ball, held in a taper shank, fitting the machine in which it is most used. The shank is drilled out to fit the ball, behind which is inserted a spring. The end of the hole is then rolled over in the lathe, so that the ball is held in place. In use as a centre indicator, the needle may quickly be centred by hand while the spindle is revolving. The most accurate method of locating holes for drilling, however,

A HANDY INDICATOR.

is to draw the proper circle and then line up the work so that the needle may follow the circle while turning the spindle of the machine by hand. The needle may be pushed out to give a circle of large radius, and it is surprising how accurately one may locate a hole by this method with a little practice .

A CYLINDER PLANING FIXTURE.

D. O. Barrett.

WHENEVER a set-up job is mentioned there is a tendency in the minds of many to associate with it a lot of tools, such as surface gauge, calipers, scriber, etc., yet there are a few elementary principles to be observed in the setting-up of jobs which make some of them quite simple matters, and easy of repetition without a cumbersome and complicated fixture.

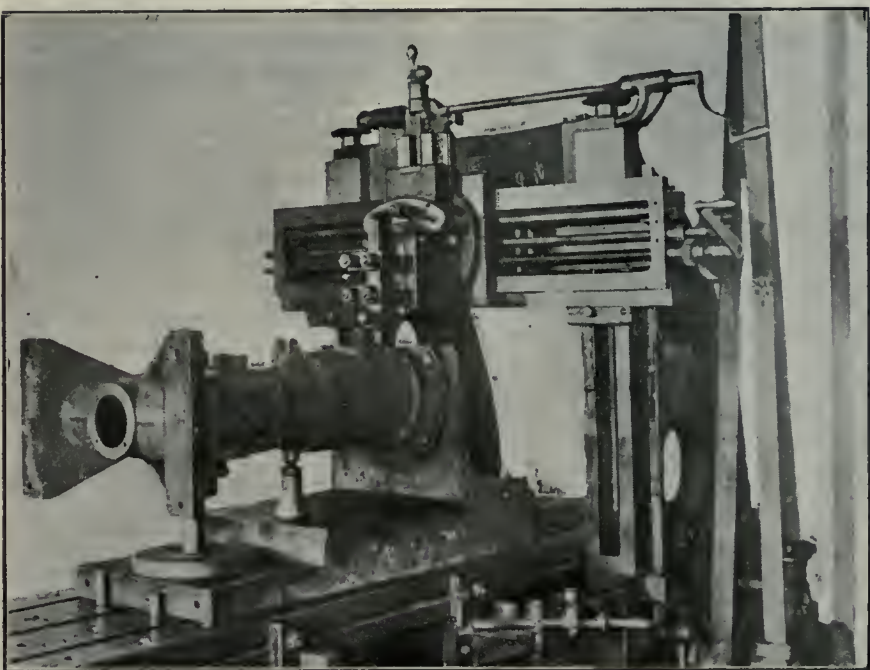
The photo shows the combined base and cylinder of a vertical gas engine, the two being cast integral and "Made in

Canada." The first operation on this cylinder was boring in the lathe, after which the bearings for the crankshaft were babbitted, the fixture for this being located from the cylinder bore. It was necessary to plane the side of the cylinder for attaching the cage containing the exhaust and inlet valves. This face must be parallel to the centre line of the cylinder and at right angles with the crank shaft. The job had formerly been done in a shaper, and some difficulty had been experienced in properly setting it up each time. The setting-up operation in the fixture shown becomes a very simple operation, without the use of any tools other than a wrench, and the principle involved is capable of other applications.

The cylinder was slipped over a plug on the angle plate at the end, and held in place by means of a couple of cap screws through slotted holes in the plate. A piece of heavy tubing was turned to the same diameter as the crank shaft, and on the one end was shrunk a cast iron disk about twelve inches in diameter this having a bearing about one-half inch wide around the circumference, and being relieved over the rest of the face. The arbor was placed loosely in the bearings before the cylinder was bolted in the fixture.

A small jack was placed under the cylinder by which it was raised the proper amount and then turned until the disk at the bottom of the arbor showed a bearing completely around the circumference. This bearing could easily be determined by sight, as a small error in parallelism between the centre line of the cylinder and the planer table would result in a line of light readily visible under one edge of the disk. After locating at the proper height, the bearing caps were tightened and the planing proceeded with.

As the shop was not provided with a radial drill, it was necessary in drilling these cylinders to slide them around under the drill press, and this same fixture was used for holding them here also, the lining up being accomplished as before. This method was quite quick and satisfactory as the operator became quite proficient with a little practice.



CYLINDER PLANING FIXTURE.

WHITE METAL ALLOY.

A new white metal alloy of high lustre, capable of taking a brilliant polish and closely resembling silver in appearance, has been invented by Edward Smith, London, England (U.S. Patent 1,114,055). Owing to its close resemblance to silver and to its property of withstanding atmospheric conditions to a great extent, the inventor claims it may even take the place of silver for many articles, but it is most suitable for the manufacture of goods which are to be silver plated. The mixture is as follows:

Copper	40 lb.
Nickel	8½ lb.
Zinc	5 lb.
Tin	2½ lb.
Lead	1 lb.

To make the alloy, the nickel is first melted with a flux of silica, and half the copper is then added gradually and mixed; the remainder of the copper is then added. The zinc is next quickly plunged beneath the surface of the molten metal, which is stirred rapidly till the whole is melted. The lead and tin are added last while liquid. The metal is stirred and brought up to 1,700 deg. F., then poured into ingot molds.

CAST IRON GEAR TEETH.

SPUR gears made from patterns have a certain taper (or, in foundry language, strip), as is well known, for the purpose of effecting a clean lift of the pattern from the sand. The fitter and erector should see that the thick part of the tooth of one wheel or pinion is arranged to run with the thin part of the other wheel or pinion. If this is not done, the wheels will run badly and may even break down. The designer, the patternmaker, the moulder, as well as the fitter and erector, must collaborate in this matter, or it will be found impracticable to suitably fix the wheels so that thick and thin parts run together.

VANADIUM STEEL IN LOCOMOTIVES.

THE following table shows vanadium parts applied to locomotives built or ordered in the United States from January, 1913, to May 15th, 1914:

Name of parts.	Number of engines equip'd.	Number of parts applied.
Driving axles	479	1,297
Main rods	377	822
Side rods	284	1,986
Frames	993	2,054
Crank pins	198	612
Piston rods	69	138
Springs (engine and tender)	366	....
Engine truck axles	62	62
Wheels	..	700
Tires	..	1,150
Cylinders (vanadium cast iron)	260	540

With the exception of wheels and tires the foregoing applies to new power only.

Australian Orders to U. S.—Australia has recently furnished from $20,000 to $25,000 worth of business to manufacturers at Milwaukee, Wis. The Affiliated Manufacturers' Co. received an order through Richardson, Orr & Co., its New York representative, for about $11,000 worth of gas engines, and the Milwaukee Concrete Mixer Co. for concrete mixers valued at between $10,000 and $12,000. A. W. O'Mara, Australian representative of the latter company, visited Milwaukee in person to place the order and to make purchases of considerable other equipment and material on Australian account.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

OUR LACK OF MANUFACTURING EFFICIENCY.

By "President."

WHILE the European war has given Canadian manufacturers the greatest opportunity in their history, it has also developed a line of criticism of them that will undoubtedly be heard much of in the years to come. We are everlastingly hearing of Germany's successes in many fields, and the part that her efficient methods have played is always emphasized. One United States manufacturer in the machine tool and allied fields personally investigated conditions in Germany with a view to finding out why it was that the Germans were able to undersell him. He had been under the impression that German labor was very much cheaper, but found that when taxes and cost of living were considered, the Germans had an advantage of only 5 per cent. to 7½ per cent. Incidentally he found that German workmen saved more money than the average American workman. He also found that the Germans studied organization and the elimination of waste, much more than do the manufacturers of Great Britain, the United States and Canada.

Most Canadian industries have started with small beginnings and there are few successful manufacturers in Canada who will not to-day look back and express surprise that they had the pluck to chance their entire savings and the courage and perseverance to keep on in the face of many discouragements. The hardest thing they had to overcome was a lack of organization and trained employees. They, themselves, were not thoroughly familiar with the work they had undertaken and they had perforce to instruct ignorant employees. They had to fight the losses and worries the best part of their lives before they got an organization that was even fairly efficient. The elimination of waste, which is efficiency, they knew nothing of in the early days. The Germans on the other hand were taught this lesson at the outset and they have thousands of efficiency experts and thoroughly trained men for every department of their business. Great Britain, too, in many lines is most efficiently organized, and where she is so the Germans have not been able to compete with her in either cost of production or quality. They have beaten her in many cases in salesmanship.

Training Employees.

Kitchener says it will take two years to train a man to be a really good soldier. Yet the recruit is under capable instructors all the time. His work is simple. It is laid down exactly in the drill books and when he comes to apply his work in war he is under the direction of more highly trained men than himself and is required chiefly to obey their orders or use a fair degree of common sense when otherwise.

If all this training is required to make an efficient soldier how much more important is the question of training and efficiency in the factory? It is the most important matter before the Canadian manufacturers to-day. It will be used against them when they ask for more protection, or when they oppose a lowering of duties because of foreign competition.

To meet the situation effectively, Canadian manufacturers must be able to show that they are efficient. They must have a man or men in their plant who is responsible for this phase of their business alone, and they must themselves read, and encourage their employees to read the best business and technical papers.

CREATING AND EVOLVING INDUSTRIES.

By J. E. Cooley.

INDUSTRIES as a rule are founded on new inventions, and these inventions are generally ideas that were first evolved from the brain of some one man, who had been or still is a workman.

If it were possible to trace backward through the successive improvements of any particular invention of what is now a highly-perfected machine, and the manufacture of which has developed into a great industrial concern employing several hundred hands, to find the beginning of this invention, it would lead us to some garret, some wood shed, or some such fitted-up home workshop, where its rudimentary design or crude model was first brought forth.

The Lone Inventor.

Nowadays the work of experimenting on changes and new designs in machinery made through the suggestions of employees, is carried on in the factory, where they are later produced; but the work of developing original inventions—ideas that have never before been brought out, are still more or less as of old, carried on in humble surroundings as already mentioned, being very often done amid hardships, accompanied by great sacrifices, and by long and patient earnest toil.

Why is this? Because, while inventive workmen can have their ideas developed in places where they are employed, providing their ideas are suitable or can be applied to machines or products already being manufactured there, those who originate ideas on other lines seldom have them accepted, and are obliged to work and develop them on their own account.

Having the confidence in the success and usefulness of their inventions, some few of these inventive workmen succeed in bringing them out alone, while on the other hand, a great many other workmen with ideas just as useful and valuable never attempt to do so, because they lack initiative for one thing, and another and most important reason is that they require but never receive the proper encouragement to do so.

The greater number of inventions and improvements are from ideas and suggestions given to employers by their workmen skilled and experienced in mechanics. It has always been a theory of the writer, which is based only on his range of experience and observation, of course, that from five to ten out of every hundred workmen in any given factory are of a "mechanical turn of mind" or inventors.

Workmen of skill and ingenuity are always inventors, and though many of them have valuable ideas, they are unable to develop them owing to their circumstances or for various other reasons. The workman with an idea for a tapping machine, when employed in a place where cash registers are made, is as much handicapped as the workman with an idea for a cash register when employed where only tapping machines are made, yet the fact so long neglected or overlooked is that it is these stray ideas developed that build up new industries; and simply because of the lack of support or encouragement, many of the ideas are lost or die with the brain that conceived them.

New Ideas Stimulate Business.

Business is always dependent on new ideas. That business which is popular to-day, whether in manufacturing automobiles or furnishing war materials, will die out to-morrow, and must be superseded by something else; and this fact is always evident, that industry and welfare are ever dependent on new ideas. Where are these ideas to come from? As already stated, the most of them come from inventive employees.

If a lathe hand has an idea for a new tool-holder, another workman an idea for a quick-acting wrench, still another an idea for a universal joint, it is to the interest of the employer to ferret out these ideas and have them developed, even though having been perfected, the originators cannot undertake the work of manufacturing them. The principal thing is to be the aid in bringing forward the first models, for it is by this aid that new industries are going to spring up and, with them, new machinery requirements. Each manufacturer in taking up this work or developing new ideas helps to create new industries, and also creates opportunities for himself to serve them with machinery of his own.

Encouraging New Ideas Development.

Industrial committees who are ever reaching out in trying to secure new industries to locate in their respective communities will find it profitable to take up the work of encouraging mechanics to develop their ideas by providing a place and means for them to do so. With a very small outlay a public experimenting room could be fitted up with a few lathes, one or two shapers, a large and small drill press, and all the necessary tools to use with these machines, also a work bench with a few vises, and a forge. The room should be provided with a few closet spaces, where the inventor can construct his invention in secret and experiment with it.

Nearly every factory can boast of employee-inventors, many of whom are ambitious and desirous of having their ideas developed, and if these could be given a slight boost, or have the necessary facilities provided, it is only reasonable to believe that, wherever this aid were given, greater industrial progress would be realized.

FORGING HIGH-SPEED TOOLS.*

By G. W. McKee.

IN manufacturing high-speed tools, the practice of forging should not be resorted to, when machining without prohibitive expense is at all possible. It can with economy be limited to special lathe and planer tools. Tools like punches may be easily forged, but they show a tendency to burst, and results are uniformly better when turned down from bar stock. Care should be taken if the piece to be forged has to be cut from a bar. Only an expert can nick and break a piece of high-speed steel from the bar without damaging its structure. A better plan is to saw it. High speed steel can also be cut by a friction disc of tough steel turning at high speed. This does not take hold well at first, but after being run awhile on high speed steel, it produces a clean cut very rapidly.

In forging, the tool should be heated slowly and thoroughly to a temperature of 1,900° to 2,100° F., and maintained at that temperature till the process of forging is complete. Precise temperatures are not as essential as uniformity.

High-speed tools should not be stamped and all nicks or marks should be avoided. A scratch on high-speed steel acts something like a diamond scratch on glass. Small invisible surface cracks caused by imperfect forging frequently occur at or near the cutting edge and cause its destruction much sooner than would otherwise be the case. Cracks can usually be detected by moistening with petroleum, wiping clean and rubbing over with chalk. This renders the nature of the cracks visible.

Excess metal or finish allowance should be removed on a dry emery wheel before hardening. The surplus metal should be about 1-16 in. or more, so that the quality of the steel forming the final cutting edge should be of the best. It is a very good practice, if conditions make it convenient, to anneal after forging before final hardening. In heating used or worn tools for forging or recutting, care must be taken to heat very slowly at first. Strains often exist in these used tools due to heavy machine cuts that have been taken, and unless carefully heated they are liable to crack.

ANNEALING HIGH-SPEED STEEL.*

By G. W. McKee.

A THOROUGH annealing of a blank from which a tool is cut removes strains due to casting and tilting, and very markedly reduces distortion when the tool is subsequently hardened. It also minimizes risk of cracking in hardening. This especially applies to tools having projections or recesses of such a shape that unequal expansion or contraction would operate suddenly. It renders high-speed steel sufficiently soft to be readily machined, and it imparts increased ductility. This is beneficial if the tool is liable to encounter sudden shocks.

High-speed stock, which used to be supplied rough from the rolls, is now usually furnished annealed. Some times, however, it is put through the annealing process again. Annealing can be carried out by placing the pieces loose in an oven furnace bringing the furnace and contents up to 1,460° F. and holding at this temperature for at least three hours, in the meantime being sure to maintain a reducing atmosphere within the furnace. Shut off air first, then gas, lute up furnace door and cover flue openings, and allow furnace to cool with contents. Otherwise, the tools can be packed with charcoal in a section of steel pipe or cast iron box, and may touch each other; but care should be taken that they do not touch the sides of the box. The container is then luted up and placed in the furnace. They are heated and cooled as above except for a longer time and, of course, it is not necessary to lute up the furnace when the gas is shut off. In fact, the container may be removed and buried in some insulating substance like loose asbestos and the furnace used for other purposes.

Some large steel manufacturers recommend the following quick method for annealing small parts that have to be treated within a limited period of time: Place the steel in furnace heated to 750° F. and raise the temperature slowly to 1,300° F., shut off the heat, and allow the furnace to cool to about 750° F. (not over), then re-heat the steel to 1,300° F., and hold at this heat for 30 minutes. Next remove from the furnace and allow it to cool in the atmosphere. This process is claimed to have proved a success, and does not take over an hour for a piece 1 in. diameter.

For all annealing operations, standard gas-fired oven furnaces are suitable.

*From a paper before the Nat. Com. Gas Association, New York.

Industrial Accidents.—According to Safety-Engineering, about 25 per cent. of the accidents recorded under the British Compensation Act were due to insufficient lighting of industrial shops.

German Patents in Poor Demand. — Despite the fact that some thousands of patents are held by Germans and Austrians, it is understood that not a dozen applications for their suspension or revocation have been made by Canadians. This, it appears, is also the case in Great Britain, where the number of such patents held is, of course, very large, and the number of applications for suspension surprisingly small. Although the greater number of enemy patents in Canada will not be challenged, this does not mean that their German or Austrian owners will be allowed to derive royalties from them. Such would be contrary to the proclamations forbidding trading with the enemy. The same course, it is understood, will be followed as with bonds and stocks held by persons of enemy nationality, that is, the royalties will be allowed to accumulate until after the war. This will mean the diversion of many hundreds of thousands of dollars from Germany and her ally, Austria.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

Question.—A bar, 2 in. by 4 in., is held by a cotter through the long side, which is 1½ in. thick. How wide should the cotter be in order that it be as strong as the bar?

Answer. — $4 - 1\frac{1}{2} = 2\frac{1}{2}$. Tensile strength of bar is $2\frac{1}{2} \times 2 \times 100{,}000 = 500{,}000$ pounds.

Shearing strength of steel $= 70{,}000$ pounds.

Cotter is in double shear; therefore, this becomes $\frac{70{,}000}{2} = 35{,}000$ pounds per sq. in.

Area of cotter cross section required $= \frac{500{,}000}{35{,}000} = 14.28$ sq. inches.

Width of cotter, then, is $\frac{14.28}{1.5} = 9.52$, or 9½ inches.

* * *

Question.—A safe weighing four tons is to be lifted by four ropes. What size should the ropes be? What would be the difference if steel cables be used instead?

Answer—Formula $L = 200\ C^2$ where $C =$ the circumference of the rope gives a safety factor of about 4.

Load on each rope is 2,000 pounds.

Formula becomes $C = \sqrt{\frac{L}{200}}$, or $C = \sqrt{\frac{2000}{200}} = \sqrt{10} = 3.16$ in. = circumference of rope. Diameter $= \frac{3.16}{3.14} = 1.01$, or 1 inch.

For cable, $L = 1500\ C^2$, or $C = \sqrt{\frac{L}{1500}}$ or $C = \sqrt{\frac{2000}{1500}} = \sqrt{\frac{4}{3}} = 1.16$.

Diameter $= \frac{1.16}{3.14} = .368$, or, say, ⅜-inch cable.

* * *

Question.—In the design of an engine cylinder the diameter is 12 inches and the piston speed is 800 feet per minute. What should be the dimensions of the port?

Answer.—The length of the port is usually made about ⅞ of the diameter of the cylinder. This gives $\frac{12 \times 7}{8} =$ 10½ inches. Say 10 inches.

Allowable steam velocity is about 6,000 feet per minute.

Necessary area of steam port $= \frac{12 \times 12 \times .7854 \times 800}{6{,}000} = 15.08$.

Width of port $= \frac{15.08}{10} = 1.508$, or 1½ inches.

Port opening allowed $= 1.5 \times .8 = 1.2$, or, say, 1¼ inches.

* * *

Question.—A wooden test piece is to be turned down to 2 inches diameter in the centre. How long must the larger gripping parts be in order to prevent them shearing off at the tensile breaking point of the specimen?

Answer.—The average tensile strength of wood is 10,000 pounds per square inch.

Area of 2-inch circle is 3.1416 sq. in.

Breaking tensile load is $10{,}000 \times 3.1416$ 31,416 pounds.

Length of shearing surface is $2 \times 3.1416 = 6.2832$ in.

Shearing strength (with grain) =600 pounds per sq. in.

Shearing strength for each inch of length of grip, then, is $6.2832 \times 600 = 3769.92$ pounds.

Length of grip required is $\frac{31{,}416}{3769.92} = 8$ inches.

In practice these would be made about twice this amount.

* * *

Question.—A gallery, whose weight is computed at 800 tons, is to be supported by 20 short posts. How much floor space could be saved by using wood instead of brickwork, adopting a safety factor of 8?

Answer.—Load on each post $= \frac{800}{20} = 40$ tons $= 80{,}000$ pounds. In the case of short posts, the bending stress does not require to be taken into account.

Compressive strength of wood is about 8,000 pounds per sq. in. With safety factor of 8, this becomes $\frac{8{,}000}{8} = 1{,}000$ pounds. Number of square inches $= \frac{80{,}000}{1{,}000} = 80$

For brickwork, the compressive strength of which would be $\frac{2{,}500}{8} = 312.5$ pounds per sq. in., the area required would be $\frac{80{,}000}{312.5} = 256.1$ sq. in.

Area saved in one column $= 256.1 - 80 = 176.1$ sq. in. $= \frac{176.1}{1728}$ sq. ft.

For 20 posts this becomes $\frac{176.1 \times 20}{1728} = 2.038$ sq. ft.

* * *

Question.—A smoke stack stay wire is fastened to a plate 20 feet above the ground, which in turn is attached by four ¼-inch rivets. The stay wire is 36 feet long. If strained to the breaking point, will the rivets fail by tension or by shearing?

Answer.—Taking the vertical component of the load as 20, the horizontal component will be $\sqrt{(36^2 - 20^2)} = \sqrt{(1296 - 400)} - \sqrt{896} = 29.9$, say, 30.

Steel with a tensile strength of 100,000 has an average shearing strength of about 70,000 pounds per sq. inch.

The strength, then, is as 10 to 7, while the load is as 3 to 2, or the strength is as 30 to 21, while the load is as 30 to 20. The rivets, therefore, are weaker in tension.

* * *

Question.—A pickling tank is three feet wide, three feet deep and five feet long. It is to contain a ton and a half of iron castings. How many gallons of pickling solution can be used without danger of overflowing?

Answer.—Volume of tank is $36 \times 36 \times 60 = 77{,}760$ cu. in. Cast iron weighs 450 pounds per cubic foot, or .26 pounds per cu. in. Volume of 3,000 pounds of cast iron is, therefore, $\frac{30{,}000}{.26} = 11538.5$ cu. in.

Amount of pickle therefore is $77{,}760 - 11538.5 = 66{,}222.5$ cu. in.

No. of gallons $= \frac{66{,}222.5}{277.274} = 238.8$ gals.

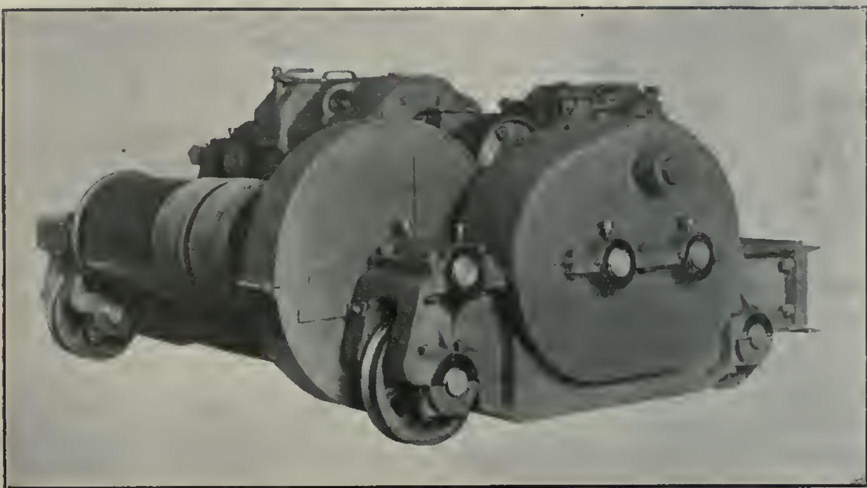
PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Marine Engineering Product Achievements

TYPE "E" NORTHERN CRANE TROLLEYS.

THE trolley shown has in its general form been on the market for some time, but during the past year or so several improved details have been added, and it now appears in a form thoroughly in accordance with the most recent crane engineering practice. Primary considerations have been safety—both in the way of strength and in the protection of working parts. Accessibility, rigidity and durability of gears and other moving parts have been secured by enclosing and protecting them from dust and grit, and running them in an oil bath. The construction is now such that the covers of the gear cases must be in place or the gearing cannot run, thus insuring against the accidental omission of the gear covers, and emphasizing the safety feature.

Each train of back gears is rigidly mounted in a single frame, bearings being bored in line, and capped and fitted with through bolts, and bronze lined. The hoisting gear train from armature to drum gear is in one casting, insuring permanent alignment, while the drum gear is enclosed with steel gear enclosure. The trolley travel gearing is also entirely enclosed in a single rigid cast unit gear case of the same general type as that used for the hoist gearing. No overhung gears are used. As the gear covers are castings, the joint of the enclosed gear cases are planed so as to make a perfectly tight construction, thus preventing the leakage of oil and its dripping over the product of the plant. Lifting the cover of either gear cases removes the cap, and any gear with its shaft can be quickly lifted out without disturbing other parts. This cover can be easily lifted, as can the motor drum and other parts of the trolley, but for inspection and attendance, large manholes are provided, so that it is not necessary to remove the gear covers.



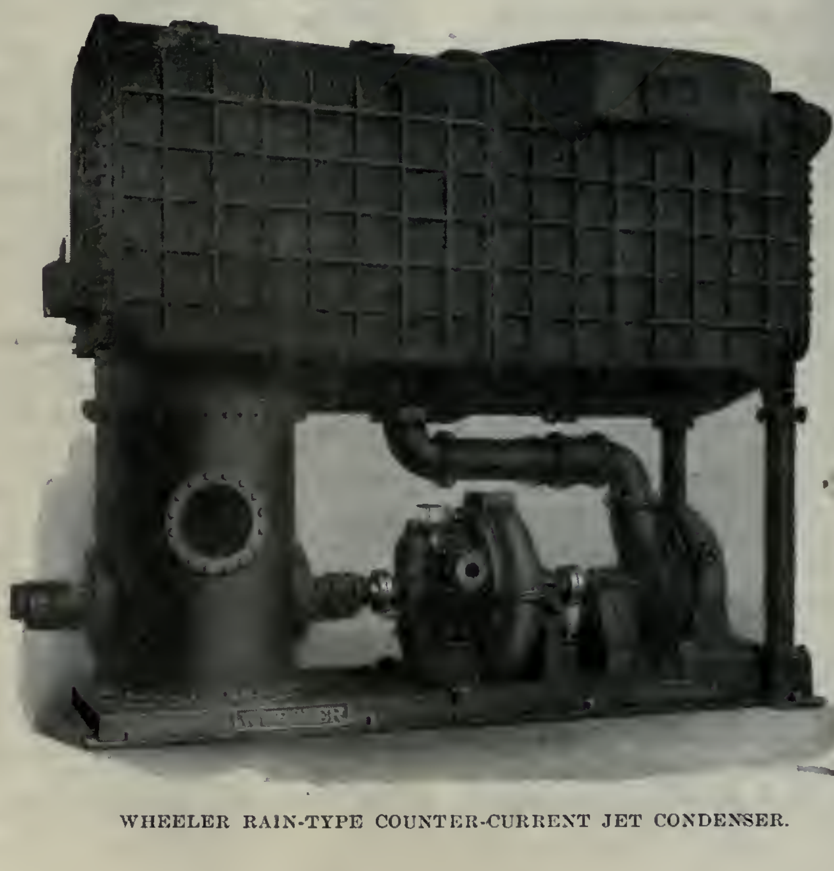
TYPE "E" NORTHERN CRANE TROLLEY.

A point emphasized is the longer life of gearing when running in an internally lubricated design of this kind. Another point is the almost noiseless operation. The trolley is wired throughout with modern wiring in steel conduits, and is made in capacities from 2 tons to 125 tons for either mill or standard service. Mill service trollies have axle bearings of either the vertically or horizontally capped M.C.B. type.

The Northern Crane Works, Walkerville, Ont., are the designers and builders of this type crane trolley.

WHEELER RAIN-TYPE COUNTER-CURRENT JET CONDENSER.

A WHEELER rectangular rain-type counter-current jet condenser of latest design, with complete turbine-driven self-contained auxiliaries, is shown in the accompanying illustration. This condenser was supplied to the City of Seattle by the Wheeler Condenser and Engineering Co., Carteret, N.J., and has a capacity of 97,500 lbs. of steam per hour at 28½ inch vacuum. The photograph is taken looking into the discharge of the tail pump, which is of the submerged type and of high-speed design for direct drive by the turbine. The Wheeler turbo air pump is shown to the extreme right and, in the centre, the turbine, which drives both air pump and tail pump. This arrangement makes a

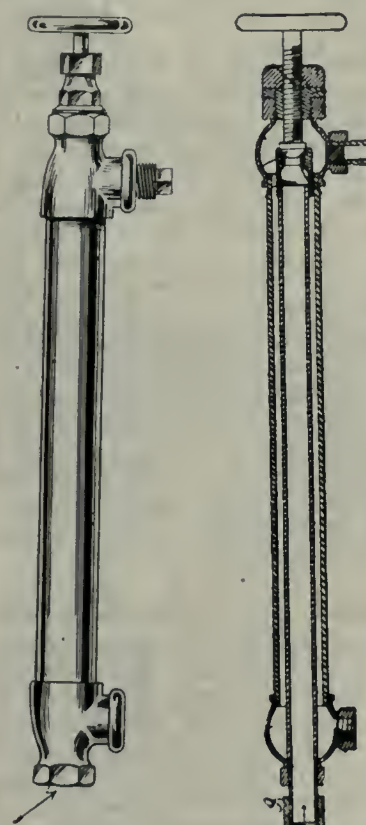


WHEELER RAIN-TYPE COUNTER-CURRENT JET CONDENSER.

very compact and simple unit. The condenser itself is of the well known Wheeler rain-type, counter-current design, with top exhaust entrance, so that the entire condenser and auxiliaries fit directly beneath the turbine.

THE "LONG" STEAM TRAP.

IN this rather ingenious trap, the only moveable part is the valve seat, and this is placed on the end of a long copper composition tube and draws away from the valve by the contraction of the copper tube as the temperature of the steam falls, cooling the tube. The valve is set tight at or about 212° F. When the temperature drops below this in the tube, the valve seat moves away from the valve and the water passes out.



INLET INLET
THE "LONG" STEAM TRAP.

When all the water has passed out, and steam again enters the copper tube, the temperature rises and the valve seat closes up to the valve again.

Construction.

The body of the trap consists of about twelve to fifteen inches of 1½-inch galvanized iron pipe threaded at both ends to take small brass castings. The copper composition tube is screwed into one brass casting and is about ½ inch inside diameter. The composition tube has a very large coefficient of expansion, and extends up through the larger pipe to nearly the end of it. A valve is fitted into the brass casting which is screwed on the other end of the galvanized pipe, and this valve closes down on a valve seat which is fastened to the end of the copper composition tube. Steam is always inside the copper tube, and when the latter is thus heated, the valve is closed down tight on its seat. When water collects, the temperature falls and the seat is drawn away from the valve and the water passes into the annular chamber outside the copper tube. Drains are fixed at either end of the trap. Water may be piped from either one of these drains and the other one plugged.

Advantages Claimed.

Before the trap goes into actual service all air and water are expelled from the pipe or apparatus to which it is connected, because the trap is wide open when cold, and does not close until steam appears. When in use, there is no possibility of freezing, if set so as to drain. The action is automatic and no valves are required except those which control the admission of steam to the apparatus to which the trap is attached. It is regulated to work against any pressure between 1 and 200 pounds per sq. in., and being always open at the start, it cannot become air-bound. It is capable of draining from 900 to 1,500 feet of one-inch pipe, and may be applied to drain steam mains, or to drying-room systems.

J. T. Long, c/o the McLaren Co., 585 St. Paul street, Montreal, is the patentee and manufacturer.

REACTIVE FACTOR METERS.

THE art of electrical measurement has reached such a state of perfection that the introduction of a totally new type of instrument to measure a quantity not previously directly measureable becomes an event of great interest.

Although instructed to keep the power factor of the circuits over which they have control as near unity as possible, switchboard attendants often maintain a power factor of one or two per cent. less than unity as being good and do not try to improve it. Computation and tests show, however, that a power factor of even only one or two per cent. less than unity is not as good as it appears to many station attendants, especially on rotary converters. At 98½ per cent. power factor, the armature copper loss in the leading tap coils of a rotary is almost half again as much as at 100 per cent. power factor. Under heavy load this is often enough to cause trouble in the tap coils. Also, the average heating in all the armature coils is about a quarter again as much at 98½ per cent. power factor as at 100 per cent. The capacity of the rotary is therefore decreased considerably.

The measurement of "idle current" is in general a recent development, wattmeters having been used recently so connected as to measure the idle volt-ampere, or "wattless component." The reactive factor meter, however, corresponds in its action to the power factor

REACTIVE FACTOR METER.

meter and bears the same relation to the latter, that the "wattless component meter" bears to the wattmeter." This meter indicates the sine of the angle of lag or lead instead of the cosine as in the power factor meter. Unity power factor is, therefore, indicated as zero reactive factor.

If instead of the power factor meter there is on the circuit a reactive factor meter, a condition of 98½ per cent. power factor is indicated as 17½ per cent. reactive factor, and the attendant will be more on the alert and will be more apt to improve it. Power factor and reactive factor are equal at the value 70.7 per cent. At higher power factor, the load conditions are more conspicuously indicated on the reactive factor scale. At lower power factor, the reverse is true. Reactive factor meters are therefore recommended for use

REACTIVE FACTOR METER.

only on circuits operating normally at power factors close to unity and which never fall below 70 per cent.

The Westinghouse Electric Co. reactive factor meter, which has been recently introduced, operates on the rotating field principle like their power factor meters, which have been on the market for several years. A rotating field is produced in angularly placed coils connected in shunt with the metered circuits, one for each phase of the system in the case of polyphase meters. In their field is provided a movable iron vane or armature, magnetized by a stationary coil whose current is proportional, and in phase with that of the line current in one phase of the circuit. As the iron vane is attracted or repelled by the rotating field of the angularly placed coils, it takes up a position where the zero of the rotating field occurs at the same instant as zero of its own field. Thus its position indicates the phase angle between the voltage and current of the circuit. The reactive factor meter is then calibrated to read the sine of the angle indicated while the power factor meter is calibrated to read the cosine.

In the three-phase meter the rotating field is produced by three coils spaced 60 degrees apart; in the two-phase meter by two coils spaced 90 degrees; in the single-phase meter the rotating field is produced by means of a split-phase winding connected to the voltage circuit.

The Westinghouse reactive factor meters are enclosed in round dust-proof cases. the type S1 being 7 inches and the type T1 being 9 inches in diameter. They match in appearance the Westinghouse types SM and TM ammeters, voltmeters and wattmeters. The entire pointer is visible, so that readings are easily made from a distance.

Question and Answer Series for Foundrymen

Foundrymen having difficulties in connection with their work are invited to forward particulars of them to this department for solution. The greatest possible care will be taken to give only reliable and tried-out advice on all questions submitted.

Question.—We make chilled car wheels and occasionally pin holes appear in the white iron tread underneath the skin. We would be pleased to have advice of some remedy that will overcome the trouble.

Answer.—If you will give your chills a light coat of kerosene and then rub them with graphite until their surface has a polish, I think your pin holes will disappear. When the chilling iron contains over 0.08 per cent. of sulphur, gas holes can be expected at almost any place in the castings. The addition of one pound of ground 80 per cent. ferro-manganese in the ladle to every 600 lb. of iron is the best way of eliminating these holes. The ferro-manganese should be put in the ladle before the iron is tapped in, as in this way it becomes well mixed with the iron and has a chance to throw off the objectionable gases.

* * *

Question.—We are making vise castings with a steel chill cast into the jaws. When these castings are machined, they show blow holes on the surface between the gray iron and steel chill. We have tried several things to remedy this, including linseed oil on the chills, also borax, but have failed to get desired results. The analysis of the iron we are using is: Silicon, 2.45 per cent.; sulphur, 0.08 per cent.; manganese, 0.60 per cent.; phosphorus, 0.65 per cent.; combined carbon, 0.10 per cent.

Answer.—If the steel chill is to become a part of your casting, great care should be taken to get a perfect union of the two metals; but if the chill is used only to prduce a hard surface on your casting, the silicon contents of your mixture is too high. Chills are coated to prevent condensation of moisture on the surface, as iron will not unite with a damp or rusty surface. Use black machine oil on chill and if just to harden the surface, it can be diluted with kerosene. If chill is to become part of the casting, have it tinned or coated with powdered aluminum mixed with gasoline and put in moulds just before casting, if possible.

* * *

Question.—We have been trying to make air-cooled cylinders from a semi-steel mixture without much success. The iron available contains 2.75 per cent. silicon. We have been using 15 per cent. steel scrap, and the metal is coarse grained and very soft. We also have added 1¼ oz. of aluminum to 150 lb. of the metal in the ladle. Can you suggest a good semi-iteel mixture for this, and the best method of charging.

Answer.—Your pig iron is too high in silicon to get a close-grained, hard iron. Your mixture would bring your silicon to about 2.30 per cent., when it should be about 1.80 per cent. or even less. The aluminum, while it helps to throw out the gases in your iron, only makes it all the softer. Ferro-manganese will give you the desired results; in this case about 20 lb. to a 2000 lb. charge. Charge your steel on top of your coke charges and scatter the ferro-manganese on the steel. The following mixture can be tried, using the iron you have on hand: 55 per cent. of pig iron containing 2.75 per cent. silicon; 20 per cent. cast scrap; 10 per cent. car wheel; and 15 per cent. steel scrap. If the scrap be hard, the car wheel can be omitted. This should be a fairly good mixture unless some of your iron contains an excess of phosphorus or sulphur, which will prevent you from obtaining the best results. Without an analysis of your different materials, it is impossible to suggest a mixture intelligently. Consult a good chemist.

* * *

Question.—Please give a mixture for safety valves that will withstand a hydraulic pressure of 300 lbs. We have tried out a mixture containing—copper 50 pounds, tin 5 pounds, zinc 2½ pounds, and aluminum 1½ ounces, but this, when tested, leaked badly at a pressure of 175 pounds.

Answer.—Aluminum should never be used in any alloy that must withstand a high pressure. It is particularly bad in any alloy of bronze and should never be used in such metals. It is sometimes used in yellow brass to improve the casting qualities. If you will omit the zinc in your formula and substitute 1 lb. of phosphorus-tin, you would greatly improve your mixture. The following alloy can also be recommended: copper 90 lb., tin 10 lb., and yellow phosphorus 4 oz. In handling phosphorus great care should be exercised. It can be secured in a one-pound can and, after opening, it should be plunged into water and kept submerged. Another good mixture is: copper 90 lb., tin 8 lb., phosphorus-tin 2 lb.

* * *

Question.—We have several different grades of iron in which the phosphorus contents are very high and some very low. They run from 1.50 to 3.25 per cent. silicon and from 0.30 to 1.30 per cent. phosphorus. It is contended that on account of the difference in the melting points that they will not mix properly in the cupola, and that after being melted will float separately.

Answer.—Iron will absorb silicon, carbon, sulphur and phosphorus. The condition you speak of would apply only to bodies like oil and water which have no chemical affinity for each other. The elements are all lighter than the iron, and after being chemically combined, none of them will float unless more is added than the iron can absorb. The iron with the highest melting point should be charged underneath those with the light melting point. The melting points of the different grades are so nearly the same that they practically reach the tap hole at the same time, and the instant the two molten irons meet they form a uniform mixture.

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Vol. XII. DECEMBER 10, 1914 No. 24

PRINCIPAL CONTENTS:

THE REAL ECONOMY—PREVENTION OF WASTE.

WHILE we have heard complaints of the monotony of a large part of the work in connection with the average manufacturing shop, this criticism cannot possibly be made of the railway or jobbing plant. The fact that one's occupation becomes dull and uninteresting indicates either a stagnation of the mind and initiative or a condition of not being permitted to exercise the latter and to put one's ideas into practice.

It may be said that the greatest improvements still consist largely of successful methods of preventing loss through waste of materials. The superintendent of a large English factory has recently reduced the oil cost about 20 per cent. and the waste cost by about 60 per cent. by the devising of a practical method for treating dirty waste to recover the oil and remove the dirt. This was done in a plant supposed to be modern in every respect and whose range of product is small enough to make a conservative foreman's duties rather monotonous.

The purchasing department of a well-known railroad shop noticed recently that after the arrival of a new tool room superintendent the purchase of the smaller sizes of high-speed tool steel was discontinued and that there was apparently very little increase in the amount of the larger sizes bought. This toolmaker's experience goes to show that it is best to use solid tools for the heavier machines, especially tire lathes, necessitating the purchase of considerable heavy tool stock.

It was found unsatisfactory, as has been recommended by some, to weld a cutting section of high-speed steel on to a bar of mild steel. This man was able, however, to economize very much by welding short, broken or worn high-speed tools together. The remainder of the short pieces were being used up by being drawn down to the smaller sizes for use in milling cutters or tool holders. This was done under the steam hammer and in the spare time of the smith. The new tool maker declared that, in this way, his predecessor had left enough small tool steel to last for a considerable time.

TRADE RESULTS FROM STUDY OF GERMAN METHODS.

THE maxim, "Capture the German Trade" has scarcely gotten beyond the announcement stage. Even neutral countries such as the United States have found that, although Germany is at war and her trade temporarily paralyzed, it must still be won by merit. It has been discovered that German trade is the result of German effort, German methods and even German temperaments and cannot be readily appropriated by aliens.

The rapid growth of the commerce of Germany is accorded many and various explanations. The one given by British competitors is that its goods are cheap and, in many cases, shoddy, while Americans claim that they are manufactured by very cheap labor. In Canada, the only article to be had in isolated lines has been that which is "Made in Germany." This remarkable development has been attained while the people of the country have been supporting a most arrogant aristocracy, to say nothing of recently the greatest military organization on earth.

Even though it be granted that some of Germany's business, and especially advertising methods, have been suspicious, there is somewhere in the great organization, to be found many lessons of value. The war has been successful in that it is teaching us to get along without German goods and forcing upon us a study of the German people and their recent prosperity. It is true that the workman of Germany can save less from his earnings than his fellow in any other country, yet there will no doubt be found enough of good principles which we can adopt, not to Germanize our own country in any way, but to go one better.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 40
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
	Montreal.	**Toronto.**
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X	18 00	17 00
Victoria, No. 2 Plain	18 00	17 00
Hamilton, No. 1	18 00	17 00
Hamilton, No. 2	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal.	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 50
Copper, crucible	10 00	9 50
Copper, unch-bled. heavy	9 50	9 50
Copper wire, unch-bled.	9 50	9 50
No. 1 machine compos'n	8 50	8 50
No. 1 compos'n turnings	8 50	8 00
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	75 per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal	Toronto.
Lake copper, carload	$13 75	$13 75
Electrolytic copper	13 75	13 50
Castings copper	13 50	13 25
Spelter	6 00	6 00
Tin	36 00	36 00
Lead	4 85	5 00
Antimony	16 00	18 00
Aluminum	22 00	22 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1¼in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect July 2, 1914:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	72	62
7, 8, 10 in.	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	18½
Benzine, single bbls., per gal.	18½
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.56
Linseed oil, boiled, single bbls.	0.59
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Dec. 7, 1914.—Conditions have not changed a great deal during the last week in the general metal markets. Trade seems to be stimulated by the better news from the various sections of the war zone. These reports have had the effect of inspiring confidence and this has been reflected to some extent in the various departments of industrial enterprise. Steel and pig iron have not felt the improvement to any great degree, however, business in these branches still remaining particularly quiet. Machine tool equipment has been somewhat livelier due to requirements for the manufacture of war material. In the metal markets considerable activity is to be noted. Copper has stiffened a little and other metals have advanced more or less.

In reviewing general conditions, it is impressed upon one that the activity due to the war orders, although large, in no way makes up for the loss of trade due to the war. Building operations also have everywhere been curtailed.

The Steel Market.

Throughout this department the outstanding feature continues to be that of dullness. True it is that a slight improvement has been noticed of late, and further developments in this direction are anticipated as the result of an export market being opened up to Canadian steel companies through the demand of the Mother Country. Despite this, however, building and manufacturing have been so greatly curtailed in a domestic sense that the new market will only partly aid to bring conditions to their normal state. The manufacture of shells still continues to keep many firms employed.

Pig Iron.

The pig iron situation remains exceedingly quiet as foundries are doing very little. The mills have been so much reduced that orders for pig iron have greatly fallen off. Recently there has been a tendency for prices to stiffen in the United States centres. This, however, is no more than has been anticipated because iron was down to a ridiculously low price.

Machine Tools.

The machine tool trade has been helped somewhat by the purchase of various machines for the manufacture of muni-

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents.
XXX extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 08¾
X Press	0 07¾
COLORED.	
Lion	0 07
Standard	0 06¼
Popular	0 05½
Keen	0 05
PACKING.	
Arrow	0 15
Anchor	0 06
Anvil	0 07½
Axle	0 09
WASHED WIPERS.	
Select white	0 06
Light colored	0 06½
Dark colored	0 05

Prices per lb.

BELTING RUBBER.

Standard	50%
Best grades	30%

tions of war. This feature has served to ward off absolute stagnation. Much machine tool equipment is now being thoroughly overhauled and repaired. The supply business still maintains its level, quite a volume of business passing each week, although no very interesting sales have been reported.

The Metal Market.

Metals have been fairly active during the past week, the feature being copper. The price has taken quite an upward jump lately, due to an increase in buying. Production of copper has been greatly curtailed because many of smelters closed down when the price dropped below 12c. Those mines which produce the lower grades of ores cannot operate profitably when the price falls below 13c or 14c. When the price lately dropped, these concerns ceased operation, and thus, with the present increase in consumption, the supply was soon taken up and the present stiffening of prices is a natural result. Export of copper has also tended to boost the price. On Dec. 2, the steamer Fraconia left New York, having on board 50 tons pig, 250 tons bar, and 175 tons plates. This represented an export of 475 tons of copper on one boat. The copper imports have been rather large in the United States, during the first four days of the month—695 tons of pig having been imported.

Spelter continues to stiffen. A slight increase is to be noted this week. There have been no reactions in tin during the week. Lead remains quiet, large amount of this metal of course, being consumed in the manufacture of ammunition. The demand for these purposes is, however, easily taken care of. Antimony has a tendency to strengthen also owing to its demand in the manufacture of ammunition. Aluminum shows signs of becoming firmer.

Sheets—Plates, Etc.

The tendency in sheets and plates is rather to weakness. Quotations are the same as last week, but undoubtedly, to land any large business, prices will be cut.

Toronto, Ont., Dec. 8, 1914.—There is no change of importance to note in the industrial situation this week. A general quietness prevails in business circles which promises to remain for some time. This may be accounted for by the season of the year as well as a result of the war. Since the initial slump, however, there has been a gradual improvement and an increase of confidence in business circles. The financial situation has improved considerably recently but facilities for obtaining loans are still very much restricted, a condition which is natural considering the world-wide money stringency. Until the outlook for the latter improves there can be little hope for any pronounced business activity. The restriction principally retards industrial development and does not necessarily prevent business from being carried on, providing orders are obtainable. This is demonstrated clearly, on the one hand by the decline in the building trade and the small number of factories being built or extensions to existing establishments. On the other hand, many factories are busy filling orders for war equipment, such industries not experiencing any trouble in obtaining financial accommodation.

The steel trade, which was the most affected by the war, is showing signs of a revival, although still below normal. The building trade is quiet and manufacturing interests are operating below capacity. The scrap metal market is practically stagnant and prices have not changed. Pig iron is firmer and the market is showing greater activity than for any time since the war started. The metal markets are firm, but business is quiet.

Steel Markets.

The outlook in the iron and steel trade is brighter and the volume of business is gradually increasing. It is probable that the market has reached the low water mark and that the next change will have an upward tendency. Prices are firm but do not show any sign of advancing, the demand being still comparatively light. Reports from Hamilton indicate a stronger market and better demand for steel products. The Dominion Steel Corporation output for November shows a substantial increase in rods, bars, wire and wire products over the corresponding month of last year, but a heavy decline in pig iron, ingots and rails. The company is making a line of oval wire nails formerly made in Germany. The Russell Motor Car Co. is actively engaged on an order for 40 armoured motor cars for the War Office, while the Steel Co. of Canada reports orders coming in freely for bolts, rivets, etc., required by makers of agricultural implements and wagons.

Notwithstanding the falling off in earnings, the railways are buying rolling stock, several nice orders having recently been placed for freight and passenger cars; some of these being of steel construction. A few locomotives have also been placed. These orders will revive an industry which has been quiet for several months.

The city of Toronto is in the market for a considerable amount of cast iron pipe and some valves. No decision has as yet been made public with regard to the Don Valley section of the Bloor street viaduct. If constructed of steel it will be an important contract. Tenders for the Rosedale Valley section are now being called.

There are indications of a revival in the steel trade in the United States and the outlook is more hopeful. Prices are firmer, but unchanged.

Pig Iron.

There has been recently considerable activity in the pig iron market in the States, which may affect the Canadian market. The Steel Company of Canada is again producing pig iron at Hamilton, having practically sold off their stocks. Prospects for business are improving, although there is not a heavy demand.

Machine Tools.

Dealers report general quietness in the machine tool business. The outlook for any immediate improvement is not encouraging, as few enquiries are being sent out. An improvement in financial conditions will be the lead to a revival of the business. Machine shop supplies are quiet and prices steady.

Metals.

The metal markets are quiet and prices generally steady. The demand is light with orders as a rule for small lots. Consumers are not laying in stocks, preferring to buy for immediate requirements. This tendency has been general for some time now and is likely to be followed in the near future. The copper market is quiet but firm with quotations ½c higher. There is no change in the situation with regard to the risk of cargoes to Europe being held up when consigned to neutral ports. Under present rulings, copper being contraband, is subject to seizure when destined to enemy or neutral ports. Tin is less active but quotations are firm. There is a good supply of tin available and no interference with shipments from the Straits. Lead is firmer and unchanged. Antimony is quiet with no change in price. Spelter is stronger, having advanced ¼c, and being now quoted at 6c per pound.

Trade Gossip

Shell Committee Appointed.—In addition to the Land Transport Committee named some days ago in connection with the purchase of motor trucks, a shell committee has been appointed by the Minister of Militia. These are advisory and administrative boards. The members of the Shell Committee are: Colonel A. Bertram, reserve of officers, chairman; Colonel T. Benson, master-general of ordnance; Hon. Colonel T. Cantley, Lieutenant-Colonel C. Greville Harston, chief inspector of arms and ammunition; Hon. Lieutenant-Colonel G. W. Watts;

Major F. D. Lafferty, R.C.A., superintendent Dominion Arsenal, and E. Carnegie.

More Active at Sydney.—At the moment there are two thousand men employed at the Dominion Steel plant, more than two-thirds full force in busiest times. When the war broke out and business the world over slumped, the big Sydney plant, in company with thousands of other institutions, was compelled to curtail its staff to the minimum, and for a time things did not look any too bright. However, bit by bit, business kept picking up. Rod, bar, nail, wire and billet mills are working full time, double shift, and a ten thousand ton order of rails is being rolled. Four shipments of wire have been sent to England, and other shipments will follow as soon as possible.

Marble in Canadian West.—R. C. V. Lett, colonization and tourist agent of the Grand Trunk Pacific, who has just returned from an extended tour through central and northern British Columbia, has brought in many valuable mineral specimens, including clays which have been proven by kiln tests to be suitable for the manufacture of terra cotta, crockery and other clay products of a superior quality. In the same district, reports Mr. Lett, graphite is found, and further west, in the neighborhood of Jasper, there are extensive deposits of marble, beautifully veined and mottled.

Antimony Deposits.—Operations are to be started on the antimony deposits at Lake George. As this mineral is used in the construction of shrapnel and 60 per cent. of the world trade has heretofore been enjoyed by Germany, it is felt that there is a bright future for the industry. The Lake George deposits were worked with profit previous to 1884, but the price dropped to 6½ cents a pound and operations ceased. Later the company put up a mill and reduction plant, but again closed down for lack of capital, and on account of the long haul to the railway. The completion of the St. John Valley Railroad to within three miles of the plant solves the transportation difficulty and the increase in the price of the metal to fourteen cents a pound, encourages the hope that active development will go on permanently.

Develop Canadian Mines.—The Mines Department, Ottawa, has had many inquiries as to Canada's ability to furnish mineral products formerly obtained from Germany or Austria-Hungary. Among these are magnetite, molybdenum, tungsten, potash salts and the salts of strontium, barium and antimony. There is a big demand for magnetite, and if it can be found where transportation is available a valuable industry should develop. In Baltimore and Trenton, N.J., the manufacture of potash from felspar is being undertaken since the German supply is cut off. It is only a question of manufacturing at a sufficiently low cost, for there are ample supplies of felspar in central Ontario and Quebec. Strontium is found in Renfrew county and near Brockville.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

MOND NICKEL CO. ENLARGING PLANT.

THE Mond Nickel Co. is offering an issue of £500,000 six per cent. redeemable debenture stock at 99. The stock ranks after the £3,750,000 five per cent. first mortgage debenture stock, subject to which it is a floating charge upon the undertaking and assets of the company. The proceeds of the issue will be used for extension of the company's plants in both Canada and Great Britain.

The Mond Nickel Co., which was organized in 1901, to acquire the process for the extraction of nickel invented by Dr. Ludwig Mond, as well as the latter's nickel and copper mines in Ontario and refining plant at Swansea, Wales, has made dramatic progress in its comparatively short career.

Announcement that the company is to extend its Canadian works is naturally of interest in view of present conditions. The immediate market for nickel is limited only by the war restrictions, forbidding export from Canada to the countries of Europe. The requirements of the allies, however, are quite evidently in excess of the world's supply of Canada; hence the decision of the Mond Company to enlarge its plants.

LUMBER BUSINESS IN WEST.

IT seems likely that an adjustment of the lumber business in Western Canada will take place during the next twelve months. This will come as the result of a great lessening in operations in the woods. It is stated that practically no work will be done this winter in the mountains by the numerous mills in that district. On the Pacific Coast very few of the mills are at work at the present time, and a number of them are shut down indefinitely.

In Manitoba, Saskatchewan, and in Northwestern Ontario, comparatively few men will be sent into the woods, according to present expectations. The Prince Albert Lumber Co., which under normal circumstances would have from 1,000 to 1,200 men at work this winter, will open two or three camps with about 200 men. The Rainy River Lumber Company, which, under ordinary circumstances, would have from 2,000 to 2,500 men at work, will have about 400. The Red Deer Lumber Co. has very large stocks on hand and will not employ any men during the winter months in the woods.

The portion of Canada, which is likely chiefly to be affected by the huge demand that will arise on the termination of the war, consists of the provinces of Nova Scotia, New Brunswick, Quebec and Northern Ontario. It is stated that the mills of Nova Scotia and New Brunswick are working overtime now preparing orders for Great Britain and getting ready for the demand which will occur later.

DOMINION COAL CO. OUTPUT.

STEAMERS bearing coal for the Dominion Coal Company this year made 280 trips with 1,953,316 tons of coal for delivery to St. Lawrence river points, as compared with 1,714,276 tons during the navigation season last year in 258 trips, being an increase of 239,040 tons.

In addition to the total for 1914, arrangements have been made to deliver via Portland, Me., for the same territory about 75,000 gross tons, making a grand total for the year in the St. Lawrence district of 2,030,000 gross tons. The greater part of this amount has been delivered in Montreal, 1,633,988 tons in all, as against 1,457,647 tons last year.

Of this year's deliveries in Montreal, 643,279 tons have gone to Hochelaga and 990,709 tons to Windmill Point. Last year 629,716 tons went to Hochelaga and 827,931 tons to Windmill Point. The rest of the coal was delivered at the following points: Quebec, 109,968 tons this year as compared with 106,109 tons last year; Three Rivers, 153,636 tons this year as against 68,088 tons; and Levis, 55,724 tons as compared with 82,432 last year. Levis, is the only point showing a decrease in the amount shipped this year.

PIT PROPS FROM NEWFOUNDLAND

THE report of the special commission now in London, Eng., which visited Canada and Newfoundland to investigate the resources of these two countries with a view to drawing upon them for a supply of timber pit props, used extensively in mining and hitherto secured from Baltic ports, is still withheld, but your correspondent gathers that their recommendations mainly favor Newfoundland and Nova Scotia. Quebec has favorable points, but the district evidently suffered in the consideration given it by the commissioners from the circumstances that they did not pay it a personal visit.

It is further gathered that the question of the difference in prices asked by the Canadian producers and those hitherto paid presents an obstacle, for a temporary supply only. The commissioners acknowledge that both the Dominion of Canada and Newfoundland have good timber resources, much of them being suitable for their special purpose. As a result of the representations of a deputation from the Scottish coal owners, the railway executive committee has agreed to a reduction of rates for the carriage of pit props in Scotland.

FISHERY RULES TO BE REVISED.

NEW regulations governing the carrying on of fishery operations in international waters, such as Lake Ontario, the St. Lawrence, etc., will be prepared by the Naval Service Department at Ottawa this winter. They will be promulgated next spring, and will then go into effect to replace the regulations formerly in effect under the terms of the International Foood and Fishes Treaty. This treaty, as was announced some time ago, has been allowed to drop by Canada, the United States not having put it into effect by necessary legislation.

Canada thus resumed her liberty of action, and will proceed to demonstrate that she has done so by replacing the regulations which have been in effect for some years past under the international treaty by new ones. The latter will probably be somewhat less strict, and more in accord with the United States regulations. This will remove a grievance on the part of Canadian fishermen, who have in the past been forced to observe the treaty regulations, while their rivals across the border were under no such restrictions. As Ontario is proprietor of its own fisheries, the Dominion authorities will confer with those of the province before taking action.

WELLAND CANAL PROGRESS.

SUPT. WELLER, in charge of the construction of the new Welland Ship Canal states that good progress is being made in digging the new waterway, and work will proceed all winter unless exceptionally severe weather sets in. Five sections are now under contract—sections one, two and three at the Lake Ontario end, section 4 and section 5, the latter being the section from Allenberg to Port Robinson, on which heavy cutting is being done. Nearly 3,000 men are engaged on the work.

Evidence of the progress made is found in the fact that the contractors are now putting in concrete in all the sections for the walls of the new canal. The estimate that the canal will be completed by 1918 still holds good, and it is expected that before long, contracts for sections six to nine will be let. Supt. Weller has seen nothing to substantiate the report of a projected attempt by Germans to wreck the canal and does not think any Germans have been near the work. The canal, he says, is well guarded.

NEW PULPWOOD REGULATION.

WHERE there is urgent need of relieving unemployment in the North and a sufficient market cannot be found in the Dominion for the Ontario pulpwood, the Ontario Government will permit exportation next spring.

Last year, following the great storm that burst over Ontario and the Lakes, causing immense damage to shipping and timber limits, the Government made provision for saving the fallen timber by providing legislation lifting the export restriction on pulpwood taken from Crown lands. The result was that a large quantity of pulpwood that would have gone to waste if allowed to lie on the ground was converted into money.

This year a similar plan will be followed. The extent of fallen or burned-over timber is not large, but it is thought that where any quantity exists and there is unemployment to be relieved, the Department will not watch too closely whether all the timber for export is burned or fallen stock.

The necessary legislation will be passed next session.

DOMINION REVENUE

A decline of $24,000,000 in the revenue of the Dominion for the eight months of the present fiscal year is shown in the November financial statement published on Dec. 4. The total revenue up to the end of last month, since April 1, the commencement of the present fiscal year, is $90,468,002, compared with $114,640,295 in the same time last year. The November receipts for 1914 are $9,495,536, as against $13,536,981 in November, 1913.

The big decline has been in the customs revenue. Postal receipts have maintained a good average. From the consolidated account $73,708,627 was spent in the eight months of this year, compared with $66,678,969 for last year.

On capital account, the outlay has totalled $28,231,933, a decrease of eight millions. The Dominion debt on December 1 stood at $364,843,247, an increase of $12,167,848 for November alone.

SOO CANAL TRAFFIC.

THE statistical report of lake commerce through the canals at Sault Ste. Marie shows a decrease from that of October of over three million tons. Grain and wheat shipments are larger, but the reduction in iron ore tonnage accounts for nearly all the reduction. The total freight carried through for the month was 4,044,368 tons, three-quarters of which was locked through the American side. The total number of vessel passages were 1,355, of which 950 used the American canal and 405 the Canadian. The details are as follows:

Articles.	Amount.
Eastbound.	
Copper, short tons	24,454
Grain, bushels	14,936,019
Flour, barrels	1,221,841
Iron ore, short tons	1,115,779
Pig iron, short tons	2,666
Lumber, M. feet B. M.	38,060
Wheat, bushels	32,770,253
General merchandise, short tons	16,580
Passengers	292
Westbound.	
Coal, hard, short tons	339,344
Coal, soft, short tons	868,382
Manufactured iron, short tons	22,535
Salt, barrels	100,362
General merchandise, short tons	121,468
Passengers	136

Summary: Vessel passages number 1,355; registered tonnage, net, 2,198,416; freight, eastbound, short tons, 2,677,685; westbound, short tons, 1,366,683. Total freight, short tons, 4,044,368.

Trade Gossip

The Canadian National Carbon Co. has increased the capital stock from $70,000 to $500,000.

Canadian Fairbanks-Morse Co., Toronto, have sold a Pratt & Whitney lathe to John Inglis & Co., Toronto.

The Du Pont Safety Powder Co, of Canada, Ltd., have changed the name to that of the Palmer Perchlorate Powder Co., of Canada, Ltd.

The Canadian Fairbanks-Morse Co. announce that the Yale & Towne new model, steel suspension, triplex block is enjoying considerable activity. Among other business in this line was an order for two 2-ton hoists for the boiler house at the new Provincial Asylum at Whitby, Ont.

Winnipeg, Man.—St. Boniface Hospital, operated by the Order of the Gray Nuns, is being equipped with a 15-ton refrigerating plant, furnished by the Arctic Ice Machine Co., Canton, O.

Victoria, B.C.—The Hon. W. R. Ross, Minister of Lands, recently announced the sale of 200,000,000 feet of timber to the British Columbia Sulphite Co., operating at Mill Creek, Howe Sound.

Toronto, Ont.—In accordance with their announcement made some three weeks ago, the Massey-Harris Company opened their shops again on Monday. A number of men were given employment, and as the works resume their normal capacity, it is probable that large numbers of men will be taken on.

Stop Exportation of All Manganese.—The exportation of manageneses and ferro-manganese from Canada has been prohibited to all destinations, under an Order-in-Council now passed. The order is made to provide against manganeses, for the manufacture of manganese steel, reaching the Empire's enemies from Canada.

World's Shipbuilding. — During the last fiscal year there were added to the shipping of the world 713 new vessels, with a gross tonnage of 2,020,185, according to the annual report of Lloyd's Register of Shipping. This is said to be the highest total for any one year recorded in the history of the society. About 60 per cent. of the total was for the British Empire. The period covered by the report ended June 30 last.

North Sydney, C.B.—Preparations are being made for the reopening of one of the open hearth furnaces of the Nova Scotia Steel and Coal Co. It is understood the company has an order for steel from a Canadian manufacturing concern which is furnishing certain material to the Militia Department. The resumption of work at the furnaces will mean employment for about forty men, some of whom have been idle since the plant closed.

Dominion Steel Output.—The condition of the steel business generally is reflected in the monthly statement of the Dominion Steel Corporation, the comparative figures of which for November of coal and steel production, are as follows:

	November. 1914.	1913.
Pig iron	5,121	28,976
Steel ingots	15,746	27,120
Rails	2,727	13,348
Rods	3,967	2,507
Bars	2,134	1,798
Wire and products	2,535	1,996

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Fraserville, Que.—It is reported that extensions will be made to the electric light plant.

Ottawa, Ont.—W. Nixon, Slater St., is building an extension to his candy factory. Refrigerating machinery will be required.

Cobourg, Ont.—A by-law will be voted on in January to raise $50,000 to take over the plant of the Provincial Steel Co., which has been shut down for some time.

Winnipeg, Man.—It is reported that the Globe Pump Co., of Green Bay, Wis., are negotiating for a site on which to erect a pump factory. R. T. Byington is the manager.

Sydney, N.S.—Official notification has been issued from the Dominion Steel plant that No. 1 blast furnace, closed down since August, had been again restarted.. This makes two furnaces in active operation.

Toronto, Ont.—The Massey-Harris Co. reopened its works on December 1, when about five hundred married men, former employees who had previously been notified, went back to their old positions. Others will be taken on as soon as circumstances permit.

Medicine Hat, Alta.—It is reported that Gilbert Hunt, of Walla Walla, Wash., who incorporated the Dominion Harvester Co., of Medicine Hat, has come to an agreement with the Alberta Foundry Co., in this city, and that work will be started at once.

Welland, Ont.—The new factory of the Tuttle-Bailey Co. of Canada, being erected in the South Ward, has been completed, and will be occupied some time this week. The dimensions of the plant, which is constructed of reinforced concrete and steel, are 200 by 100 feet, and the cost is $60,000. Peter S. Gordon is local manager.

Fort William, Ont.—A contract for the construction of concrete docks at the Canadian Northern coal and ore docks at Port Arthur has been let to the Barnett & McQueen Co., and work will be commenced as soon as the lake freezes over, so as to allow the heavy equipment to be moved out upon the ice. It is understod that the contract amounts to $600,000.

Ottawa, Ont.—Two hundred motor trucks will be ordered for the Canadian forces at an approximate cost of half a million dollars. The special committee which has been laboring over the question of selecting a standard truck has, it is understood, practically agreed upon the Kelly-Springfield type. The probability is that the parts will be bought in the United States, and the assembling done in the seven principal motor car factories of Canada.

Port Arthur, Ont.—A permit for the erection of a blacksmith and forging plant at the yard of the Western Dry Dock and Shipbuilding Co., Ltd., to be erected at a cost of $25,000, has been taken out. The building will be constructed of steel and brick. It will be 150 ft. long by 50 ft. wide, and will contain fourteen forges and two forging and welding machines, besides a five-ton and a two-ton crane. It is announced that work will be started at once.

Electrical

Lambeth, Ont.—A by-law has been passed to authorize the raising of $4,000 for a hydro-electric power supply to the village.

Drumbo, Ont.—Hydro-Electric lights were turned on in the town on December 1 in the presence of the superintendent of Hydro Power and a number of the citizens.

Newmarket, Ont.—On January 4th the ratepayers will vote on a by-law to authorize the expenditure of $15,000 on the construction of a sub-station for hydro-electric power.

Guelph, Ont.—Consumers of electric light and power in Guelph have been notified that on January 1 next the new rates ordered by the Hydro-Electric Power Commission will go into effect, thus effecting a saving of approximately 10 per cent. The rates for commercial lighting will be 6 cents per hour for the first 30 hours' use and 2½ cents per hour for all over that, with a discount of 10 per cent. The power rates will be practically the same except for an additional discount of 10 per cent.

Municipal

Cochrane, Alta.—The town will probably install a waterworks system.

Winnipeg, Man.—The town of Transcona will build a pumping station. General contractor, G. H. Archibald & Co., Winnipeg.

Weston, Ont.—A by-law will be voted on by the ratepayers to authorize raising $6,000 for extensions to the waterworks system recently completed.

Vancouver, B.C.—The town of West Vancouver have under consideration a waterworks system. H. McPherson is the engineer.

Peterborough, Ont.—The location of the proposed sewage disposal plant is proving a vexatious question. The plans and site were approved of by the Provincial Board, but a number of residents in the district objected.

Moncton, N.B.—The city is making arrangements for the street lighting of the villages of Lewisville, Sunny Brae, and Humphries. The question of street railway extension is also being discussed. E. B. Reesor is general manager of these departments.

Owen Sound, Ont.—Another effort will be made at the coming municipal elections to get sanction from the ratepayers to expend $6,000 to make needed improvements to the Town Hall building, the municipal offices and improved market facilities.

Quebec, Que.—The City Council will ask the next Legislature for power to make an additional loan of $500,000 to enable this city to municipalize, at an approximate cost of one million dollars, the light and power service of the Dorchester Electric Co.

Brantford, Ont.—The ratepayers of Brantford will be asked at the January elections to vote on a by-law providing for the issuing of debentures to the amount of $100,000 for the completion of the waterworks scheme now under way. This was decided at a meeting of the Water Commissioners on Dec. 1.

Owen Sound, Ont.—The public utilities of the town, which include the electric light and power plants, gas plant and waterworks, will go under the control of a commission after the beginning of the New Year. The Mayor and two others to be elected will form the commission. The Hydro-Electric will be furnishing light and power here about midsummer next.

Relative to Cam Grinding and Cam Grinding Equipment--I.

By Howard W. Dunbar.

The purpose of this series of articles is to describe as clearly as possible the methods employed by the Norton Grinding Co., Worcester, Mass., in the production of the master cams which are used for cam grinding. There are doubtless many of our readers whose knowledge of the subject will be materially increased thereby. For the text and cuts we are indebted to the Norton Co.

CAMS can be one of two types—those which by their nature and size must of necessity be separate from the cam shaft (known as loose cams), and which are located in their proper relative positions by means of a key-way or pin, or those more commonly used in the automobile engine in which the cam and cam shaft are integral or of one piece. Since the principles involved in the grinding of these are the same, the only difference being in the type of equipment used, let us take for consideration the latter type.

Essentials of Production.

To satisfactorily make master cams that will produce cam shafts in accordance with a customer's requirements, it is essential that we should have full and complete information pertaining to the cam shaft.

First, we must have a complete drawing of the cam shaft itself, giving all dimensions, showing the relative position of one cam to the other, and giving a completely dimensioned outline of each cam.

Second, we must have a fly-wheel diagram giving the opening and closing points for the valves as marked on the fly-wheel.

Third, we must know the type of lifter used, whether it be roll, mushroom or of special design, and if a roll type we must know the diameter of the roll.

Fourth, we must have the clearance, which is the distance that the lifter moves under the action of the cam before picking up the valve stem. If no clearance or a very small clearance is allowed, it is impossible to guarantee the operation of the cam shafts to come within our usual limit of one and one-half degrees. We have made cams where this clearance was as small as .002 in, but this is considered a very small amount, and should be avoided if possible. The usual amount allowed for clearance is .006 in. to .010 in.

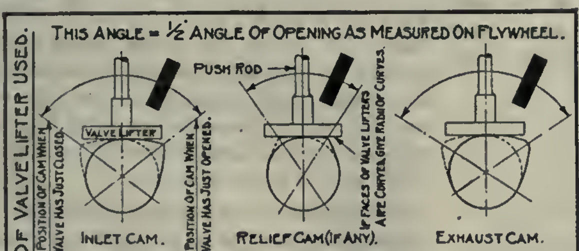


FIGURE 1.

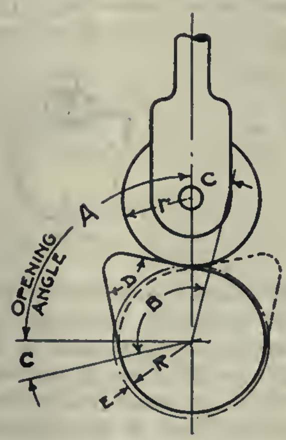


FIGURE 2.

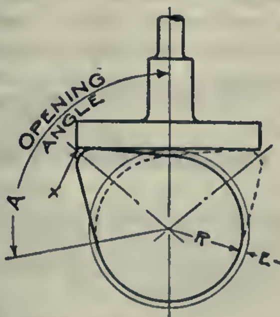
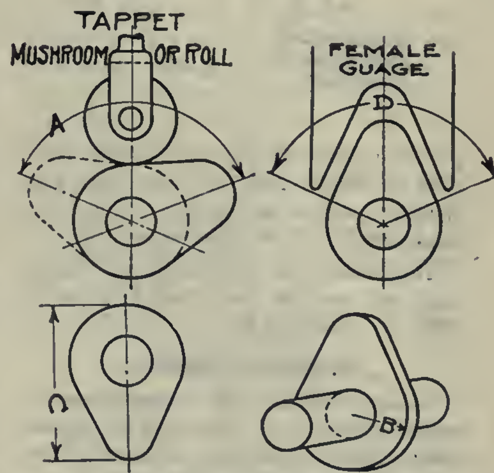


FIGURE 3.



DIAGRAMMATIC ILLUSTRATION OF LIMITS.

Information Sheet.

For convenience in supplying this information we have arranged information sheet, Fig. 1, to be filled out when ordering master cams. On this sheet all possible conditions have been considered, and if the blank spaces are properly filled in and the other requirements complied with as noted, we will be supplied with all the information required for making master cams, which, when used in our cam grinding attachment, will produce cams complying with limits as shown below:

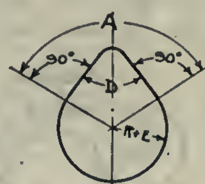


FIGURE 4.

Arcs of opening (angle A) (see diagrammatic illustration of limits) to be correct with plus or minus 1½ degree.

All opening and closing points on the cam shaft (i.e. the relative position of one cam to the others) shall be correct within plus or minus 1 degree. (Not additive.)

The contour of the cam between the opening and closing points D shall fit a female gauge (made to fit the model cam) within plus or minus .003 in. for small cams such as used on automobiles and plus or minus .005 in. for large engine cams.

When the concentric part of the cam is within the limits allowed, the body

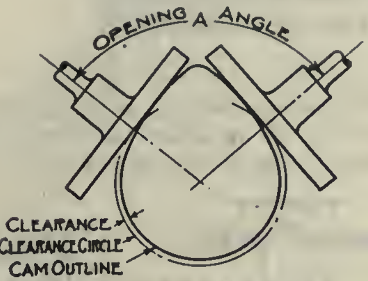


FIGURE 5.

plus the lift or C must be correct within plus or minus .003 in. for small cams such as used on automobiles and plus or minus .005 in. for large engine cams.

The concentric part B of the master cam and product shall run true within .001 in. (indicated).

Model Cam Feature.

Before starting the manufacture of master cams, it is necessary to develop model cams, which are an exact duplicate of a pair of cams shown on a customer's drawings. In order to insure a correct model that will produce master cams for grinding cam shafts which will function as required, it is necessary to insure that all information furnished is consistent, and that no one requirement makes another requirement impossible. To this end we proceed to check up the information, the following being a brief description of the manner of determining the functions of a cam outline.

When practical we do this by means of figures, but in some cases, such as

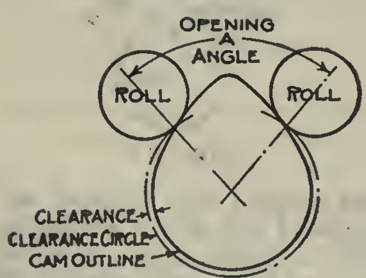


FIGURE 6

curved side cams where the process is long and tedious, we have found it best accomplished by means of a layout ten to twenty times the actual size.

To determine the opening angle of a straight-side cam using a roll type of push rod or lifter, let us refer to Fig. 2. Here A is the opening angle of the cam and is equal to B minus 2C, B being the included angle between the lines drawn at right angles to the sides of the cam, and is equivalent to 180 minus the angle D.

C equals the number of degrees that the cam moves while taking up the clearance, and is known as the clearance angle (it being understood that the clearance is the distance that the lifter or push rod moves, before picking up the valve stem). The cosine of angle C equals R (the radius of the concentric portion of the cam) plus (r), (the radius of the roll in the lifter or push rod), divided by R, plus (r), plus E (the clearance), i.e.,

$$\text{Cos C} = \frac{R+r}{R+r+E}$$

D equals the included angle between the sides of the cam, the manner of determining this being described later.

E equals the clearance (which is always supplied by the customer).

R equals the radius of the concentric portion of the cam (taken from the customer's drawing), while (r) equals the radius of the roll (supplied by the customer).

If the push rod or lifter is of the mushroom type, and the cam has straight sides, refer to Figs. 3 and 4 for the method of procedure. Fig. 3 shows the cam and the working conditions, the

FIGURE 7.

dimensions of which are furnished by the customer. The angle A or the opening angle is the figure to be determined. To do this, draw an outline as shown in Fig. 4, in which the radius of the concentric part is the radius of the cam, plus the clearance, all other dimensions being the same as cam outline on customer's drawing. Figure the included angle between lines drawn at right angles to the side of this outline (the method of doing this is described later), and the resulting angle is the desired dimension or opening angle of the cam.

This applies when the mushroom overlaps the toe of the cam as shown at X in Fig. 3. If it does not over-lap but its edge strikes on the flat side of the cam, the only procedure is to lay out this condition, using a scale of from ten to twenty times actual size. These are very unusual types of cams and should be avoided because they are noisy and mechanically imperfect.

In curved-side cams using a mushroom type or push-rod or lifter, proceed to lay out from ten to twenty times actual size and measure the opening angle. Referring to Fig. 5, draw outline of cam in accordance with blue-print. Draw clearance circle and show the mushroom on each side of the cam in position where it is tangent to the clearance circle and the side of the cam. The included angle between lines drawn from the centre of the cam and at right angles to the mushroom is the opening angle or A.

If a roll type of push rod or lifter is used with a curved side cam, proceed in the same manner and as illustrated in Fig. 6. In the diagrams used, if the cam is shown in full and dotted lines,

FIGURE 8.

it represents the cam in opening and closing positions.

Again, if the mushroom has a round end as shown in Fig. 7 it may be regarded as a roll type push rod.

We cannot grind a cam with a re-entrant curve of less than 9 in. radius. This is illustrated by Fig. 8. Our grinding wheel is 18 in. in diameter which cannot be varied for special cases (cams ground in the No. 1 Loose Cam Grinding Attachment on a 6 in. machine are exceptions to this case, as a 14-in. diameter wheel is used which allows for a 7 in. radius re-entrant curve).

To determine the included angle between the sides of a straight-sided cam or the angle D in Fig. 9, proceed as follows, assuming that the undernoted dimensions are known:—R—the radius of the concentric portion of the cam, F—the distance from the centre of the cam to the tip, and G—the radius of the tip of the cam.

The right angle triangle (a-b-c) can be constructed, in which sides (a-b) and (b-c) are known. Then the sine of angle

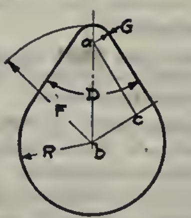


FIGURE 9.

(b-a-c) equals (b-c) divided by (a-b). Two times angle (b-a-c) equals angle D. This follows since (b-c) if extended comes at right angles with the side of the cam, and (a-c) is parallel to the side of the cam, i.e.,

$$\text{Sin angle bac} = \frac{bc}{ab}$$

$$2 \times \text{angle bac} = \text{angle D.}$$

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

REAMERS AND REAMER HOLDING.—II.

By Spring Craig.

IN making or buying reamers, one question to decide is whether they will be carbon steel or high-speed steel. The high-speed steel costs more, but if the amount of work to be done is considerable, the difference in price will more than be made up by increased production and longer life of the reamers. In most smaller shops there is to be found a set of hand reamers up to one inch and a quarter in diameter, and the writer is quite safe in saying that three-quarters of the time they are used in machines for which they never were designed.

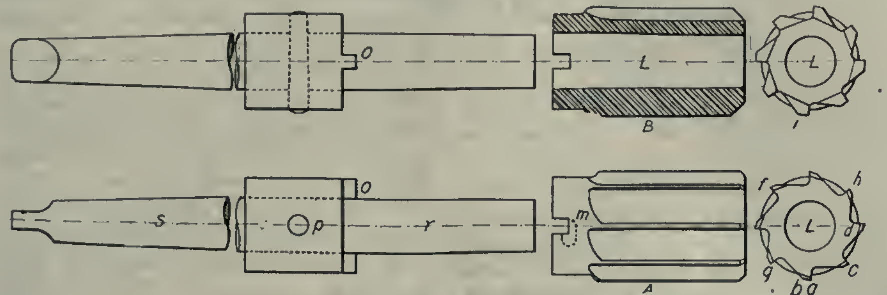


FIG. 3. MACHINE AND ROSE REAMERS.

There are two classes of reamers used to a great extent, namely, machine reamers and rose reamers. Usual practice is to make them solid with a taper shank up to inch and a quarter, and from that up they are made without shanks and are known as shell reamers. This type is illustrated in Fig. 3, in which is shown both machine and rose reamers. All reamers with even number of lips have their lips opposite, as g and h, which are on a line drawn through the centre, but the distance between c and d may be greater than the distance between d and h; but c and f, d and e, and h and g are all exactly opposite each other, or are on the centre line.

The unequal spacing is to overcome the tendency to chatter. Having the cutting edges on the centre line is to facilitate measuring, and to prevent warping in hardening. Reamer A is a general purpose reamer in that it will finish ream any material and is not intended to remove much more than a sixty-fourth in diameter. The relief at (a b) is straight and is shown exaggerated. Some manufacturers make reamers with a radial relief which is claimed to prolong the life of the tool. Others give double clearance on the lips. The width of land being, on hand reamers, up to 0.030 inch for cast iron or brass, and up to 0.010 inch for steel. Chucking reamers for cast iron and bronze have their ends bevelled about thirty degrees.

Rake and Clearance.

Machine reamers for the same material have the same width of lands. The cutting or last clearance should, preferably, be ground on with a disc wheel or as large a circular wheel as possible. A wheel too large will grind the cutting edge off the lip following, but the smaller the wheel the more concave the clearance and less support is left for the cutting edge. This clearance may vary from 2 degrees to 10 degrees, but is usually made between 5 and seven.

The angle on the front face of the flute is usually given a slight negative rake—that is, a line drawn parallel with the front face would make an angle of not more than three degrees with a centre line terminating on the cutting edge. If reamers are to be used on steel only, they work best with the cutting faces on centre line or so as to give a very little positive rake. This helps the chips to curl and makes it free cutting. For reaming all material except aluminum there should be a slight bevel on the front end. For reaming aluminum the squarer the front end the freer the reamer will cut.

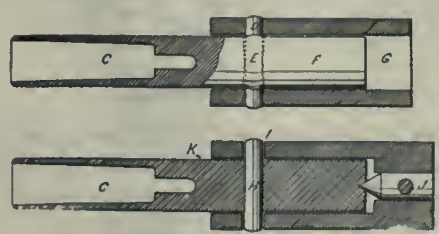


FIG. 4. FLOATING HOLDERS FOR MACHINE REAMERS.

Reamers are usually made with straight flutes. Spiral fluted reamers are, as a rule, unhandy to back off. When so made, the spiral should be left-handed. With right-hand cutting edges the spiral has a tendency to draw either a taper or straight reamer into the hole. They are always made correct size on the front end and tapered towards the back about four-thousandths to the foot. Too fast a speed, no lubricant and not enough clearance will make the chips stick or gum to the cutting edges.

Rose reamers as shown at B, Fig. 3, are designed the same as machine reamers, as shown below with this difference, that the lands are not relieved and all the cutting is done on the front ends. They are beveled off the whole depth of flute and are intended to remove more stock than machine reamers. They are used extensively in jig reaming and also for turret and automatic machine working on steel.

In jig work the rose reamer does not wear the bushings and the bushings in turn do not injure the reamer. The front clearance on all the lips should always be the same, in order to get accurate results and the greatest production. The hole in the reamer shell is given a taper of ⅛ in. per foot to fit the shank, as shown at C, Fig 4. These shanks can be purchased or made either straight or taper. The tapered form is preferable as the shanks are more easily inserted in the machine. They are driven by a tongue, as at O, Fig. 3, and are held on by the taper.

The writer has often drilled and tapped the end of the shank for a cap-screw. This screw, with a washer, was put in to keep the reamer from drawing off the shank into the hole. Sometimes the reamer will seize or take a bite, as the saying is, and if it be forced ahead, a broken reamer will be the result. When the shells are made to work on a straight reamer bar, the bayonet lock is used to overcome this as shown in A, Fig. 3, at m by dotted lines.

Floating Reamer Holder.

To one not very familiar with reamer practice the holding and driving of a reamer is apparently a simple matter. To those of a wider experience, however, it presents difficulties of its own, and is a study in itself. The reamer must not be rigidly held, but must be more or less free to locate itself at the centre of rotation of the hole being reamed. Why is this necessary? Because in order to get a true parallel hole to size and keep on reaming hole after hole to gauge size, the reamer must line up perfectly with the axis of the work.

This perfectly accurate setting up,

even on a new lathe, turret machine or automatic would be a lengthy and tedious job. Next, the turret cannot be depended upon to index exactly alike each and every time, and the tail stock of the lathe will not always remain in perfect alignment with the spindle of the machine. To facilitate setting up and to allow the reamer to centre itself, some form of floating holder is used. In Fig. 4 are shown two styles much used in general practice and often made by the writer. The upper one in particular is both efficient and cheap, while the lower one is, by many, considered the best.

The part F is turned about 1-64 in. smaller than the hole, G, except at E. when a ridge is left about the diameter of the bore. The driving pin D is made a driving fit in the body and a loose fit in the adapter F. C is a Morse taper for different size shanks to be used with sockets. The body is cast iron and the adapter machine steel, while D is made of drill rod or Stub's steel.

The lower type is a better style, but costs a little more. The difference is that pin H is tight in the adapter K and loose in the body at I, with a centre J, at the back, to take the thrust. No ridge is left at H. These floating holders save broken reamers and tend to produce rapid and accurate work. In Fig. 5 are two views of an adapter that can be attached to the tail stock spindle of an engine lathe. At K the holder is bored out to fit the spindle and the cuts show its working without further explanation, more than to say that it is cast iron. This holder can be used to hold simple boring bars. By drilling a hole through it at I and J, also by using taper reamer adapter K, Fig. 4, it can be turned into a floating holder.

The type of holder illustrated in Fig. 4 are designed to be held in a turret lathe, automatic or flat turret. With this floating holder fitted to the engine lathe in a tool room jobbing shop, or small manufacturing shop, reamers can be used to the very best advantage for rapid production and accurate work.

IGNITER DRILLING JIG.

By D. O. Barrett.

IN the Jan. 29, 1914 issue of **Canadian Machinery,** there was shown the drawing for an igniter body for a gasoline engine together with the turning and drilling fixtures for same. This igniter body was fastened to the cylinder by means of three 3/8" studs and the accompanying drawing shows the jig for drilling the holes for these studs in the cylinder in which the igniter was used. The igniter hole was located near the head end of the cylinder and was accurately bored for the igniter body. The locating of the hole was done from the rough casting so that the distance from the faced end of the cylinder was not always exactly the same.

The body of the jig is shouldered and sets into the hole, and is squared up on the cylinder by means of the steel piece

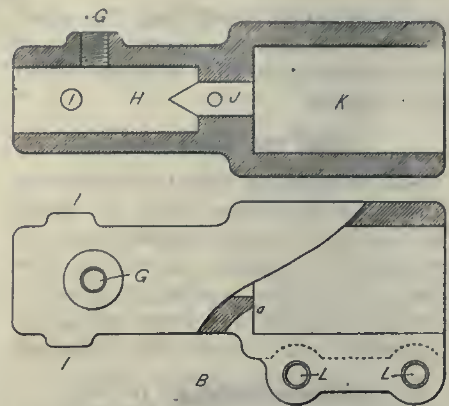
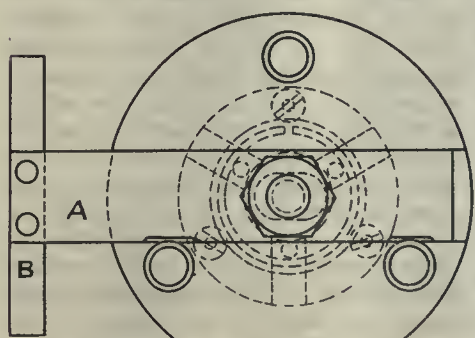
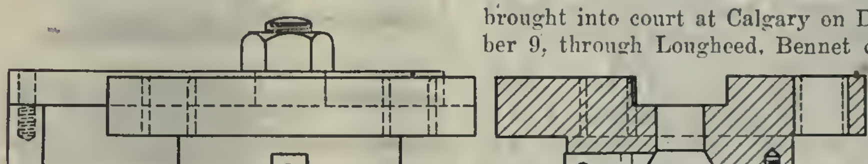


FIG. 5. TAIL STOCK SPINDLE ADAPTER.

A which carries at the outer end the piece B; this is shoved up against the head end of the cylinder which has been previously faced, and brings the holes for the igniter into their proper relation with the centre line of the cylinder. In order to clamp the jig in place, the centre nut shown is tightened, thus drawing up the tapered centre bolt which pushes out the three square steel pieces S against the side of the hole. This it will be noticed, not only clamps the body of the jig in the hole, but also the locating piece A at the same time. The pieces S are held in place by a plate bored out on





IGNITER DRILLING JIG.

the inside to accommodate the small pins driven into the pieces S. Around these three pins is placed a piece of heavy spring wire bent to a smaller circumference. When the clamping bolt in the centre is released, this spring pulls in the clamping pieces and relieves the pressure. The drilling for this particular job was done with a special three-spindle drill head which will be shown at some future time.

TRANSMISSION OF POWER BY CHAINS.

TRANSMISSION OF POWER BY CHAINS was the title of a paper recently read by H. T. Hildage before the Birmingham Association of Engineers. The author stated that about a year ago Hans Renold, Ltd., of Manchester introduced the multiple bush roller-chain which is built up of the inner combinations of the bush roller-chain, threaded upon a stud entirely independent of any of the links, and consequently perfectly free to rotate. Its power-transmitting capabilities can be increased by increasing the width. For example, an ordinary ½-in. pitch cycle-chain can be made to transmit about 7 horse-power at about 3,000 revolutions per minute, and a multiple bush roller-chain, 5 in. wide and of 6 by 6 combinations, would readily transmit 20 horse-power at 2,000 revolutions per minute, and be in every way satisfactory. This is better than could be done with a silent chain, because a ½-in. pitch silent chain to transmit 20 horse-power would have to be about 12 in. wide, and would consequently be made up of several strands.

The general object of the paper was to give information which would enable every engineer to make his own chain-wheels, as he now makes his own spur-wheels. It also contained some discussion of the limiting numbers of teeth that should be used.

The Otis-Fensom Elevator Co., Toronto, has been awarded a contract for two freight and six passenger electric elevators for the Examining Warehouse at Montreal.

Contractors Sue C.N.R.—The Canadian Northern interests, Sir William Mackenzie and Sir Donald Mann, are named as the defendants in a suit brought into court at Calgary on December 9, through Lougheed, Bennet & McLaw, on behalf of the Phalen, Shirley Co., railway contractors. Judgment is asked for $379,000 for work alleged to have been done on the defendant's railroad west of Edmonton, also damages to the extent of $50,000.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

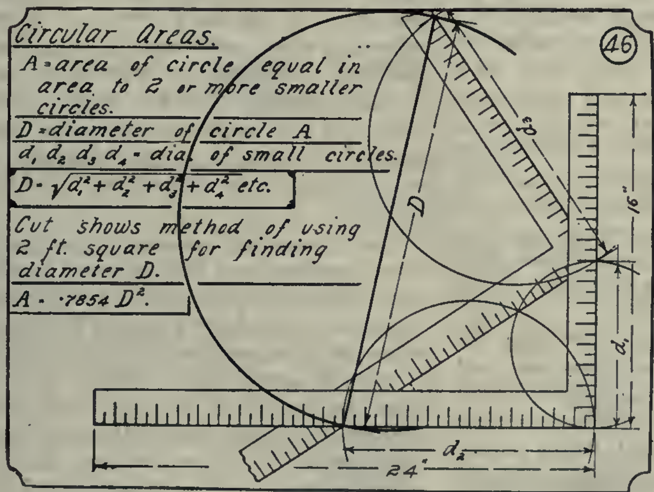
It will be found by those who have followed the previous lessons and profited by them that the various practical applications can now be easily observed, applied and appreciated.

CAPACITY.—III.

Fig. 4, Chart 45, shows the method of finding the length of the hypotenuse of a right triangle—that is, the hypotenuse equals the square root of the sum of the squares of the two sides; thus the hypotenuse of a right triangle whose sides are 10 in. and 18 in. will be

$\sqrt{10^2 + 18^2} = \sqrt{424} = 20.59$ in.

This may be more clearly seen in Chart 46.



ARITHMETIC CHART 46.

The area of a circle whose diameter is the hypotenuse of a right triangle is equal in area to that of the two circles whose diameters are the two sides of the right triangle. By the continued use of right triangles (as illustrated by the two-foot square), the diameter D may be found for the circle whose area equals that of two or more smaller circles. This also applies to the areas of squares.

A square (x) whose side is the diagonal of another square (y) is twice the area of the square (y). If (y) is a square 3 inches on a side, the area will be $3 \times 3 = 9$ sq. in., and the diagonal will be the square root of 3 squared plus 3 squared or,

$\sqrt{3^2+3^2} = \sqrt{18} = 4.242$ ins., then $4.242 \times 4.242 = 18$ sq. in.

In the sheet metal industry, one of the most common articles of manufacture is pieced ware. In many places it falls to the lot of the tool-maker to lay out the templet for the desired blank from which the body of the article is to be made. The first essential requirement is usually the capacity of the vessel; from which the necessary dimensions are determined.

In Chart 47 is shown a skeleton sketch of an elevation and one section of a four-piece flaring pan; the body being composed of 3 pieces of equal size, and the bottom.

A pan similar to the above is required to have an approximate capacity of 24 quarts (6 U.S. gallons), the diameter of the top being 18 ins., and that of the bottom 15 ins. What will be the height (h) and the radius (o c) and (o a) with which to strike the arc forming the top and bottom of the blank?

To find the volume, multiply the number of gallons by 231, or $6 \times 231 = 1386$ cubic inches.

Area of top $= .7854\ D^2 = 254.47$ square inches.

Area of bottom $= .7854\ d^2 = 176.71$ square inches.

Then by formula:—

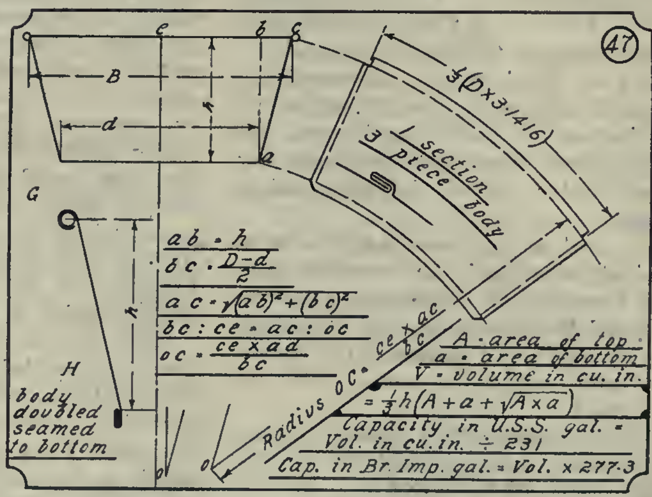
$$\text{Vol.} = 1/3\ h\ [A + a + \sqrt{(A+a)}] \text{ or,}$$

$$1\text{-}3h = \frac{\text{Vol.}}{[A+a+\sqrt{(A+a)}]} \text{ or,}$$

$$h = 3 - \sqrt{\frac{\text{Vol.}}{[A+a+\sqrt{(A+a)}]}} =$$

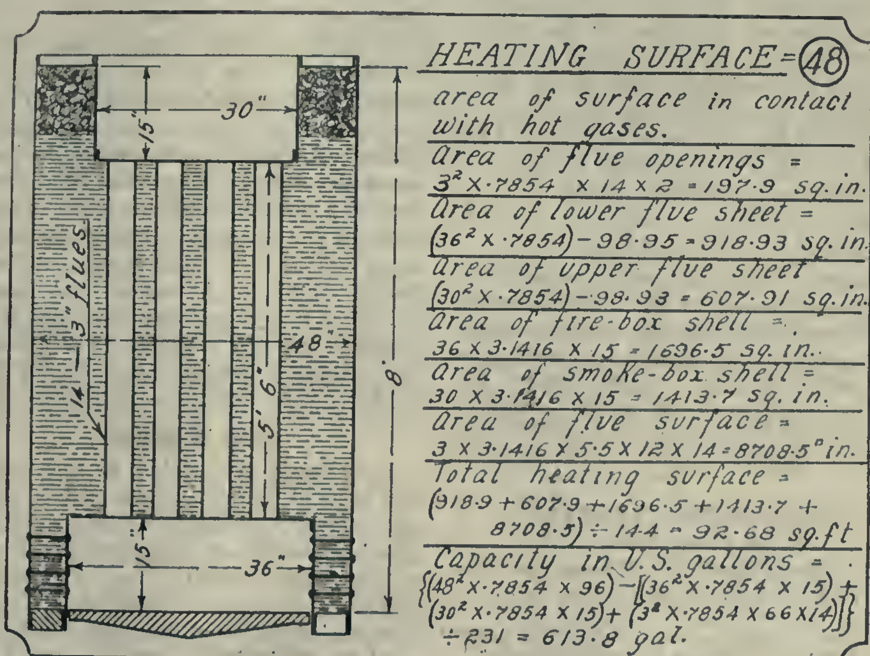
$$3\frac{1386}{254.47+176.71+20.76} = 9.198 \text{ ins.}$$

or approx. 9 inches.



ARITHMETIC CHART 47.

The radius O C may be found graphically or by calculation. To find by the graphical method, lay off the elevation of the pan; produce the centre line (e o) indefinitely, also the flaring side (c a) until they intersect at O, then O C and O A are the required radii.



ARITHMETIC CHART 48.

By calculation, we proceed on the principle of the proportion of similar triangles. The right triangle o e c is similar to that of a b c and the dimensions of one can be found if we know those of the other.

a b = h = 9 ins.

$$b\ c = \frac{D-d}{2} = \frac{18-15}{2} = 1.5 \text{ ins.}$$

$$ac = \sqrt{(ab^2 + bc^2)} = \sqrt{(9^2+1.5^2)}$$

= 9.124 ins. or 9⅛ ins.

be:ce = ac:oc or

$$oc = \frac{ce \times ac}{bc} = \frac{9 \times 9.125}{1.5} = 54.75 \text{ ins.}$$

oa = 54.75 — 9.125 = 45.625 ins.

For the length of arc we have, for top, 1/3 (D×3.1416) = 1/3 (18×3.1416) =6 × 3.1416 = 18.85 ins.; these dimensions being for the skeleton templet.

For the blank proper, allowance must be made at the top for wiring and at the bottom for double seaming, and also at the sides; these conditions being governed by the size of wire and width of seams.

In chart 48 is shown a sketch of an upright boiler and the necessary rules and formulae for determining the capacity and the heating surface. The heating surface of all boilers is the area of the total surface in contact with the hot gases.

In the example here shown, the area of the flue openings equals $3^2 \times .7854 \times 14 \times 2 = 197.9$ sq. ins.

The area of the lower flue sheet equals the diameter of the firebox squared multiplied by .7854, minus the flue opening, or $(36^2 \times .7854) - 98.95 = 918.93$ sq. ins.

The area of the upper flue sheet equals $(30^2 \times .7854) - 98.95 = 607.91$ sq. inches.

The area of the firebox shell equals the circumference multiplied by the height, or 36 × 3.1416 × 15 = 1696.5 sq. ins.

Area of smokebox shell equals 30 × 3.1416 × 15 = 1413.7 sq. ins.

Area of flue surface equals 3 × 3.1416 × 5.5 × 12 × 14 = 8708.5 sq. ins.

Total heating surface equals (918.93 + 607.91 + 1696.5 + 1413.7 + 8708.5) ÷ 144 = 92.68 sq. ft.

Capacity in U.S. gallons equals the volume of the boiler shell minus the sum of the volumes of the firebox, smoke box and fourteen flues, divided by 231, or $48^2 \times .7854 \times 96 - [(36^2 \times .7854 \times 15) + (30^2 \times .7854 \times 15) + (3^2 \times .7854 \times 66 \times 14)]$ the whole divided by 231 = 613.8 gals.

DIE-CASTING ALLOYS.*

By Chas. Pack.**

THE alloys used for die-castings may be divided into three groups, viz.: A, zinc alloys; B, tin alloys; C, lead alloys. The writer in his experience has found the constituents of Group A alloys to vary as follows:

Zinc	70 to 90 per cent.
Tin	0 to 20 per cent.
Aluminum	0 to 5 per cent.
Copper	2 to 5 per cent.
Antimony	0 to 2 per cent.
Lead	0 to 2 per cent.

A typical example of this group of alloys is the following:—Zinc, 84.5 per cent.; tin, 9.0 per cent.; copper, 4.5 per cent.; aluminum, 2.0 per cent. Zinc alloys of the type given have a tensile strength not exceeding 18,000 lb. per sq. in., and an exceedingly low elongation and reduction of area. The strength of these alloys compares favorably with cast iron. Zinc alloys are corroded by aqueous solutions of any kind, and should not be used for food containers or conveyors. Gasoline, which theoretically should be inert toward metals, has been found to corrode zinc alloys, when in direct and constant contact, due to impurities in the commercial gasoline sold to motorists. A good copper-plating, however, will aid a zinc alloy to resist the action of gasoline.

Zinc alloy die-castings may also be plated with nickel, silver, brass, etc., and such coatings protect the castings from corrosion. Zinc alloy die-castings may be buffed to a beautiful white polish, which, unfortunately, becomes dull upon exposure to atmospheric conditions for a few days. A permanent white polished surface may be imparted to zinc die-castings by electro-plating with nickel and buffing. Of all die-castings produced on this Continent and in Europe, approximately 85 per cent. are made from zinc alloys, 10 per cent. are made from tin alloys of group B, and 5 per cent. from lead alloys of group C.

An understanding of the extensive application of zinc die-castings may be gained by a partial enumeration of the parts for use in the motor vehicle industry: Magnetos, self-starting devices, water-circulating pump bodies, force-feed oil pumps, ball-bearing cages, speedometers and wing nuts for windshields. Many of the inventions patented annually would not be commercial possibilities if the present-day zinc alloy die-castings were not available. The numerous automatic vending machines on the market to-day illustrate this fact.

Group B Alloys.

This group, containing 60 per cent. and upward of tin, may be said to consist entirely of babbitt metals. The original tin, antimony, copper alloy patented by Isaac Babbitt, has undergone numerous changes. Constituents have been varied, lead and zinc have displaced the higher-priced tin in many cases, and at the present time any white metal alloy used for bearings is usually styled babbitt metal. Die-castings of this group are mostly used for motor bearings, although they are also used for machine parts where resistance to corrosion is of major importance and where high tensile strength is not required.

In the die-casting process, the metal is poured under pressure into a water-cooled metallic mold. The rapid chilling produces a close-grained babbitt bearing, free from blows and dross spots, so often encountered in the place-poured bearing. An automobile concern producing 50,000 cars per year has used successfully die-cast bearings for eight years without a single complaint and many die-cast bearings on that particular make of car have traveled 50,000 miles and more, only requiring slight adjustment occasionally. The alloy used by this company is of the genuine babbitt type, i.e., containing only tin, copper and antimony in proportions varying only slightly from the original Babbitt formula.

The die-casting company producing these bearings uses only primary Straits tin, Cookson's antimony and the finest drawn or rolled Lake copper. This alloy is mixed by a process in which no constituent is heated above 750 deg. F. and, after mixing it, it is kept below this temperature until cast. Die-cast bearings made in this manner are far superior to those cast in place around the shaft and also more economical.

Under this group of alloys mention must also be made of Parson's white brass, an alloy of tin, zinc and copper. This alloy cannot be cast in the plunger type of machine (due to freezing of plunger), and only with difficulty in the air machine. The alloy, although partially molten at 400 deg. F., is not thoroughly fused and entirely liquid until a temperature of 1,000 deg. F. is reached, at which temperature the alloy drosses excessively, segregates easily and is in general a poor die-casting alloy. There has been, however, a demand for die-castings of the tin-zinc-copper type, and this has caused the placing on the market of a bearing metal known as Comet white bronze, an alloy consisting essentially of tin, zinc and copper, in such proportions and treated in such manner as to overcome the objections to which Parson's white brass is open, although retaining its good bearing qualities.

Group C Alloys.

These alloys, containing 60 per cent. and upward of lead, are so well known as to require no further discussion here beyond saying that the die-casting process is not limited to any particular composition and is applicable to all alloys of this type.

*From a paper presented before the American Institute of Metals, Chicago, September 8.
**Doehler Die-Casting Co., Brooklyn, N.Y.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

Question.—Will a boiler shell burst by ripping lengthwise or in a circular direction?

Answer.—Let the diameter be represented by D and the internal pressure by P. The force tending to split the shell lengthwise is $\frac{D \times P}{2}$. The force tending to rupture it in a circular direction is $\frac{D^2 \times .7854 \times P}{D \times 3.1416} = \frac{D \times P}{4}$

The longitudinal strength is, therefore, only half of the transverse strength.

* * *

Question.—The analysis of our cupola slag is silica 48.41 per cent., alumina 15.27 per cent., lime 17.87 per cent., magnesia 3.22 per cent., manganese 1.60 per cent., oxide of iron 13.14 per cent., and metallic iron 9.20 per cent. We consider this slag contains an unusually high percentage of oxide of iron. Is it possible for us to control the nature of our slag from day to day, and would the averaging of percentages of impurities indicate the quality of iron we are melting.

Answer.—If you will use more limestone and try to get your iron as hot as possible, the percentage of oxide of iron in your slag will be considerably less and the metallic iron will also be reduced. Run your cupola with the softest blast you can use and get your iron right and use sufficient flux to insure a fluid slag so that it will carry off all the waste product. If your slag is fluid, the metallic iron will fall through it and the increase of lime will decrease the oxide of iron. Ideal slag should contain about 40 per cent. of silica.

* * *

Question.—We have been using 10 to 20 per cent. steel scrap in our cupola mixtures to lower the cost and increase the strength of our castings. The steel scrap we are using is very light and our melting losses are very heavy. We would like to know whether you consider it economical to use steel scrap, or to get good machinery scrap.

Answer. — There is always a heavy melting loss when the scrap is very light and rusty. In this case it would be advisable to use scrap cast iron, even if it be a trifle more expensive. If you will charge your light scrap on the top of your coke charges and then cover it with fine coke, you can melt fairly light scrap with very little waste, as the pig iron and heavy scrap on top of it push it down quickly into the melting zone. If you can purchase boiler plate clippings, structural steel scrap, or old rail cut into short lengths for the same price as cast scrap, it will be economical to use this material. The main object in using steel is to obtain a close-grained, strong iron.

* * *

Question.—The drivers of a locomotive are 72 inches in diameter. If they register 3,500 revolutions in going nine miles, what is the percentage lost by slippage?

Answer.—Circumference of drivers $= \frac{72}{12} \times 3.1416 = 18.8496$. Distance traveled by drivers $= 18.849 \times 3500 = 65{,}971.5$ feet. Number of feet in 9 miles $= 9 \times 5280 = 47{,}520$. Slippage $= 65{,}971.5 - 47{,}520 = 18{,}451.5$ feet. Per cent. of slippage $= \frac{18{,}451.5}{65{,}971.5} \times 100 = 28$ per cent.

* * *

Question.—What is the approximate water capacity in gallons of a return tubular boiler, 18 ft. x 72 in. with 72 3-inch tubes?

Answer.—Rule, from 2-3 the volume of the shell subtract the volume of all the tubes.

Volume of 2-3 of shell $= 72 \times 72 \times .7854 \times 18 \times 12 \times 2\text{-}3 = 586{,}297.9584$ cu. in.

Volume of one tube is approximately $3 \times 3 \times .7854 \times 18 \times 12 = 1526.8$ cubic inches.

Volume of 72 tubes $= 109{,}929.6$ cubic inches.

Volume of water contained $= 586{,}297.9 - 109{,}929.6 = 476{,}368.3$ cubic inches.

Number of gallons $= \frac{476{,}368.3}{277.274} = 1718.04$

* * *

Question.—An engine piston rod is $3\frac{1}{4}$ inches in diameter, and the stuffing box is bored to $4\frac{3}{4}$ inches. How much square flax packing will be required if the box is filled by 5 rings?

Answer.—The mean diameter of the ring is $3\frac{1}{4} + \frac{3}{4} = 4$ inches.

Length of each ring is $4 \times 3.1416 = 12.5664$ inches.

Taking off about 0.1 inch for closing up, this becomes 12.46 inches, or for 5 rings $12.46 \times 5 = 62.3$ inches, or a little over 5 feet.

Question.—What would be the approximate weight of a steel chain of 290 links whose dimensions are: Length, 3.7 inches; length inside, 1.7 inches; outside width, 3.3 inches; inside width, 1.3 inches?

Answer.—The volume of the link would be the volume of a circular ring plus the volume of the straight sides.

The mean diameter of the ring is $3.3 - 1 = 2.3$ inches. Circumference $= 2.3 \times 3.1416 = 7.215$ inches.

Volume of ring $= 1^2 \times .7854 \times 7.215 = 5.6666$ cubic inches.

Length of straight sides $= 3.7 - 3.3 = 0.4$ inch.

Volume $= 1^2 \times .7854 \times .4 \times 2 = .62832$ cubic inches.

Total volume of one link $= 5.6666 + .6283 = 6.2949$ cubic inches.

Weight of one link $= 6.2949 \times .28 = 1.7625$ pounds.

Weight of 290 links $= 1.7625 \times 290 = 511.12$ pounds.

* * *

Question.—A common squirt oil can has a body shaped like a segment of a sphere. Its base diameter is 4.5 inches and its height is 2.1 inches. How many times could it be filled from a can containing a gallon

Answer.—The volume of a spherical segment is three times the square of the radius of the base plus the square of the height multiplied by the height and by .5236.

Radius of base $= 2.25$; $2.25^2 \times 3 = 15.187$.

Height squared $= 2.1^2 = 4.41$.

$4.41 + 15.187 = 19.597$; volume $= 19.597 \times 2.1 \times .5236 = 21.5477$ cub. ins.

Number of fillings $= \frac{277.274}{21.5477} = 13.2$

* * *

Question.—The smoke outlet of a furnace is in the form of an ellipse, whose axes are 30 inches and 20 inches. What diameter should a round connecting pipe be to have the same area?

Answer.—The area of the ellipse is the product of the axes of the ellipse multiplied by .7854, or

Area $= 20 \times 30 \times .7854 = 471.24$ sq. in.

Diameter of circle = the square root of the area divided by .7854, or

$$\text{diameter} = \sqrt{\left(\frac{471.24}{.7854}\right)} = \sqrt{600}$$

$= 24.49$, or, say, $24\frac{1}{2}$ inches diameter.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

12-INCH HEAVY DUTY CUTTING OFF MACHINE.

THIS machine is intended primarily for severing heavy bar stock, such as nickel steel projectile stock, axles, forgings, etc. The capacity is 12¼ in.; rounds down to 3 in., and either square or hexagon stock of a maximum that may be passed through a 12-in. diameter circle.

As shown on Fig. 1, the machine is equipped with a stock rack, usually 22 feet long, provided with a stock trolley and measuring device operated close to the machine. The bar is dropped on the stock trolley, by which medium it is forced through the cutter blade, and as stock is severed from the end of the bar, its movement is constantly in one direction. The stock trolley forces the severed piece through the rear of the machine; chips also being removed from the rear.

The machine base is a heavy one-piece casting weighing 18,000 lbs. On this is a swinging head containing the cutter rear view. The clutch is flooded with oil. The main pinion shaft bearings are of bronze equipped with sight feed oilers, the oil flowing inwardly and finally ending in the swinging head containing the large cutter drum gear, thus keeping this flooded and with its bearing, operating in oil.

The feed mechanism case shown at the right on Fig. 2 is filled with oil. A high-speed return clutch is provided, also a clutch for throwing in the in-feed, both having automatic knockout, and being controlled by the inside lever shown on Fig. 1.

The feed screw is of nickel steel, 3½ in. diameter, and of coarse pitch, while the feed screw nut is in two parts, with oil pocket in the top nut, and provision to take up lost motion by revolving one-half of the nut. The corner gear box and feed screw gear box are also filled with oil, and all thrusts are provided with extra heavy self-aligning ball thrust bearings. All bearings are of bronze and renewable.

vided with three rollers, the two outer of which run on the lower ways as shown; the centre roller on the upper wedge block, which is pivoted on one end of the cylinder, and provided on the other end with a vertical adjusting screw, 3 in. diameter, passing through a swinging nut 6 in. diameter, as shown at the end of the main clamping lever. This lever and all others are of O.H. steel. In the end of the main clamping lever is an adjusting screw 3 in. in diameter, having a heavy tool steel point, which bites directly on to the bar being clamped. This arrangement provides 150,000 lbs. pressure for securing the bar being severed. It has been found that from 125,000 to 150,000 lbs. is necessary in order to properly hold the bars under the pressures with which the machine can be operated.

The lower V block supporting the bars, there being one at the front and one at the rear, have hardened faces, and also are adjustable to and from the blade. The clamping arrangements admit of gripping very close to the blade. The

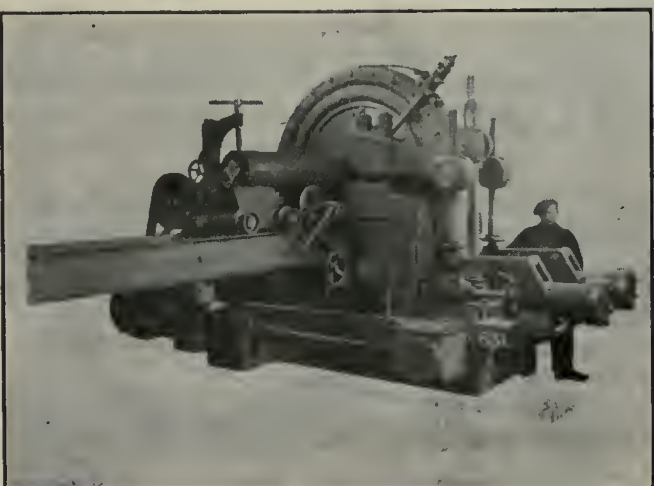


FIG. 1. FRONT VIEW 12-IN. HEAVY DUTY CUTTING-OFF MACHINE.

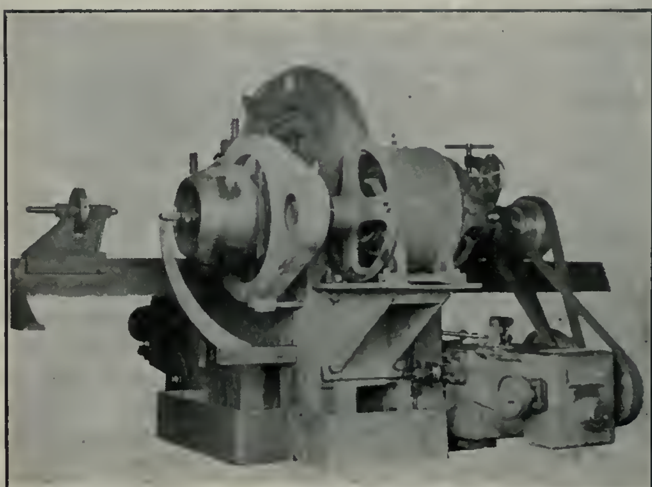


FIG. 2. REAR VIEW 12-IN. HEAVY DUTY CUTTING-OFF MACHINE.

blade with its ten cutters. The gear on the cutter drum surrounding this blade is 70-in. diameter, with 5-in. face of semi-steel, and direct into this meshes the main driving pinion, a crucible steel forging integral with its shaft. On one end of this shaft is the main driving clutch, which is operated by one of the levers shown on Fig. 1, the clutch being provided with a shearing pin, disconnecting all heavy rotating parts from the cutter drum gear, in the event of accident happening to cutters.

On the other end of this shaft is the upper cone pulley which drives the feed mechanism shown at the right in the

The stock to be severed is clamped with a powerful power clamping arrangement, two clamps being provided on standard equipment, one in the front and one at the rear; only one of which is used at a time, however. The rear clamp avoids the necessity of removing the bar and turning it end for end when the short final cut is made on the last end of the bar. The operation of these clamps is indicated by the cuts. Each of the main clamping levers weighs 800 lbs., and they are arranged for any pressure from 100 lbs. up to 1,000 lbs. per sq. inch, hydraulic air, steam or water.

The crosshead on the cylinder is pro-

heavy tie bolts receiving the strains from the power clamping levers are of 3-in. nickel steel, and pass through the steel shoes on which the clamping levers are pinned, from the top down almost to the bottom of the base. There are two of these tie bolts on each side of the machine.

It has been the builders' experience that high-speed steel cutters in particular will not stand excessive vibration, therefore in order to eliminate any possibility of vibration and to obtain a constant steady drive, cutters are on the bore of the blade and the driving gear outside of that circle.

With the powerful drive obtainable, it has been found necessary to develop a type of cutter blade and cutters of great strength. Between each cutter, which is not a portion of the blade proper, are inserted what are termed thrust blocks, all of which are made interchangeable, so that any thrust block may be located between any pair of cutters. Pressure placed upon the point of one cutter has the tendency to revolve the entire inner ring, and to resist this are the ten pockets in the blade proper.

One cutter cannot be revolved without revolving all, consequently any one cutter in operation is backed up by the entire ten pockets and all other cutters. If the thrust block were a part of the blade proper, then any pressure brought to bear on the point of one cutter would be taken almost wholly by that portion of the blade immediately back of it and, after severe duty or through broken cutters, the blade invariably begins to bell-mouth—that is, the cutter bearing in the blade begins to force back after excessive pressure, and the blade itself is finally ruined.

In a severe test given this machine, the makers have broken off the entire ends of cutters, including wedges; in one instance having broken three cutters ⅝ in. and 2½ in., together with the ends of the wedges, without damage to the blade.

When severing extremely soft stock under heavy feeds, it is a common occurrence for the chips to become welded to the points of the cutters, and to remove these chips is, of course, desirable, if not really necessary, as they cause cutter breakage. For this purpose, each machine is equipped with a chip breaker, which removes the chips from the points of the cutters, allowing the latter to again pass into the cut free. This chip breaker is automatic, and a pump is furnished so as to supply a copious stream of water to keep cutters cool, a drainage chamber being provided in the bottom of the base and extending through to the rear and the chip side. The upper portion of the base is arranged with pockets and drainage arrangements for taking care of this water supply, and preventing it throwing on any portion of the machine not intended to receive it.

To operate the machine to its normal capacity, a 35-horse power, 300 to 900 variable speed motor, is required, mounted on a heavy bracket, as shown at the rear and direct connected.

The size machine as described will, it is claimed, sever 12¼ in. round nickel steel armor-piercing stock at the rate of 8 cuts per hour for actual production day in and day out.

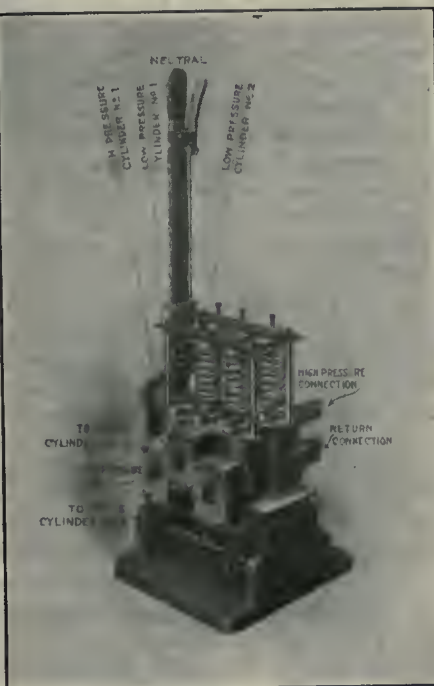
With these machines is furnished, in addition to the equipment noted above, a special grinder, weighing 1,800 lbs. for properly sharpening the wide and round nose cutters, and placing the proper radius on the corners and the ends and obtaining the correct overall length. The round nose cutter projects slightly beyond the wide nose. The pockets in the blade are variable. Those for the round nose cutters are located the correct amount nearer the centre of the blade than are the wide nose cutters. All cutters are then brought to the correct length by means of the grinder in removing stock from the adjusting pin at the tail end of the cutter, consequently a sharpened set of cutters is placed in the machine without further adjustment. It is possible, we understand, to remove a dull set of cutters, replace them with a sharpened set, and have the cutting-off machine in operation within 15 to 20 minutes.

The total net weight of machine as shown without motor is 55,000 lbs.; the width, 8 ft.: the length, 15 ft.; and the height, 9 ft. 6 in. The length of the stock rack is 23 feet, being suited to the handling of bars 20 feet or less in length. Blades, cutters, wedges, thrust blocks and all other portions of the machine are interchangeable.

The Geo. Gorton Machine Co., Racine, Wis., are the designers and builders.

NEW HYDRAULIC VALVE.

THE HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio, has designed and is placing upon the market a five-way high and low pressure double-acting balanced poppet operating valve, which has many unique and interesting features, and is illustrated by the accompanying photograph. Its operating and constructional features are as follows:—



NEW HYDRAULIC VALVE.

The low pressure is admitted to the first cylinder, leaving the second cylinder open to the return line and, when the low pressure has done its work in the first cylinder, the high pressure is turned in, while a check prevents the liquid from the high pressure line from flowing into the low pressure line. The valve can then be shifted to the position which applies low pressure to cylinder No. 2 and releases cylinder No. 1. A similar valve is made with another position, which applies high pressure to cylinder No. 2, with No. 1 still open. In most cases the last position is not necessary, the work of cylinder No. 2 being done at low pressure only, as in the case of auxiliary return cylinders. On account of the length of the operating lever, it is necessary for the operator to stand above the level upon which the valve rests.

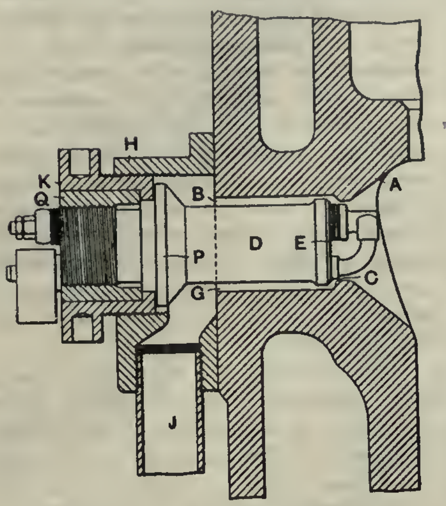
The valve has five stems and checks, and is suitable for a pressure up to 5,000 lbs. It is constructed from a special grade of bronze made by the company from patterns constructed in their own pattern shop.

STARTING INTERNAL-COMBUSTION ENGINES.

A method of starting internal combustion engines has recently been patented by A. R. Bellamy, Spittlegate Ironworks, Grantham, England, in which the compressed air or gas for starting purposes is introduced around the ignition plug, which normally closes the inlet passage for the air or gas to the cylinder, but which can be adjusted to open the passage when the engine is to be started. The accompanying sectional elevation illustrates the arrangement, and shows the ignition plug raised from its seat in order to allow the compressed air to enter the cylinder. A is the cylinder end and B the inlet for the passage of compressed air or gas to the cylinder for starting purposes. C is a mitre seat formed at the inner end of the inlet passage B, and D is the ignition plug which is provided with the usual contacts for making and breaking the electric ignition current and with a mitre seat E adapted to fit the mitre seat C. This plug D is of less diameter than the inlet B in the cylinder end, so that an annular space G is provided around it. H is the air-box or chamber which is arranged on the cylinder end, and the interior of which is in communication with the inlet passage B. J is the branch which is laterally provided upon the air-box for the admission of the compressed air or gas for starting the engine.

An internal screw-thread is formed in

the air-box or cylinder H, and K is a lifting nut in the form of a hollow cylinder having an external screw-thread which engages with the internal screw-thread of the air-box H. An internally-screwed sleeve fits into the hollow nut K, by means of which this nut is loosely attached to the ignition plug by the engagement of its screw-thread with an external screw-thread upon the outer end of the plug. The plug D is normally



INTERNAL COMBUSTION ENGINE STARTING ARRANGEMENT.

—that is to say when the engine is running—screwed down on to the seat C by the operating nut K. When, however, the engine has to be started, the nut K is turned so as to move the plug D from its seat, thus opening up communication between the air-box H and the cylinder.

MULTI-STAGE, MOTOR-DRIVEN CENTRIFUGAL PUMP.

THE accompanying illustration shows a three-stage centrifugal pump, of quite small capacity, built for a head of 150 feet, and driven by electric motor. The pump is equipped with closed impellers, of bronze, polished all over. The case is of cast iron. The coupling is of the flexible type, and the design is such as to eliminate end thrust, as well as give smoothness of operation, combined with noiselessness.

The Smart-Turner Machine Co., Hamilton, are manufacturers of this product.

A MODEL DRAWING OFFICE SYSTEM.

In a paper read before the members of the junior Institution of Engineers on the subject of "A Model Drawing Office System," the author C. E. Ford, said that the manufacture of small and complicated apparatus, such as met with in electrical instrument making, lends itself by the very intricacy of the apparatus admirably to systematical subdivision; a condition which is required in order to avoid waste of time and material. Since successful manufacture depends entirely upon the proper subdivision and distribution of labor, and since practice has shown that the proper way to obtain accurate detailing and records is by means of systematized drawings and the complimentary specifications, it necessarily follows that the drawings are one of the most important details of the system, and the starting point from which the whole process of manufacture springs. Further, if the system has been developed on lines giving, besides the permanent manufacturing details, facilities for the order and sales departments to intelligently dissect the apparatus, and follow up any part thereof, without having to refer to third persons, we shall have, as near as is possible, an ideal system to ensure the smooth and regular working of interdepartmental management.

The system as laid out aims at obtaining all that is necessary, (a)—for manufacturing; (b)—to avoid overlapping in and to bring about uniformity and interchangeability of manufacture; (c)—for order and sales execution. For the working of the system four kinds of drawings are necessary. (1) — Stock sheet. (2)—Assembling. (3) — Part drawing. (4) — Partial assembling drawing.

Stock List—Since in order to be able to construct a piece of apparatus, we must know its parts, a specification of them will of course be the starting point, and can be considered the backbone of the drafting system. It is one of the drawings which first of all should be properly considered and roughly drawn out when new apparatus has to be designed, or an existing design modified.

Assembling.—Next to the stock list we can consider the assembling drawing as the most important link in the system, inasmuch that the stock list indicates a complete list of parts and materials necessary; therefore the assembling drawings should show a complete ensemble.

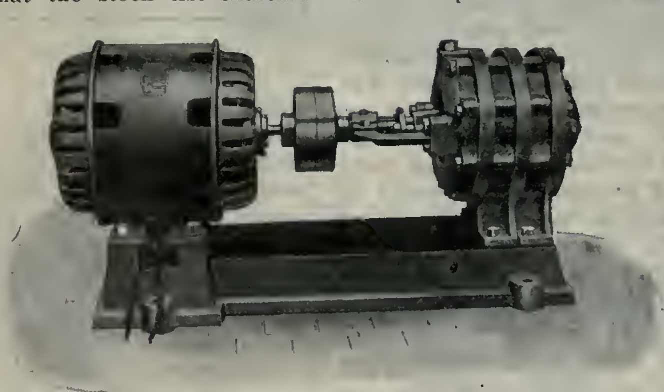
Part drawing.—These drawings can be subdivided into three sections. (1)—special or individual; (2)—bare; (3)—finish. Section 1 covers all parts which are entirely special and which for that reason can only enter into the establishment of one piece of apparatus. Section 2 covers all parts which are standard in some respect, and which for that reason can be used on a number of different pieces of apparatus. Section 3 covers all parts which can be converted from any of the bare parts by simply applying an ornamental finish.

Partial assembling drawing.—It is not possible in every case to build apparatus from individual parts, and for this reason the partial assembling drawing is introduced to cover such operations of assembling as are subsequent to final assembling.

In conclusion, the author mentioned that although he only dealt with the system as applicable to electrical apparatus, it could be applied to any branch of engineering where a large amount of repetition work is in operation with equal efficiency.

Sarnia, Ont.—The first war contract to come to Sarnia was one received by the Mueller Mfg. Co. last Friday, calling for 50,000 brass parts for shrapnel shells for the Dominion Government.

More Shell Orders. — It is reported that orders aggregating about eight million dollars for the manufacture of shells for the British army are in prospect for Canadian factories. Two hundred thousand have already been made, and 600,000 are in process of construction. The Minister of Militia some time ago received an enquiry from the British War Office as to our capacity to turn out shells, and a special committee was appointed to deal with the matter. As a result, Major-Gen. Hughes is now able to report the extensive orders above mentioned with further heavy requests in prospect. They will be distributed as widely as possible among steel works and shops properly equipped to manufacture.



MULTI-STAGE MOTOR-DRIVEN, CENTRIFUGAL PUMP.

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Vol. XII. DECEMBER 17, 1914 No. 25

PRINCIPAL CONTENTS:

ROLLING BACK THE TRADE DEPRESSION.

INDUSTRIAL activity, not to speak of industrial enterprise, is still in the "dog days," and what strikes us is that comparatively little effort, or at least infinitesimal results as its consequence have accrued. The disposition seems to be that of expectation or, worse still, working up excitement over some more or less ridiculous and extravagant proposition. Too much valuable time and opportunity are being wasted in discussing probabilities of our building submarines in wholesale fashion, or in retailing stories of gigantic combines whose purpose is the establishment of equally gigantic shell manufacturing plants. There is just about as much to be gained in our adopted attitude as there are possibilities in the realization of the schemes to which it applies, and better far would it be for all concerned if we devoted our time and attention to giving a lead by doing what lies to our own hand. The following letter from David McLain, of Milwaukee, the well-known American foundry expert, is not only refreshing on account of its splendid and good sense optimism, but is clearly indicative as well of what should be our part in rolling back the cloud of depression which so threatingly challenges us. He says:—

> If you would refer to my advertisement on page 5 of the August issue of Canadian Foundryman, you no doubt will be surprised to learn that I predicted boom times in 90 days, and I believe I can hear you say "Bunk," or "Mack over-reached himself this time." The copy for this advertisement was furnished you early in July, and represented the results of a careful survey of conditions as reported to this office from many different sections of the United States and Canada. There was no stopping the boom under ordinary conditions, but you know "man proposes and the Kaiser disposes."
>
> Naturally, after going on record through the advertising columns of your paper I kept close tab on the market and war reports through the month of August and believed that September would open up fairly active and close good and strong.
>
> Beaten again, but by whom? Not the Kaiser this time, but by the business men in general, who had simply quit giving orders as soon as the war started and, of course, if no orders are going out, very little business is being done. I feel that the war is going to be a long, drawn-out affair, because even if the Allies do drive the Kaiser back into Germany, how are they going to lick him there? As soon as the Mohammedans get started, I am going to quit reading the daily papers and devote all of my time to my own business. This is my fourth experience with the trade depression and can recall that of '73, '93 and '07.
>
> Should the war last forever—or should the railroad companies be unable to get their hundred million increase—or should business men generally allow themselves to drift along until the sheriff gets them, then I believe that if the small and medium business men of Canada and the United States will devote all of their energies to their business, they soon will have no need to fear what the big fellows are doing, as they themselves have it in their power to say whether or not we shall have good or bad times. I firmly believe that if every firm requiring equipment or material would place its order now, the wheels of industry again would begin to turn at a merry pace.
>
> Foundry history shows, however, that there have been more dollars and cents than common sense invested in the business. The idea that a little sand and a little melted iron will make a casting must pass. Poor trade did not cause failures in one out of every four foundries. Prices were as high as ever and wages did not materially increase. No, the profit that was added to the job in the office was lost when the castings reached the shipping room.
>
> Why? That's the puzzle, and the answer is locked up in things that cannot be seen in the foundry. A man may have eyes, ears and hands, but unless he adds to these trained brains, he never can be a success in the foundry or any other game.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 40
Lake Superior, charcoal, Chicago		15 75
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	Toronto.
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X	18 00	17 00
Victoria, No. 2 Plain	18 00	17 00
Hamilton, No. 1	18 00	17 00
Hamilton, No. 2	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, 1/4 to 1/2 in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 75
Copper, crucible	10 00	9 75
Copper, unch-bled, heavy	9 50	9 75
Copper wire, unch-bled	9 50	9 75
No. 1 machine compos'n	8 50	8 75
No. 1 compos'n turnings	8 50	8 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 25	$2 25
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, 5/8 diam., 100 lbs.		2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, 3/8 and less	70 & 5
Machine bolts, 7-16	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4½c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	75 per cent.
Boiler rivets, base, 3/4-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$21 00
Open hearth billets, Pittsburgh	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload	$13 75	$14 00
Electrolytic copper	13 75	13 75
Castings copper	13 50	13 50
Spelter	6 00	6 00
Tin	37 00	36 00
Lead	4 85	5 00
Antimony	16 00	18 00
Aluminum	22 00	22 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
1/8in	$ .05½	1/8in	$ .12	1/2	$ .32
1/4in	.06	1/4in	.07½	3/4	.35
3/8in	.06	3/8in	.07½	1	.37
1/2in	.08½	1/2in	.11	1¼	.52½
3/4in	.11½	3/4in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect July 2, 1914:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
1/4, 3/8 in.	64	49	....	....
1/2 in.	69	58	....	....
3/4 to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	72	62
7, 8, 10 in.	....	....	66½	55½
X Strong P. E.				
1/4, 3/8 in.	56½	46½	....	....
1/2 in.	64	54	....	....
3/4 to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
1/2 to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	18½
Benzine, single bbls., per gal.	18½
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.56
Linseed oil, boiled, single bbls.	0.59
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Transmission rope, Manila	0.18
Drilling Cables, Manila	0.16
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents.
XXX extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 08¾
X Press	0 07¾
COLORED.	
Lion	0 07
Standard	0 06¼
Popular	0 05½
Keen	0 05
PACKING.	
Arrow	0 15
Anchor	0 06
Anvil	0 07½
Axle	0 09
WASHED WIPERS.	
Select white	0 06
Light colored	0 06½
Dark colored	0 05

Prices per lb.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Dec. 14, 1914.—The general situation has undergone but little change during the last week. Everything seems to be going on in much the same manner as before. The business placed by Britain for war material has done a great deal for Canada, far more, as a matter of fact, than the mere employment of a large number of men who would otherwise have been without work. In many cases there has not been a very large margin of profit in the execution of these orders, the reason being that prices to be paid for such material were set in Britain, and although a small allowance was undoubtedly made for the greater cost of labor here, the proportion of cost to be allowed for production purposes here is similar to that allowed in Britain.

Our shops have been so busy filling orders, as it were, that their production systems have been in most cases hurriedly made, to suit immediate requirements. Thus small leaks and minor inefficiencies have been allowed to pass unnoticed. With quiet times and the orders in hand only admitting of a narrow margin in profit, we are undergoing an experience for the better in so far as efficient, better and more economical methods of production are concerned.

This has a very deep significance, because it will mean more business will be placed with us as a direct result. The factor that has militated most against Canadian manufactured mechanical products has been the price, and if this can be offset there will be a very much extended market opened up for our wares. Our lesson will have been learned largely through the placing of orders for war material with us. The regular channels have, of course, not been the medium through which much business has been placed since the war began, although there has been rather more activity in these directions than might have been expected.

An encouraging factor in this vicinity has been the opening of the large plant of the Armstrong-Whitworth Co. of Canada at Longueuil, P.Q. In spite of the general depression, this plant has been pushed through to completion with all possible speed, and upwards of two hundred men will shortly be employed. The Canadian Vickers, Ltd., have also been pushing forward their plant to completion, and when this has been accomplished, a large number of men will find employment.

In and around Montreal there is considerable activity, and although it is not of the nature to produce immediate results, with the renewal of normal conditions, a new era in the annals of Canadian manufacturing will have been ushered in.

The Steel Market.

Prices remain very much the same as for some time past. With regard to machinery steel, the demand still continues to be steady and prices have been fairly firm. The present demand is, however, rather lower than normal, although representing a very healthy condition, taking everything into consideration. In the structural steel, business is extremely quiet, and not much change is anticipated until the recommencement of building operations in the spring.

Pig Iron.

Pig iron continues to be very dull. Prices have a slight tendency to strengthen, and sales are perhaps a little better than have been for some time past. Very little British iron is moving. American furnaces are doing most of the little business moving at present.

Machine Tools.

The machine tool market still remains rather quiet. There is, however, quite a little business doing in a small way. Sales usually consist of one machine only, or perhaps two; however, the net total serves to keep organizations more or less intact. The supply business remains about the same as usual.

Metals.

The metal market has not been very active this week. Copper has been the chief centre of interest. Although no actual increase in price has been recorded, the tendency is decidedly toward stiffening and an advance is expected.

Tin also has stiffened in price during the week. The other metals have not shown any particularly active signs, although all prices remain firm.

Toronto, Ont., Dec. 15, 1914.—The general industrial situation is practically unchanged; factories working on Government orders show continued activity, but others, particularly lumber mills, steel plants and general engineering works, are quiet. From now until the end of the year there will be some further restriction of business, partially on account of stock-taking. It is satisfactory to note that further orders for war equipment are being placed which will continue to relieve the situation in certain districts. In this respect a good purpose is being served, even though it is of a more or less temporary character, that is, during the duration of the war. There is a possibility, however, that on account of this new business these industries will develop and enlarge the scope of their operations.

Construction and development work is still very much restricted, owing to the difficulty of obtaining working capital under the present conditions. The Dominion Government and some municipalities, however, are proceeding with public works wherever possible. Owing to the restriction in trade during the past twelve months, manufacturers had curtailed their operations and made necessary readjustments in the conduct of their business. On this account they were better prepared to meet the present conditions occasioned by the war.

The iron and steel trade shows a quieter tendency but prices are firm. The scrap metal market is dull, but prices of scrap copper have advanced slightly. Tin is unchanged but copper is stronger and prices have advanced. Other metals are generally firm. There is a fair volume of business passing, but orders are generally only to satisfy immediate requirements. The pig iron market is dull and prices unchanged.

Steel Market.

As might be expected at this time of year, the iron and steel market is quiet, although some contracts are being made for delivery early next year. Building operations are very restricted and manufacturing interests quiet: the demand from these sources is therefore light. Further orders for shells recently announced will cause increased activity in the plants engaged upon the production of the various parts. Being a new industry, much time and trouble is being expended in producing a satisfactory shell, and the development of this industry will be followed with interest.

Perhaps the most important feature locally, of recent date, is the awarding of the contract for the Bloor street viaduct, which will be built of steel. The cost is estimated at $947,076 and approximately 6,800 tons of steel will be required for its construction. Reports from the United States indicate a better feeling in the steel trade and an increase in the volume of business. There have been no important price changes at Pittsburgh and local quotations are also unchanged and firm.

Pig Iron.

There is little activity in the pig iron market, business generally being quiet. Foundries are, generally speaking, operating at considerably reduced capacity and only buying to fill immediate requirements. The recent activity in the Buffalo market has not caused any change in prices locally.

Machine Tools.

The machine tool market is very dull. Some tools have been purchased for machining shells and further orders may be placed as that industry develops. Local dealers report few inquiries of any importance. There is a steady demand for supplies but sales are generally for small lots.

Ssrap Metals.

The market for scrap metals is quiet and the demand is light. The continued strength of copper has caused an advance of 25c per hundred pounds in scrap and composition. The new quotations are as follows: Copper, light, $8.75; heavy, crucible and copper wire, $9.75; No. 1 machine composition, $8.75 and No. 1 composition turnings, $8.25 per hundred pounds.

Metals.

There has been a little better demand for some metals during the week and more inquiries received. Prices generally are steady with few changes. Copper is showing some strength in the London market and has advanced 25c, being now quoted as follows: Lake, $14; electrolytic, $13.75, and casting copper $13.50 per hundred pounds. The reason for the continued rise seems to be on account of big consumers placing large orders and a general optimistic feeling in the market. Tin is firm at $36, but the demand is light. There is no longer any difficulty in obtaining supplies and the situation is better. Spelter is firm but quiet at unchanged prices, being quoted at $6. There is no change in the price of lead which is steady at $5. The situation is unchanged but there is a possibility of an advance in price. The antimony market is firm at $18 but business is quiet.

Motor Truck Contract.—It is reported from Ottawa that the big motor truck contract, for which the representatives of nearly a dozen different firms have been working at the capital for more than a fortnight, has been practically decided upon. As matters now stand, three firms—the Kelly Springfield, the White and Packard—have been awarded the contract, provided that they reduce their catalogue prices by twenty-five per cent. It is understood that the Kelly firm has consented to come down to this price, and word to a similar effect is expected from the other firms. The contract calls for one hundred and fifty trucks in all, approximating in cost about $800,000. It is believed that the trucks will be assembled on the Canadian side by Canadian companies. It is understood that a contract for two hundred bicycles and one hundred motorcycles for military use has been secured by the Ketchum Co., of Ottawa.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

ARMSTRONG-WHITWORTH PLANT FORMAL OPENING.

SHORTLY before noon on Saturday, December 12, Master George Buchanan Foster, the young son of the vice-president, turned on the electric current which started the machinery of the plant of the Armstrong-Whitworth of Canada, Limited, and George G. Foster, K.C., declared the works formally opened.

For nearly two years, M. J. Butler, C.E., director of the company, whose first units are now completed at Longueuil, has been at work directing the laying out and construction of what is no doubt destined to be one of the leading industries of the country.

A number of prominent citizens were invited on Saturday to visit the works, the success of which means so much for Longueuil, and the South Shore. Representatives from the railways and the manufacturing houses of the city, and others interested in the development of Canadian manufactures generally accepted the directors' invitation, the party leaving the city by a special car, which was placed at the disposition of the visitors by Managing Director Powell, of the Montreal & Southern Counties Railway.

Reaching the works, the visitors were taken in charge by Mr. Butler, and conducted over the raw material and the crucible manufacturing departments, the rolling mill, the hammer department, and the machine shop, which contains the last word in everything that goes to the manufacture of the highest quality of steel, the latest inventions of both continents having been incorporated in the plant by the engineers in charge of the installation.

Plant Scope.

The company have an area of 250 acres, extending down to the river front, and J. H. Rainville, M.P., gave assurance that steps had already been taken to secure the dredging of the river, so as to permit the company to land supplies and ship their output at their own wharves.

The floor area of the units now at work covers 65,000 square feet, and every attention has been paid to the lighting of the several departments, and the comfort of the employees. At present about 150 men are at work.

When the plant had been inspected and its proposed extensions explained by the vice-president and the managing director, lunch was offered by the management. Following the toast to the King, G. Drinkwater proposed "The Armstrong-Whitworth of Canada, Limited." Mr. G. G. Foster, K.C., vice-president, made an eloquent reply, in which he traced the development of the plant from its inception, and through its various phases up to the present time. He especially extolled the labor, ability and energy of M. J. Butler, and also referred to the assistance received from the Mayor and council of Longueuil, and the Ottawa and Quebec members for the county, J. H. Rainville, M.P., and Dr. E. M. Desaulniers, M.L.A.

Mr. Foster also stated that as the company had fulfilled its promises to the municipality, he felt sure that the Municipal bodies would reciprocate. About $1,250,000, he said, had been expended. The vice-president also spoke in eulogistic terms of the company's president, Sir Percy Girouard, scion of an honored Canadian family, whose unavoidable absence was regretted. He referred with pleasure to the fact that Sir Percy had been promoted to the rank of Brigadier-General since the outbreak of the war.

To Emulate Parent Concern.

M. J. Butler, in his address, told something of the achievements of the parent company in Britain, and foreshadowed the possibilities of the Canadian establishment. He spoke interestingly of the genesis of the original company, and told how its founder, who had first entered the legal profession, invented a hydraulic crane which drew its motive power from an elevated tank. This method proving cumbersome, experiments were made with the object of supplying the hydraulic power from a force-pump, but it was found that the steel cylinders could not withstand the high pressure, but allowed the water to escape because of the porosity of the metal.

After further experiments, a harder steel was produced for use in the cylinders, and it was only then that the idea was propounded of using this superior steel for armaments. From that arose the present great Armstrong-Whitworth enterprises. Speaking of his personal share in the establishing of the plant, Mr. Butler said that the credit must be shared by Messrs. Clarke, Bristol, Russel and others who had worked energetically to bring the plant up to its present stage.

The health of the mayor and councillors of Longuenil having been proposed, the former replied, promising the good offices of the municipality. J. H. Rainville, M.P., Dr. Desaulniers, M.L.A., and Hon. Messrs. Girouard and Simard, M.L.C., also delivered brief addresses congratulating the company and pledging support in their respective spheres.

The toast to the Montreal & Southern Counties Railway brought a reply from the managing director, Mr. Powell, and Mr. H. B. Walker, manager of the Montreal branch of the Canadian Bank of Commerce, having proposed "The Press," Messrs. Smeaton, White and T. Kelly Dickinson responded.

The Guests.

Among those present were: W. P. Ladd, works manager, St. Lawrence Bridge Co., Limited; John Russell, P. A., Canadian Explosives, Limited; W. J. Johnson, superintendent Canadian Car & Foundry Co., Limited; E. B. Tilt, engineer of tests, Canadian Pacific Railway Co.; P. L. Miller, manager, Canadian Vickers, Limited; J. A. Johnson, superintendent Steel Company of Canada, Limited; Geo. Cuttle, P.A., Steel Company of Canada, Limited; F. A. Smith, works manager, Canadian Steel Foundries, Limited; H. A. Wilson, editor, Canadian Machinery; H. B. Walker, manager Bank of Commerce; W. H. Ardley, comp., Grand Trunk Railway; H. Vaughan, assistant to vice-president, Canadian Pacific Railway Co.; J. H. Rainville, M.P.; D. E. Blair, supt. rolling stock, Montreal Tramways Co.; E. A. Fraser, manager, Montreal Locomotive Works; G. H. Duggan, manager Dominion Bridge Co., Limited; Jos. Waldie, manager, Canadian Tube & Iron Co.; mayor and aldermen of Longueuil; Dr. E. M. Desaulniers, M.L.A.; F. C. Wilson, of Williams & Wilson; Smeaton White; A. A. Mayer, master mechanic, G.T.R.; G. Drinkwater, vice-president, Canadian Fairbanks-Morse Co., Limited; J. T. Bethune; Cecil Doutre, commercial manager, Canadian Vickers, Ltd.; Frank Scott, V.P., Grand Trunk Railway System; D. Swinton, supt., Canadian Car & Foundry Co., Limited; T. Scott, supt., United Shoe Machinery Co. of Canada; W. T. Clarke, Lawrence Riopelle and H. Johnston.

PANAMA CANAL TRAFFIC.

DURING the first three months of its commercial operation, from August 15 to November 15, the cargo transported through the Panama Canal amounted to

1,079,521 tons. The total charge on loaded vessels of $1.20 per net ton has been found in this period to be equivalent to a charge of approximately 75c. on each ton of cargo, and the revenue of the Panama railway from each ton of through freight carried across the isthmus during the fiscal years 1913 and 1914 was $3.06. Over 95 per cent. of the traffic may be grouped under four heads:—

(1)—The United States coastwise trade.

(2)—The traffic between the Pacific coast of the United States and Europe.

(3)—The trade of the west coast of South America with the Atlantic seaboard of the United States and with Europe.

(4)—Traffic from the Atlantic coast of the United States with the Far East.

The coastwise trade (1) has employed 95 vessels, transporting 506,357 tons of cargo, and this amounts to 46.9 per cent. of the total cargo carried.

Traffic to Europe from the west coast of the United States (2) has amounted to 201,848 tons; and traffic to the west coast of South America from the United States (3) has consisted of one vessel with 610 tons of coal from Norfolk to Valparaiso and seven vessels with 40,746 tons of general manufactures from New York for distribution between Callao and Valparaiso. The trade from the Atlantic seaboard of the United States through the canal to the Far East (4) has been as follows:—

To Japan, three vessels with 17,570 tons of refined petroleum and petroleum products, and seven vessels with 25,258 tons of general cargo and 14,817 tons of raw cotton.

To China, four vessels with 24,730 tons of refined petroleum.

To Australia and New Zealand, three vessels with 22,498 tons of general merchandise and two vessels with 12,701 tons of refined petroleum.

The total export to the Far East through the canal has amounted to 117,574 tons. None of the vessels carrying this cargo have returned to the canal, and no cargo has been shipped through direct from the Far East to the United States or to Europe. The following table may be taken as a summary of the traffic over the several routes:—

	Vessels.	Tons of Cargo.
Coastwise, eastbound	45	265,388
Do., westbound	50	240,969
United tSaies Pacific coast to Europe	27	201,848
Europe to United States Pacific coast	4	21,102
South America to United atates and Europe	12	150,444
United States and Europe to South America	13	63,638
United States Atlantic coast to Far East	19	117,574
Miscellaneous traffic	5	18,558
Vessels without cargo.......	27	......
Total	212	1,079,521

The National Regulating Co., New York, has been awarded the following contracts: To install a heat-regulating system at the North Toronto High School, $850; at the Givens street school, $1,850; and at Euclid Avenue School, Toronto, $11,070.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Exeter, Ont.—The town council contemplates installing an electric lighting plant. T. B. Carling, town clerk.

Montreal, Que.—Tenders will be called shortly for the heating and electrical work for the James Strachan bakery, City Hall avenue.

Peterborough, Ont. — The Canadian General Electric Co. are contemplating an expenditure of $150,000 on a plant and equipment for making electric locomotives and cars.

North Sidney, N.S.—It is announced that Thompson & Sutherland have started operations at their foundry, which was damaged by fire a few months ago.

Hamilton, Ont.—The council are contemplating building a pumping station and installing turbine pumps. A. F. Macallum is the city engineer.

Sarnia, Ont.—The city has raised $112,814 for the purchase of the Port Huron Thresher Works, which plant is on the site required by the G. T. R. for the location of their car shops at S. Port Huron.

Cobalt, Ont — The Cobalt Reduction Co. has commenced the construction of a cyanide annex to the present mill to be ready in March of next year. The plans for the new addition show a large building, 193 feet by 70 feet, with a wing to the east of 80 by 70 feet. The structure will be of steel with fireproof covering. The building is entirely separate from the main mill.

Kingston, Ont.—The application of the Gananoque Electric Light and Water Supply Co. for permission to bring power into the city from Kingston Mills for the purpose of operating the flour mills of the Kingston Milling Co. at the foot of Brock street, and also for operating the flour mill at the foot of Gore street, has been granted by the City Council. The Electric Co. is controlled by John M. Campbell, of Kingston.

Electrical

Ottawa, Ont.—The Niagara-Welland Power Co., will apply to parliament next session for an extension of time within which it may complete and put in operation its works.

Port Arthur, Ont.—A by-law will be voted on by the ratepayers on Dec. 29 to authorize the construction of a transformer station and high and low tension power lines. The cost is estimated at $44,600.

London, Ont.—Mayor C. M. R. Graham has asked Chief Engineer Gaby, of the Hydro-Electric Power Commission of Ontario, to appraise the holdings of the London Street Railway Co., which has offered to sell out to the city. No by-law will be submitted at the coming municipal elections.

Brockville, Ont.—In connection with the electric power installation here by the Hydro-Electric Commission of Ontario, the announcement is made that the Commission will begin construction at once upon an auxiliary power house, adjoining the main power house of the electric light plant. The building will cost in the neighborhood of $4,000, and will be 20 x 39 feet. It will house the transformers for stepping down the voltage of 26,400 of the new power line now under construction from Prescott to the town voltage of 2,200.

Municipal

Leamington, Ont.—The town is in the market for a quantity of cast iron pipe. John A. Baird, engineer.

Hull, Que.—A by-law will be voted on by the ratepayers to authorize extensions to the water distribution system to cost $100,000.

Port Dalhousie, Ont.—A by-law will be submitted to the ratepayers on January 4, to authorize the raising of $50,000 for the installation of a waterworks system.

Peterborough, Ont.—At a special meeting of the Utilities Commission the secretary was instructed to write William Kennedy, Jr., of Montreal, asking him to advise as to the installation of an auxiliary pumping plant.

Toronto, Ont.—Works Commissioner Harris presented a report on the tenders for the construction of the Don section of the Bloor street viaduct to the Board of Control on Dec. 9, and recommended that the contract be awarded to Quinlan & Robertson, of Montreal, for a steel structure, to cost $947,076.01. The Board concurred in his recommendations which were later passed by the council.

Ottawa, Ont.—The Board of Control decided recently to adopt the recommendation of Engineer Haycock and Fire Chief Graham with respect to the purchase of new fire engines. The board also adopted the recommendation of the fire chief as to the purchase of 4,000 feet of fire hose.

Tenders

Toronto, Ont.—The date for receiving tenders for the supply of 567 feet of 48-in. and 400 feet of 66-in. cast iron pipe has been extended to Tuesday, December 22, 1914.

Toronto, Ont.—Tenders will be received by the chairman of the Board of Control up to Tuesday, December 22nd, 1914, for the supply of 567 feet of 48-in. and 400 feet of 66-in. steel pipe. Specifications may be seen and forms of tender obtained at the office of the Commissioner of Works, Toronto.

Toronto, Ont.—Tenders will be received by the chairman of the Board of Control, City Hall, up to Tuesday, December 22nd, 1914, for supply and installation of one or more 20-million gallon centrifugal pumps. Specifications and tender forms may be obtained upon application at the accounting and purchasing section of the department of works, Room 12, City Hall, Toronto.

Ottawa, Ont.—Sealed tenders will be received at the office of the Commissioner of the Transcontinental Railway, at Ottawa, Ont., until Jan. 4, 1914, for the furnishing and erection complete, in accordance with the sketches and specifications of the commissioner, of one or more, or all of the traveling cranes, as listed in the specifications, which are to be erected in the locomotive and carshops plant of the National Transcontinental Railway at Quebec, P.Q. Sketches may be seen and form of tender and specifications obtained at the office of W. J. Press, mechanical engineer, Ottawa, Ont.

Ottawa, Ont.—Tenders will be received up to Friday, January 8, 1915, for the undermentioned metal and miscellaneous supplies for delivery to H. M. C. Dockyards at Halifax, N.S., and Esquimalt, B.C. Metals.—Steel angles, bars, sheets and plates; iron bars; babbit metal, tin.

antimony and aluminum; brass bars, sheets and tubes; lead sheet; solder and spelter; zinc plates; wire rope. Miscellaneous:—paints, dry and mixed; white lead, red lead, zinc oxide, iron oxide, marine dryers, enamel, varnish, putty, cleansing powder; soap, hard, soft and castile; tallow, brooms and brushes, polishing paste, squeegees, rubber sheet packing, etc.; cotton waste. Forms of tender and full information may be obtained by application to the undersigned or to the Naval Store Officers at H. M. C. Dockyard at Halifax, N.S., and Esquimalt, B.C. In making application for forms the particular item or items for which forms are required should be clearly stated. G. J. Desbarats, Deputy Minister of the Naval Service.

General Industrial

Brantford, Ont.—The Brantford Scale Co. will erect a new factory. Plans have been prepared.

Kincardine, Ont.—A proposition submitted by Mayor Mitchell regarding the establishment in Kincardine of a factory for the manufacture of woolen articles, is now in the hands of committees of the Board of Trade. Mr. Mitchell desires a loan from the corporation of $15,000, with other concessions, to supplement an investment of a smilar amount.

Wood-Working

Falkenburg, Ont.—Arthur Moore's sawmill has been destroyed by fire.

Revelstoke, B.C.—The Forest Mills Co., Ltd., planing mill has been destroyed by fire.

Edmonton, Alta.—The Alberta & Great Waterways Railways Co. are erecting a large lumber mill.

New Incorporations

The Little Sturgeon River Timber Slide Co. has increased their capital from $15,000 to $18,000, as well as extending the existence of the company for a further term of fifteen years from Dec. 14, 1914.

Societe de Construction des Maisons Ouvrieres, Ltd., has been incorporated at Ottawa, Ont., with a capital of $50,000 to carry on the business of contractors at Montreal, Que. Incorporators: J. A. Marcel Marin, Chas. Desmarais and David Deschamps, all of Montreal, Que.

Harris Lithographing Co., Ltd., has been incorporated at Ottawa, Ont., with a capital of $300,000 to carry on a wholesale and retail business in stationery and stationers' supplies, at Toronto, Ont. Incorporators: S. Harris, H. Harris and H. Currie, all of Toronto, Ont.

Port Lobos Petroleum Co., Ltd., has been incorporated at Ottawa, Ont., with a capital of $30,000,000 to engage in the business of manufacturing and refining petroleum and the by-products at Montreal, Que. Incorporators: C. G. Ogden, H. C. G. Mariotti and J. A. Perodeau, all of Montreal, Que.

Canadian Cartridge Co., Ltd., has been incorporated at Toronto, Ont., with a capital of $100,000 to manufacture cartridges and allied products, at Toronto, Ont. Incorporators: R. H. Parmenter, A. J. Thomson and W. S. Morlock, all of Toronto, Ont.

International Lime Co., Ltd., has been incorporated at Ottawa, Ontario, with a capital of $200,000, to manufacture lime and plaster, at Montreal, Que. Incorporators: W. K. McKeown, H. Lacerta and E. A. Barnard, all of Montreal, Que.

WORTH EMULATING.

The A. B. See Electric Elevator Co. of Canada, Ltd., are taking advantage of the dull days to completely equip a large factory in the city of Montreal, where in future they will manufacture everything in connection with their elevators. The orders for machinery will be placed at an early date.

The Walkerville Roofing Mfg. Co., Ltd., has been incorporated at Ottawa with a capital of $60,000 to manufacture roofing materials at Walkerville, Ont. Incorporators: L. H. Cheeseman, C. J. Cheeseman and J. T. Sullivan, all of Walkerville.

Building Notes

Bassano, Alta.—M. C. Lockrider is the general contractor for the new Government building which will cost $25,000.

Guelph, Ont.—During the month of November the value of Guelph building permits amounted to $14,325. as compared with $8,911 for the same period last year.

Toronto, Ont.—Anderson & McBeth, Ltd., have received a building permit from the City Architect's Department for the erection of a five-storey warehouse on the north side of King Street, near John Street. The new structure will be of mill construction and cost $50,000.

Toronto, Ont.—The Board of Education have approved of plans for the proposed Administration Building to be erected on College street. The building will cost about $100,000, and will be

Railways--Bridges

Hamilton, Ont.—A report has been prepared by the Westinghouse, Church, Kerr Co., relative to track elevation and depression. The report was submitted to the Dominion Railway Commissioners by the T. H. & B.

Toronto, Ont.—A new bridge at Moore ave., over the old Belt Line of the G. T. R., was again ordered by the Dominion Railway Board last Friday, provided the city can prove to the Railway Board's engineer that the present bridge, which has recently been reconstructed, is weak.

Moose Jaw, Sask.—The Railway Commission has granted the Western Officials of the G. T. P. ten days to ascertain from the head office at Montreal what is proposed to be done in regard to construction of a terminal here and to hand in a written reply on the matter.

Hamilton, Ont.—City Engineer Macallum, Mayor Allan, Controller Cooper and others condemned the bridge erected by the T. H. & B. at the intersection of the tracks of its Toronto branch and West King street as being totally inadequate to meet the heavy demands that traffic of recent years has made on it. A bridge with a superstructure of steel was asked for to replace the present one. The board's engineer will report.

Contracts Awarded

Ottawa, Ont.—B. H. Baldwin was recently awarded a contract for elevator machinery at the Isolation hospital.

The Pease Foundry Co., Toronto, has been awarded a contract for the installation of a $6,995 heating system in the North Toronto High School.

Southend, Ont.—The contract to supply 100 water connections for Stamford Township has been awarded to the Canadian Brass Goods Co., Galt, at $4.74 each.

Ottawa, Ont.—The contract for an electrically-operated vacuum pump for the waterworks department has been awarded to the Canadian Allis-Chalmers Ltd., Toronto, the price being $595.

Safety First as Applied to Overhead Travelling Cranes *

By H. F. W. Arnold

The purpose of this paper as will be noted is not so much to consider the detailed design of a traveling crane as to direct attention to those fundamental matters relating to design and operation which tend to lesson the possibility of accidents.

IT is well for us to realize that in considering this subject of Safety as Applied to Traveling Cranes that we have to deal with a force which is always on the alert, never napping, but ever ready to take advantage of man's carelessness and inattention. The force of gravity is no respecter of persons; its laws are carried out swiftly and surely, and the unsupported object returns to earth in a manner that is quite sure to spell disaster, in case it is connected in any way with a traveling crane.

Employees working beneath a crane are perfectly justified in assuming that all necessary provisions have been made to ensure their safety, for under proper conditions, the traveling crane is a safe and reliable medium for transferring material from one part of the shop to another with smoothness and despatch. However, serious accidents are only too frequently due, to the breakage of defective parts, poor and inadequate equipment, negligence or carelessness on the part of the crane operators, or those who attach the chains or sling to the object to be moved. The greater bulk of these accidents may be avoided by the exercise of a reasonable amount of care and foresight and an appreciation of the dangerous features by the builder, the owner, and the operator.

After a crane is once installed, it becomes a fixed part of the equipment of the factory or building, and remains in service for a long term of years. Even if it is deficient in the essentials of satisfactory service, it will nevertheless be continued in use, as a rule, for a considerable time, a source of danger, inefficiency and expense. Of course, a poorly arranged installation can be improved to a certain extent by eliminating, where possible, its hazardous features and providing the safety devices which should have been incorporated with the crane when it was built. In new equipment there is no excuse for not writing the specifications in such a manner that the defects of the past will be avoided, and apparatus secured, that is safe, serviceable and durable.

*From the transactions of the Ohio Society of Engineers.

Tracks and Runways.

It is usually safe to assume that the runways and tracks were designed by a competent engineer, and consequently are of safe proportions. However, it is necessary to see that the rails and rail fastenings are maintained in good condition. The nuts on the bolts or clips holding the track to the runway frequently work loose, due to vibration. They should be supplied with efficient lock-washers and kept tight at all times. Effective rail stops should be provided to eliminate the chance of derailment from over-running.

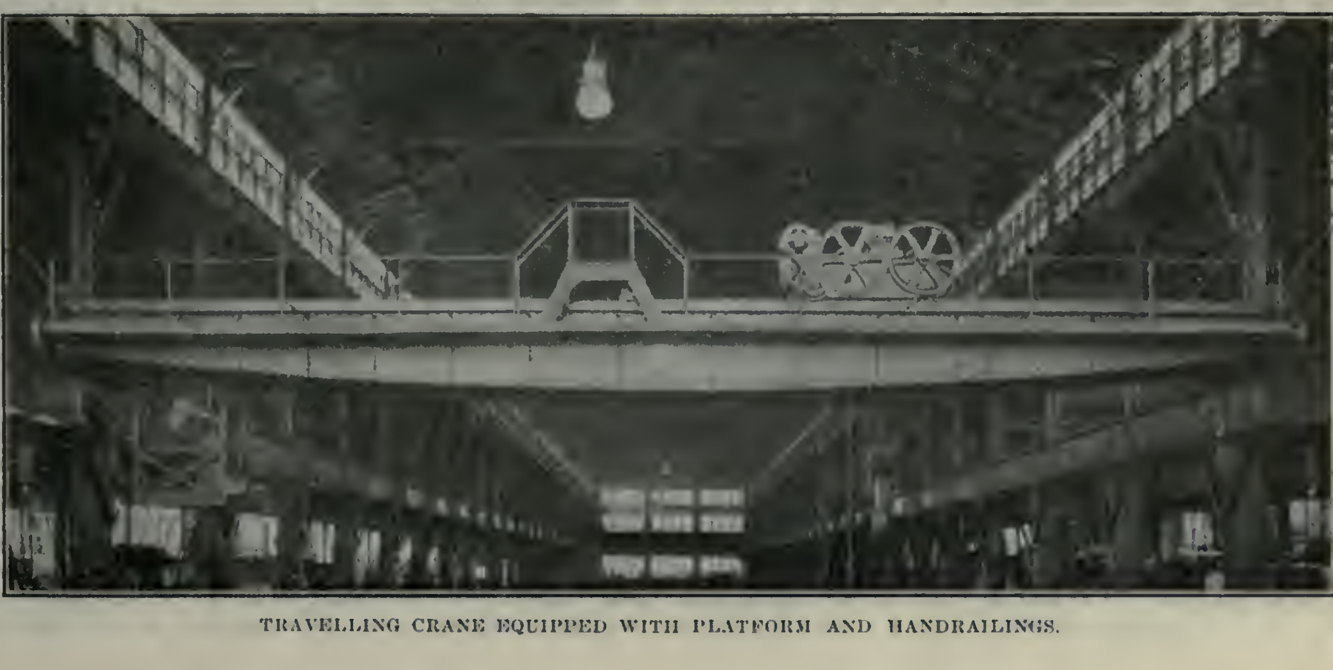
The Bridge.

The bridge and end trucks should be designed to have sufficient strength to provide against severe strains from sudden starting and stopping, and should show very little vertical or lateral deflection in service. The end trucks should be connected to the girders with turned bolts in reamed holes. The driving gears and pinions should be properly guarded. Each girder should be equipped with a platform with substantial metal handrailings, extending the entire length of the bridge, and these platforms should be provided with skirting boards to prevent objects from being knocked off and falling on the heads of those below. It is not a difficult matter to apply the above described platforms to cranes which are already in service without them.

The accompanying illustration shows one of the cranes at the plant of the Jeffrey Mfg. Co., which was equipped in this manner. The raised platform at the centre is for the purpose of trimming or adjusting the high lamps, the latter operation being an exceedingly dangerous one if the trimmer is obliged to stand on a greasy crane bridge without safety guards of some sort. The danger element is practically eliminated in the case illustrated. Guards should be provided extending ahead of the truck wheels, the purpose being to warn a thoughtless person, who may be resting his hand or arm on the track or runway, of the approach of the crane, which he may fail to notice because of other noises .

The Trolley.

It is not advisable to use cast iron in the construction of the trolley, which



TRAVELLING CRANE EQUIPPED WITH PLATFORM AND HANDRAILINGS.

should be of the enclosed type with no overhanging gears. All gears, including the drum gears and traverse drive, should be enclosed in oil-tight cast iron cases, which render personal injury practically impossible and at the same time exclude all dust and grit, and enable the gears to operate in a bath of oil or soft grease. All gear-cases should be provided with large covers that can be easily and quickly removed for the purpose of inspection. The parting lines of the gear cases should be so placed that oil cannot leak out and spoil the clothes and temper of the men below.

Old equipment which is not of the enclosed type should have wire nets provided beneath all gears or other parts which might fall and inflict injury in case of breakage or parts working loose. If continuous platforms are provided on each girder, they will take care of the overhanging parts. The trolley should be completely floored to prevent loose parts or tools from falling. The rail stops for the trolley should not be overlooked when the systematic inspections are made.

Load Brake.

No part of the electric crane exceeds in importance the load brake. It should be so designed as to insure safety and efficiency in handling the load, and should be exceptionally accessible for inspection and adjustment.

Electric Motor Brake.

The electric motor brake should be capable of holding the full load independently of the load brake, although its chief function is to bring the hoisting motor promptly to rest and prevent drifting when the current is shut off. Its efficient operation is extremely important on close work, and in connection with the safety limit switch.

Bridge Foot Brake.

The bridge foot brake should be powerful and effective, and should be kept in working order at all times. In the case of old equipment, the foot brake is often allowed to become more ornamental than useful.

Automatic Limit Switch.

Many accidents have come under the writer's notice due to the fact that the automatic limit switch was not in working order, or was not set to operate at the proper limit. This part of the crane should be tested at least daily, and maintained in good working order. In setting the limit switch, proper allowance must be made for the distance the block will drift while the motor is coming to rest after the current is shut off.

Operator's Cage.

Care should be taken to provide a safe means of enabling the operator to enter and leave the cage. It should be provided with a continuous skirting board or guard at least six inches high from the floor to prevent tools or other objects from being knocked out, and injuring those below. A suitable switchboard should be provided with a main switch, circuit-breaker, and enclosed fuses for the individual motors.

A pilot lamp should be located in the cage, within the operator's vision, to enable him to detect any interruption of the current. He should be provided with a danger sign to hang on the main switch while he is working on the crane with the current shut off. The cage should be so located as not to interefere in any way with hoisting when the trolley is at the extreme end of travel.

Controllers.

The controllers are an exceedingly important part of the crane or hoist, and should receive frequent inspection and attention. Powerful blow-out magnets should be provided on direct current controllers, capable of promptly disrupting the arc formed when the circuit is open. In order to promote smooth and safe working, all burned contacts should be promptly repaired or replaced, as otherwise, sticking of the controller might occur at a critical time and the results be extremely disastrous.

Cables.

The superiority of wire rope over chain has been too thoroughly established to admit of any uncertainty, providing rope of a proper quality and size is used in connection with drums and sheaves of a suitable size. Special flexible crane rope should always be used. It is false economy to use a cheaper construction. In choosing the size of cable, a factor of safety of not less than eight should be used, as sudden stops and starts, and careless taking up of slack, subject the cable to a very great tensile strain. Provision for equalizing the stress among all the ropes should always be provided. At least two full turns of the cable should be on the drum when the hook is at the extreme lower limit of the travel.

Great care should be taken to have the grooves and drums of the sheaves perfectly smooth and of the proper size to fit the cables, being neither too large nor too small. When the cable is subjected to the proper working conditions, the wires comprising the strands will wear nearly half through before they fracture. If, on the contrary, the wires break square off before wear has taken place to any extent, and the cable has been in service but a short time, the working conditions are improper. The fault should be corrected, and the defective cable replaced by a new one immediately. The breaking of the wires in this way is often due to the ropes being bent around sheaves of too small diameter, or to the grooves of the sheaves being too narrow, causing the rope to be cramped or too wide, so that the rope flattens out. Drums and sheaves should have a diameter equal to at least thirty times that of the cable.

It is not necessary to replace a cable having only a few broken wires in a single strand, although it should be watched closely and discarded just as soon as several wires in adjacent strands are broken. Whenever there is any doubt or question, it is better to be on the safe side. In addition to lessening the cable's strength, the broken wires may separate out and become a menace to persons or property.

If small pieces of broken wire appear in the lay of the rope, it is an indication that the inside wires are breaking. In a case of this kind, the cable should be replaced at once, as it is impossible to determine how many of the wires are broken. Consequently it is extremely dangerous to continue to use the cable. It is just as important to lubricate wire ropes as any other rubbing surfaces. Several good rope dressings are on the market, or a mixture of heavy cylinder oil and graphite may be used with good results.

Clevises and clips should fit the rope perfectly. Sharp bends in wire ropes are very dangerous and injurious, for this reason the cable should always be bent around a thimble to make a loop. A high grade of commercial zinc should be the metal employed when using a wire rope socket. All water and moisture should be kept from wire cable as much as possible, as the deterioration due to corrosion is very rapid. It is hardly necessary to state that under no circumstances should crane cables be spliced.

Shafting.

All shafting should have the diameter uniform from end to end. Reductions in area should be avoided, as change in section with sharp re-entrant angles introduces an element of weakness. Even when the design calls for a liberal fillet, poor workmanship may defeat the purposes of same. The cracks which start at the shoulder cannot be detected, as this part of the shaft is usually in contact with the box. Set-screw holes should not be drilled in shafts, as it weakens the section, and many accidents have resulted from this practice.

Care and Maintenance.

The electrical traveling crane of today is a fairly complicated machine, and as such it should be kept in first-class operating condition by a competent mechanic possessed of at least some electrical knowledge. While this matter is a vital requirement for the safety of all concerned, it is one which receives far too little consideration, especially in the smaller plants where only one or two cranes are in service. In the larger plants, competent men are usually available. The practice of leaving such important equipment to the care of incompetent or inexperienced men cannot be too strongly condemned.

Operation.

The safe operation of the crane depends more than anything else upon the man in the operator's cage. It is a man's job, and a man should be furnished. For the safety of the hitch, a certain amount of judgment and prompt action is needed, not only when an emergency arises, but in the routine operation. In judging the weight of the load to be lifted, and the safety of the hitch, a certain amount of experience is necessary; consequently an inexperienced man should never be placed in charge of a crane until after he has been under the direction of an experienced operator long enough to become proficient. For certain classes of crane work, a high degree of skill is required, and one of the best preventives of accidents is to avoid the frequent change of operators.

An efficient method of signalling, by the use of colored electric lamps, or other means, to indicate to the operator where the lift is to be made, is exceedingly important. It promotes smooth working and does away with shouting, pounding on metal and other undesirable methods of attracting the crane operator's attention.

The speed of the different functions of a traveling crane depends so much upon the local conditions that it is impossible to give figures that will apply to all cases. However, it is believed that the figures given below should be considered as maximum and should not be exceeded. It must be borne in mind that the greater the speed, the greater the possibility of accident, and the more disastrous the results.

Maximum Speeds.

Bridge Travel .... 400 ft. per min.
Trolley Traverse .... 200 ft. per min.
Hoisting Speed ...... 50 ft. per min.

In order to assist the operator in judging the weights to be lifted, it is desirable that a table giving the weights of the more common materials be posted in a conspicuous place in the operator's cage. Table 1 gives the necessary information of this character.

TABLE I. WEIGHT OF MATERIAL.

Material.	Weight in Pounds per cubic foot.	—Shafting— Diameter in inches.	Weight in Pounds per lineal foot.
Cast iron	450	6	95
Steel	489	8	169
Lead	709	10	264
Oak	59	12	368
Concrete	155	14	676

Inspection.

Systematic inspection at regular intervals has long been recognized as indispensable to the safe operation of traveling cranes. For the ordinary factory crane, a daily inspection of the chief mechanical and electrical features is advisable. It is a good rule to have the inspections made by a man who does not do the actual work of repairing. Without question, a great many potential accidents will be prevented by the conscientious inspector.

Chains and Slings.

Chains and slings should be kept in first-class condition. Cable slings are much preferable to chains, as they give warning before breaking. Chains that are in constant use should be annealed every six months, the date of annealing being stamped with stencils upon the book or ring. It should be impressed upon all concerned that when a Manila rope sling becomes old or worn, it cannot be expected to be as strong as when new. The writer has found it a good rule to instruct the crane operator never to make a lift when a hitch is improperly made or when the load is in excess of the safe limit of a chain or sling.

TABLE II. SAFE LOADS IN TONS FOR ROPES, CHAINS AND CABLES.

—Manila Rope—				—Chains—				—Wire Cable—			
Diam. Rope, Ins.	Single Rope, Tons.	Two Part, Tons.	Four Part, Tons.	Diam. Link Stock, Ins.	Single Chain, Tons.	Two Part, Tons.	Four Part, Tons.	Cable Diam. Ins.	Single Cable, Tons.	Two Part, Tons.	Four Part. Tons.
½	⅛	¼	½	¼	½	⅞	1½	½	1	2	3½
⅝	¼	½	¾	⅜	1	1¾	3	⅝	1¾	3¼	6½
¾	⅜	¾	1¼	½	2	3½	6	¾	2½	4½	9
⅞	½	1	2	⅝	3	5	9	⅞	3¼	6	12
1	¾	1½	2½	¾	5	9	15	1	4	8	16
1¼	1	2	3	⅞	6	10½	18	1¼	6	12	24
1½	1¼	2½	4	1	8	14	24	1½	10	19	36
1¾	2	4	6	1⅛	11	19	33	1¾	13	25	48
2	2½	5	8	1¼	13	23	39	2	16	32	60

THE ZEPPELIN PASSENGER AIRSHIP.

WE fear that the Zeppelin has still far to travel along the path of progress before Lloyd's will be prepared to class her 100 A1, or the Board of Trade grant her a passenger certificate. However, they do these things differently in the Fatherland, from whence it is reported that, during her one and only season, the Zeppelin passenger airship Sachsen made 170 voyages, and carried 3,983 passengers, who paid fares varying from $25 to $50 each, inclusive, no doubt, of life insurance. As the total time afloat is given at 327½ hours—say, 1 hour and 54 minutes per voyage, or less than 9½ miles per voyage, the passengers paid pretty heavily for their little joy rides.

The Sachsen was the seventeenth airship built at Frederickshaven and was 465 ft. 9 in. long, 48 ft. 10 in. in diameter, with a capacity of 695,410 cubic ft. The eighteen gas cells in the balloon, separated by aluminum partitions, were so arranged that one or more cells may be completely empty without compelling the descent of the vessel. The skeleton is covered with impregnated cotton material to reduce air resistance and the effect of the sun's rays, while making the whole fabric waterproof. Below the balloon as suspended the two machine gondolas, and the passenger cabin is between them.

Operating Equipment

One 185 h.p. Maynach motor is placed in the fore and two si,milar motors are placed in the aft gondola. Steering, ballast, and valve controls are assembled in the front gondola, from which the vessel is navigated. The fore motor drives a twin-blade propeller at 530 revolutions per minute, while the stern motors each drive a four-blade propeller at the same speed. The elevating and steering rudders are mounted in a common framework at the stern of the ship. Six vertical rudders enable the vessel to be turned on a radius of 350 mm. Large horizontal fins extending above the rudder frame reduce any tendency to rolling to a minimum.

A new feature is the addition of supplementary stabilizing surfaces, extending from the hull through the propeller frames at about 45 degs. to the horizontal, these frames being designed to prevent the formation of eddy currents by the propellers. The multiplication of the driving and controlling equipments makes it possible to proceed after any breakdown at all likely to occur to any component part of the equipment. Two motors drive the vessel at 41 miles per hour, and three motors drive it at 46 miles per hour (in still air).

The gross lifting power of the Sachsen is 23 tons at sea-level, and the net or effective lifting power about 6 tons, according to altitude and temperature. The lifting power is reduced about 440 lb. per 262 ft. of altitude, and about 176 lb. per 1 deg. C. rise in atmospheric temperature. From 2,640 to 3,300 lb. of oil and petrol are generally carried; this suffices for ten or twelve hours cruising under full power, or fifteen to twenty hours' cruising with two motors working. The distances traversed through the air are about 500 miles to 625 miles, respectively but, acording to the direction of the wind the distance travelled with regard to land or sea varies from 250 miles to 920 miles. A crew of nine is divided between the fore and aft machine rooms. The central cabin accommodates twenty-five persons and is luxuriously padded. A wireless equipment is carried.—Page's Weekly.

Relative to Cam Grinding and Cam Grinding Equipment--II.

By Howard W. Dunbar.

The purpose of this series of articles is to describe as clearly as possible the methods employed by the Norton Grinding Co., Worcester, Mass., in the production of the master cams which are used for cam grinding. There are doubtless many of our readers whose knowledge of the subject will be materially increased thereby. For the text and cuts we are indebted to the Norton Co.

IN cams having a broad tip as in Fig. 10, the procedure is a little different. Let us assume that the following dimensions are known: R—the concentric portion of the cam, F—the lift, G—the radii on the corners of the tip, and tho distance between these centres,

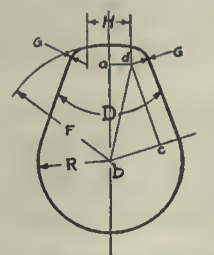


FIGURE 10.

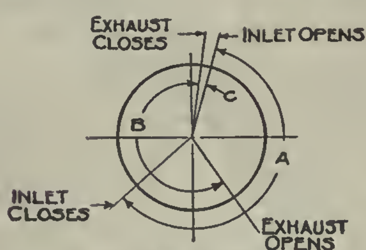
H. From this right angle triangles (a-b-d) and (d-b-c) can be constructed. In (a-b-d), sides (a-d) and (b-d) are known, therefore the sine of angle (a-b-d) equals (a-d) divided by (b-d). Similarly, sine of angle (b-d-c) equals (b-c) divided by (d-b), and two times angle (b-d-c) minus two times angle (a-b-d) equals the included angle between the sides of the cam, or D; i.e.,

$$\text{Sin angle abd} = \frac{ad}{bd}$$

$$\text{Sin angle bdc} = \frac{bc}{db}$$

$$2\times\text{angle bdc} - 2\times\text{angle abd} = \text{angle D.}$$

We next compare the fly-wheel diagram with the results obtained from the cams as follows, referring to Fig. 11. A equals degrees fly-wheel moves while in-



FLYWHEEL DIAGRAM.

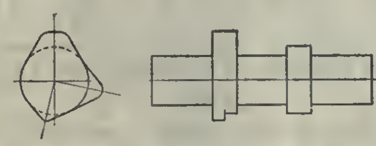
FIGURE 11.

let is open and should equal twice the opening angle of the inlet cam. B equals number of degrees fly-wheel moves while exhaust is open, and should equal twice the opening angle of the exhaust cam. The angle from the centre of inlet cam to the centre of the exhaust cam on the cam shaft must equal one-half of angle A, plus one-half of angle B, plus C, divided by two,

$$\text{i.e., } \frac{\frac{1}{2}A+\frac{1}{2}B+C}{2}$$

It is by these methods that many of the inconsistencies in the information furnished for the production of master cams are discovered. It is generally found that the angle from the centre of intake to the centre of exhaust is correct. This is a known factor with the customer, and seldom causes any trouble. It is often found, however, that the opening angle on the cam does not agree with the opening and closing points from the fly-wheel diagram.

There are many other things which affect the opening angle and which are not given careful consideration. The radius of the tip of the cam can change the opening and closing point, and this radius must be correct to permit of the



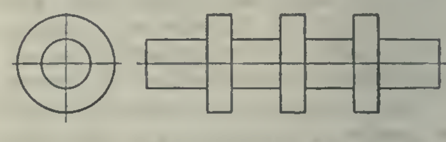
METHOD OF MAKING MODEL AUX. CAM WHEN IT IS A PART OF EXHAUST CAM.

FIGURE 12.

other information being consistent. There can be but one figure for any given cam on the radius of the tip of the cam, and it is not for the draftsman to say that "we will make that radius the nearest even fraction." If this be done trouble will result. The same is true of the clearance for any one given cam, for there is but one figure which will answer the clearance for that cam, and this must be correct.

We are often asked to produce master cams for cam shaft, where the type of lifter or push-rod is not known. Many times a roll type push-rod is used, the diameter of the roll is not given, and this omits information which we must have in order to figure our cams, as illustrated by Fig. 2. Frequently cams with re-entrant curves of less than 9 in. are called for, and in but one exception, viz., where we can use the No. 1 Loose Cam Grinding Attachment on a 6-in. machine, can we grind a re-entrant curve of less than 9 in. The point of contact and the tangential point are often confused. These two points can never be the same if there is any clearance allowed. If there is no clearance, then the point of contact and the tangential point lie at the same place.

It is generally customary in making up model cams that the exhaust and inlet are formed on the same shaft and bear the proper relationship to each other as determined by the cam shaft to



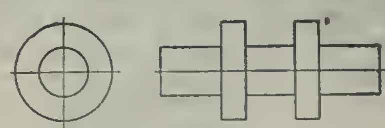
MODEL CAM BLANK WHEN THERE IS AN ECCENTRIC CAM.

FIGURE 13.

be produced. This applies also in cases where auxiliary or eccentric cams are used. As an auxiliary cam is generally associated with an exhaust or inlet cam, combine it on the model with the cam to which it is associated as shown in Fig. 12. If there perchance be a pump eccentric to be ground we allow an extra blank on the model cam shaft (Fig 13), which is formed to the required shape.

The blank from which the model cam is made consists of a cylindrical shaft about 1 in. in diameter, having two or more concentric portions on it about 1 in. apart, as illustrated in Fig. 14. These model cam blanks are formed into the proper shapes having the exact relative location to each other as indicated by the customer's drawings. The finished model cam is illustrated in Fig. 15.

By means of ingenious fixtures and attachments it is now possible to produce model cams by the process of grinding to extremely accurate surfaces. Formerly



MODEL CAM BLANK

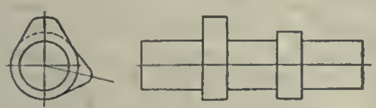
FIGURE 14

it was necessary to finish these largely by hand and with a "cut and try" method.

Testing Model Cams.

When completed and during the process of making, the model cams are carefully tested to insure that we are approaching the requirements. To accomplish this, a testing fixture is used as illustrated in Fig. 17. In this photograph it will be noticed that a cam shaft is in position being tested. The procedure, however, in testing model cams is identical with that of the cam shaft, and is as follows:

To test a cam shaft or model cam, the type of lifter to be used should be properly placed in the plunger at A. If a roll type, the diameter of the roll should



COMPLETED MODEL CAMS.
FIGURE 15.

correspond exactly with the one to be used in the engine. With this roll B resting on the concentric portion of the cam, the indicator is set to read the amount of clearance as shown in Fig. 16. The amount that the pointer rests off of the zero mark is equal to the clearance allowed. The cam is now rotated so that the roll mounts the side until the indicator C reaches zero. This is the opening point.

The graduated wheel E is movable but is arranged so that it can be brought to the desired position and fixed. With the cam shaft and pointed D in a position that will allow the indicator C to point to zero, move the graduated wheel E until zero comes under the pointer D. Now rotate the cam (which will also rotate the pointer) in the direction which will allow the roller B to ride over the concentric portion of the cam again, until it mounts the other side of the cam. When the indicator C again reaches zero, the closing point has been reached. At this point by reading on the graduated wheel the

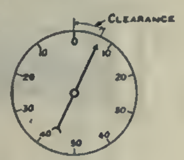


FIGURE 16.

number of degrees the pointer has passed over, and subtracting this from 360 degrees, we obtain accurately the angle of rotation of the cam while the valve is being held open, or in other words the opening angle of the cam.

This testing machine has been a big factor in the successful grinding of cams, and it has helped us to many discoveries in connection with this work. In particular it has revealed the fact that many times the customer's information would not produce the desired result. If such errors exist they are at once detected, and we immediately take the matter up with the customer.

In the design of this testing machine, we have bent every effort to make its construction and use as simple as possible, so that there can be no question in the minds of either our operators or our customers as to the results which we obtain. The machine is rigid in its construction so that no error is introduced from such a source. The large dial wheel reads direct in degrees with the divisions far enough apart to approximate quarter degrees. We purposely avoid micrometer means of determining fractional parts of degrees, as being confusing to the operator and unnecessary in actual practice.

The amount of lift of cam is checked by the simple method of measuring with a micrometer—first the diameter of the concentric portion, and second the distance from the concentric portion to the highest point of the tip. Then by subtracting the first from the second the lift will be determined. The great advantage of this inspecting and testing of cams is that it puts an end to all disputes as to the accuracy of the work which we have produced.

In succeeding issues, the author will treat of the production of master cams and the grinding operations on cams and cam shafts.

FIG. 17. CAM-TESTING FIXTURE.

HARDENING HIGH-SPEED STEEL.*

By G. W. McKee.

THE process of hardening high-speed steel consists briefly in heating slowly to about 1,300 deg. F., then rapidly up to white heat and cooling it in air or oil. The method employed in hardening depends on the character of the work. For instance, lathe and planer tools for roughing cuts in hard stock require to be heated to the highest possible temperatures. If the cutting edge is destroyed or scale is formed on the tool it does not matter as it can readily be renewed by grinding. This is, however, not the case with milling cutters, dies and like tools where the cutting edge must be carefully preserved and scale avoided. The methods of employing this treatment vary greatly in different establishments, but the treatment is essentially alike for all brands of first-class high-speed steel, and is now invariably followed.

It is generally believed that the higher the heat the better the tool. As a matter of fact, it is true that the higher the hardening heat the greater the possible cutting speed. On the other hand, the maintenance of the finish, size, the absence of scale, the preservation of the cutting edges and increasing the toughness of the tool is often infinitely more important than an increase in the possible cutting speed. It has repeatedly been shown that the fitness of a high-speed tool does not usually depend on extreme hardness, but on "red hardness." In fact, extreme hardness is very often undesirable, inasmuch as it is often accompanied by brittleness and liability to breakage. It is a common error among users of high-speed steel to suppose that a tool is not properly hardened if it can be touched by a file. It has been shown that a high-speed tool that a file will not only touch, but will take hold of is superior for many purposes. The file test is consequently of little value.

Proper hardening temperatures for different classes of high-speed tools are:

(1)—Maximum temperature obtainable without melting, slightly less than 2,250 deg. F; turning, planing, slotting and boring tools for roughing and medium cuts.

*From a paper before the Nat. Com. Gas Association, New York.

(2)—2,375 deg. F. to 2,450 deg F.; milling cutters for heavy roughing.

(3)—2,100 deg. F. to 2,300 deg. F.; forming cutters, milling cutters for light and finishing cuts, screw machine tools, and tools for brass and wood working.

(4)—2,150 deg. F. to 2.200 deg. F.; twist drills, flat drills, reamers, threading dies and taps, and tools subjected to severe tortional strains.

(5)—1,750 deg. F. to 1,900 deg. F.; shear blades, punches and punch dies, stamping and forming dies, and tools subject to repeated jars. Light punches, dies and file cutting chisels should be given the lower heat.

The following appliances have been used for hardening high-speed steel:

(1)—Forges or open combustion chamber furnaces.

(2)—Lead bath.

(3)—Barium bath.

(4)—Oven and semi-muffle furnaces.

(5)—Muffle furnaces.

Electrical methods: (a)—By potassium carbonate method. (b)—by arc method. (c)—Between points of spot welder. (d)—Electrical muffle furnace. (e)—Electrical carbon resister furnace. (f)—Electrical barium chloride bath.

Forges with Horizontal Combustion Chambers.

Furnaces of this class are suitable for hardening tools mentioned above that require hardening temperature of 2,400 deg. F.—namely: turning, slotting, boring, and planing tools for roughing or medium cuts. The burners enter at a tangent to the combustion chamber, consequently a tool can be inserted into the clear space in the centre and heated evenly by radiant heat without risk of burning in the direct flame. Temperatures up to 3,000 deg F. can readily be obtained.

In all furnaces of circular cross section, the products of combustion will escape from the end having the largest opening. In a common type furnace, the largest opening is 3 in. in diameter, consequently, the opening in the other end can be made up to 2 in. by 1½ in. and the operator can work without the annoyance of the products of combustion escaping in his face, and without unnecessary exposure to radiation from the intensely heated interior. The largest high-speed tools in common use for lathe and planer work will pass readily through the 2-in. by 1½-in. opening. If the furnace is so placed that the operator can readily get at both ends, the progress of heating can be observed through the larger opening, while the tool may be left resting on the hearth.

If the centrifugal action of the products of combustion draws air in alongside of the tool, this should be prevented by closing the space around the tool as much as possible. The linings are made of fire brick capable of rapid expansion and contraction, and at the same time are sufficiently refractory. The necessary temperature can be secured in 25 minutes with gas consumption 50 to 250 feet per hour.

The Lead Bath.

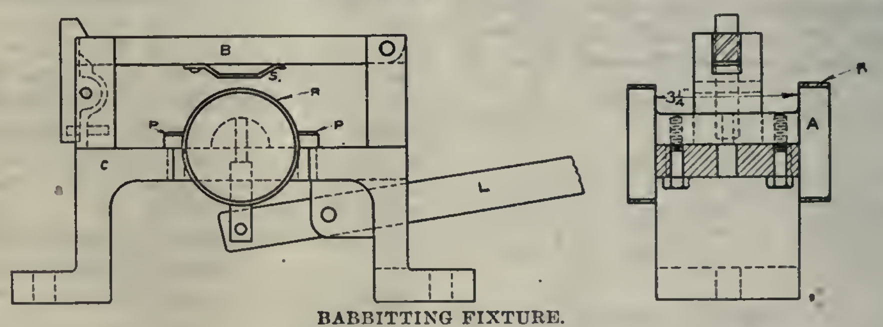
The lead bath can be used in hardening those high-speed tools which should be treated at temperatures of 1,700 deg. F. to 1,900 deg. F. It can be used at higher temperatures and is commonly used in the manufacture of high-speed twist drills. The successful manipulation of a lead bath at such high temperatures requires close attention. In the first place, a special grade of lead is necessary. Electrolytic lead is now obtainable at a slight advance on market prices for lead of the ordinary quality. The surface of the lead should be covered with a deep layer of fine charcoal. This prevents oxidation and also serves as a heat insulator and to a great extent prevents evaporation.

In operating with steel containers, it is absolutely necessary that a direct jet of flame does not impinge on the container, and it is equally important that a slightly reducing flame is used. When the furnace is cooling off, all openings should be closed to prevent currents of air through the combustion chamber, or the entire furnace can be protected by lowering an asbestos lined cover over it.

A BABBITTING FIXTURE.

By A. S. Mann.

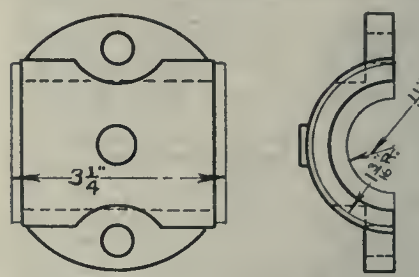
THE accompanying drawing shows the main bearing cap for a 1½ horse-power gasoline engine together with the fixture for babbitting same. These caps had



BABBITTING FIXTURE.

the holes cored for the studs, and holes for retaining the babbitt in place were also cast-in, so that the caps were ready for use as they came from the foundry. The caps were, however, disk ground, both on the face and on the sides, holding merely by hand, thus serving to take off any small lumps which might prevent them from resting evenly on the fixture.

As each of the two caps were similar, it was decided to babbitt these separate from the bed, thus making them interchangeable. The main casting C is raised off the bench about four inches (that is the portion on which the cap is placed) with a post at either end to carry the cross-bar which with the spring S holds the cap in place. The bar B is hinged at one end and held at the other by means of a latch. The arbor A is turned with a shoulder at either end as large as called for by the babbitt at the sides of the cap. Between the shoulders the arbor is turned 1⅜", a little more



BABBITTING FIXTURE.

than half of which is planed away, enabling the arbor to sit down on the main casting as shown in the end view. The two pins P, P, serve to locate the cap in position after which the spring rings R, R, which are slipped over the ends of the arbor are slid up against the cap, making a tight joint against the ground face and doing away with the necessity of using any clay or putty to prevent the babbitt from running out. A hole is drilled in the top of the tap at one side for pouring. Notches are cut into the base casting corresponding to the circle of the arbor at the large end, which permits the spring rings to slide in as far as necessary.

To remove the caps as expeditiously as possible, the lever L is used which pushes up the pin in the centre of the bearing. After being once relieved, these caps come off quite readily, as a slight draft is left on arbor at the ends.

The Canadian Sirocco Co., of Windsor, Ont., has appointed the following sales engineers:—A. M. Nichols, 301 McGill Building, Montreal; C. T. Morse, 43 Victoria Street, Toronto; W. P. Eddy, 301 Tribune Building, Winnipeg, S. S. Clarke, 605 2nd Street, Calgary, Alta.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

A COMBINATION FLY-WHEEL TOOL.

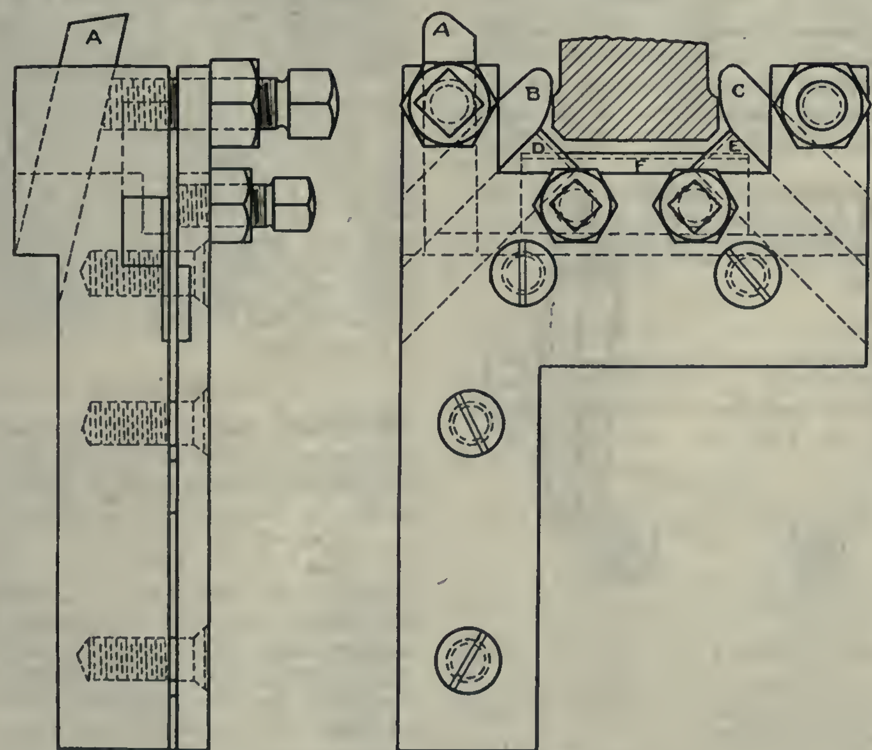
By D. O. Barrett.

THERE is practically no modern shop at the present time but what is equipped with a turret lathe for the rapid and economical reproduction of similar parts. Where a few years ago this work was laboriously performed on engine lathes with multitudinous tool changes, as well as the changing of feeds and speeds, this newest type of lathe has been provided with turrets holding a number of tools, each properly set for its particular work, which may be swung around into correct position and with quick changes of feeds and speeds. As far as feeds and speeds are concerned, however, the latest engine lathes are being provided with means of changing these as rapidly as any turret lathe.

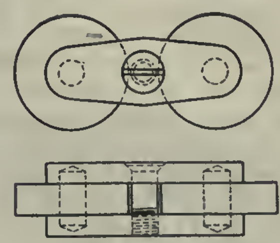
The field of the turret lathe, then, lies in its adaptability to carry a large number of tools, each set up for its particular purpose and being provided with means for quickly bringing these into their respective positions. Where a variety of tools is not required, the turret lathe has no advantage and, in fact, many of the larger automobile shops use large numbers of engine lathes, each set up for a particular job. The original investment is thus largely kept down as well as enabling less experienced and, consequently, cheaper labor to handle the work.

It will thus be seen that, to improve upon the turret lathe, either the operator must be done away with entirely, as in the automatic, or else time must be saved in the bringing up of each tool to its respective work. As an aid to the latter, we now find all the machines equipped with rapid power traverse for both the turret and saddle. However, it is still necessary to unclamp, index and re-clamp the turret for each tool change, and any means devised for eliminating any or all of these operations will result in a decrease in the time necessary for doing any particular job.

The section shown in the plan drawing represents the rim of a gas engine fly-wheel, 18 in. diameter. It will be necessary to turn and finish smoothly the outside of the rim as well as each side, and chamfer the corners. The tool was designed for the turret of the cross-slide, the tools being so arranged that no indexing was necessary whatever. The separate tools are shown in position in the top view, but in the side view they have all been removed with the exception of A, which is used for roughing off the outer circumference with as coarse a feed as is possible for the tool to stand. The cross-slide is then fed in with the power feed, tools B and C finishing the edges. As soon as these clear the inner edge, the power feed is thrown off, and further feeding done by hand, tools D and E chamfering the corners at 45 deg., and tool F taking a light shaving cut across the entire face. With this tool it was only necessary to make one revolution.



A COMBINATION FLYWHEEL TOOL.



A LIMIT GAUGE.

Tool A was held in place by the ½-in. set-screw shown. Over the main body of the forging was placed a 5-16- in. steel plate fastened therto by means of the four ⅜-in. countersunk head screws and the ½-in. screw and stud at the ends. On the set-screw holding tool A was a nut which pulled down the plate holding the tool B. The corresponding tool C was held down by the stud on the other side. Tools D and E were partially in both the forging and the plate, and were held mainly by the two countersunk screws These tools also bore down upon the tool F, which was further held by the two ⅜-in. set-screws provided with locknuts. When the whole arangement was fastened in the turret, the tools were rigidly held, and no trouble was experienced with any of them becoming loose.

The fly-wheels were held in soft V-jaws attached to the regular scroll chuck so that no truing was necessary. The hole was bored and reamed in the regular manner, one end of the hub being faced with a flat tool in one of the turret heads.

A LIMIT GAUGE.

By C. Hulin.

FOR gauging slots such as piston rings, the limit gauge shown in the drawing makes an excellent type. The two discs are held between two cross bars fastened together by means of a countersunk head cap screw. They are ground and lapped to the desired thicknesses and, as fast as any wear occurs, the discs may be turned slightly and thus bring new surfaces into use. To readily distinguish between the under and oversize disc, the larger is knurled on the edge. The sizes are stamped on the cross bars on each side directly over the centre of the discs, as the centre pins do not extend entirely through the outside bars.

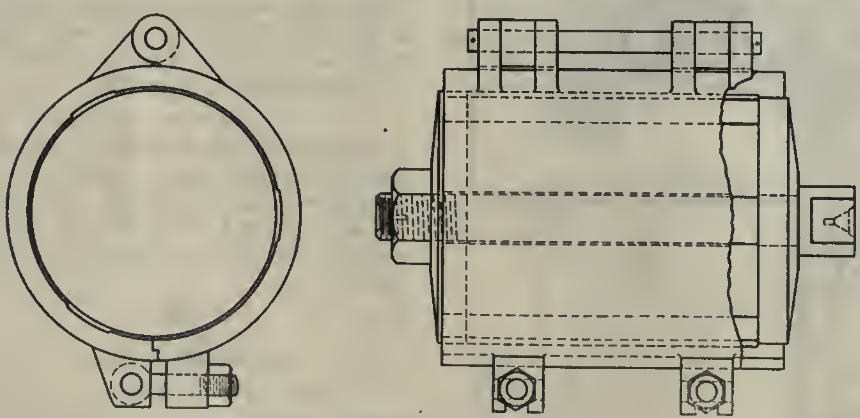
These gauges are quickly and cheaply made, and have a much longer life than the solid pin gauges. Again, with the knurled edge, it is unnecessary when using to look at the sizes, as they are readily distinguishable by the sense of touch.

PISTON RING RETURNING FIXTURE

By A. L. Loy.

IN the manufacture of piston rings, it is necessary after splitting to return them to the diameter of the cylinder in which they are to be used in order to insure a proper bearing around the entire circumference. Even then, it is sometimes difficult to get this bearing for some distance back from the point where the rings are split.

After splitting the rings, they are placed in the divided cylinder shown, this being provided with a shoulder at one end against which the rings are pushed, thus retaining them square before clamping. This cylinder is made in two parts, hinged at one side, and provided with two clamping bolts at the other. The faces of the hinged side are shouldered, thus performing the same function in keeping the two halves properly lined up as would dowel pins. It will be noticed that the interior is relieved in three places for the entire length. Into these relieved spots are placed the joints of the rings permitting them to spring out slightly farther than the ring body. When returning, this causes a slightly greater amount of metal to be taken off this point, and insures a much better bearing. The amount to be taken out here, as well as the width of same, depends upon the thickness and general design of the ring and must be determined by exxperiment.



PISTON RING RETURNING FIXTURE.

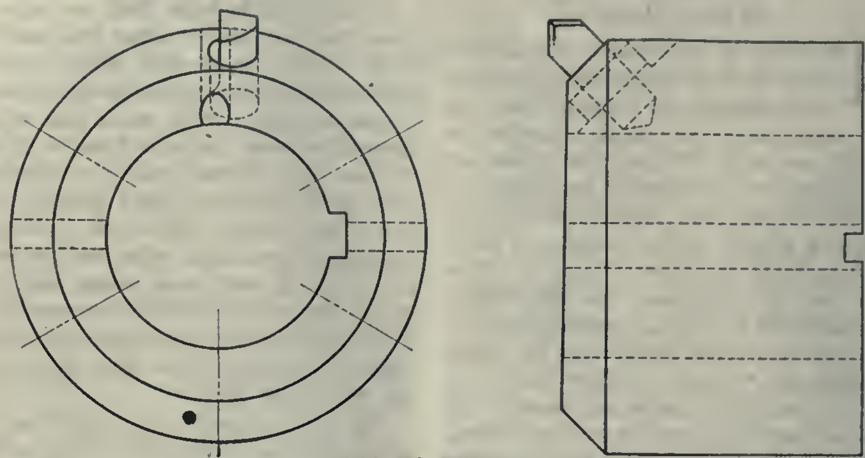
A one-inch arbor is used up to about 7 in or 8 in. rings, and is provided with a standard thread for clamping. No trouble was experienced in holding rings of this size, although for larger sizes it is well to use a plain arbor and three or four extra clamping bolts near the outer edges. This arbor is enlarged at one end and is flattened for driving; the flange at this end being shrunk on. Extra deep centres are provided, and these are protected by using a 90 degree countersink so that it is impossible to strike the edges in handling. When starting a cut, which, of course, is done from the clamping end, it is necessary to go slightly into the flange at that end.

BORING HEADS FOR CYLINDERS.

By C. Charles.

IN boring cylinders or other cored holes using boring heads, difficulty is often experienced where the cores are out of position, and especially so in the smaller sizes. The heads will often strike the rough surfaces ahead of the cutting blades, necessitating turning down the bodies and giving insufficient metal to hold the cutters.

The illustration shows a boring head which enables the body proper to be of maximum size, as the cutting is done entirely ahead of the body. These bodies are of steel and are driven from the regular keyways in the boring bar, the thrust being taken by another key at the back extending entirely through the bar. The head shown was for a 6-in. bore, and the cutters of 5/8 in. round Allen's Imperial special high-speed steel, were set in the head at an angle of 45 deg. These cutting pins were milled off to 1/2 in. thickness almost to the one end, this being left the full diameter so that the pins entirely filled the reamed hole at the bottom, preventing them tipping under the strain of a heavy cut, and thereby causing chattering. The cutting pins were held in place by a 3/8 in. cold drawn pin, the holes for which are drilled at a slight angle, about 2 deg., to the cutting face of the pin and close enough so that it was necessary to mill off about 3-32 in. at this same angle. Driving in these smaller pins forces them up against the cutters and holds them quite securely.



BORING HEAD.

These cutter heads are maintained at a set size, both for rough and finish boring. When re-grinding, the cutters are taken out and a small washer or steel ball is dropped in the hole, the cutter being then pressed down on same. Six cutters were used in the regular boring heads. This construction is highly economical of steel, a factor of importance in a small shop.

Brantford, Ont.—With interesting ceremonies, six new cars of the Brantford Municipal Railways were placed in service in December 17, inaugurating an improved service under municipal ownership. Galt, Paris, Brant County and the City of Brantford were all represented, and in the new cars visitors an dother guests of the Street Railway Commissioners were taken for a free ride over the railway lines. An inspection was made of the new pay-as-you-enter cars, which met general approval, and six new cars, together with rebuilt Grand Valley cars and a new freight car, formed a parade through the city, thus giving citizens cars started out on their routes .

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent, practical questions, and give same direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division will be found a useful companion study.

Question.—A pendulum is made up of a ten-pound weight suspended by an ordinary string, the distance from the point of suspension to the centre of the weight is 8 feet. How many times will it swing back and forth in an hour?

Answer.—Formula, time in seconds of vibration $= 3.1416\sqrt{\frac{l}{g}}$ where l=length of pendulum in feet and g= force of gravity=32.16.

$$\text{Time} = 3.1416\sqrt{\frac{8}{32.16}} = 3.1416\sqrt{\frac{1}{4.02}}$$

$= 3.1416\ \sqrt{.248} = 3.1416 \times .4987 = 1.5667$ seconds.

Number of seconds in 1 hour $= 60 \times 60 = 3600$.

Number of vibrations, then, is $\frac{3600}{1.5667} = 2297.8$.

* * *

Question.—A governing mechanism of an elevator consists of two four-pound weights, connected together by a cast iron bar of 1 x 2-inch cross section and 12 inches long. The whole revolves about a hub in the centre of the bar. At what speed would the centrifugal force become sufficient to break the bar?

Answer.—The tensile strength of the bar is $20,000 \times 2 = 40,000$ pounds.

The centrifugal force $= F = .000344\ W\ R\ N^2$, in which F=total centrifugal force; W=weight of the rotating mass; R=radius=distance between the centre of rotation and the centre of the rotating mass; N=number of revolutions per minute.

From the above we get $N = \sqrt{\left(\frac{F}{.00034\ WR}\right)}$

or $N = \sqrt{\left(\frac{40,000}{.00034 \times 8 \times .5}\right)} = \sqrt{(29411765)} = 5.432$ R.P.M.

* * *

Question.—A certain machine contains four bearings of cast iron running in cast iron. The load on two of these bearings is 3,000 pounds each, the speed 240 r.p.m., and the diameter 10 inches. The load on the other two is 2,000 pounds, the speed 480 r.p.m., and the shaft diameter 6 inches. What power would be required to overcome the bearing friction of the machine?

Answer.—For cast iron to cast iron the co-efficient of friction is 0.15. For the first two bearings the surface speed = circumference $\times$ r.p.m.

$= \frac{10 \times 3.1416}{12} \times 240 = 628.32$ feet per minute.

Friction load $= 6000 \times .15 = 900$ pounds.

$$\text{Horse-power} = \frac{900 \times 628.32}{33,000} = 17.136.$$

For the second pair of bearings, the surface speed $= \frac{6 \times 3.1416}{12} \times 480 = 753.984$ feet per minute.

Friction load $= 4,000 \times .15 = 600$ pounds.

Horse-power absorbed by friction, then, is $\frac{600 \times 753.984}{33,000} = 13.708$.

Total work lost in bearing friction is $17.136 + 13.708 = 30.844$ horse-power.

* * *

Question.—A workman desires to lift a weight of 1,320 pounds with a 6-foot bar. Which would require the less force (a) if he place the end of the bar 6 inches under the load and lift up on the other end, or (b) if he place a block 6 inches from the end of the bar and lift the load on the short end by pressing down on the other? What would be the requisite force in each case?

Answer.—In case (a) the fulcrum is at the end of the bar. The load arm of the lever is 6 inches and the power arm is $6 \times 12 = 72$ inches.

$$\text{Force required is } \frac{6 \times 1320}{72} = 110 \text{ lbs.}$$

In case (b) the fulcrum is 6 inches from the end. The load arm of the lever is 6 inches and the power arm is $72 - 6 = 66$ inches.

$$\text{Force required is } \frac{6 \times 1320}{66} = 120 \text{ lbs.}$$

Case (a) would require less pressure, but the greater downward pressure of case (b) would probably be easier to apply.

* * *

Question.—In a hot water heating plant, the water level in the expansion tank is 72 feet above the lowest return piping. The expansion tank is under an initial pressure of 3 pounds per square inch. What is the greatest static pressure on the piping of the system,

Answer.—A cubic foot of water weighs 62.4 pounds, or a column of one square inch cross section and one foot high weighs $\frac{62.4}{144} = .433$ pound.

Pressure due to water alone $= 72 \times .433 = 31.176$ pounds.

Total pressure $= 31.176 + 3 = 34.176$ pounds per sq. in.

* * *

Question.—What would be the weight of a casting of bronze whose specific gravity is 8.6. The weight of the pattern is 38 pounds, and it contains two cores which, with prints, are $6 \times 2 \times 12$ inches.

Answer — The specific gravity of pine pattern lumber is 0.45, which gives $.45 \times .036 = .0162$ pound per cubic inch. The weight of the pattern representing the cores is $2 \times 6 \times 2 \times 12 \times .0162 = 4.665$ pounds.

Net weight of pattern $= 38 - 4.665 = 33.335$ pounds.

The ratio of the specific gravities—that is, the ratio of the weights of the pattern and the bronze, is 0.45 to 8.6, or 19.11.

Weight of casting is, then, $33.335 \times 19.11 = 637.031$ pounds .

* * *

Question.—The specific gravity of a lubricating oil is given as 0.81. What would be the weight of a 50-gallon barrel of this oil?

Answer.—The volume of 50 gallons $= 50 \times 277.274 = 13863.7$ cubic inches. One cubic inch of water weighs .036 pound.

Weight of 50 gallons of oil $= 13863.7 \times .036 \times 0.81 = 404.26$ pounds.

* * *

Question.—A pipe line, when measured at a temperature of zero Fahrenheit is just 102 feet long. What will be its length when under a steam pressure of 120 pounds per square inch?

Answer.—Temperature of steam at 120 pounds gauge is 350 degrees F. Coefficient of expansion for wrought iron is 0.00000648. This means that an iron rod will expand 0.00000648 of its length for every degree rise in temperature.

The amount of expansion in the pipe line is then $102 \times 12 \times 350 \times .00000648 = 2.776$ inches.

The length of the pipe when heated, then, is 102 feet +2.776 inches=102 feet 2.776 inches.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

SPECIAL HAY PRESS.

SOME idea of the big tax put on Canadian transport authorities by the European war may be gleaned by the fact that, after England's declaration, orders for foodstuffs and supplies practically poured into the Dominion, not only from the Imperial Government, but from the French, Russian and Belgian Governments. In order to cope with the demand, the first thing made necessary was the installation in various parts of Canada of proper machinery for the preparation of such shipments as were to go forward. One of the contributions in this direction made by the Angus Shops of the C. P. R. was the manufacture of special hay presses.

To facilitate the movement of hay bought in Canada by the Imperial and French Governments these presses have been working day and night. The bale turned out by them measures 14 in. x 17 in. x 22 in., and averages 100 pounds in weight, and the output per press is one bale per minute.

SPECIAL HAY PRESS AT C.P.R. ANGUS SHOPS, MONTREAL.

C. P. R. LOCOMOTIVE NO. 2900

THE illustration and description herewith refer to C. P. R. locomotive No. 2,900, built at the Angus shops, Montreal, and recently put into service. Among the interesting features in the general design and equipment may be mentioned the firebox, which is 13 ft. 5⅝ in. long by 7 ft. 4⅞ in. wide, and is equipped with a Gaines combustion chamber and arch; a Vaughan-Horsey superheater, vestibuled cab, and new arrangement screw reverse gear. The company's standard practice of interchangeability of various parts with other types of engines has been carried out wherever possible, thus we find that cylinders, pistons, piston rods, piston valves, cylinder heads, steam chest covers, axle boxes, axles, etc., correspond to those of class P-1 and N13 engines. The main driving wheels run in Cole axle boxes, 11 in. diameter by 21 in. long. The following is a list of general particulars:

Type, 4—8—2.
Sub-class, H-1a.
Boiler pressure, 200 lb.
Firebox width inside, 88⅞ in.
Firebox length inside, 161⅝ in.
Number of tubes, 210 and 30.
Diameter of tubes, 2¼ in. and 5¼ in.
Length over tube sheets, 20 ft. 8½ in.
Superheater, Vaughan-Horsey.
No. and dia. of superheater aubes, 120 1¼ in.
Average length of superheater tubes, 19 ft. 4½ in.
Superheating surface, 760 sq. ft.
Firebox heating surface, 299 sq. ft.
Tube heating surface, 3,414 sq. ft.
Equivalent heating surface, 4,853 sq. ft.
Grate area, 59.6 sq. ft.
Cylinders, 23½ in. by 32 in.

HIGH-SPEED MULTI-SPINDLE DRILLS.

THE National Automatic Tool Co., Richmond, Ind., has recently added to its line two high-speed multiple drills which embody many features of high productive value. They meet the demand for powerful machines capable of drilling up to ⅞-in. holes in cast iron at heavy feeds.

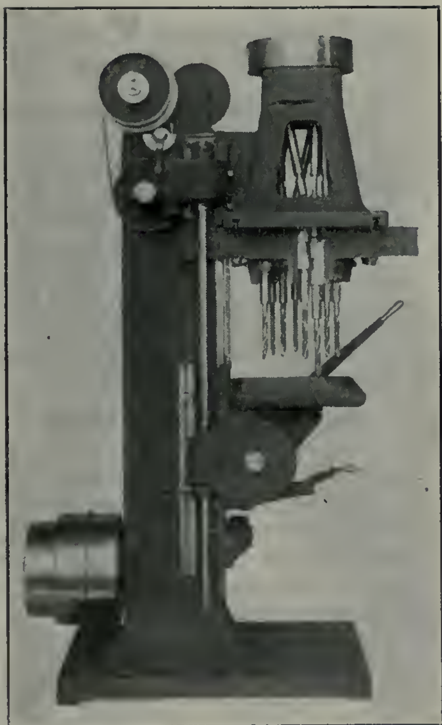
"Natco" No. 18 Drill.

The "Natco" No. 18 drill is of the table feeding type, the head being tongue grooved and bolted solidly to the column. It is designed to drive eight ½-, twelve ⅜- or twelve 5/16-inch drills in cast iron at a feed of 5 inches per minute, with the drills running at a peri-

TYPE 4-8-2, SUB. CLASS, H-1a. C.P.R. LOCOMOTIVE NO. 2900.

pheral velocity of 75 feet per minute. Under a test it carried a much heavier complement of drills than the above with ease under the heaviest feeds. The "Natco" multiple drill embodies weight, proper distribution of metal to insure maximum regidity, proper speeds and feeds for high-speed drills and, above all, a machine with all its parts designed to deliver the power necessary to obtain the above results.

The column is of heavy box section, the metal being so distributed as to insure a maximum of strength and rigidity. It has a wide base to which a steel rack is securely fastened. The drive is by means of a two-step cone and continuous belt. The idler pulleys are of



HIGH-SPEED MULTI-SPINDLE DRILLING MACHINE.

large diameter and are mounted on Hyatt high-duty roller bearings. The cone pulley on the base is also mounted on Hyatt high-duty roller bearings. The knee has an extended top, providing a support where it is needed most, and the main part is of box section which insures a very stiff support for the work to be drilled.

The table is made with a large oil channel around the outer edge to catch the overflow of lubricant, and a screen oil pocket in this channel prevents chips from choking up the pipe. The feed box is located near the top of the column on the side, which provides three changes of feed that may be made while the machine is running. The feed gears are hardened and run at moderate speeds in a bath of oil. All the bearings are bronze bushed. The feed worm-gear is made of bronze, the worm being provided with an extra heavy ball thrust, and the bearings at this point are bronze bushed. A guard is provided which completely covers these parts.

The rack pinion shaft is made of crucible steel and the pinion is cut from the solid. This construction insures great strength. The right-hand end of this shaft is provided with an adjustable hand lever or a four-arm pilot for rapid easy advance and return of the table. The power feed, which is of the worm knockout construction, may be tripped by hand, or automatically at any point. The table returns automatically to its "home" position after being tripped. Pressing down on the feed lever releases, and pulling up engages the feed.

This machine is provided with a 9 by 15-inch rectangular head which can be equipped with from two to sixteen adjustable spindles. All gears in the head are hardened and ground and run in oil. All bearings are bronze bushed. The head may be equipped with various combinations of arms of cluster boxes. The drill spindles are made of special steel hardened and ground and provided with ball thrust bearings at the lower end and locknuts at the upper end to take up such end wear that may develop.

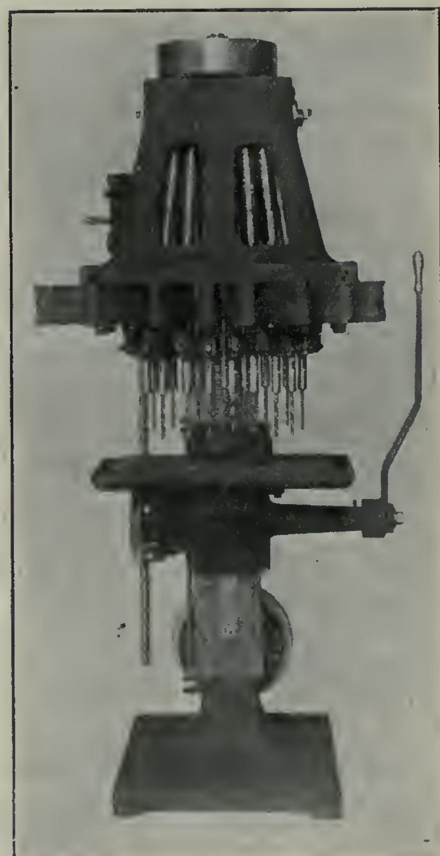
The spindles are made to carry either straight shank or Morse taper shank drills, as required, and the machine may be provided with a reservoir to carry lubricant to the point of the drills.

The bronze bearings which carry the drill spindles are provided with vertical adjustment to compensate for variation in the drill collets. The adjustment is quickly and easily secured by simply loosening one nut which is always accessible, regardless of how close the spindles may be clustered together. This spindle adjustment—which is a patented construction—holds the bearing rigidly to the end of the arm, and the arm may be moved to cover any layout within the range of the head. The weight of the No. 18 drill is 1,400 pounds without the adjustable arms.

"Natco" No. 20 Drill.

The "Natco" No. 20 drill is a heavier machine, and is equipped with larger sizes of heads and a greater number of spindles. It is extremely powerful, being capable of driving up to $\frac{7}{8}$-in. high-speed drills in cast iron. The table feeds the work up to the drills, the head being tongue grooved and bolted securely to the column. It was designed to drive from six to eight $\frac{3}{4}$-inch drills or their equivalent in cast iron, at a feed of 5 inches per minute with the drills running at a peripheral velocity of 75 feet per minute. The No. 20 drill embodies all the essentials for high-speed drilling results, namely, weight, proper distribution of metal to insure rigidity, proper speeds and feeds for high-speed drills.

The column is of heavy box section, and has a wide face to which the steel rack is securely fastened. The drive is by means of a two-step cone and continuous belt, the two-step cone being mounted on Hyatt roller bearings. The idler pulleys are of large diameter, and are also mounted on Hyatt roller bearings. The knee has an extended top, providing a support where it is most needed, and the main part is of box section. It is counter-balanced and is provided with a new friction power feed which is an en-



HIGH-SPEED MULTI-SPINDLE DRILLING MACHINE.

tirely new principle applied to multiple spindle drills. The advantage of the friction power feed is that the drills can be brought up against the work before throwing in the feed, thereby saving time in bringing the work to the point of the drills. It also eliminates any danger of breakage to the power feed mechanism, because should anything become caught, the friction would slip when the pressure reaches a certain point. The friction is adjustable to compensate for the different loads that are being drilled.

The rack pinion shaft is made of crucible steel and the pinion is cut from the solid, insuring great strength. The right-hand end of this shaft is provided with either an adjustable lever or four-arm pilot for rapid easy advance or return of table.

The power feed may be tripped by hand or automatically at any point, the table returning automatically to its "home" position. The table is made with a large oil channel to catch the overflow of cutting lubricant and a screen pocket prevents chips from choking up the oil pipe.

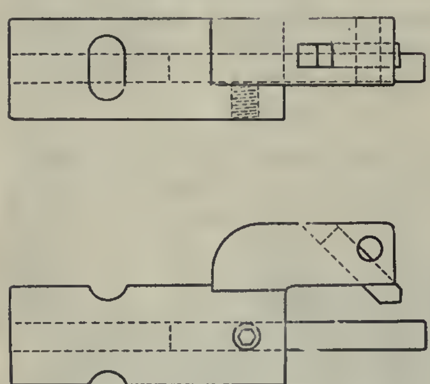
The feed box is located on the side of the column near the top. It provides three changes of feeds. The feed gears are hardened and run at moderate speed in a bath of oil. All the bearings are bronze bushed. Several sizes of heads are provided, all of which may be equipped with various combinations of adjustable arms or cluster boxes. Some of the heads are equipped with the "Natco" independent drill speed feature which gives two independent changes of speed in the head for each step of the cone, thereby making possible the drilling of large and small holes in the same operation at correct cutting speeds. All gears in the head are hardened and ground and run in oil. All bearings are phosphor-bronze bushed. The smaller-sized heads are arranged with from two to sixteen adjustable spindles and the larger sizes have from two to twenty-four adjustable spindles. The adjustable arm, drill spindles and universal joints are of the same construction as the No. 18 drill.

The main points of advantage of the No. 20 over the No. 18 are greater capacity, the independent drill speed feature, larger sizes of heads, greater number of spindles and the new friction power feed. The weight of the No. 20 drill is 2,300 pounds with the adjustable arms.

TURNING IN THE DRILL PRESS.

By D. S. Mann.

THE turning tool shown was designed for turning the valve stem bosses on the cylinder head of a gasoline engine. As the valve stem holes were bored from



TURNING IN THE DRILL PRESS.

the opposite side of the cylinder head, they did not always come central with the bosses around which the springs were placed. These bosses were, therefore, made somewhat larger than necessary to allow for this, and then were afterwards turned on the outside to bring them central with the valve stem holes. The tool is a steel forging and is made to fit a 1¼ in. Magic quick-change chuck. The pilots were of tool steel and were held in place by a hollow set-screw. The turning tool was of 5-16 in. square high-speed steel and was held in place by a pin milled off at a taper and driven in along the side.

The speed with which one of these little tools accomplishes its work is marvellous, and is indeed a time-saver for any work of this class where it would not be possible or advisable to do the work on a lathe. The tool is also quickly set for different diameters and, in the case mentioned, the diameter was not particularly important.

BRASS DIE-CASTINGS.

FOLLOWING are a number of reasons why brass die-castings cannot be produced commercially:—The writer has seen produced brass die-castings of small machine parts, but due to advances that have been made in modern foundry and machine shop practice, these castings could be made cheaper when sand cast.

Modern automatic molding machines, automatic screw machines, etc., make it possible to produce small brass castings accurately machined at a comparatively low figure. In order to compete, brass die-castings must be made rapidly, must be accurate to within at least plus or minus 0.002 in., and must have smooth finished surface. The expansion and contraction of the metallic molds used make accuracy impossible.

Although it is possible to make brass die-castings by forcing molten brass into a metallic mold, it will be found that after 500 or 1,000 castings have been made the mold will crack or warp, necessitating the construction of a new die, which is usually very expensive.

Aluminum Die-Castings.

The die-casting of aluminum alloys shows some promise of becoming a permanent industry. Very complicated aluminum die-castings are now being produced, but the writer is not at liberty to discuss either the process or alloy used, since patents are pending for both.

ONTARIO HYDRO RATES CUT.

THE Hydro-Electric municipalities continue their prosperous career, even in spite of the general depression, and, in addition to the reductions which were made last year, further appreciable cuts will now be made. The municipalities on an investment of $11,000,000, after providing for interest on sinking fund, debentures, operating cost, maintenance of plant, administration, etc., have over $1,000,000 surplus.

Consumers Save $200,000.

It is computed that the new rates will save the light and power consumers $200,000 per annum, in addition to the $150,000 per annum saved by the 1913 reduction. Toronto does not figure in the list, having been ignored because it had not adopted the reduction in rates previously ordered by the Ontario Hydro Commissioners. It is understood that, had the rates been fixed, the figures would have warranted a further reduction for Toronto.

Peak Load Now 79,000 H.P.

All over, the total power consumption is 79,000 horse-power, of which Toronto shares 27,000 horse-power. When the reductions were made last year, about 40 municipalities were operating. There were 72 three months ago, and the figures before the end of the year will be 90.

By the adjustments now made by the Ontario Hydro-Electric Commimssion, it is noted that the municipality of Port Arthur receives a reduction of 25 per cent., Georgetown and New Hamburg receive 20 per cent., 55 municipalities receive over 10 per cent. and under 20 per cent., and 14 municipalities get a 10 per cent. reduction. The municipalities receiving the lowest rates are Ottawa, London, Port Arthur and St. Thomas.

Reduction in Service Charge.

The principal reduction has been made in the floor space charge, which has been reduced from 4 cents to 3 cents per 100 square feet, with a minimum of 1,000 and a maximum of 3,000 square feet. A second rate has been added for domestic consumers to permit of the general use of cooking and other electrical appliances in the homes. This rate is 50 per cent. of the initial rate.

Another important feature is that the reduction for other than lighting purposes will be 50 per cent. in the case of the small house on current in excess of 40 kilowatts, and the large house where the current is in excess of 100 kilowatts.

Basis of New Rates.

The recommended lighting rates were: For incorporated villages, police villages and rural municipalities, 3 cents per 100 square feet of floor area per month; minimum floor area charge for 1,200 square feet; maximum floor area charge for 3,000 square feet.

For urban districts outside the municipalities, 3 cents per 100 square feet of floor area; minimum floor area charge per month for 1,500 square feet; maximum floor area charge per month for 3,000 square fet.

For cities and towns, 3 cents per 100 square feet of floor area per month; minimum floor area charge for 1,000 square feet; maximum floor area charge for 3,000 square feet.

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Vol. XII. DECEMBER 24, 1914 No. 26

PRINCIPAL CONTENTS:

SHELL MANUFACTURE IN CANADA.

If any credence can be attached to the many rumors flying around, then this European War now raging is about to initiate a shell manufacturing boom. We had thought, however, that this country had just about gone the limit with booms of one sort and another in recent years and that, even without the sobering influence which the general trade depression hanging over us for such a lengthened period has had there would have been little inclination even on the part of perhaps naturally speculative souls to throw the dice, as it were. We sincerely hope, both for the good of the Dominion at large and those who may be inclined to propagate schemes for the wholesale manufacture of shells for naval or military purposes, that there is more "atmosphere" than anything else in the rumors.

Our very closeness to the heart of the Empire, coupled with the latter's knowledge gained from pre-war experience of our manufacturing enterprise and capability has, surely, in this time of stress been demonstrated in the most prodigal fashion, with the result that a large and daily increasing percentage of our factories are, in diversified lines, running, if not to capacity, to an extent utterly impossible otherwise under the circumstances, in catering to that Empire's meantime requirements.

This war, with its accompanying horrors and its mechanisms and engines of destruction which bring the latter condition about, is not going to last for ever; nay, many competent authorities believe the major portion of its duration to have already been realized. We could also wish that the worst of its destructiveness and shockingness had passed the peak, but that perhaps is too much meantime to expect.

In any case, what justification is there for even dreaming about the establishment of several huge concerns whose sole purpose is that of more or less cornering everything at sight that smells of powder, and perhaps of incidentally making a few people wealthy as a result. In the matter of shell manufacture, Canada both from the machine shop (large and small) point of view, and from that of expert mechanics has no need to feel ashamed when compared with other nationalities. What then should hinder our machine shops spread over as they are from Halifax to Vancouver being made participants in the work.

From reliable data in our possession, we can say without fear of contradiction that no craft or calling in this Dominion has been harder hit than that of mechanical engineering, and most acutely so on account of the war. Our machine shops, the majority of which are well equipped according to their size, would every one of them be prepared to undertake contracts commensurate with their capacity covering the machining and finishing of shells, and such of them as are progressive (very few being otherwise), would not hesitate to add to their plant such modern equipment as they know to be available and perhaps necessary.

Such an opportunity given to machinists in our towns and cities, would ensure more rapid fulfillment of quantity shell orders; would stimulate the machine tool business; would tend to create a pride of craftsmanship because of the care and skilful operation required; would intensify the patriotic spirit; would minimize distress among mechanics over a widespread area, and would, when this clash of nations ceases, leave in the possession of each individual concern a tool or tools that would enable them to develop a peace-time business which, without the opportunity and need to acquire modern equipment to accomplish high-grade work, they might not otherwise have been able to secure.

Spreading the shell work broadcast as suggested will without doubt aid if it does not altogether bring about a revival in the machine tool business, and when the latter begins to get active, kindred callings don't usually lag. Concentrating the work or endeavoring to corner it is usually disastrous in many ways, and as the European War is in nowise a permanent institution, the disaster possibilities are materially increased.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 40
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 00	17 00
Victoria, No. 2X......	18 00	17 00
Victoria, No. 2 Plain..	18 00	17 00
Hamilton, No. 1.......	18 00	17 00
Hamilton, No. 2.......	18 00	17 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	1.95
Steel bars, f.o.b., Toronto	1.95
Common bar iron, f.o.b., Montreal.	1.95
Steel bars, f.o.b., Montreal	1.95
Bessemer rails, heavy. at mill	1.25
Steel bars, Pittsburgh	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh	1.15
Beams and angles, Pittsburgh	1.15
Steel hoops, Pittsburgh	1.30
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lbs	$2 15	$2.15
Heads, per 100 lbs.	2 35	2 35
Tank plates, 3-16in.	2 40	2 40

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$ 8 50	$ 8 75
Copper, crucible	10 00	9 75
Copper, unch-bled, heavy	9 50	9 75
Copper wire, unch-bled	9 50	9 75
No. 1 machine compos'n	8 50	8 75
No. 1 compos'n turnings	8 50	8 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	7 25	7 50
No. 1 brass turnings ...	6 00	6 25
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

NAILS AND SPIKES.

Standard steel wire nails, base	$2 15	$2 05
Cut nails	2 50	2 70

Miscellaneous wire nails... 75 per cent.
Pressed spikes, ⅝ diam., 100 lbs. 2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws....	75 & 5
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70 & 5
Machine bolts, 7-16......	60 & 5
Blank bolts	60
Bolt ends	60 & 5
Machine screws, iron, brass	35 p.c.

Nuts, square, all sizes....4½c per lb. off
Nuts, Hexagon, all sizes.4¾c per lb. off
Iron rivets .... 75 per cent.
Boiler rivets, base, ¾-in. and larger. $3.25
Structural rivets, as above 3.15
Wood screws, flathead, bright ......85, 10, 7½, 10, 5 p.c. off
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh ...	$21 00
Open hearth billets, Pittsburgh.	21 00
Forging billets, Pittsburgh	26 00
Wire rods, Pittsburgh..........	26 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in. ..	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in. ..	70%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

METALS.

	Montreal.	Toronto.
Lake copper, carload ...	$14 00	$14 00
Electrolytic copper	13 75	13 75
Castings copper	13 50	13 50
Spelter	6 00	6 00
Tin	37 00	36 00
Lead	4 85	5 00
Antimony	16 00	18 00
Aluminum	22 00	22 00

Prices per 100 lbs.

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	.1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect July 2, 1914:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	72	62
7, 8, 10 in. ..	....	....	66½	55½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in...	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ..	....	....	66	56
4½ to 6 in. ..	....	....	67	58
7 to 8 in.	....	....	58	47
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.95
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$2.75
Red dry lead, 5 cwt casks, per cwt	8.00
Glue, French medal, per lb.	0.14
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	18½
Benzine, single bbls., per gal.	18½
Pure turpentine, single bbls.	0.68
Linseed oil, raw, single bbls.	0.56
Linseed oil, boiled, single bbls.	0.59
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.08
Pure Manila rope	0.14
Transmission rope, Manila	0.18
Drilling Cables, Manila	0.16
Lard Oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto ... 40%

PROOF COIL CHAIN

¼ inch	$7.25
5/16 inch	5.10
⅜ inch	4.35
7/16	4.05
½ inch	3.80
9/16 inch	3.80
⅝ inch	3.65
¾ inch	3.60
⅞ inch	3.40
1 inch	3.20

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Center	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	45%
At warehouse	40%

Discounts off standard list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3 50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.70	2 70
Canada plates, dull, 52 sheets	3 00	3 15
Canada plates, all bright	3 90	3 95
Apollo brand, 10¾ oz. (galvanized)	4 00	3 90
Queen's Head, 28 B.W.G.	4 25	4 35
Fleur-de-Lis, 28 B.W.G.	4 00	4 25
Gorbal's Best, No. 28	4 25	4 45
Viking metal, No. 28	3 90	4 00

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$9.50	....
1¼ in.	9.50	....
1½ in	9.50	....
1¾ in.	9.50	....
2 in.	10.00	$8.75
2¼ in.	11.50	....
2½ in.	13.00	11.50
3 in.	15.00	12.10
3¼ in.	....	13.25
3½ in.	19.00	14.25
4 in.	24.00	18.00

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50%
Standard	60%
Cut leather lacing, No. 1	$1.25
Leather in sides	$1.00

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents.
XXX extra	0 11
X Grand	0 10½
XLCR	0 09¾
X Empire	0 08¾
X Press	0 07¾
COLORED.	
Lion	0 07
Standard	0 06¼
Popular	0 05½
Keen	0 05
PACKING.	
Arrow	0 15
Anchor	0 06
Anvil	0 07½
Axle	0 09
WASHED WIPERS.	
Select white	0 08
Light colored	0 06½
Dark colored	0 05

Prices per lb.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Dec. 19, 1914.—During the past week there has been a somewhat better tone to the iron and steel business. A number of factors have contributed to the improvement. Pig iron, however, still remains quiet, although there is an increase in the number of inquiries. Machine tool equipment, although not moving in large lots, also indicates an improved situation. A more optimistic feeling prevails throughout the province generally. Business in the Maritime Provinces is somewhat better than here, due, no doubt, to the fact that many of the large coal and steel industries are situated in that section of the country, and are receiving large orders from the British Admiralty and War Office.

The Steel Market.

The present situation in the steel market shows a very much improved complexion. Some months ago the Interstate Commerce Commission refused to grant the railways operating in the Eastern States a 5 per cent. increase in freight rates. The railways represented that their earning power had been so greatly impaired that they could not dispose of their bonds, and thus were crippled from a financial standpoint. On account of the recent unusual conditions, the Interstate Commerce Commission reversed their decision a few days ago, adding thereby a new stimulus to the steel industry.

Statistics show us that the railways consume about one-third of the amount of steel manufactured, thus if this additional 5 per cent .increase in the railway freight tariffs will enable these corporations to finance, there is no doubt that they will be in the market for steel rails and other steel products, locomotives, freight and passenger cars, etc. This will most certainly have a stimulating effect upon Canadian trade.

Large orders for munitions of war and marine steel forgings have, it is reported, been received by the Nova Scotia Steel and Coal Co., who have had representatives in Britain soliciting orders. The manufacture of shells shows further development in the matter of new orders and increased number of firms undertaking the work.

For boiler tubes, the demand shows an increase, many American seamless steel products finding their way to Britain to fill orders there.

Pig Iron.

Sales of pig iron continue to be small. The exceedingly low price of a few weeks ago stimulated business to a certain extent. The low prices of the early months of the present year were taken advantage of by the majority of consumers, and rather heavy stocks were then purchased, and these stocks have been sufficient to carry most foundries through the present unsettled situation. A further cause for the sales remaining practically at a standstill is the fact that all purchasers know that iron can be obtained from the dealers' stocks at short notice, and no delay will be entailed should any situation arise which would demand any great amount of iron.

Machine Tools .

The machine tool market continues to remain rather dull. From time to time small orders come in, and the encouraging feature in the situation is that they are becoming more frequent. Inquiries also are more numerous. The equipment being disposed of at present is largely turret lathes and grinders, for use in the manufacture of shells. The supply business keeps brisk, considering the present conditions.

Metals.

The metal markets have been rather dull during the week. The feature has again been copper. Production has been restricted to those smelters handling the higher grade ores, and this reduced production has tended to increase the price, because consumption has recently become considerably in excess of that prevalent during the earlier weeks of the war. The other metals have remained rather quiet during the week, but prices keep firm.

Toronto, Ont., Dec. 22, 1914.—The approaching holiday season is having the usual effect in business circles, and conditions generally are quiet. There will also be further restriction in business for the rest of the year on account of stocktaking. Apart from the above, however, there is little change in the industrial situation. There is continued activity in those industries supplying war equipment which promises to continue for some time to come. This business, while being of the greatest benefit commercially to the country, goods to the value of several million dollars already having been ordered, will not nearly counter-balance the injurious effect of the war upon trade. A difficult situation is being handled in a commendable manner by the Government, and also by financial and business men generally.

The Dominion revenues for November show a heavy decrease, principally in Customs receipts. This affects the ability of the Government to carry on the ordinary programme of National development. Operations on public works, however, are being continued in some cases as far as finances will allow. Municipal works have been restricted, rather more so than is usual at this time of the year, and there is a general suspension of other undertakings, such as new plants, factory and mill extensions, partially on account of the condition of the money market and also because of the widespread desire to economize. Notwithstanding these features, however, legitimate business is fundamentally sound.

Steel Market.

There is a quieter trend in the iron and steel trade, due principally to the general tendency of consumers to keep out of the market at this time of the year, which is stocktaking season. Manufacturing concerns using steel products are still quiet, and the building trade is exceptionally dull. It is reported that the Dominion Steel Corporation has received a substantial order for steel rails from Ireland. The same concern has shipped six ship loads of steel products to Europe since the war broke out, and there is a probability that they will start a steel furnace early in January.

Conditions in the steel trade in the United States are about the same, although buying of finished steel for the first quarter of next year has increased somewhat. A number of important enquiries have been received from the Old Country, but high freight rates have in some cases militated against any chance of doing business. There has been no change in prices locally.

Pig Iron.

Although some activity in pig iron is reported from Hamilton, the market is dull and business quiet, a condition which will prevail for the rest of the year. Prices are stationary.

Machine Tools.

Continued quietness prevails in the machine tool market, a few sales having been made locally; but as a rule dealers report little business. Considerable interest has been aroused in machine tool circles by the developments in the shell business, and there is a possibility of further orders being placed for tools. The announcement that a large machinery house has sold 22 lathes to an Old Country firm will be received with interest by the trade, and it is to be hoped that this export business will develop.

Metals.

There is practically no change in the situation in the metal markets, business being quiet and prices unchanged. The copper market is dull, with prices firm, at 13½c to 14c per pound. The tin situation is a strong one, and higher prices may be expected in time; at present the market is dull and prices firm at 36c per pound. Spelter is unchanged at 6c per pound, the market is quiet, but firm. There is a steady demand for spelter from Europe, which is holding the market strong. The lead market is dull and prices unchanged at 5c per pound. The antimony market is quiet; business is light, and prices unchanged at 18c per pound. Ingot aluminum is steady at 22c per pound.

Trade Gossip

The Don Foundry Co., Toronto, has been awarded a contract for the supply of brass castings by the Toronto Board of Control.

The Canadian Westinghouse Co., Hamilton, have been awarded a contract for a 25 k.w. 2,200-100 volt transformer by the Toronto Board of Control.

Toronto, Ont.—At the yearly meeting of the Canadian National Exhibition, held at the City Hall recently, a surplus of $26,048 was announced from the recent exhibition. The total receipts were $336,150.04 and the expenditures were $310,101.53.

Fredericton, N.B.—James M. Queen, George E. Dawes, Murray W. Long, John M. Long, of Lancaster, St. John county, and H. Colby Smith, of St. John, are applying for incorporation as the Colonial Construction Co., with an authorized capital of $24,000 and head office at St. John, N.B.

The Mesta Machine Co., Pittsburgh, Pa., recently acquired the rights from the Stumpf Una-Flow Engine Co., Syracuse, N.Y., to build the Stumpf Una-Flow type of engine in the United States. The agreement gives the Mesta Co. the patent rights of Prof. Stumpf, and the benefits of practical experience gained by European builders during the last six years.

Filling Shell Contracts.—The Renfrew Machinery Co., at whose factory cream separators are made, will shortly begin to manufacture shells for the British War Office. A contract has been awarded the company which will keep its factory running at full pitch. Leading members of the company are M. J. O'Brien and Thos. A. Low, who are also interested in three woollen mills at Renfrew, all of which are busy on orders received from the British and French Governments.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

CANADA'S TRADE INCREASED.

An increase in the total trade of Canada for the month over the corresponding period of last year is indicated in the trade statement for November, just issued by Hon. J. D. Reid, Minister of Customs. The total trade was $126,455,299, an increase of about fifteen millions over November, 1913. Exclusive of the import of coin and bullion, which has largely increased, both total exports and imports showed a decrease, this being chiefly due to a falling off in the export of agricultural products.

Total imports for November including coin and bulion, were $79,880,917, as compared with $52,016,560 in 1913, and the total for the eight months ending November was $447,911,144, as compared with $446,169,481 in 1913. Imports of coin and bullion in November were $48,328,727, as compared with $1,814,404 in November, 1913.

Exports in November, 1914, were $74,424,299, as compared with $107,964,484. Exports of manufactures have increased, a healthy sign, and were $6,376,500 for the month, compared with $4,841,922 in 1913. Exports of animals and their produce were $8,470,602, compared with $7,795,511. Exports of agricultural products however, dropped from $31,417,055 in November, 1913, to $18,846,286 this year.

RUSSIAN IMPLEMENT TRADE PROSPECTS.

BRITISH trade papers have been urging United Kingdom manufacturers of agricultural implements and tools to take full advantage of the exceptional opportunity at present offered for an increase in their trade with Russia. The following, for example, is an extract from "Made in England," which, although written from the point of view of United Kingdom trade extension, may nevertheless be of interest as indicating the prospects presented to Canadian manufacturers in their endeavor to capture some of Russian trade.

Increase in German Trade.

Of late Germany has vastly increased her trade in agricultural implements and tools. In 1912 her exports of agricultural implements and tools reached a total value of £1,431,000, while that of Great Britain stood in 1913 at £745,900 only. She has achieved this success not because her goods are better, nor because they are cheaper, but because her manufacturers have studied the markets and have made what the people demand instead of requiring them to buy the goods produced for other countries.

For these goods her best customer has been Russia. In 1912, Germany's export of agricultural implements to Russia was valued at £485,900, and Austria's export of the same classes of goods reached £150,200, while the exports of Great Britain, to the huge dominions of her ally in this great continental war, stood at the paltry total of £2,300. (These figures, it must be understood, are in all cases exclusive of the value of locomotive engines, threshing machines, motors, and the like). Now, not only is Germany unable to fulfil her contracts, but nothing is more certain than that Russian prejudices aroused by the war against anything of German origin will be long in dying out, and that if British manufacturers care to enter the market here and now they can secure the larger part of the trade.

The total annual export trade of Great Britain to all the countries of the world in this particular class of goods amounts to only £745,000; while Russia's annual imports from Germany and Austria aggregate £636,100, which is only £109,800 short of Great Britain's entire export output.

Importance of Russian Market.

Tackled properly the Russian market alone—after allowing for American and other competition—should produce orders sufficient to increase our export trade by somewhere near 75 per cent., and the Russians will be waiting for us. As one of our allies in this war against Germany's arrogant aggression, Russians will welcome with open arms the representatives of British firms. Already British goods have the reputation, won by years of honest work, of being the most substantial, and if manufacturers will combine and send out representatives who can talk the language, who thoroughly understand the goods they have to sell and the work to which they apply, and who are furthermore empowered to accept orders, even though the pattern may have to be modified to meet Russian requirements, there will be no doubt as to the result.

Russia Must Have the Goods.

The agricultural development of Russia during the past twenty years is one of the most striking features of her national life, with the result that the demand for all manner of agricultural implements from steam and internal combustion engines and tractors down to hoes and forks shows an annual upward tendency, despite the action of the Russian Government in giving a premium to home manufacturers on the output of their factories. Years must pass before Russia can supply her own demands. She has scarcely yet awakened commercially. Her population is largely pastoral and years of training will be necessary before her people are blessed with the nimble fingers of British industrial workers. Here and there individual firms are establishing factories, but the lack of system and of knowledge of economic management is obvious in every one of them.

Russian Requirements.

We must however, supply, what the Russians want. The Russian has his likes and dislikes, and whether they appear to us to be nonsensical or not it is his likes that our manufacturer should strive to meet. Moreover, as the vice-consul at Omsk, in Siberia, suggests, catalogues should be printed in the Russian language, the weights quoted should be in kilos or pouds, the price in roubles and their units, so that the dealer is able to calculate easily the cost delivered of the goods he may be inclined to order. Such requirements are in no way beyond the power of British manufacturers to compass, and there is no reason why, if they seriously make the attempt, they should not divert much of the enormous trade which Germany has hitherto done with the great nation of the east with which she is now at war. On the contrary they have everything possible in their favor.

COMPANIES TAKING OUT NEW CHARTERS.

MANY inquiries as regards the re-incorporation of provincial companies under the Dominion Companies Act have recently been received by the Secretary of State's Department at Ottawa. As a consequence, the Department is for the time being as busy as it was before the war in spite of the falling off in the number of regular incorporations.

The reason advanced for this steady increase in the number of inquiries for re-incorporation is the dissemination generally of the news of the recent judgment of the judicial committee of the Privy Council in the John Deere Plough Co. case upholding the Dominion contention. There is a section of the Dominion Companies Act which apparently authorizes re-incorporation, according to what can be learned. There is some doubt however, as to whether the section is competent.

There are a number of questions as to taxation of companies by the Province, etc., which will have to be adjusted between the Provincial and Dominion authorities. This will not be done, of course, before decision is given by the Privy Council in the Companies case. Another case is one now before the Supreme Court. It concerns the right of the Province of Ontario to incorporate the Bonanza Mining Company to carry on business in the Yukon.

NEWFOUNDLAND FISH EXPORT.

LAST year representations were made by the Government of Newfoundland to the Secretary of State for the Colonies in reference to the preferential treatment accorded Norwegian codfish entering Portugal. The duty chargeable in Portugal on Newfoundland codfish was greater than that charged on the Norwegian product, and it was requested that in the Treaty of Commerce, which his Majesty's Government were negotiating with the Republic of Portugal, this matter might be adjusted and Newfoundland codfish allowed in on equal terms with that from any other country.

The Government are now in receipt of a bill, which has been introduced into the House of Commons in London, to give effect to the provisions of the Treaty of Commerce and Navigation, which has been concluded with the Portuguese Republic. The provisions of this Treaty will apply to his Majesty's Dominions Oversea, and to goods produced or manufactured therein.

The preferential advantage hitherto enjoyed by Norwegian codfish will, therefore, now come to an end, and Newfoundland codfish will enter Portugal on equal terms with that from any other country. The Government of this colony are to be congratulated upon the successful accomplishment of this matter.

PLEA FOR GREATER PRODUCTION.

INCREASED production, with a view to better meeting the adverse balance of trade and to assist in paying interest charges abroad, was urged by Hon. W. T. White, Minister of Finance, in a recent address before the Canadian Club, Montreal. Referring to the share of the Empire's burden that Canada must assume, Mr. White said that, in all probability, Canada would borrow $100,000,000 a year during the course of the war.

Comparing the advent of war to the entrance of a crowbar into a delicate and complicated printing press in full action, Mr. White paid a tribute to the resource and genius of the Canadian people in meeting the new situation. The Canadian banks, the Minister of Finance said, had provided for the legitimate banking requirements of the community, made advances to the Government, and municipalities to enable them to complete works under contract, provided for the payment in whole or in part of Treasury bills and other short-date securities maturing due abroad, which, but for the war, would have been funded, and had financed the movement of the grain crops and other products of Canadian agriculture. To-day they found confidence restored, panic allayed, trade passing across the ocean in tranquil security, the Stock Exchanges opening, money becoming easy, and industry in all lines quickening into activity.

Meeting Adverse Trade Balance.

Dealing with the matter of Canadian currency, Hon. Mr. White explained that debts to another nation must be paid, directly or indirectly, in products, services, interest on investments, or in gold. Until the balance is redeemed she must export her gold.

"This is preliminary," said the speaker, "to some remarks I desire to make as to the so-called 'balance of trade' against Canada. This adverse balance of trade against Canada amounted in the fiscal year 1912 to over $225,000,000; in 1913 to $300,000,000, and in 1914 to $180,000,000. How did we pay it? The answer is that we paid interest and balance of trade by borrowing.

The Marvel of Great Britain.

"We are overtaking our adverse trade balance. From April 1, the beginning of our fiscal year, to October 31 we had an excess of imports over exports of $56,000,000, while for the same period of last year the excess was $141,000,000. Another factor that will materially help us is our borrowings in London for war. War is our first business until it is over. We shall borrow probably a hundred million a year, the greater part of which will be spent here. That borrowing is gold—the equivalent of exchange, so far as it is spent in Canada. Then there are the orders placed by British, French and Russian Governments. The funds for those orders are also gold. Then there will undoubtedly be borrowing abroad on a reduced scale as money markets become easier, as is now their tendency. London may within a few months resume lending.

What a marvel is Britain to-day, financing the war out of her savings, and with a margin left over for investment! No doubt the United States will purchase some of our high-class securities, because, as I pointed out, we cannot buy unless we borrow or sell, and we buy more from the United States than from any other country. Next year our agricultural production will be immensely increased. Every man with a plot of land should plant it next spring. Our exports will thus be greatly swelled. By all these means Canada is taking and will take steps, no doubt unconsciously to the great body of her citizens, who work by sure instinct, to meet the subversive conditions created by the war and the large adverse trade balance without resorting to gold exports."

Export Trade Good.

The speaker showed that while in the month of August last the exports of the United States decreased 40 per cent., and those of Great Britain 45 per cent., Canada's increased 17 per cent. In September, Canada held her own. United States declined 28 per cent. and Great Britain 35 per cent. In October, our exports declined 36 per cent.

"From all the foregoing facts," said Mr. White, "it is apparent that we have great cause for thankfulness. We may have a more or less trying period to go through before the light of peace again breaks, but I believe it will be a briefer period than we have dared to hope for."

CANADA'S WAR ORDERS.

A LARGE amount of money is being spent in Canada by the Imperial, Dominion, French, and Russian Governments in connection with orders for equipment for armies and navies, and with gifts to the Imperial authorities. These are stimulating industry considerably, keeping thousands of employees working throughout the winter in factories, many of which are running night and day shifts. While many of these industries may find conditions slack after this active and obviously artificial period, these war orders have prevented such unfavorable conditions from being present this winter. About 2,500 factories are said to have been affected favorably by the orders.

The Government authorities are too busy to give out information as to war orders just now, but details will come forward in official documents later, probably long after the war has ceased. In the meantime, there have been gathered reports, facts and figures, from which an approximate estimate can be made as to the value of war orders being placed in Canada. The information has been obtained from official sources whenever possible.

The following figures represent the value of only a portion of the orders placed in the Dominion. They include the Dominion and Provincial Government gifts to Great Britain and Belgium.

Details of Orders—British.

Canned goods and other food supplies	$ 1,000,000
Shirts	1,250,000
Sweater coats	900,000
Socks, mitts, belts, etc.	900,000
Miscellaneous woolens and textiles	950,000
Mess tins, picket poles, and pegs	130,000
Shovels, picks, etc.	1,000,000
Horses	3,850,000
Sheepskin coats (second order)	25,000
Saddles	2,000,000
Shrapnel shells (to October 16)	2,000,000
Boots and shoes	2,500,000
Rifles, ammunition, and shell cases	2,000,000
Total	$18,505,000

Dominion Government Orders.

30,000 Ross rifles and bayonets (first order)	$ 1,000,000
Conversion of 10,000 old type rifles	65,000
Flour, 1,000,000 bags	3,000,000
Blankets	155,000
Wagons, 1,000	155,000
	$4,340,000
Numerous other orders (details not available yet) estimated at	11,000,000
	$15,340,000

Provincial Govt. Orders—Imperial Gifts.

Horses (Saskatchewan)	$ 162,500
Flour (Ontario(, 250,000 bags	750,000
Flour (Manitoba), 50,000 bags	150,000
Evaporated apples (Ontario), 100,000 lbs.	6,000
Oats (Alberta), 500,000 bushels	300,000
Canned salmon (British Columbia), 25,308 cases; and charges	102,000
Potatoes (New Brunswick), 100,000 bushels; and expenses	90,000
Oats (Prince Edward Island), 100,000 bushels	50,000
Cheese (Quebec), 1,000,000 lbs.	620,000
	$ 2,230,500

Provincial Govt. Orders—Gifts to Belgium

Flour (Alberta), 5,000 bags	$ 20,000
Barrels (New Brunswick), 15,000; and charges	25,000
Evaporated apples (Ontario), 100,000 lbs.	16,000
	$ 61,000

French Government Orders.

Boots	$ 1,000,000
Blankets	1,845,000
	$2,845,000

Summarizing the above, we have the following results:

Total War Orders Placed in Canada.

British	$18,505,000
Dominion	15,340,000
Provincial	2,291,500
Foreign	2,845,000
	$38,981,500

This sum represents only the orders given during about the past two months. Many more are sure to follow.

Trade Gossip

The Canadian General Electric Co., Montreal, have secured a contract for electrically equipping the new Customs House, Ottawa, which is being constructed by Peter Lyall & Sons Construction Co. Six transformers will step down the current for lighting and power purposes. The elevators, ventilating, pumping and heating systems will be electrically operated, direct connected motors being installed.

War Orders.—The Western Drydock and Shipbuilding Co., of Port Arthur, has received an order for shells and munitions of war for the British Government to the amount of $100,000. The company has, for some time, been working on a proposition to get orders for the construction of submarines as foreshadowed in a despatch from Ottawa. The Port Arthur wagon works are almost continuously making transport wagons for the army.

Canadian Commercial Intelligence Service

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Commissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS

Argentine Republic.

H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.

D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Cancoma.

British West Indies.

E. H. S. Flood, Bridgetown, Barbados, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.

J. W. Ross, 6 Kinkiang Road, Shanghai. Cable Address Cancoma.

Cuba.

Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.

Philippe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona.

Japan.

G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.

J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.

W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.

W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.

W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.

E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.

J. E. Ray, Central House, Birmingham. Cable address, Canadian.

Acting Trade Commissioner, North British Building, East Parade, Leeds. Cable address, Canadian.

F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.

Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Cancom.

Harrison Watson, 72 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.

Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Nassau, Bahamas.

Colombia.

A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.

C. E. Sontum, Grubbeged No. 4, Christiana, Norway. Cable address, Sontums.

South Africa.

D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.

E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.

W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Mount Forest, Ont.—The council contemplate installing electrically-driven pumps.

Toronto, Ont.—The Board of Control are in the market for a lathe for the Works Department.

Bracebridge, Ont.—By-laws will be submitted on January 4 to authorize the expenditure of $10,000 on new pumps, water main extensions, etc.

Winnipeg, Man.—It has been announced that the construction of the aqueduct for the Greater Winnipeg Water District will be commenced in March.

Sydney, N.S.—It is reported that the Dominion Iron and Steel Company have received a substantial order for rails from Ireland. The amount specified is not given.

Winnipeg, Man.—Extensive alterations are proposed for the power plant at the Municipal Hospital. These include a forced draft plant, pumps, valves, etc. Roberts & Frith, Winnipeg, are the consulting engineers.

Electrical

Delaware, Ont.—The ratepayers will vote on a by-law for the installation of a hydro-electric system.

Port McNicholl, Ont.—Hydro-electric power was inaugurated here last Thursday by chief electrician Braybrick.

Kamloops, B.C.—The Town Council contemplates making extensions to the waterworks system and power plant at a cost of $70,000.

Toronto, Ont.—The Scarboro Township Council are contemplating the installation of a Hydro-Electric plant at Birchcliffe, near here.

Durham, Ont.—A by-law will be voted on to provide for the purchase of a portion of the electric lighting plant and the installation of a hydro distribution system.

Toronto, Ont.—The Provincial Hydro-Electric Commission will erect a transformer station near Owen Sound at a cost of $20,000. The building will be of steel and reinforced concrete construction.

St. Catharines, Ont.—At a meeting of the joint Hydro-electric Union of Niagara district, held here recently, it was decided to petition the Hydro-electric Power Commission of Ontario to make additional surveys for Hydro-radial lines from St. Catharines by way of Power Glen and Smithville, through the townships of Caistor, Binbrook and Barton to Hamilton, also from Niagara Falls, through the townships of Thorold and Stamford West, also to continue the survey for a line for Port Colborne north on the east side of the Welland Canal, through Thorold township and town, and to furnish estimates for the same. A standing committee on routes was appointed to act in consultation with the Hydro engineers, consisting of Mayor Petrie and W. C. Bash, St. Catharines; D. McGillivray, Port Colborne; J. Goodwin, Welland, and Hugh Bertram, Saltfleet township.

General Industrial

Thorold, Ont.—Thorold pulp mill was completely destroyed by fire on Dec. 15, at a loss of $15,000.

Toronto, Ont.—The Leach Concrete Co. have assigned to Jas. J. Langley. The company was a large contracting concern with offices at 76 and 78 Albert street, and during recent years had done a large amount of concrete work for the city. The liabilities are given as between $15,000 and $20,000, with nominal assets of about the same. No meeting of creditors has been called as yet.

Municipal

Galt, Ont.—The town will probably buy a number of hydrants.

Weston, Ont.—The Ontario Railway and Municipal Board have incorporated the village of Weston into a town.

Fort William, Ont.—A by-law will be voted on in January to raise $65,000 for waterworks improvements.

Hull, Que.—The waterworks improvements include the installation of an eight million gallon turbine pump.

Tara, Ont.—It is proposed to spend $2,500 on fire-fighting equipment. A by-law will be submitted on January 4.

Welland, Ont.—A by-law to provide $5,000 for a fire alarm system will be voted on by the ratepayers in January.

Hespeler, Ont.—Extensions to the waterworks system are contemplated. A by-law will be voted on to raise the necessary funds.

Parkhill, Ont.—A by-law will be voted on by the citizens on January 4 to provide for extensions to the waterworks at a cost of $3,000.

Welland, Ont.—A by-law will be voted on by the ratepayers on January 4, to authorize the expenditure of $5,000 on a fire alarm system.

Sarnia, Ont.—A by-law to raise $60,000 for a new city hall to replace the one recently burned, will be submitted to the ratepayers in January.

Brantford, Ont.—A by-law will be voted on by the ratepayers to authorize the expenditure of $100,000 on a pumping station and water mains.

Dunnville, Ont.—It is proposed to spend $12,000 on waterworks extensions. A by-law will be voted on by the ratepayers to raise the necessary funds.

Vancouver, B.C.—The town of West Vancouver is calling tenders for work in connection with the proposed waterworks system. H. McPherson is the engineer.

Toronto, Ont.—A by-law will be voted on by the ratepayers on Jan. 1, 1915, to provide for the raising of $465,000 for the building and equipping of civic stheet car lines.

Fort William.—On January 1 by-laws will be voted on for improvement of the waterworks system and the water supply from Loch Lomond. Estimated outlay, $77,000.

London, Ont.—The city council has authorized the immediate construction of additional storm and sanitary sewers. to cost approximately $14,000, to relieve the unemployment situation.

Ottawa, Ont.—The following by-laws will be voted on by the ratepayers on January 1:—$420,000 for water mains; $287,000 for intercepting sewer; $100,000 for civic abattoir, and $50,000 for an incinerator.

Ottawa, Ont.—The Board of Control, after several weeks of deliberation, has