THE

SCHOOL HOUSE:

ITS ARCHITECTURE,

EXTERNAL AND INTERNAL ARRANGEMENTS;

WITH ELEVATIONS AND PLANS

FOR PUBLIC AND HIGH SCHOOL BUILDINGS.

TOGETHER WITH

ILLUSTRATED PAPERS

ON THE IMPORTANCE OF

SCHOOL HYGIENE AND VENTILATION;

ALSO WITH

PRACTICAL SUGGESTIONS AS TO SCHOOL GROUNDS, SCHOOL FURNITURE, GYMNASTICS, AND THE USES AND VALUE OF SCHOOL APPARATUS.

WITH UPWARDS OF 400 ILLUSTRATIONS.

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PREFATORY NOTE.

In compiling the following pages, the editor has endeavoured to meet an obvious want, or rather many obvious wants, in the general economy and management of our public schools.

The subjects upon which he has sought to supply information are the following:—

1. School Architecture—including plans for collegiate institutes, high, intermediate, and primary schools.

2. School Sites—the laying out, planting, and care of the school premises.

3. The various methods of warming and ventilating school-houses.

4. The interior arrangements of the school-room—furniture, seating, etc.

5. School Apparatus—with directions for its use and preservation.

6. Physical Training in Schools—with illustrations of gymnastics and calisthenics.

7. The School-room—its internal arrangements and care.

School Architecture.—Although a very gratifying improvement has lately taken place in the architecture of the school-houses in Ontario, yet much more remains to be done in order to render the rural or village school—what it ought ever to be—the most attractive spot in the neighbourhood. The local school authorities indeed have sought to avail themselves of such information, in regard to the details of school architecture, as has been accessible to the Department. The people themselves also have evinced an anxiety to profit by the experience of other places in this matter, and applications have been frequently made to the Education Department for Plans, Specifications, &c., to this end. In complying with these requests, as far as possible, school architectural engravings have been procured and published, from time to time, in the *Journal of Education.* These plans, with many additional ones (some of which are Canadian), have been collected and classified, and are now

published together in the following pages.* Much additional information has also been incorporated in the accompanying letterpress.

School Grounds; Warming, Ventilating, Seating, &c.—The same remarks apply in all respects to the chapters on the laying out of the school grounds, and on the warming, ventilating, and seating of the school-rooms. The numerous engravings inserted will be of interest and value in the illustration of this important part of the subject.

School Apparatus.—The facilities which the Department, through the liberality of the Legislature, has been enabled to offer to school trustees for procuring apparatus, diagrams, and maps for their schools, have induced trustees freely to avail themselves of the privilege, and to furnish their schools with these articles. The proper use and careful preservation of the apparatus have, therefore, become important matters of school economy. In the chapter devoted to this subject will be found embodied, it is believed, the result of much practical experience and intelligent discrimination.

Physical Training.—To this chapter we have devoted a large space, and illustrated it with a great variety of engravings. The importance of this branch of education is more and more felt every day. In Europe, especially, it has long held a prominent place in school discipline and instruction. In the Normal and Model Schools it has always formed an attractive and valuable feature in the ordinary exercises of these institutions.

* For many of the illustrations in this work we are indebted to the courtesy of several American friends and others.

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SCHOOL ARCHITECTURE

INTRODUCTORY CHAPTER—THE SCHOOL-HOUSE.

INFLUENCES OF A GOOD SCHOOL-HOUSE AND ITS SURROUNDINGS.

1.—The Influence of an Attractive School-House.

It is highly desirable to remove, as far as possible, all obstacles that interfere with the education of youth. The very place of instruction should be rendered as attractive as possible. If the school-house should happen to be the meanest house in the neighbourhood, the impression of the children attending it would naturally be that it was one of the meanest things in the world to attend school; whereas if the school-house is neat, elegant and attractive, as it should be, the impression fixed in the minds of the children would be that school was a place of power, influence and importance. It was requisite that the interior of the school-house should be rendered as clean and comfortable as possible. There is, therefore, much true philosophy in the erection of a good school-house, with pleasant and agreeable surroundings.—*Rev. Dr. Ryerson.*

2.—Ample Return for Investment in a good School-House.

I differ very widely from those who regard the erection of a good school-house as altogether an unproductive investment, even in a pecuniary point of view. It will not, I think, be disputed that education has become an indispensable institution in every civilized community, so much so, that no respectable head of a family would reside where its benefits could not be obtained for his children. A school-house, then, is no longer a matter of choice, but a necessity. It is now pretty generally understood that, if a community desire its youth to keep pace with the march of events going on almost everywhere, it must educate them; to neglect to do this would be to make them pariahs in society—the hewers of wood and drawers of water for their better instructed neighbours. A school-house being thus a necessity of the times, it appears to me that the difference of cost between a good one and an inferior one would be but little felt by the ratepayers, whereas one in all respects complete might, in many instances, decide respectable persons to settle amongst us. Without a constant influx of settlers and capital, a new place will retrograde, and its property depreciate in value; whereas, by making it attractive to people with means, they might be induced to make it their home, and nothing will do this with more certainty than a good school. In that case the demand for property would increase; it would rise in value far beyond the amount required to build a good school-house, and thus repay indirectly, manyfold, the cost of its erection. I am quite convinced that a good school, well managed, is just one of those things calculated more than almost anything else to promote this end. So that even in a pecuniary sense I do not think the money spent a dead loss. On the contrary, I believe it would repay every proprietor ten times the cost of the school by the increase it would effect

in the value of his property. We need not travel far for an example illustrative of this fact. It was $400,000, I think, this county advanced towards building our railway. No part of this large sum, so far as I know, has been paid back; yet will any one pretend to say—even should there never be a cent of it repaid—that this was a losing investment? I say most emphatically, no: because the railroad has increased the value of property in this county to more than double what it would have been without a railroad. And so it will be found with school-house and other improvements. It is a narrow view of the matter to look only at the outlay, without considering the effect the improvement might have upon the value of the property and the business of the place. We may, I think, rest assured that it is only by a liberal municipal and school policy, just as much as by a liberal national policy, anything good or great for a people is ever accomplished."—*Dr. Bowie, at School Examination in Mitchell, Ont.*

3.—School-Houses should be Pleasant Way-Marks.

It is to be regretted that school-houses generally have such an uninteresting sameness, and want of educational expression. They should have as much pleasing variety as the private houses which adorn our land. There should be something about them different from those monotonous and dreary circumstances which so often surround them everywhere here. If men would build them more nearly to resemble their own homes, going to school would be robbed of half of its irksomeness. Those boys and girls who have pleasant homes, would hardly realize their absence from them, and the children of poor or untasteful parents would enjoy the privilege of spending a portion of each day where their love of beauty and propriety would be gratified and increased. We would say that the country is becoming noted for the improvement made in the style and comfort of its dwelling houses. How much more should it have attractive school-houses. Since the passage of the revised school law, good houses, commodious and well ventilated school-rooms, have been the result, and neighbourhoods have been improved morally and economically a thousand fold by the expenditure.—*Ohio Journal of Education.*

4.—The School-House an Index of the Character of a Neighbourhood.

In many parts of the country there is a decided demand for better school-houses. The condition of a school-house and the school in a neighbourhood reveals more of the character of that neighbourhood than is generally supposed. In many localities the people are abundantly able to build; but it is often the case in wealthy and growing communities that the school-house is the last building reconstructed in such ample proportions and style as to be in harmony with the improved condition of the country. This does not show the true spirit of intelligence, or even exhibit ordinary sagacity, for an intelligent and far-seeing community will look *first* after the education of the children, and see that the necessary educational appliances of a good school-house are amply provided.—*North-western Home and School Journal.*

5.—School-House and Appliances as Instruments of Education.

Among the instruments of right education may be classed under the School-House and the Playground:

1. *The School-House*—The arrangements of a school-house as to neatness, taste, and cleanliness, have a great influence on the character of our children. Schools should have a tasteful, simple, inexpensive style of decoration. Objects of beauty and taste should be always within the sight of the children, but of such a character as might reasonably be expected in the dwelling of a thrifty and industrious artisan, or well-to-do cottager.

2. *The Playground and its Influence.*—The playground, from allowing character more freely to develop itself, is not only educative in itself, but furnishes the means of education to the teacher. By observing the associates selected, the positions assumed as leaders or followers, the games played, the forbearance or otherwise, he acquires knowledge which must be of great use in the conduct of his school. Should the teacher not use this knowledge, he would be very unwise, and the chief benefits of the playground be not realised.

6.—School-House Influence on the Morality of its Frequenters.

It is a part of our philosophy that ethics and æsthetics are as nearly allied as Christianity and cleanliness. If you would render the moral character of a school pure, you must cleanse and purify your school-building and its appurtenances, and keep them so. While we would form our opinion of the practical results of the moral instruction by the general deportment of the pupils in and out of school—by their quarrelling, vulgarity, and rudeness, or the reverse—we would not consider these indications infallible, as a very profane boy may not, and probably will not, indulge in that vice in our presence. Under observation children rarely do wrong; and the great query is to know the value of our influence when that observation is withdrawn. This we may learn as Robinson Crusoe did the presence of humanity on his desolate island—*by the tracks.*

It is a very delicate subject to point out all the tracks which indicate vicious indulgence in and around the school. It is certain, however, that they who might be shocked the most are they who understand the subject least, and have most to learn, that the moral character of a school and their fitness as teachers are indicated by the *moral character of the building and its premises.*

Can children be virtuous who are daily brought in contact with vulgar, profane and indelicate associations about the school-house, shocking to every sense of decency and virtue? Can the best precepts of morality, daily uttered, overcome that taint which is patent in, on, and around the school-building? Can that teacher's influence be virtuous, whatever attention may be given to instruction in the duties of morality, who goes in and out daily before the school and is too blind too see, or too careless to cure, those vices which are indicated by such *tracks?*

Perhaps these things are so common that they are not regarded as they should, as powerful immoral forces, operating on the susceptible minds and passions of children. That they are immoral forces we know; and knowing it we should see that they are removed from every school, and that all its arrangements and appliances are calculated to promote virtue and morality.

Were we seeking to know the intellectual and physical character of a school, we would go where the children *are.* Did we desire to learn the moral character of a school, we should go where they *have been,* and find their "tracks"—around the school-house and back of it.—*Illinois Teacher.*

7.—What every School-House should have—Its Surroundings.

In the first place, it should have a pleasant situation, not on the highway, nor be near noisy factories, distilleries, or pork-houses. Nor is it advisable, for many reasons, to place it close by the burying-ground. Its surroundings are potent educators, not to be lightly esteemed, neglected or despised.

It should have, *in all cases,* separate entrances for boys and girls, and entrance-halls large and light, well supplied with wardrobe hooks, to accommodate the outer garments of the pupils. An umbrella stand, and boxes, or pigeon-holes, for over-shoes and dinner-pails, are desirable. If the school be large and graded, the primary scholars should have separate entrances, and separate grounds; otherwise, they will always be exposed to injury from the larger pupils.

Every school-house should have a room which can be made comfortable for the pupils, to be occupied by them at noon, or when the teacher is away. Most of the damage to school-houses is done at noon by those who remain, often expressly to be rude and noisy. A plain room, with only a single stout bench around the wall, will answer. This can be put into the ordinary small school-houses between the two doors. It can be used as a recitation-room; and it will generally repay very large interest on its cost.

Every school-house should have a well, and a place for washing. What thirsty creatures school-children are, can only be realized by teachers, and by those who live near schools. And to save annoyance to teacher and to neighbours, and to enforce cleanliness, water and the means of using it should be freely supplied. (See No. 3, page 23.)

Every school-house should have an ample play-ground, especially in villages, so that the scholars can have room for active amusements without being on the street, or in the neighbouring premises. And this should not be made a garden, or closely set with trees. Ornamental shrubbery is out of place in a mere play-ground. A small group of shade-trees here and there in the grounds is well, but no cramping of the play-ground itself should be allowed. (See chapter iii, page 21.)

Every school-house should have a large floor-space unoccupied by desks. There should be a wide passage-way outside the desks, entirely around the room. No teacher wants scholars lolling against the wall, or leaning on the window-sills. The walls are thus free to be used for blackboards, and classes can be placed on either side of the room at convenience. There would then be room for visitors at examinations, where they can sit apart from the pupils. A teacher should be able to pass entirely around the room with freedom.

Every school-room should have a suitable place to keep its books and apparatus under lock and key when not in use—a closet, with glass doors, if there is anything worth displaying, but something safe and strong, where the globe can be kept from revolving too often, and the dictionary be secure from that "play upon words" which is sometimes indulged in.

Every school-room should have its windows so that they can be lowered from the top, as a safe and cheap assistant to ventilation.—*Illinois Teacher.*

8.—Condition of our School-Houses the Result of Carelessness.

No travelled man, even of moderate observation, can have failed to notice the sad condition of some of our country school-houses. They are a libel on the thrift of our people. In no other single thing do you so neglect beauty, convenience, utility, and your own personal interests. We speak advisedly when we say that many of our farmers have out-buildings for their cattle, sheep, and horses, better situated, in better repair, and more comfortable than some school-houses. This lamentable state of things is not the result of ignorance or poverty, but of *habitual neglect—carelessness.*

Modern ingenuity has done as much to improve school as dwelling-houses. That ingenuity only needs to be appropriated to make the school-houses as comfortable, convenient, healthy and attractive as the dwelling-houses.

The prime secret of the difficulty is here: new school-houses, especially in small sections, ease the purse-strings somewhat; and it is an outlay of money which the people say they do not expect to realize any immediate benefit from. And it is too much the character of our people to make all their calculations in dollars and cents. And so the fathers cover their love of money by saying "the school-house is as good as when *they* went to school; the seats are as easy, the desks as convenient, the room as comfortable, the books and instruction better."

If there were any reason why every school-house should not be pleasantly situated, surrounded by appropriate play-grounds, and built in modern style,

there is none why they should not be furnished with every improvement of modern invention. The teacher's desk ought to be deemed no better furnished without a standard Dictionary than the pulpit without a Bible. And suitable and reliable maps and charts are as appropriate and far more necessary on the walls of the school-room, than frescoings in churches and parlors. We think they would be of more benefit to children. Children, generally, don't love their books any too well; and don't study any more than is necessary in our common schools. Therefore it should be the study of parents to make the school-room in every respect as pleasant, convenient, and attractive as possible. *Utile cum dulce* should be the motto of every one who has influence with children, everywhere. It would save a great deal of the labour of making crooked characters straight. Let "beauty and utility dance together" always, when they will.—*New Hampshire Journal of Education.*

9.—The Rural School-Houses of the Past.

In all our travels we have found but very few old school-houses that should not be indicted and burnt! Small, pent-up, unventilated, and furnished with back-breaking benches, they are as uninviting to the child as a prison, and should never be entered with either its own or any intelligent parent's consent. But this is not all; the exterior is almost universally repulsive. Think of an old bald *red* school-house, when there are so many pleasing forms and colours that are just about as cheap. Think, too, of the situation of many of our school-houses—stuck down in some low, quaggy spot, where it is impossible for children to be healthy, or up in bold relief on some barren knob, without a suitable enclosure, and without either a shade-tree or a flower-bed anywhere near. There it stands—the old red, or unpainted shanty—reared by unwilling tax-payers, who see the advantage of building good barns for their horses, and yet consent, for a few dollars, deliberately to cripple the bodies, and cramp, and stint, and disease the minds of their children, because they have no apparent cash value in the market!—a humiliating evidence of the short-sighted folly of the parents of our youth, and a burning shame and disgrace to the enlightened sentiment of the country.—*Wisconsin Farmer.*

10.—Why should there be such Inadequate School Accommodation?

From time immemorial the country school-house has been an object of satire and ridicule, on account of its cheapness and neglected condition. While great improvements have been made of late years in school-house architecture, specimens of the olden style remain still to confirm and illustrate all that has been said or sung about this sad monument of public economy. A single glance at its structure, in comparison with the church, the court-house, or town-hall, will reveal how much deeper interest in these structures was felt by the builders than in that more important edifice where the young receive those lessons which are to determine the whole character of their future manhood.

One would suppose that within those walls, where the children are to spend so large a portion of their tender years, some of the comforts which men demand for themselves in mature life might be provided by them for the young, to mitigate, in some degree, the severity of those tasks which rigid mental discipline requires. But the carpeted floor, the cushioned seat, the frescoed wall of the church, the rich finish and furniture of the bank, or elegant store, would be quite out of place where children are assembled for the culture of the intellect, of refined habits and manners. Is it a matter of surprise that those children who come from homes richly supplied with whatever can contribute to comfort, refinement, and the culture of taste, should deteriorate under such surroundings as are too common? or that those whose homes are destitute of comfort

and refining influences should fail to receive that culture—from coarse surroundings—which is a most desirable part of an education?

Sometimes great care is taken to build the house of suitable materials, thoroughly put together according to plan and contract. But often here ends the responsibility of the builders. The money is expended, and, at the last, the very requisites essential for the success of the school fail to be furnished. Inadequate provision for warming and ventilation, or for the necessities of the pupils on the out-door premises are wanting.

A competent teacher works successfully, as does a workman in any other business, only as necessary implements and conveniences are provided for his use. If denied them, his efforts must be a failure. What can reasonably be expected of a teacher under such adverse circumstances?—*A. Parish, in Connecticut School Journal.*

11.—Children's Ineffaceable Memories of the School-House.

The influence of external surroundings and associations in moulding character is a subject of general observation, and certainly at no period in life do they exert so powerful an influence in shaping the plastic mind as during childhood and youth. As the delicate wing of an insect resting on the newly-moulded potter's vessel may leave an imprint there which will far outlast its own fleeting life, so the impressions which the mind receives from external objects are ineffaceable, and remain fresh and distinct long after the objects which produce them have perished.

How well do we all remember the school-house where we received our early education, the foundation upon which has been reared all our subsequent attainments! What a prominent place does this picture occupy in memory's gallery! We view all its surroundings: every tree, hillock, and shady nook has its own little story of childish sports and youthful pleasures. There, too, we recall everything connected with the internal arrangement, the maps which relieved its dusky walls, the few inferior pictures which attracted our youthful fancy, the arrangement of the school furniture and its adaptation or non-adaptation to the wants of the pupils; and all these impressions as certainly had their effect in moulding the character as the instruction which was imparted by the teacher. We may not have recognized it at the time, and may not now be conscious of it yet we now know that it was actually the case.

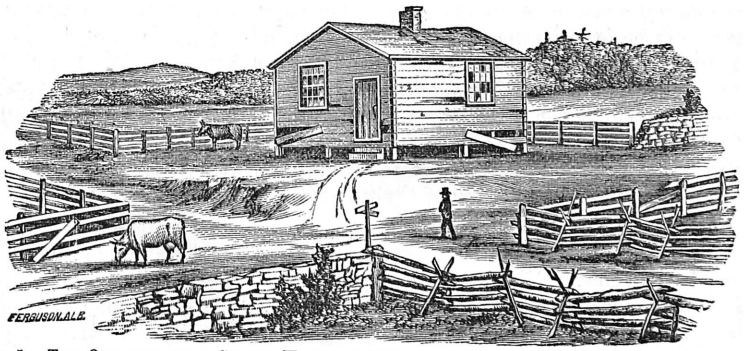

Fig. 1.—The Old-fashioned School-House, which is still to be found in some Localities.

Take, for example, one of the old, shattered, broken-down school-houses, that we so frequently find scattered throughout the country. There is no play-ground attached to it, and weeds grow rank and luxuriantly around it. Enter: the door creaks on its hinges, and you find yourself in a small, low, dark room, where

ventilation is secured by openings beneath door and windows, through which the wind howls dismally. The walls are without maps, or charts, or pictures. The room is cold and comfortless, the children are found huddling together as near the stove as possible, to secure greater comfort. What must be the effect of such surroundings upon the youthful mind which here receives its first impulse in the path of knowledge? No wonder that the children look upon it as a miserable place of torture, and that in after years they recall their school (not their school-days) as anything but the happiest memory of their lives, but rather as a place of imprisonment from which they longed to escape.

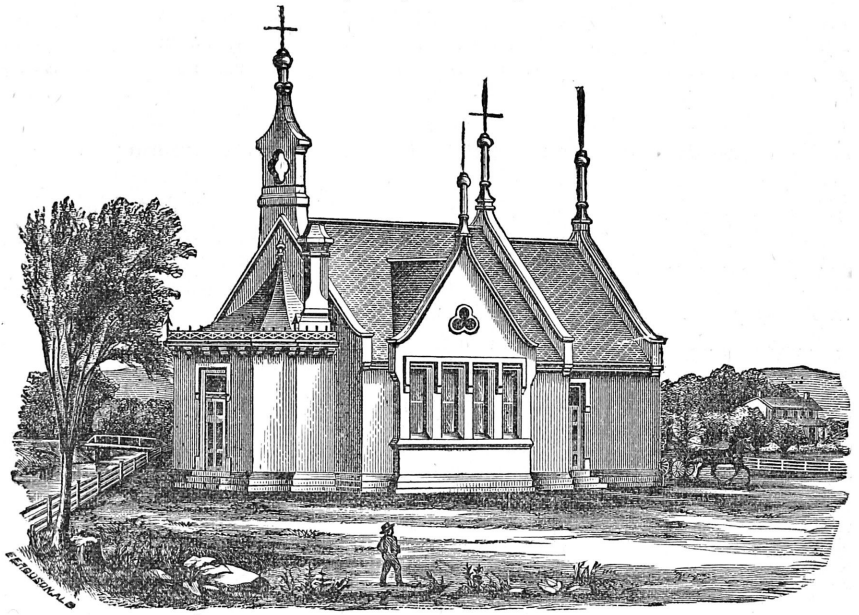

Fig. 2.—New and Elegant Style of School-House, in contrast.

On the contrary, let us visit a neat, substantial, tasteful school-house, such as, we are happy to say, do dot the country here and there. The site is beautiful: it is surrounded by ample grounds, tastefully laid out and planted; the building itself presents an attractive appearance; and within are all the appliances necessary to the comfort of the pupils and their advancement in study. The furniture is appropriate; the walls are clean, and furnished with blackboard, maps and charts, such as will best facilitate the acquisition of knowledge in all the branches pursued, and, here and there, looking calmly down upon the proceedings of the school-room, is a painting or engraving of one of the great world's great men, to which the teacher can occasionally point as an example worthy of imitation by all the pupils. Pictures of such men will render the children familiar with their faces, character and history, and convey impressions to their minds which will never afterwards be forgotten.

Such things as these give an air of refinement to the school-room that renders it attractive to all hearts; and in after years hundreds who have bid farewell to its hallowed scenes, recall with delight the associations of their school days.

The school-room gives us almost our first impressions of life, aside from home influences; and how important that the associations should be pleasant and agreeable, influences refining and elevating! for the ideas and impressions there received will be fresh and vivid long after the school-house itself may have crumbled away.—*Albany Journal of Education.*

12.—Why not Adorn the School-Houses, Messrs. Trustees?

There is no class of buildings, whether residences or outbuildings, which, as a class, show so much neglect, and have about them, in so many cases, such an air of dilapidation as our school-houses—although they are "The *People's* Colleges."

"What is everybody's business, is nobody's," is a saying as applicable to school matters as to any other; and is legibly written by the hand of neglect on large numbers of our school-houses.

The place in which children spend the greater portion of their waking hours, the place in which their tastes and manners are surely and certainly formed, their habits and character moulded and fixed, is *the* place in which the least taste is displayed, and the best calculated to cultivate—by association—bad habits and boorish manners. Somebody's to blame.

The trouble is, *everybody* is to blame; and as nobody is everybody, Mr. Nobody takes all the blame, and himself sets about the work of reform; and when Nobody undertakes a thing, he always does it.

Every school-house ought to be thoroughly cleaned, as the first thing. The seats, desks, doors and windows should all be in working order; that old rusty stove and pipe should be blacked; those unsightly spots of naked lathing should be covered, the ceiling nicely whitewashed, and the walls nicely papered with neat tasty paper. Who will do all this?

A day's work of a few individuals in a section, and a few dollars in money, will do it all. It costs but little—takes but little time. Yet it changes your dirty, disagreeable, uncomfortable and disgraceful old school-room, into a neat, tasty, little parlour; makes attractive what was before repulsive; encourages your teacher, and does more towards cultivating good taste and refinement in your children, by association, than can be done in any other way. The trustees ought to see to these things; but trustees are proverbially slack in the discharge of their duties. They need prompting. Now let the first man or woman that reads this article take the matter in hand without delay, and if "nobody" is there, but only yourself, go to work; you can do it alone, and feel well paid while doing it, and a thousand times paid hereafter. With how much better spirit can a teacher work when he finds things in shape upon the first day, than when the surroundings tell of neglect, and foreshadow want of interest in, and appreciation of, his future labours.—*Anon.*

13.—Who should see to the Condition of the School-House.

It is the duty of teachers, as well as parents and school trustees, to see that the circumstances under which children study are such as shall leave a happy impression upon their minds; for whatever is brought under the frequent observation of the young must have its influence upon their susceptible natures for good or evil. Shabby school-houses induce slovenly habits. Ill-constructed benches may not only distort the body, but, by reflux influence, the mind as well. Conditions like these seldom fail to disgust the learner with his school, and neutralize the best efforts of his teachers. On the other hand, neat, comfortable places for study may help to awaken the associations, enchaining the mind and the heart to learning and virtuous instruction, with links of gold brightening forever.—*Ibid.*

CHAPTER II.

ORNAMENTATION OF THE SCHOOL GROUNDS.

1.—Why not Plant and Ornament the School Grounds?

All the school-houses and grounds in the country are susceptible of very great improvement, in an æsthetic point of view. It becomes then the teachers of the young to give their aid in ornamenting with trees, shrubbery and flowers, the school grounds, for the gratification and pleasure of those under their instruction, as well as for the gratification of the community in which they labour.

The position of the school-house, of course, has much to do with the number and nature of the ornaments to be placed around it. There are houses to be met with in almost all sections of the country which are either perched up among rocks and briars on the apex of a hill, or down in the midst of the mire and miasma of a swamp; yet even here there may be something done. No matter how desolate and uncomfortable a place the school-house may occupy, there is room for improvement. The very rocks may be converted into ornaments. The swamps may be drained, and healthy, dry land secured as the result, which is then just in proper condition to be beautified. These out-of-the-way places are the very ones where ornament is most required, to make the school ground a pleasant and inviting place.

It is in the power of every one to procure a few shade trees and some shrubbery to place in the school grounds. The cost is no consideration, inasmuch as they can be secured almost everywhere free of expense; and where this is not the case, a dollar or two contributed by the teacher, or collected by the pupils, will purchase all the trees required. Linden, maple and ash are among the most beautiful; but if these are not to be obtained, secure the most ornamental of other kinds to be had. But, by all means, plant and ornament the school grounds. It will prove a pleasant and profitable investment.—*Ex.*

2.—How Uninviting School Premises may be Beautified—Example.

A correspondent writes:—It was our lot some twelve years ago to attend a country school known as the "Old Sandstone." The school-house was rather rude in structure, and occupied a position on a slight elevation surrounded by a few oak and hickory trees. A new teacher came, and after becoming acquainted with the pupils, he made a proposition to ornament and beautify the old school-house and the grounds surrounding it. The whole school accordingly fell to work collecting funds and materials. Several afternoons were devoted to the work of improvement, and in a few months both interior and exterior of the old house were carefully white-washed; a neat lattice fence surrounded the house; flower borders were made and filled with flowers; shrubbery was planted within the enclosure; the heretofore barren grounds were carefully covered with sod; and the whole thing presented such an altered appearance, that even its nearest neighbour scarcely recognized the "Old Sandstone" in its home-like dress. All the work, with the exception of a few half days, was accomplished during the time of recess and in the morning before school. A small portion of the flower border was allotted to each of the larger pupils, who in the main performed the work, and all felt an interest in the preservation of the flowers and shrubbery, and the maintenance of the general beauty of the house. It was merely an ordinary public school; but, ordinary as it was, all felt a pride and interest in adding to its neat and cozy appearance.

The more home-like the school, the more interest and pleasure will the pupils manifest in attending it. There is no more effective way of overcoming irregularity of attendance and truancy, permanently, than this. When school once becomes a pleasant place to pupils, the temptation to play truant is in a great measure overcome. When we come to look at the matter closely, it is not much wonder that children dislike to attend school when the school-house and all about it are repulsive.

There is no better time in the year for planting trees and hardy shrubbery than in the fall or early spring. Nurserymen, as a general thing, prefer the fall for removing and planting trees. A few evenings and Saturdays expended in a judicious manner will accomplish much. In the spring months the planting of flowers and seeds, and the laying of sod and the making of walks, may be attended to. By thus occupying a portion of the spare moments of both seasons, due time and attention can be given to the legitimate work of each.—*Ex.*

3.—Ornament your School as well as your Home Grounds.

No time should be lost at the proper season in planting shade trees and evergreens; and while all are busy in ornamenting the home grounds, let them not forget their neglected school grounds. It is such a pity that people take so little interest in making the place where their children must spend so much of their lives, pleasant and attractive. But where they fail in this duty, we would urge teachers to take the lead in this work, and to get all the help they can from others. We trust that no teacher who is, or ever expects to be *anybody*, will say, "I do not intend to teach more than this term in this district, so there is no use of my going to the trouble and labour of planting out trees, I shall never get any good of them."

We hope no teacher is so narrow-minded or selfish, as to make any such miserable plea. The truth is, teachers should labour not only for their own good, but also for the good of others. Fellow-teachers! go to work and plant young and thrifty trees around every school-house in the land. If this were done in any one year, what an improvement the school-house grounds of five years hence would be upon the school-house grounds of to-day. We would recommend the school authorities, where school grounds have not been selected, to select a pleasant and convenient site, of not less than three acres; fence it, and have it planted with trees. In a few years it will be a beautiful spot, where children would delight to assemble. If the trees were properly selected, tastefully arranged, and good care taken of them, they would soon form a grove, as enchanting as the groves of Athens were.

Let us have all the varieties of forest trees that abound in our country, and let us not forget to plant a few evergreens on either side of the path that leads to the door of the school-house.—*Iowa Instructor.*

4.—Organize to make a Town or School Beautiful.

In one of Mr. Northrop's Connecticut School Reports are remarks on "How to make a Town Beautiful." He states that the citizens of Stockbridge formed an association for this purpose. It has changed an unsightly village into one of the most beautiful towns of New England. The record shows that over 3,500 trees of many varieties have been set out, not only in the village, but along the streets leading into the country. Both public and private grounds abound in hedges, evergreens and choice plants, and the wide streets are kept like a lawn. It also suggests the propriety of forming associations in our schools to beautify the school grounds. Pupils could easily be led thus to organize, and their united efforts would soon work a wonderful change. The association should be a permanent one, and the work should be carried on from year to year. Try it.

5.—Reasons why we should Promote Rural Refinement.

Many people have yet to learn what value there is to a family in a well-kept flower garden. Does it not supply to children their most beautiful memories? A child who has nothing but a dirty house and neglected ground to recollect as connected with his early home, lacks an important impulse to a well-ordered life. Beauty in morals can hardly be expected from deformity in condition. And not only to childhood do flowers minister happy influences, but also to the labours and fatigues of manhood and old age. Is not the farmer who returns from the labours of the field to repose in a well-kept house, in the midst of green lawns and beautiful flowers, a happier and better man for their presence? Does not old age find them an added element of its repose? It were useless to ask, "What good comes of flowers? Can we eat, drink or wear them? How can I spare the time to cultivate them, when the necessaries of life demand so much of my attention?" Just as if ministering to our love of the beautiful is less of a necessity than eating, drinking or wearing. Virtue and happiness depend as much upon neatness, order and beauty, as animal life upon eating, drinking and sleeping. Even in those parts of the country where the people still live in log houses, there is all the difference imaginable between a well-constructed, well-kept, and pleasantly situated house of this kind, and one that is otherwise. A refined family will show their refinement in such a house, as much as in a palace; and the vulgar will make their vulgarity equally conspicuous. It is not costliness which is demanded in our rural architecture, but taste and refinement. And these may appear in putting logs together into a cabin, and in the air of neatness with which they are surrounded, as much as in a palace on Fifth Avenue or Walnut street.—*American Chronicle.*

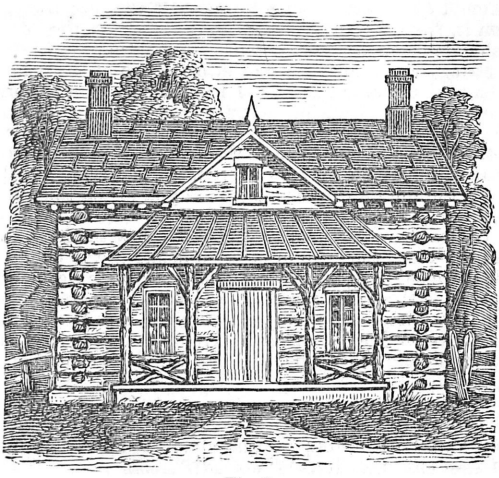

Fig. 3.

6.—Reasons why Trees and Shrubbery should be Planted.

As the school grounds should be planted with shade trees, it is desirable to select such as are of rapid growth—the maple, locust and poplar, are perhaps the best; with less rapidity of growth, but of equal beauty, the oak, sycamore, ash and beech might be chosen; and of evergreens, it is scarcely necessary to name the pine, cedar and hemlock. It will be observed that all those named are indigenous to our Canadian forests, and if the school grounds were sufficiently large, they might be planted with a variety of all our most conspicuous and useful trees; that while enjoying their shade, the inquiring pupil might learn their names, classes and uses. The same principle should be applied in selecting shrubbery and flowers, as trees. Their cultivation would refine their taste, and the pupils might learn useful practical lessons in the study of botany. Though Canadian trees and Canadian flowers should be selected, on account of their real merit, and the facility with which they can be obtained, yet no unjust discrimination should prohibit those which are exotic; but these are so numerous, and possess so many varied attractions, that the whole subject is left to the taste of intelligent trustees and teachers.

7.—How to Arrange Flowers about School Premises.

A Flower Pole is one of the handsomest ornaments ever seen in the country, but is rather a rarity, because so few persons know how to make one, or know how to start the seed. But it well repays all labour and expence.

The materials needed are a pole or staff from eight to eighteen feet long, a barrel or hogshead hoop, a round wheel or truck made of a piece of pine board, from six to twelve inches in diameter, three hooks or pegs, plenty of good, strong linen twine, one or two balls, and some shingle nails. The pole, hoop and truck must correspond in dimensions; as, for instance, if you use a short staff, you must use a small hoop and truck, etc.

Select a good, fertile spot, not exposed to the wind, or shaded by trees or buildings; manure well, dig deep, rake fine and smooth, lay your hoop on the bed, and mark a furrow just outside of it for your seed, which should have been soaked six or eight hours in tepid water. Sow sweet peas, morning glory, or other flower vine, and cover about an inch deep, perhaps a little less.

NOTE.—Two or three weeks after sowing, or when the vines begin to grow, set your pole, which is prepared as follows: The pole, which should be from one to two inches in diameter at the large end, according to length, should be tapered down to one-half the size at the small end, and the truck fitted firmly on it, from fifteen inches to four feet from the top. Now drive from fifteen to twenty-five shingle-nails, at equal distances from each other, into the edge of the truck, to fasten the strings upon; drive a nail into the top of the pole; begin and string the top first, by fastening the twine to one of the nails in the truck, then pass to the nail in the top, then down to the next nail, giving the twine a turn around every nail as you proceed. Now cut off as many lines, twice as long as from the truck to the foot of the pole, as you have nails in the truck, then fasten them in the centre upon the nails, taking care not to get them snarled or tangled, which may be prevented by driving a nail into the pole near the bottom and giving the lines a turn around it; as you fasten them to the nails in the truck, draw them taut, so as to keep each line separate.

The best pegs are made from a piece of board, with a notch cut in it to allow the hoop to rise and fall, as the lines shrink or stretch. Place the hoop in position inside of the plants, and fasten with the pegs driven with their backs inwards; leave the hoop a few inches above the ground, resting on the lower shoulder of the pegs; now fasten the lines at equal distances apart to the hoop, being careful not to raise the hoop by drawing the lines too tight, as this allowance must be made for contraction from dampness. Train the little vines as they appear, water and cultivate as you would any other vine, and you will have something to show your friends in a few weeks.

Rockwork.—As many school-houses are placed in an enclosure, it gives a fine chance for flowers around the house and grounds; and as every teacher is supposed to know how to arrange and sow the flower-beds, we will speak of another embellishment—rockwork. Gather stones ranging in size from a pint mug, or a piece of chalk, to a bushel basket, and lay some of the largest around in a circle, from three to six feet in diameter, according to the size and number of the stones at hand; then fill up even with good soil; then lay on another row of the largest stones left, filling up as before, taking care to break joints, and to draw in as you proceed, so as to have the pile come to a point, which may be made of one large conical-shaped stone. It may be as well to put in some sods, with the grass side down, among the stones, to prevent the dirt from washing out.

On the rockwork you can plant Nasturtium, Morning Glory, Portulacca, Petunia, and if you have a Lautana, Heliotrope, Verbena, or Madeira vine, it will be all the better. Be careful to water copiously for a time, and keep the weeds out, and you will have plenty of flowers.—*R. B. Cutter, in Illinois Teacher.*

8.—By all means let us have School Flower-Shows.

We feel persuaded that we address hundreds of teachers, who are not only able, but will also be most willing, to further that which it is our privilege to advocate. We wish to interest them in a "movement" to which we believe

there can be no possible objection, whilst it may be conducive of much benefit. We allude to the "Flower-Show Movement," in its most recent development—flower-shows in schools. The reader may say, that to exhibit flowers in a school is not a very wonderful achievement. True; but it leads to important and useful results. We want the teachers of schools to urge their pupils to the practice of floriculture, and to submit the results of their endeavours to periodical examination. If we desire the masses to *enjoy* the sight of flowers in our public parks and gardens, we must teach them how to duly *appreciate* them; they need not be taught to *admire* them. The love of flowers is inherent in mankind.—*English Pupil Teacher.*

NOTE.—*Prizes for School Bouquets.*—The County of Yarmouth Agricultural Association, in Nova Scotia, offer prizes of $10, $15, and $20 for "bouquets composed solely of flowers grown on grounds belonging to any public free school in the county."

9.—The Beautiful Flowers!—Why not more Cultivated?

Why does not everybody have a geranium, a rose, or some other flower in the window? or why do not teachers have one or more in their schools? It is very cheap, next to nothing if you raise it from seed or slip, and is a beauty and a companion. As charming Leigh Hunt says, it sweetens the air, rejoices the eye, links you with nature and innocence, and is something to love you in return; it cannot hate you, it cannot utter a hateful word, even for neglecting it, for though it is all beauty, it has no vanity; and living, as it does, purely to do you good, and afford you pleasure, how can you neglect it, teachers?

CHAPTER III.

GENERAL CONSIDERATIONS IN REGARD TO THE CONDITION OF SCHOOL PREMISES.

1.—Suggestions as to the External Arrangement of School Premises.

(1.) *The Lot.*—A large and commodious school lot is a matter of prime necessity. Without it, some of the most essential ends of education are impossible to be attained. A little attention on the part of trustees will secure an ample lot at very little expence. When public attention has been sufficiently turned to the importance of this subject, it will be a comparatively easy matter to secure the donation of a school lot, or, at least, the purchase of one at a small price. About one acre of ground is necessary for our ordinary country schools. If such a lot can be obtained, a school-house should never be erected upon a smaller one. It cannot be less than half an acre; but under our law an owner can be compelled to sell as large a lot as the trustees require. If no natural obstacle oppose, the centre of the section would seem to be the best place for the school-house; this centre having reference, of course, to population as well as distance. (See section 3 of chapter xii.)

(2.) *Position of the Building.*—In a lot sixteen rods by ten, the house should stand very nearly in the centre. This would be at a sufficient distance from the street to avoid all noise and dust, with room enough in the rear for the necessary outbuildings. It would also divide the grounds into two parts, for boys and girls. In any lot, the house should be placed in the middle as to width, and at a distance from the street. The front of the house should always face the street, so that the outbuildings may be thrown into the background, not only in reference to the house, but to the street also.

(3.) *Outside Structure.*—In all cases two separate porches should be provided. It prevents the possibility of improper communication between boys and girls, while passing in and out of the school-room. The rooms in or off the lobby should be used for a hat and cloak room, at a manifest saving of expence.

(4.) *Wood-House.*—The wood-house might be placed directly in the rear, so that a portion of it may serve for a back hall. This arrangement contributes to harmony of external appearance, and prevents the out-door air from blowing directly into the school-room. Thus serving a double purpose, the wood-house is almost indispensable. A basement, however, might be prepared for the storage of fuel.

(5.) *Privies.*—With the yard divided by a high, substantial board fence, running from the back side of the wood-house to the rear fence. On every school ground two privies are indispensable. A double privy should never be erected, for although so arranged as to shut out the intrusive gaze, it cannot be made impervious to sound; and the vicious may take advantage of its construction to outrage the feelings of the pure-minded, without the fear of detection. A better way would be to separate the privies entirely. The entrances should be upon the rear side, or else a screen should be erected to shield them from observation. (See plans of these outbuildings on pages 24-27.)

(6.) *Walks.*—That is very false economy which refuses or neglects to furnish the necessary walks in and about the school premises. During some seasons of the year (where walks are not provided), the children must wade through mud and water to reach the school. The consequence is that dirt is everywhere brought into the school, and tidiness is impossible. To remedy this, arrangements should be made so that pupils could avoid getting into the mud, within the school grounds, or remove it from their feet, when coming in from the road. A plank or gravel walk should be laid from the front gate to the front doors. The steps at the doors should be large and commodious. These steps, and perhaps also a portion of the walk, should be provided with scrapers. A strip of band-iron, nailed upon the edge of a plank twelve feet long, so that the edge may rise half an inch above the surface of the plank, will make an excellent and economical scraper, and accommodate a dozen or more pupils at the same time. Plank walks should be extended from the back entrances to the privies, and perhaps around the sides of the school-house.

(7.) *Fence.*—The school lot can never be kept in order unless it is enclosed by a good and substantial fence or paling, as required by the official regulations; this fence should be built of good materials, and put up in a solid manner. A picket, or a post-and-rail fence, would answer every purpose. The gates should be built strong and heavy, and so arranged as to shut of themselves. It might be well to set posts within the gates in such a manner that cattle could not get in, even if the gates should be left open. The fence that divides the yard should be of a matched stuff, and from eight to ten feet high, faced on the boys' side. The wood-house door should always open into the boys' play ground.

2.—Teacher Responsible for Keeping the Grounds in Order.

The trustees, in whom is vested the exclusive control of the school property of the locality, should first project and erect school buildings and arrange the school grounds; but after they are in order, they should be entrusted to the teacher's care, as required by the regulations,* and he should be made responsible for their

* *Care of School Property.*—The teacher shall exercise the strictest vigilance over the school property under his charge, the building, outhouses, fences, &c.; furniture, apparatus and books, belonging to the school, so that they may receive no injury; and give prompt notice, in writing, to the trustees, of any repairs which may require to be made to the building, premises, or furniture, &c., and of any furniture or supplies which may be required for the school.—*Official Regulation 5.*

abuse. It is considered his duty to keep a clean and tidy school-room, and he should be held equally responsible for the condition of the yard and its enclosure. It is true that the destructive propensities of children, uncontrolled, often lead them to do mischief—to throw down the fences, to cut and bark the trees, to cover doors and furniture with uncouth writings and figures; but it is emphatically the teacher's duty to prevent these acts.* This propensity on the part of the young, to cut, scratch, deface and destroy school property, should be corrected. They do not thus misuse the property of their parents, and it is but mismanagement at school that induces them to act differently there.† Teachers may create such a spirit among their pupils, as not only to prevent them from doing harm to the school property, but to render them willing and ready to assist in protecting it from the trespasses of others. They can be taught to love neatness and order, to guard affectionately the trees and flowers about the school grounds, and to take pride in their protection and preservation.

NOTE.—The master of the school has power to suspend (subject to appeal, by the parent or guardian, to the trustees,) any pupil for any of the following reasons: * * * * Cutting, marring, destroying, defacing or injuring any of the School property, such as buildings, furniture, fences, trees, shrubbery, seats, &c.; or writing any obscene or improper words on the fences, privies, or any part of the premises; provided that any master suspending a pupil for any of the causes above named, shall, immediately after such suspension, give notice thereof, in writing, to the parent or guardian of such pupil, and to the trustees, in which notice shall be stated the reason for such suspension.—*Ontario Official Regulations.*

3.—A Well, or other Convenience for Water Required.

It is not always possible to have a spring of water on the premises, but the regulations require that there shall be an open well and bucket, or a pump, from which cool, fresh water could be brought at all times; and this should be of such easy access that all might undergo those frequent ablutions so necessary to cleanliness, and upon which depend, to so great an extent, the good looks of school boys and school girls.

4.—Improving Existing School Grounds.

The existing school grounds can be levelled and smoothed, and good enclosures be provided, if not already done. They can be enlarged by the purchase of adjoining grounds, as provided by the School Act; and in view of the probable increased future requirement of the schools in this respect, and the increasing value of land, good economy would dictate that there should be as little delay as possible in so doing. Shade trees can be planted in all school grounds, in which they do not at present exist. It will take them years to grow; and, in the far future, the little folks who shall then enjoy the comfort of their shade, will look back and thank those to whom they may be so much indebted.

5.—Enclosure of the School Grounds.

The enclosure should combine the qualities of neatness and substantiality. A wall has been recommended by some, and it would undoubtedly possess the latter quality. It could not be easily broken down; and, if sufficiently high, would enable the children, when at play, to conduct their sports unobserved. But school grounds thus enclosed have a heaviness and gloom about them, which are

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* *Duties of Masters in regard to School-House and Premises, &c.*—"The trustees having made such provision relative to the school-house and its appendages, as are required by the Consolidated School Act, and as provided in the Regulations relating to the "*Duties of Trustees,*" it shall be the duty of the master to give strict attention to the proper ventilation and temperature, as well as to the cleanliness of the school-house; he shall also prescribe such rules for the use of the yard and outbuildings connected with the school-house, as will ensure their being kept in a neat and proper condition; and he shall be held responsible for any want of cleanliness about the premises."—*Ontario Official Regulation 6.*

† As an encouragement to teachers, it may be stated that during the twenty-three years the Toronto Normal and Model Schools have been in existence, neither cut nor defacement can be perceived on any of the seats or desks of those institutions.—ED.

neither pleasant to the feelings nor congenial to the taste. Cast-iron paling, in cities and towns, would cost less, be equally substantial, and certainly much more beautiful. A neat pale or board fence, strongly made, with posts sunk deeply into the ground, would, however, be cheaper than either, and might be so constructed as to be an ornament to the grounds. The paling should be close and firmly morticed to the rails. The fence should be six feet high, and, by all means, painted. If the entrance to the grounds be through a gate, it should be hung with weights, or a spring, so as to close of itself when left open; but some grounds are entered by short flights of steps, or a stile, which ascend to a landing nearly on a level with the top of the fence, and descend in the same manner on the other side.

CHAPTER IV.

CONSTRUCTION OF SCHOOL OUTBUILDINGS.*

The following illustrations of outbuildings for schools (prescribed by the Provincial Board of Education for New Brunswick), were obtained through the courtesy of Theodore H. Rand, Esq., Chief Superintendent of Education for that Province. They are drawn on the scale of eight feet to the inch, and are accompanied with specifications, as follows:

1.—Specifications for the Privy Outbuildings.

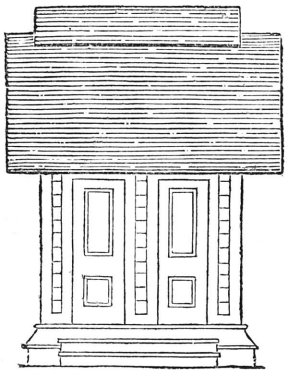

Fig. 4.—FRONT ELEVATION (BOYS').

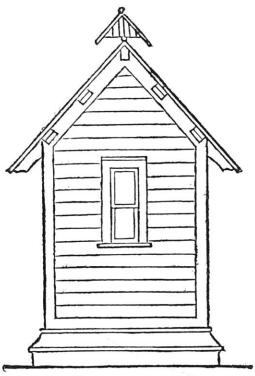

Fig. 5.—END ELEVATION (BOYS').

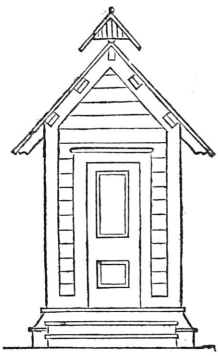

Fig. 6.—END ELEVATION (GIRLS')

(1). *Excavations.*—The vault to be excavated 6 feet deep below the surface of the ground, and to be made 4 feet longer than the building; this projection of 4 feet to be made at the gable end, opposite to or at one side of the door.

(2). *Walls, &c.*—Build rubble stone walls under three sides of the building one foot above the surface of the ground, to receive the sills; the side and end walls projecting beyond the building to be built only 3 feet high from the bottom of vault, and the space to be covered with 3-inch plank laid sloping, and secured at the foot to a plate laid on the low wall, and at the top to a 3-inch piece,

* DISINFECTING SCHOOL OFFICES.—The Rev. J. C. Ryle, M.A., Vicar of Stradbroke, England, says: In regard to the best mode of disinfecting school offices, one simple remedy, recommended by a schoolmaster in Lancashire, I have found very effectual and very cheap. It is copperas, or green vitriol, dissolved in water and thrown into the offensive place. It costs very little in coarse crystals

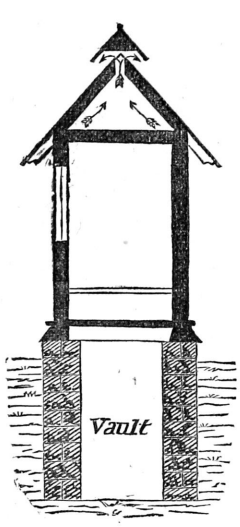

Fig. 7.—SECTION.

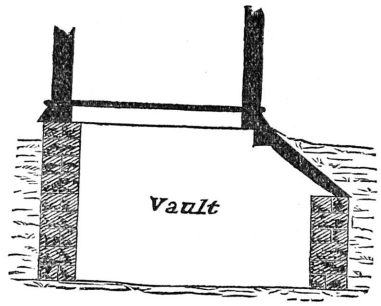

Fig. 8.—SECTION THROUGH VAULT.

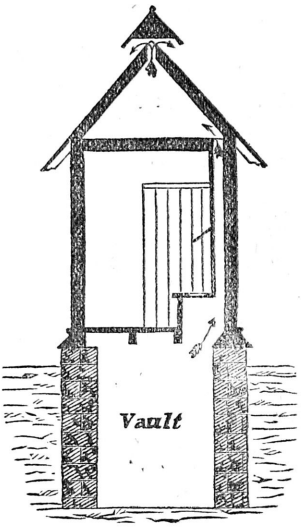

Fig. 9.—SECTION.

supported at the ends on the side-walls; these planks to be so secured in place that they can be readily removed for the purpose of cleaning the vault, and to be covered over with earth, sloping from the building to shed the rain.

(3). *Framing, &c.*—The frame to be boarded with sound boards, and covered with rough siding or shingles; the roof to be shingled; the ridge of roof to be left with an open space of 6 inches for the escape of foul air, and this opening to

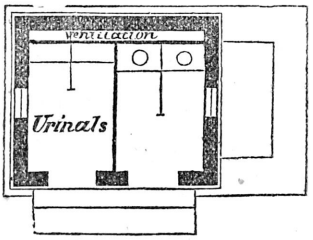

Fig. 10.—BOYS'.

Plans of Outhouses for Schools of one Department.

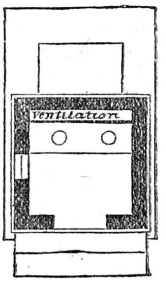

Fig. 11.—GIRLS'.

be protected from the weather by a saddle with a flat soffit, and closed at the ends and supported on board brackets. The smaller class of houses, both for the boys and for the girls, and the larger class for girls, to have a clear space of 4 inches left at the back of seats for ventilation; this space to have free connection with the vault and with the opening in ridge of roof; the larger class of houses for boys to have this space for ventilation in the centre of the building.

The sills to be set in the centre of the stone walls, and the water-table to be sloped to cover the projecting wall.

The floors to be laid double and crossways.

The smaller class of houses for boys to be divided by a partition, made of $1\frac{1}{4}$-inch tongued-and-grooved plank, *not planed;* one side of the houses for boys to be fitted up with seats with hinged flaps, hung with butts, and a sloping plank to be fixed above the seats to prevent the flaps from being opened beyond an

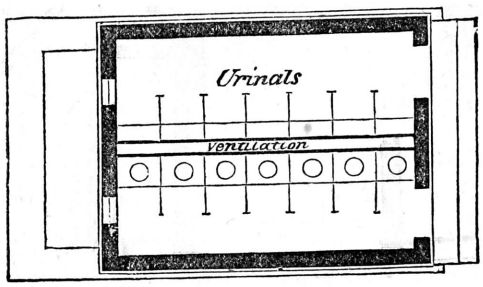

Fig. 12.—Plan of Boys' Double Privy.

Plans of Outhouses for Schools of two or more Departments.

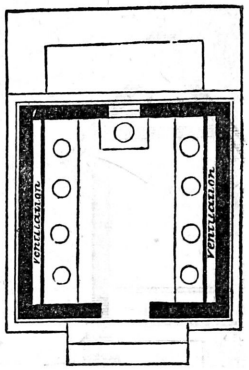

Fig. 13.—Plan of Girls' Privy.

angle of sixty degrees, the other side to be fitted up with a trough, set with a sufficient incline to carry off the water, and to have a down pipe leading into the vault. The seats and the trough to be divided into stalls by tongued and grooved boards 6 feet high.

The houses for girls to be fitted up with seats with hinged flaps.

The houses for boys should invariably be provided with a urinal, as shown in figs. 10, 12 and 17, otherwise the seats are constantly wet and dirtied, and unfit to sit upon.

The doors to be panelled, hung with butts, and supplied with mortice or rim lock, with mineral knobs.

The windows to have 2-inch sills and $1\frac{1}{4}$-inch casings, and $1\frac{1}{2}$-inch sashes, glazed with two panes 10-inch by 16-inch glass.

The interior walls and ceilings to have one thick coat of coarse brown mortar.

All the wood work usually painted to have three coats of paint, and to be sanded with coarse sand on the last coat, to prevent scribbling.

Note.—The arrows show the upward direction of the foul air to the cowl at the apex of the roof.

2.—Other Illustrative Plans of Privy Outbuildings.*

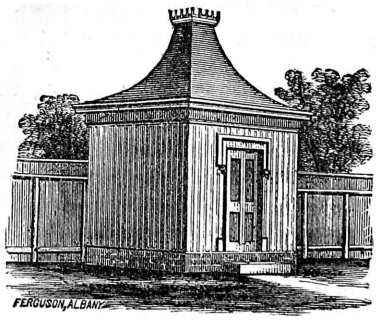

Fig. 14.—Single Privy (Exterior).

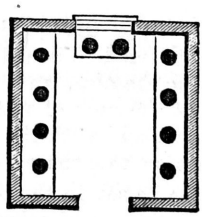

Fig. 15.—Plan of Girls' Single Privy.

Fig. 14 presents another illustration of a handsome style of single privy for girls. It is adapted to the plan shown in figs. 13 or 15. If designed for boys, the interior arrangement should be similar to that shown in fig. 10.

* From Johonnot's "School Houses," with Illustrations by S. E. Hewes.

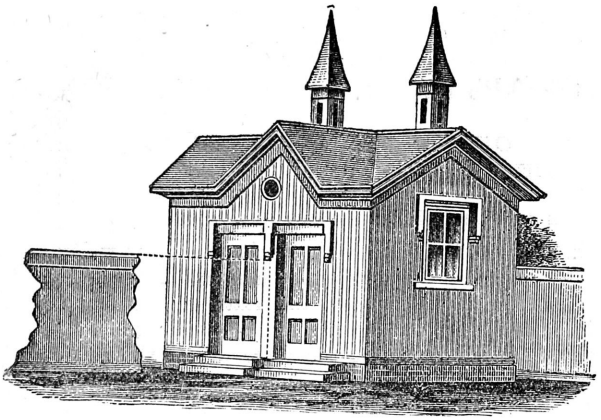

Fig. 16.—Double Privy.

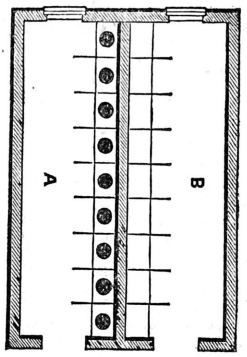

Fig. 17.—Plan of Boys' Double Privy.

Fig. 16.—The illustration shown in fig. 16 is adapted to plans 12 or 17, and may be arranged for boys or girls. If for girls, the part marked "urinals," in fig. 12, or B, in fig. 17, may be arranged like A in the same figure.

3.—Specifications for these Additional Plans.

The excavations, walls of vaults, framing, interior fittings, &c., should be the same as specified in section 1 of this chapter. The walls should be left hollow, opening into a ventilating chimney or shaft, to freely carry off the deleterious gases. The plaster should be brown and left *very rough*, and the wood work, when painted, should be dusted on the last coat with coarse sand, so as to make the usual scribbling and figure-writing impossible. The urinal, B, fig. 17, should be provided with a trough, and divided into stalls or partitions.

4.—Essential Rules in Regard to School Privies.

1. The privy building, or closet, should be masked, and its approach equally so.
2. There should be little or no exposure to mud or wet weather in reaching it.
3. There should be no unpleasant sight or odour perceptible.
4. The apartment should be as well finished as any part of the establishment.
5. It should be kept entirely free from cuttings, pencillings or markings, and scrupulously clean.
6. There should, of course, be two privies attached to each mixed school; and they should be so separate that neither in approaching nor occupying them can there be either sight or sound observed in passing from one to the other. This cannot be effected by a *mere partition*. Nothing can secure the object but considerable distance, or extra heavy brick or stone walls resting on the ground. In omitting this precaution mistakes which should never occur are common, whereas they are too serious ever to be made.

The question arises, can all this be done? Certainly; it can and should be done. It is done in all large and well regulated public schools. How? In general terms—first, by proper construction; and, second, by proper discipline.

Note.—The privy should be as rigidly inspected and policed as the school-room; and the behaviour of pupils in visiting it should, if possible, be controlled. There is no serious difficulty about this when there is a teacher of each sex in the school, and when proper arrangements exist for cleaning the closet constantly, and for reporting on its condition. When there is but one teacher in charge of a school of both sexes, the trustees should make special arrangements for looking after one of the privies.

CHAPTER V.

GENERAL REMARKS ON SCHOOL HYGIENE AND VENTILATION.

1.—Perils of the School-Room.

Under this heading, Dr. Bell, editor of the New York *Sanitarian*, thus writes: "While reflecting on how best to discuss a subject so abundant in detail as 'The Perils of the School-Room,' came the intelligence of the death of Dr. Anstie, caused by a wound which he received in a *post mortem* examination, while engaged in an investigation which had for its object the discovery of the causes of a *fatal school disease*—acute idiopathic peritonitis—a disease often found to be due to malaria, which, in this particular instance, was caused by sewer gas. I use the word malaria in this connection in its simplest sense, to signify bad air, but recognize the usual distinction of two kinds of malaria—vegetable and animal.

"(1.) *Vegetable Malaria.*—The diseases common to vegetable malaria, or marshy emanations, are, unfortunately, so well known as not to require special description in this connection. It will suffice to state that they are liable to be greatly modified and aggravated by animal malaria, the kind common to school-rooms.

"(2.) *Animal Malaria* may be engendered anywhere by the neglect of animal excretions. It is especially liable to occur as the result of crowding, darkness, want of ventilation, want of or defective sewerage, and filthy habits, and is subject to intensification by extremes of temperature in crowded apartments.

"(3.) *Space for Air Required.*—The importance of air space rests upon the absolute necessity of pure air for healthy respiration; but the amount of space required depends upon a variety of circumstances. Hospital conditions, for example, require the largest amount of space, and modern experience has shown that, other things being equal, *no* enclosed space equals plenary exposure. But, for various practical purposes, the limits of space vary from 300 to 4,000 cubic feet—the smallest proportion being the exaction for lodging-house dormitories, and the largest for hospitals—making due allowance in all cases for space occupied by furniture. And *no deviation should be made on account of children*, whether in regard to the different members of a family or a school-room.

"NOTE.—With regard to this point, Mr. John Simon well observes: 'It is to be desired that laws and regulations as to overcrowding should not proceed on the assumption that children (to any measureable extent) require less breathing space than adults. Against any such assumption, two facts have been considered: first, that even healthy children, in proportion to their respective bodily weights, are about twice as powerful as adults in deteriorating the air which they breathe; secondly, that the children will almost invariably have certain eruptive and other febrile disorders to pass through, from which adult life is comparatively exempt, and in which the requirement of space is greatly increased. And having regard to these two considerations, I think it best that children and adults should be deemed to require equal allowance of air and ventilation.'*

"(4.) *Necessity of Means for Renewal.*—Moreover, it should be observed that the mere space allowance should in no case detract from the absolute necessity of means for renewal, and the smaller the space so much the more certain should be this provision. If 300 cubic feet only be allowed, the air must be changed, at the least, every twenty minutes. *To neutralize the deleterious properties of*

* Eighth Report of the Medical Officer of the English Privy Council.

respired air, and to replenish it, every person requires 2,000 cubic feet of fresh air hourly; and with less provision than this, contamination is sure to follow.

"(5.) *Poisonous Effluvia Adheres Everywhere.*—The poisonous effluvia which pervades the atmosphere of close and unventilated rooms is not only re-breathed, it adheres to all the surroundings; it sticks to the walls and furniture, settles into the drinking cups, into the food utensils, food and drink, permeates the clothing, and attaches to the person.

"(6.) *Fatal Results—Diseases Caused.*—It creates a nidus, which is not only in itself poisonous, perpetually lessening the vital force of all who inhabit it, and predisposing to blood poisons of every kind, but it also becomes a hotbed for the planting and propagation of specific poisons, such as small-pox, scarlet fever, measles, whooping cough, diphtheria, and the whole category of epidemic diseases, and a fruitful source of scrofula and consumption. The consideration of these diseases in detail, and their relations to crowded and unventilated places, would comprehend a treatise on the predisposing causes of epidemics.

"(7.) *Sleeping Epidemics.*—It may be stated in general terms, however, that the specific poisons which perpetuate this class of diseases are kept alive by the conditions common to school-rooms, always exist somewhere, and the history of them all demonstrates alternations of repose and activity, of prevalence in one place and absence in another, of successive invasions of contiguous neighbourhoods and succeeding immunities. But the specific morbid poisons, the *seed*, never die; they remain and live on from generation to generation, ever susceptible to enlivening influences, and liable to transmission from place to place, renewing strength by the way, again to become dormant and lie in ambush, awaiting the return of congenial conditions for renewed activity.

"(8.) *When they Break Out.*—The epidemic influences or constitution, which some authors are wont to describe as conditions precedent to the activity of epidemic diseases, and which are believed to be periods predisposing to the receiving of specific poisons, are due in no small degree to the prevailing condition of school-rooms. As a rule, the longer the period of time in which they have been occupied, the more depressed the vital powers of their occupants, and the greater their predisposition to air poison. Besides, the depressed state of the system under such conditions is not only predisposing to epidemic diseases, but the liability to and the danger of all diseases is thereby intensified. Vicissitudes of weather, which otherwise might be encountered with impunity, under these depressing influences become dangerous perils; and, doubtless, much that is attributed to the season of the year as predisposing to scarlet fever, measles, whooping cough, diptheria, and some other common affections of children, is due to the same cause. It is at any rate very remarkable that the beginning of the autumnal school term should be speedily followed by the sickly term. There is surely something more than a mere coincidence in these relations; they stand much more like cause and effect. The effect of high temperature may seem to imply an exception to these conclusions. To the influence of heat especially has been attributed the excess of mortality common to infants in hot weather. There is no question that heat exercises a very important influence; but we are fully persuaded that it is so entirely secondary in its relations as to be among the most preventable of causes. Its influence is mainly due to its effect on organic matter, unventilated apartments and filthy surroundings. Its specially dangerous effect is, in short, due to conditions such as are usually present in close school-rooms and tenement houses. Heat intensifies, but it does not cause the excess of summer mortality, and it frequently has the same effect in overheated school-rooms at other seasons.

"(9.) *Carbonic Acid in School-Rooms*, in some respects, bears similar relations to heat. Dangerous and fatal as it is known to be, when in great excess, its

importance, *per se*, is unquestionably very much exaggerated. Yet *respired* air, containing only 1.5 volumes of carbonic acid per 1,000, is well known to cause headache, vertigo, and other painful admonitions of danger. It is apparent, therefore, that the ill effects of air which contains only a little more than 1 volume per 1,000 of carbonic acid, are due to other and more potent poisons. Such air not only contains, besides the excess of carbonic acid, and not unfrequently the more deadly carbonic oxide, dead and decomposing animal matter, and other mephitic gases and exhalations, but it is deficient in its very first life-sustaining property, oxygen.

"(10.) *Amount of Oxygen Required.*—The average amount of oxygen consumed by a healthy person is half a cubic inch every respiration, which in a day amounts to upwards of 25 cubic feet. And as oxygen constitutes but one-fifth of the volume of the air, a single individual renders not less than 125 cubic feet of air unfit for respiration, every twenty-four hours, by the mere abstraction of oxygen alone. Meanwhile there is exhaled by the lungs about 15 cubic feet of carbonic acid, 30 ounces of watery vapour, and an indefinite amount of organic matter, which has been variously estimated at from 10 to 240 grains.

"(11.) *Quantity of Air Respired.*—The whole quantity of air actually respired in twenty-four hours by a healthy person is about 400 cubic feet. This contains, when once passed through the lungs, about five and a half per cent. of carbonic acid. It may be estimated at about 200 cubic feet per hour. 1,000 parts of vapour exhaled from the lungs consists of—pure water, 907 parts; carbonic acid, 90 parts; and animal matter, 3 parts. In addition to these, it is well known that other substances introduced into the circulation may be thrown off from the system, and increase the danger.

"(12.) *How the Human System Suffers.*—Besides the danger from active and fatal disease from exposure to the conditions which have now been described, all physiologists recognize the influence of depressing agents on the human organization in blunting the sensibilities, obtunding the intellect, promoting stupidity, idiocy and physical deformity."

CHAPTER VI.

EXTRACTS FROM OFFICIAL REPORTS IN REGARD TO SCHOOL HYGIENE.

1.—To Overcome the Difficulties of School Ventilation, is a Public Duty.

In the Reports of the Massachusetts Board of Health for 1871 and 1873, the question of School Ventilation is discussed. That for 1873 says: "It must be considered that one-fifth of our population are children, and these are all in the growing, formative, susceptible stage of life, not only most readily, but most *permanently* affected by every influence to which they are subjected. Without doubt the instinct of childhood is for frequent, almost constant, change of position and interest during the waking hours, and any steady occupation within a restricted space, may be fairly termed *unnatural* for children. But since they cannot have an "education" without some degree of violation of the normal conditions of childhood, it becomes of the first importance to maintain a constant, jealous watch over the health of school children, and to persevere in the attempt to harmonize school methods and influences with the healthy instincts of childhood.

Confinement, vitiated air, enforced quiet, prolonged mental effort, the use of the eyes on small objects in trying arrangements, are all, *in some degree*, conditions necessary to school, but threatening danger to the health of the scholars. To reduce this to a minimum, and there maintain it, is a public duty."

2.—"Better Ventilation" in Schools, a Necessity.

In order to obtain the best information on the subject of School Hygiene, the Massachusetts State Board of Health sent out a circular of queries on various school subjects. The tenth question was as follows:

X. How can our schools be modified to improve their hygienic influences? (*a*) As to tasks and discipline. (*b*) As to physical conditions.

The reforms called for in the answers to this question (*a*) are:

Lightening tasks	38	More cheerfulness	24
More discriminating teachers	37	Abolishing "marking"	16
Less routine in methods	32	Pursuing fewer studies	14
Lightening discipline	25	More variety of exercises	13

The answer to (*b*) may be analyzed as follows:

Better ventilation	77	Better seats and desks	17
More equable heating	27	Shorter sessions	17
Regularity in daily physical exercises	21	Better lighting	14
More frequent change and freedom of position	21	More frequent recesses	13
		Fewer pupils to each teacher	10

Defective ventilation is very generally and very emphatically complained of in the answers received, and such expressions as follow are common: "We have no tolerable system of ventilation;" "School ventilation is thus far a failure;" "The air in our school-house is simply execrable." * * *

3.—The Difficulties in School Ventilation can be easily Overcome.

The Report further says: "The difficulties to be overcome in ventilating school-rooms are very great, but not too great to be conquered by intelligence and money, both of which are at our disposal, but neither of which is willingly applied to the problem of ventilation by building committees, with whom, rather than with architects, the responsibility rests. * * * But the trouble is that every *tolerable* system of ventilation is expensive, and those having the matter in charge cannot bring themselves to lay out much money on that which will make no show whatever. Nevertheless, it is the fact that in our climate, for seven months in every year, *fresh air* cannot be had within doors without paying money for it. Not only does it pre-suppose a somewhat expensive arrangement of ducts and flues, but it requires for the efficient working of these, when provided, more fuel than we like to pay for.

4.—Three Things Essential in School Ventilation.

Three things must be done to secure good ventilation. *First*, supply *fresh* air; *second*, warm it *before* bringing it into the room; *third*, get rid of it after it has been breathed *once*. In rooms heated by stoves, or by steam-pipes in the room, the first and second demands cannot be met except by transforming them into "portable furnaces." To meet the third, requires both larger, more numerous, and differently placed openings and ducts than are to be found in one school-house in a hundred; and, in addition to these, a shaft or flue of ample size, and *well heated*. And these all cost money. But then, *pure air is a necessity to health*. No State or town can afford to allow its school children to be slowly poisoned by breathing foul air. If we are wise, we shall be more ready to spend freely so as to secure thorough ventilation. Nay, we shall insist on it at what-

ever price. In every school-house which costs from $10,000 to $20,000, enough might have been saved, by making the ceilings two feet lower, to pay the cost of supplying the building with pure air, while at the same time the labour of going up stairs would be sensibly less. * * *

As to the practice of ventilating in winter by opening windows, we say, in the words of Dr. Angus Smith, "though foul air is a slow poison, we must not forget that *a blast of cold air may slay like a sword.*" (See Dickens on School Ventilation, page 37.)

It seems to be forgotten that the old-fashioned open fire is a very efficient means of ventilation, and might be used for that purpose in moderately-sized modern school-rooms. Excellent furnaces can be and *are* made of soapstone and brick, which furnish a perceptibly purer air than the ordinary furnace, without an inch of iron-heating surface, as do also some of the furnaces made of *wrought* iron.

5.—Important Reasons for Sanitary Precautions in School.

I. That from many published medical and health reports, it appears that children are much less liable to the disease than adults; that while it is doubtful that the disease is communicable by contact, it is certain that children are not, under proper regulations, more exposed in schools than elsewhere to infection; and that attacks of the disease are much more frequent by night than by day.

II. That while the cause which specially determines an attack eludes observation, it is found that all such conditions as are at any time unfavourable to health predisposes to and aggravate the disease. Of such unfavourable conditions, those most frequently occurring in schools are:

1. The depression produced by too long confinement.
2. Fatigue, whether in the school-room or play-ground.
3. Sudden change of temperature, as from overheating and subsequent chills.
4. Impure air resulting from overcrowding, want of ventilation, or defective drainage.
5. Inattention to strict cleanliness of school-rooms, basements, play-grounds, and outhouses.

III. That regular and not exhausting employment of body and mind, and the assembling of children in airy, healthful situations, are so far from tending to aggravate the epidemic, that they may rather be considered as precautionary measures in the event of its prevalence.

IV. That, in addition to strict attention to whatever can promote comfort of body and cheerfulness of mind, through pleasant employment, sufficient recreation, adequate rest, thorough ventilation, scrupulous care to secure cleanliness, a supply of pure drinking water, and the free use of disinfectants in schools, and, with all these, wholesome and plentiful diet and woollen underclothing provided at home—nothing can be recommended to guard our children during the prevalence of cholera.

In accordance with the principles above advanced, the following are recommended:

I. That all school-rooms, with their basements, outhouses and play-grounds, be immediately thoroughly cleaned and aired; lime and disinfectants being freely used.

II. That all drains be examined, cleared, and put in thorough repair.

III. That throughout the summer this state of cleanliness be maintained, particular care being taken to secure continual and ample ventilation and dryness.

IV. That the warming apparatus of schools be kept in readiness for use during chilly or damp weather, and even during sultry and close weather, to maintain a circulation of air.

V. That more ample provision than is usual be made for the personal cleanliness of the children—as, plenty of water, with soap and towels, for occasional ablutions.

VI. That a supply of fresh-drawn, filtered, or boiled water for drinking be supplied.

VII. That the hours of school study be temporarily shortened, and this rather by frequent and lengthened recesses than by closing schools at an earlier hour.

VIII. That such arrangements be made as shall avoid exhausting examinations after the warm weather has begun, either by dispensing with them in part, or holding them at an earlier period than is customary.

IX. That an air of cheerful refinement and recreation be given to the school routine, by the introduction of drill gymnastics, object oral lessons, lectures and conversations, music, drawing, and the lighter branches of study; especially avoiding onerous home lessons.—*Report of Committee, McGill Normal School.*

6.—Examples of Poisoning by Bad Air in School-Houses.

Dr. Janes, the Sanitary Inspector of New York, in his report to the City Board of Health, February, 1873, says: "In connection with the recent inspection of public school buildings and factories, made by the Health Inspectors, I directed Dr. A. Endemann, Assistant-Chemist of the Health Department, to collect specimens of air from a few of the schools and other public buildings, and submit them to chemical analysis for the purpose of determining the amount of carbonic acid and other impurities. This duty he has performed, and from the public schools Dr. Endemann obtained seventeen samples of air, the examination of which determined the presence of carbonic acid, varying in amounts from 9·7 to 35·7 parts in 10,000; or, in other words, from more than twice to nearly nine times the normal quantity. The ventilation in these buildings was generally faulty, and could be obtained only by opening the windows—a practice detrimental to the health of the children who sit near or directly under them. The following experiment made in one school, shows the inefficiency of ventilating flues in the walls, unprovided with means for creating an upward current. An examination of the air in one of the class-rooms provided with a ventilating flue was made while one of the windows was opened, and yielded 17·2 parts of carbonic acid in 10,000. The window was then closed, and after the lapse of ten minutes another examination gave 32·2 parts of carbonic acid, or an increase of 15·6 parts. The experiment now became to the teacher and children so oppressive that it was not continued. Dr. Endemann says: 'If the accumulation of carbonic acid had been allowed to continue, we might have reached within one hour the abominable figure of 110.'"

As respired air contains not only this poisonous gas, but also effete animal matter escaping from the bodies of those present, and in quantities in proportion to the amount of carbonic acid exhaled, it follows that air vitiated by respiration is far more deleterious than air vitiated by the same amount of carbonic acid from other sources; and as the standard of permissible impurity has been placed by high sanitary authority (Dr. Parkes and others) at 6 parts of carbonic acid in 10,000 of air, it is evident that the best practical talent should be engaged in designing and perfecting means for securing to our public schools adequate and thorough ventilation in order to save the lives of the pupils.

7.—Influence of the School-Room on the Health of Children.

The Medical College of Middlesex, Massachusetts, having considered the influence of public schools on the health of children, publishes the following facts as the opinions of its members:

1. No child should be allowed to attend school before the beginning of his sixth year.

2. The duration of daily attendance—including the time given to recess and physical exercise—should not exceed four and a half hours for the primary schools; five and a half for other schools.

3. There should be no study required out of school, unless at high schools, and this should not exceed one hour.

4. Recess time should be devoted to play outside of the school-room—unless during stormy weather; and as this time rightfully belongs to the pupils, they should not be deprived of it except for serious offences; and those who are not deprived of it should not be allowed to spend it in study; and no child should ever be confined to the school-room during an entire session. The minimum of recess time should be fifteen minutes each session, and in primary schools there should be more than one recess in each session.

5. Physical exercise should be used in school, to prevent nervous and muscular fatigue, and to relieve monotony; but not as muscular training. It should be practised by both teacher and children in every hour not broken by recess, and should be timed by music. In primary schools, every half hour should be broken by exercise, recess, or singing.

6. Ventilation should be amply provided for by other means than by open windows, though these should be used in addition to special means during recess and exercise time.

7. Lessons should be scrupulously apportioned to the average capacity of the pupils; and, in primary schools, the slate should be used more and the books less, and the instruction should be given as much as possible on the principles of "Object Teaching."

8.—Effects of School Life upon the Eyes of School Children.

Dr. Agnew, at a meeting of the American Social Science Association, in 1875, states that Herman Cohn, of Breslau, published, in 1867, the results of observations made upon the eyes of 10,060 school children. He established the fact that school life in his country was damaging to the eyes of scholars to a most alarming degree. He was followed by Erismann, of St. Petersburg, and others, who showed that elsewhere the same results were being produced. The broad fact was evidently demonstrated, that wherever children were brought under observation, and the effects of the use of their eyes upon minute objects carefully noted, nearsightedness, *a grave malady*, was found to exist. That this malady was found less frequently, and then generally in a mild form, in young children; but that it increased rapidly in frequency and gravity as these children were pushed forward in their education from the lowest to the highest schools. Cohn, for example, found that the nearsightedness rate in village schools was less than 2 per cent., that it had increased, however, to more than 26 per cent. in the gymnasium (or higher schools), and in that the Breslau University, out of 410 students examined, *not one-third* had normal eyes.

9.—Dr. Agnew's Rules for the Care of the Eyes.

When writing, reading, drawing, sewing, etc., always take care that—

(*a*) The room is comfortably cool, and the feet warm;

(*b*) There is nothing tight about the neck;

(*c*) There is plenty of light, without dazzling the eyes;

(*d*) The sun does not shine directly on the object we are at work upon;

(*e*) The light does not come from in front; it is best when it comes over the left shoulder;

(*f*) The head is not very much bent over the work;

(*g*) The page is nearly perpendicular to the line of sight; that is, that the eye is nearly opposite the middle of the page, for an object held slanting is not seen so clearly;

(*h*) That the page, or other object, is not less than fifteen inches from the eye;

NOTE.—Nearsightedness is apt to increase rapidly when a person wears, in reading, the glasses intended to enable him to see distant objects. In any case, when the eyes have any defect, avoid fine needlework, drawing of fine maps, and all such work, except for very short tasks, not exceeding half an hour each, and in the morning.

(*i*) Never study or write before breakfast by candle light;

(*j*) Do not lie down when reading;

NOTE.—If your eyes are aching from fire light, from looking at the snow, from overwork, or other causes, a pair of coloured glasses may be advised to be used for awhile. Light blue or grayish blue is the best shade; but these glasses are likely to be abused, and usually are not to be worn except under medical advice.

(*k*) Never play tricks with the eyes, as squinting or rolling them.

(*l*) The eyes are often troublesome when the stomach is out of order.

(*m*) Avoid reading or sewing by twilight or when debilitated by recent illness, especially fever.

CHAPTER VII.

MISCELLANEOUS REMARKS AND SUGGESTIONS IN REGARD TO SCHOOL VENTILATION.

1.—Axioms in Ventilation of Schools.

The following propositions may be considered as *axioms* in the important subject of ventilation:

1. There must be an opening into each room large enough to admit a sufficient supply of fresh, pure air.
2. In cold weather this air must be warmed before it is brought into the room.
3. There must be an opening for the escape of foul air as *large* as that which admits the fresh air.
4. This last opening must be near the floor.
5. The escape of foul air will be greatly accelerated if the flue into which it is discharged be heated.

The *first* of these seems self-evident; yet, in almost every house, these flues are totally inadequate. In many instances no provision whatever is made for this important prerequisite. The fresh air is expected to find its way under doors, around windows, and through the floors.

From a neglect of the *second* axiom, people are led to cry "humbug" against all systems of ventilation. The man who sits in a crowded audience until he is well-nigh smothered, and then has a window opened immediately above him, whereby a column of air is projected upon his head and shoulders, from the effects of which he does not recover for months, is very apt to feel that ventilation is a nuisance. So it certainly is in this form.

Third.—It is impossible to pour water into a jug already full. It is just as impossible to force fresh air into a room already full of foul air, unless the latter can escape. For two reasons, the place of exit should be near the floor: 1st, the most impure air is at the floor; 2nd, if it be allowed to escape at or near the

ceiling, the heat will also escape, and you cannot heat the room in a proper manner.

Fourth.—Openings in or near the ceiling are excellent for one purpose. When the room is too hot, they serve an excellent purpose in cooling it. For the purpose of ventilation they are useless, because all the heat will escape, and it will be impossible to heat the room while the ceiling flues are open. When provision is made for the escape of foul air *near the floor*, it is well to have the outlets in different parts of the room. Unpleasant currents are thus avoided.*

2.—Ventilation Essential to School-Rooms.

Why is it essential? Because life and health in school depends upon it. There is pure air enough, just outside, that may be had for the asking; and yet how many of our school-rooms are reeking day after day with the deadly poison sent forth again and again from the lungs of two or three scores of pupils, and with the no less poisonous exhalations from uncleanly clothing and uncleanly persons. The teacher enters the school-room in the morning, when the air is comparatively pure, but the constantly increasing impurity steadily blunts the senses, though it is not perceived. The air becomes charged and surcharged with noxious matter, teacher and pupil grow dull, and listless, and irritable; the head aches, and the work of the school drags wearily and drowsily on. By and by another recruit is added to the great army of broken-down teachers.

Father or mother, do you know what kind of an atmosphere your child is living in at the school? The air that he is breathing has repeatedly been down into the lungs of thirty, forty, or fifty of his school-mates, and each time has been reinforced with a fresh supply of decaying matter, until it is loaded with poison which cannot be taken into the system without at least weakening the vital forces.

But what can be done? Much can be done. In the first place, there are now to be had, at reasonable prices, stoves and furnaces of a variety of make, with which pure air may be introduced warm into the school-room, and the foul air removed through a shaft by an opening at the floor. (See chapter ix.) No school-room is fit to occupy without some such arrangement for securing ventilation—certainly no new school-house should be erected without something of the kind. But parsimony says that all this costs. Yes, it does cost; and it is well worth the cost. Good ventilation does, indeed, cost money; but the doctor, and the undertaker, and the lot in the graveyard cost, too; and the question is, *which is the best investment?*

But if no such provision for ventilation can be secured in old houses, something may still be done toward making the school-room clean and healthful. The floor and walls may be kept free from anything that will contribute to the impurity of the air. Something may be done in the way of enforcing personal cleanliness upon the pupils. Where the conditions are such as to render it possible, a window may be lowered a little from the top and bottom on the other side. At the recesses, and at noon, and oftener if need be, the windows may be thrown open from the top and the bottom, and the pure breezes of heaven invited in to drive out the accumulated stench and nastiness. At any rate, with these miles of life-giving air above and around us, let us not kill ourselves and murder the innocents with the villainous air compound so often found in our school-rooms.—*Illinois Teacher.*

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* A better plan is to have a ventiduct and smoke flue built together, the former being separated from the latter by a sheet iron partition. The heat from the smoke in the flue rarifies the air in the ventiduct, causing a brisker current to pass out, while the emission of smoke is not retarded. It might be well to have the ventiduct extend to the floor, and have two registers, one at the ceiling (with a cord attached), the other at the floor, because gases condense suddenly when brought in contact with a flat surface, hence some of those obnoxious gases abundant in the school-rooms, will cool suddenly at the walls, and being rather more than one-half heavier than pure air, will fall to the floor, and there remain, unless some provision is made for their escape.—(See note to (5) of section 2, chapter viii.)

3.—Charles Dickens on Ventilation and Air Poison.

People have often said that no difference can be detected in the analyzation of pure and impure air. This is one of the vulgar errors difficult to dislodge from the public brain. The fact is, that the condensed air of a crowded room gives a deposit which, if allowed to remain for a few days, *forms a solid, thick, glutinous, mass, having a strong odour of animal matter.* If examined by a microscope, it is seen to undergo a remarkable change. First of all it is converted into *a vegetable growth, and this is followed by the production of animalcules;* a decisive proof that it must contain organic matter, otherwise it could not nourish organic beings. This was the result arrived at by Dr. Angus Smith, in his beautiful experiments on the air and water of towns, wherein he showed how the lungs and skin gave out organic matter, which is in itself a deadly poison, producing headache, sickness, disease or epidemic, according to its strength. Why, if "a few drops of the liquid matter, obtained by a condensation of the air of a foul locality, introduced into the veins of a dog, can produce death, with the usual phenomena of a typhus fever," what incalculable evil must it not produce on those human beings who breathe it again and again, rendered fouler and less capable of sustaining life with each breath drawn! Such contamination of the air, and consequent hot-bed of fever and epidemic, it is in the power of man easily to remove. Ventilation and cleanliness will do all, so far as the abolition of this evil goes; and ventilation and cleanliness are not miracles to be prayed for, but certain results of common obedience to the laws of God.

4.—The Whole Science of Ventilation in Schools.

To ensure pure air, it should be taken at an elevation of several feet from the ground, and the higher the better. It should be heated by radiating surfaces, so ample, in fact, as not to exceed 220 degrees Fahrenheit. It should, when heated for use, come as relatively near saturation, with moisture, as it was in its normal condition when taken from the atmosphere. In that event, it will feel soft and bland to the skin, and yield an immediate sensation of warmth and comfort to one coming from the coldest outside weather. And all the wood-work of a room thus heated, and the furniture within it, will not suffer injury from unnatural shrinkage. It should enter a room above the heads of the occupants, to avoid sensible currents, and should leave it from its lowest point, and by as many and diffusive places of egress as the architect can readily devise, but mainly at the base of the walls, as it is in contact with these that the warm air first becomes chilled, and hence acquires a specific gravity, which causes it constantly to pour down the same in a steady current. It is also upon the floor of a room that foul air—the product of breathing, and of burning lamps and gaslights, constantly find a place—for the reason that it is heavier than common air.

5.—Suggestions How to Ventilate School-Houses.

All the windows of a school-room should be hung with pulleys, in order that they may be easily raised or lowered. In planning a school-house, arrangements should be made to have a smoke-flue start from the cellar and run up to the roof; commencing at the floor of the school-room, a ventiduct should be carried up in front of it, and separated from it by a sheet-iron partition. In this way the smoke in the flue will heat, and therefore expand, the air in the ventiduct, and make it rise in a strong current, while the air in the ventiduct will not interfere with the draft in the flue. The ventiduct should have two registers, one at the ceiling and the other at the floor; though during the school sessions—unless the room be too warm—the upper one should be closed. Impure air is heavier than other air, and will generally find egress from near the floor.

If a stove must be placed in the room, it should be surrounded with a tin casing, extending from the floor to about one foot above the top of the stove. There should be a door in the casing for putting in fuel; and a duct for the conveyance of fresh air should start outside of the building, run under the floor, and communicate directly with the stove. This arrangement will distribute the heat much better about the room, and avoid those cold currents of air which always, in a room heated by an ordinary stove, sweep along the floor from the bottom of doors and windows, and openings in the floors and walls.—*Wickersham's School Economy.*

6.—Necessity of Upper and Lower Ventilators in a School-Room.

It has commonly been supposed that the impure air (carbonic gas) which is expelled from the lungs, descended to the floor. This has been shown by Professor Dalton, and other eminent chemists, to be erroneous. It has been ascertained by repeated experiments that carbonic gas diffuses itself rapidly into every part of the room. This being the case, the impure air must be drawn off from the upper stratum of the room, as well as from the lower. Some have supposed that an aperture half way between the upper and lower one, would draw off the impure air as it escapes from the lungs, and thus retard its diffusion; this, however, has not yet been established by satisfactory experiments. The deleterious effect of impure air is no longer questioned, and the necessity of some more thorough and effectual means of ventilation is urged by the most weighty considerations. In a room of 50 scholars, from 200 to 500 cubic feet of air are vitiated every minute; and, unless some effectual means are devised for expelling the impure air, the most serious consequences must ensue.

7.—Evils of Over-Crowded Schools.

One of the crying evils in our schools is that seventy or eighty children are frequently put into a room which should accommodate only half the number comfortably, and here they are confined six hours each day for the entire term. The considerations which should induce a different arrangement are many and powerful. Let us look at some of them.

1. *Health.*—Many, nay most, of the primal laws of physiology are daily violated; fresh air cannot be supplied in sufficient quantities for so many beings; the limbs of the scholars are cramped into unnatural positions, and the amount of animal heat evolved is both uncomfortable and unhealthy. It is true, some rugged constitutions may pass through with little injury, but think of the frail ones. In many instances the seeds of disease are sown in school, and a life of suffering is the consequence.

2. *Cleanliness*—The mother's parting injunction in the morning usually is, "Now, keep your clothes clean." In a closely-crowded school-room this is clearly impossible, and children often suffer from being wrongly blamed.

3. *Neatness.*—All admit the importance of early associations; but habits of neatness and order, no matter how carefully they may be taught at home, cannot be successfully practised in a crowded school-room.

4. *Inadequate Instruction with one Teacher.*—The next consideration is the over-time which pupils must be kept in the school-room in order to give them any instruction whatever. It is clearly impossible for any teacher competently to instruct more than forty or fifty pupils in the six hours usually allotted to them. Never let the school-room be crowded with so many pupils that each one cannot receive adequate instruction.—E. McV. Moore, *in Pennsylvania School Journal.*

5. In these over-crowded schools the air—especially near the close of the day—becomes almost pestilential, indicating a sad lack of ventilation and much uncleanliness of person and clothing.

6. The dietetic habits of the children, too, are often utterly neglected. They eat before school, at recess, after school, sometimes during school hours—eat pies, doughnuts, fried meat, and other heavy, indigestible food, sure to ruin the health early or late. The odour from the *débris* of these "school feasts," added to the poisonous air from the lungs of half a hundred children, is enough to sow the seeds of disease in many a constitution. The correction of many of these evils is, however, quite within the teacher's province.—*Michigan Teacher.*

8.—Nature's Signals of Distress in School-Rooms.

1. What teacher and pupil does not remember the comparative freshness and vigour of mind and body with which the morning's study and recitations were begun, and the languor and weariness of body, the confusion of mind, the dry skin, the flushed cheek, the aching head, the sickening sensations, the unnatural demand for drink, the thousand excuses to get out of doors, which came along in succession as the day advanced, and especially in a winter's afternoon, when the over-heated and unrenewed atmosphere had become obvious to every sense? These were nature's signals of distress, and who can forget the delicious sensations with which her balmy breath, when admitted on the occasional opening of the door, would visit the brow and face, and be felt all along the revitalized blood, or the newness of life with which nerve, muscle, and mind were endued by free exercise in the open air at the recess, and the close of the school?

9.—The Necessity of Renewing the Atmosphere

Does not arise solely from the consumption of the oxygen, and the constant generation of carbonic acid, but from the presence of other destructive agents and impurities. There is carburetted hydrogen, which Dr. Dunglinson in his Physiology, characterizes "as very depressing to the vital functions. Even while largely diluted with atmospheric air, it occasions vertigo, sickness, diminution of the force and velocity of the pulse, reduction of muscular vigour, and every symptom of diminished power." There is also sulphuretted hydrogen, which, the same author says, in its pure state, kills instantly, and in its diluted state produces powerful sedative effects on the pulse, muscles, and whole nervous system. There are also offensive and destructive impurities arising from the decomposition of animal and vegetable matter in contact with the stove, or dissolved in the evaporating dish.

10.—Errors in Regard to Low Temperature and Ventilation.

There is a mischievous error prevailing, that if a room is kept at a low temperature there is no need of ventilation. Dr. Alcott mentions the case of a teacher who, when asked if she did not find it difficult to keep her room ventilated, replied, "not at all, as it is one of the coldest rooms in the city." The necessity of ventilation arises from the consumption of the oxygen, and the generation and accumulation of carbonic acid, principally in breathing, and both of these processes can go on and do go on, in a cold room, as well as in a warm one, if human beings are collected in it, and goes on rapidly and fatally according to the number of persons and the size and closeness of the apartment.

11.—Importance of Uniform Temperature—Thermometer Necessary.

But whatever may be the mode of warming adopted, whether by open fireplace, or grate, stove wood or coal, or furnace, the temperature of the room should be uniform, and of the proper degree in every part. Not a child should be exposed to sudden and extreme changes of temperature, or compelled when overheated, or at any time, to sit against an inlet of cold air, or, with cold feet. This last is a violation of an indispensable condition of health. To secure a

uniform temperature, a thermometer will not only be convenient, but necessary. It cannot be ascertained for different parts of a room, or for thirty or forty persons differently circumstanced as to heat or cold, or differently employed, some of whom are seated, some standing or changing their position from time to time, without some less variable and uncertain standard than the teacher's feelings. However anxious he may be to make every scholar comfortable, he cannot be conscious at all times of the differing circumstances in which they are placed. He is not exposed to the rush of cold air from a broken or loose window, or from cracks in the ceiling or in the floor. He is not roasted by a seat too near the stove. He is not liable to a stagnation of the blood in the feet from want of exercise or an inconvenient bench. Even though he were capable of thus sympathizing with them, the temperature of the room after the fire is thoroughly going, and the doors closed, may pass gradually from 65° to 70° without change being perceptible. Now, though we may breathe freely in such an atmosphere, gradually heated, we cannot pass into the open air 40° or 50° colder as would be the case on most winter days, and much less receive a current of such air on a portion, and a sensitive portion of the body, without great danger. With a thermometer in a room, the beginning and progress of such a change would be indicated, and could be guarded against.

12.—Two Pictures—Unventilated and Well Ventilated School-Houses.

FIRST PICTURE—IN AN UNVENTILATED SCHOOL-HOUSE.

In a school-room small and low,
This is the way the minutes go—
If you further wish to know,
Call, and facts will plainly show:

Eyelids drooping,
Figures stooping;
Classes listless,
Scholars restless;
Teacher weary,
School-room dreary;
Looking sadly,
Lessons badly;
Many sighing,
Some are crying;
Others idling,
Sitting sideling;
Left their seat
To pinch or beat;
Study loudly,
Answer proudly;
Circumvention
Claims attention;
Air is horrid,
Faces florid;
Learning never,
Sickness ever.

SECOND—THE PICTURE REVERSED—IN A WELL VENTILATED SCHOOL-HOUSE.

To a school-room large and airy,
Hastens many a little fairy;
Flowers are blooming all around,
Wide and smooth the green play-ground;
Boughs are waving in the breeze,
Birds are singing in the trees,
Sunlight streaming gayly over
Fields of waving grain and clover;
Some are shouting, some are singing,
Till the clear-toned school-bell ringing,
Calls them from their happy play
To the labours of the day.

Sunny looks and rosy faces,
Wearing childhood's thousand graces
Bow in solemn silence there
While they lisp the morning prayer;
And each sparkling eye is hid
By its fringed and drooping lid.

—*Connecticut C. S. Journal.*

Softly falls, with holy seeming,
Love, from realms of glory streaming.
While each spirit eye is open
To behold some heavenly token
Of a blessing on the hours
They shall spend in learning's bowers.

Happy seems each little creature—
Happy, too, their smiling teacher,
While 'mid truth and bloom and song,
Glide the rapid hours along.

Those young hearts are learning well,
Nature's most enchanting spell;
Souls to holier life are bounding
By the influence surrounding;
Spirits plume their new-fledged pinions
For a holier home's dominions;
And in wisdom's pleasant ways,
Fleets the morning of their days.

CHAPTER VIII.

LIGHTING, HEATING, AND VENTILATION.

This subject is probably one of the most important connected with the internal economy of a school-house. In a recent work on School-House Architecture, published in England, by Mr Robson, we find some valuable remarks on the subject, which we subjoin. We also insert illustrations of the system of school-house heating and ventilation which has been officially adopted by the Provincial Board of Education in New Brunswick.

1.—Best Mode of Lighting the School-Room.

From Mr. Robson we learn that the quantity of glass contained in the windows, or skylight, has a direct influence on the amount of warming-power required. The general request for "plenty of light" in school-buildings is too often answered by the introduction of windows anywhere and everywhere. When this is done not only is an unpleasant and trying glare of complex lights and shadows produced, but in the severe weather of winter it is found almost impossible to warm the rooms. The power of glass in cooling the atmosphere of a room heated to a higher point than the external air is so great that, unless we provide double windows, we must not introduce windows quite so lavishly without due consideration. If we place them exactly in the proper places, we shall find that a less quantity than is generally supposed will afford abundant results.

NOTE.—As to the influence of the window surface on the temperature of the room, Mr. Hood, in his work on *Warming and Ventilation*, tells us that experiments have shown that one square foot of glass will cool 1·279 cubic feet of air as many degrees per minute as the internal air exceeds the external in temperature. Calculating the cubic contents of a room and the superficial area of window glass, we shall easily find on this basis the total amount of cooling-power at work, and the corresponding increase required in warming-power. The more window there is, the greater the warming-power must be. To over-light a room is nearly as bad as to under-light it.

The principal windows of a school-room lighted mainly from the back should face the north and east, these being the best aspects for ensuring a good and steady light for purposes of work; yet the importance of other windows on the sunny sides should never be overlooked. Back-lighting alone is better than front-lighting alone; and side-lighting is superior to both combined. In Germany the light is invariably admitted *from the left side only* of the children. In the double class-rooms, for instance, if one room be lighted from the children's left, the other must, of course, be lighted from the right. Again, in the school-rooms, *all* the light cannot possibly be obtained at the sides of the classes, and then the back-lighting from the north or east, already described, should be adopted, but should be assisted, corrected and diffused by other windows, placed highly up in the opposite wall. The teacher, being thus made to face a cool, steady light, will not experience that common evil of having the sun in his eyes while teaching. This arrangement has the advantage of securing, at any time when required, a current of air through or across the room, and light both on the faces of the children and that of the teacher.—(See section 14, of chapter xii.)

2.—Best Modes of Heating the School-Room.

As to the amount of heating-power practically required in buildings, Mr. Hood further tells us that we should calculate for warming three and a half to five cubic feet *per head per minute*; and, in addition, one and a quarter cubic feet for each square foot of glass.

(1.) *Bad Modes of Warming the School-Room Discussed.*—The following modes of warming school-houses should be condemned in the most unequivocal manner. Of the most deleterious, or dangerous, are those which may classified under four general heads, as follows:

(1.) All warming by means of ordinary stoves, not provided with a ventilating flue sufficient for the escape of smoke leakage or the products of combustion.

(2.) Any method which merely warms the same air again and again.

(3.) Any system by which the air is liable to be vitiated by direct contact with overheated metal surfaces.

(4.) All methods in which warmth is obtained by water-pipes heated at high pressure.

The *first* of these requires no comment, their objectionable nature being now pretty well understood and condemned by experienced educationists and school managers.

The *second* and *fourth* consist of a coil of hot-water pipes in a corner, or of lines of steam pipes carried round the walls, without any provision for a renewed supply of air. The coil, or line of pipes, heats the particles of air with which it is in contact, and thus transmits warmth; but the principle is merely to heat and re-heat the same air which is being breathed again and again by the children, with the certainty of becoming more and more impure at each respiration. Another example of the *second* method is that of the apparatus for heating being placed in the basement, where the supply of air is from the *interior* of the room, or building. There could not be a worse plan for health than this. The heated air rises to the ceiling; and, as it descends by cooling, is again drawn down to the basement to be re-heated, and to perform the same process as before. The heat is certainly economized, and the process may, by some, be ranked as "cheap;" but the principle is eminently vicious, and the effects on health disastrous in degree according to the length of the time during which the air is thus breathed.

The *third* method is the result of over-zeal for economy. It usually aggravates its evil by obtaining heat from metal stoves. The radiation of heat from iron plates in contact with the air (almost always fired violently when warmth is quickly required), is also cheap, but most dangerous to health. The air is deteriorated, and numerous instances could be given, from actual observation, of the bad effects produced.

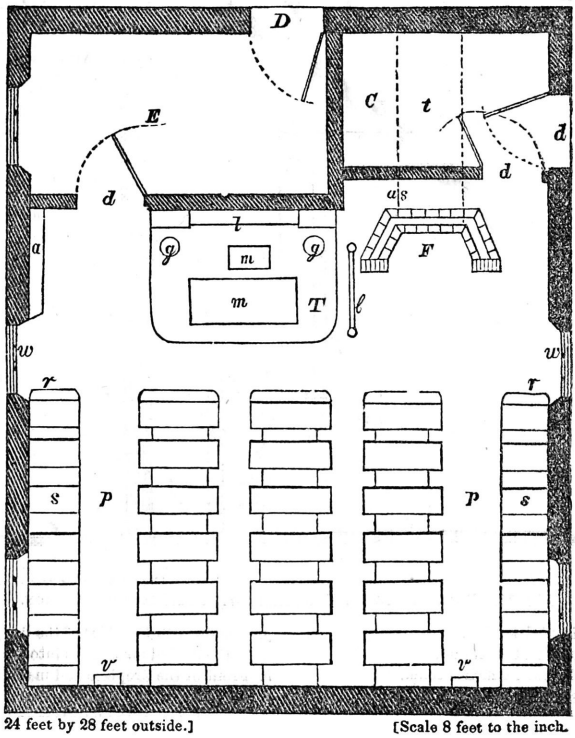
Generally, all methods are objectionable which deteriorate or render too dry the air, which in any way tend to prevent a copious supply of oxygen, and which are not capable of simple and easy management.

(2.) *Usual Modes.*—There are four modes of warming school-houses in this country, viz:—by means of an open fire-place, stove, hot air and steam. The fire-place is preferable with reference to health, and, by a little pains in its construction, may almost equal the stove in the economy of fuel—furnishing the room at the same time with an ample supply of fresh, warm air from abroad.

(3.) *Fire-place Modes.*—There are two modes of heating a school-house by an open fire-place, *i.e.*, for wood and for coal. A fire-place constructed for wood may be somewhat large, especially in rural school sections, where wood is cheap. But even then, economy and efficiency demand that, while the fire-place should project a little into the room, the aperture for the escape of the smoke, or "throat" of the chimney, should be comparatively narrow, otherwise too much of the heat generated by the fire would escape up the flue, and thus be lost in the school-room. If the fire-place be constructed for a coal grate, it can be made so as to project sufficiently into the room to ensure economy, in rendering avail-

able all the heat which may be generated. The aperture for the coal grate should be made as small as possible consistently with efficiency, so as to prevent (as in the case of the wood fire) the escape of too much of the heat up the chimney. Of the two modes, the wood fire-place will be found best adapted and most economical in rural schools, while the fire-place for coal is more suitable for towns and cities. As to the question of health, there is no doubt that the open fire-place is most conducive to it, as it always ensures ample ventilation in the room. Should a fire-place for wood be preferred, the following is specification for its construction :—

(4.) *Specification.*—In a suitable position, a brick fireplace might be built. (See *F*, in *Fig.* 18.) Let this be enclosed, on the back and on each side, by a casing of brick, leaving, between the fireplace and the casing, a space of four or five inches (see *d*, in *Fig.* 19), which will be heated through the back and jambs. Into this space let air be admitted from beneath by a box, *f*, leading from the



24 feet by 28 feet outside.] [Scale 8 feet to the inch.

Fig. 18.—GROUND PLAN OF SCHOOL-HOUSE, SHOWING BRICK FIREPLACE.

D. Entrance door.
E. Entry.
F. Fire-place.
C. Wood closet, or recitation room.
T. Teacher's platform.
a. Apparatus shelves.
t. Air tube beneath the floor.
d. Doors.
g. Globes.
l. Library shelves.
m. Master's table and seat.
p. Passages.
r. Recitation seats.
s. Scholars' desks and seats.
v. Ventilator.
w. Windows.
b. Movable blackboard.
a.s. Air space behind the fire-place.

outside by an opening at some convenient place. The brick casing should be continued as high as six or eight inches above the top of the fireplace, where it may open into the room by lateral orifices, *g*, with iron doors, through which the heated air will enter the room. If these orifices are lower, part of the warm

air will find its way into the fireplace. The brick chimney should rise at least two or three feet above the hollow back, and should be surmounted by a brick top, with an opening for a smoke-pipe, *i* (*Fig.* 19), which may thence be conducted to any part of the room, the same as a common stove-pipe.

(5.) *Advantages.*—The advantages of this double fireplace are: (1.) The fire, being made against brick, imparts to the air of the apartment no deleterious qualities which are produced by the common iron stove, but gives the

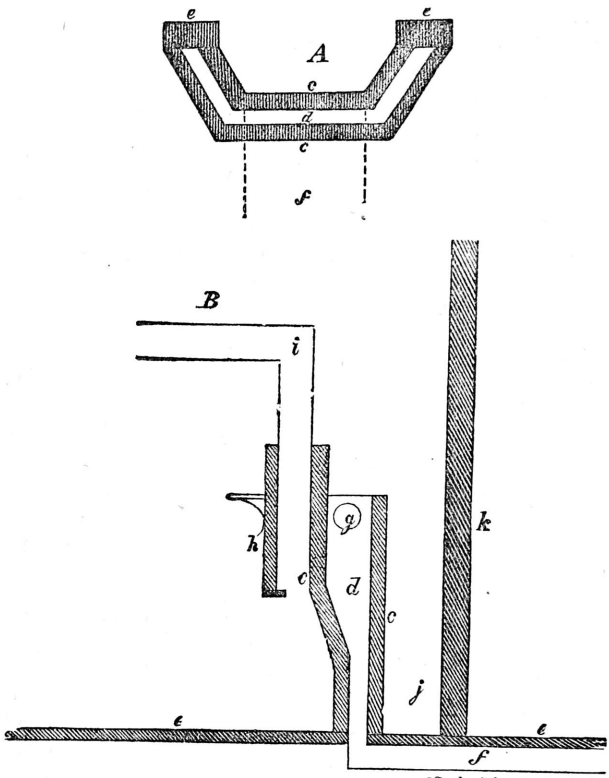


Fig. 19.—PLAN OF SCHOOL FIREPLACE, WITH HORIZONTAL SECTION.

A. Horizontal section.
B. Perpendicular section.
c. Brick walls, 4 inches thick.
d. Air space between the walls
e. Solid fronts of masonry.
f. Box for supply of fresh air from outside.
g. Openings on the sides of the fireplace for the heated air to pass into the room.
h. Front of the fireplace and mantelpiece.
i. Iron smoke flue, 8 inches diameter.
j. Space between the fireplace and wall.
k. Partition wall.
l. Floor.

pleasant heat of an open fireplace. (2.) None of the heat of the fuel will be lost, as the smoke-pipe, *i* (*Fig.* 19), will communicate nearly all the heat contained in the smoke. (3.) The current of air heated within the hollow-back, *d*, and constantly pouring into the room at *a*, will diffuse an agreeable heat throughout every part. (4.) The pressure of the air of the room will be constantly outward, little cold will enter by cracks and windows, and the fireplace will have no tendency to smoke.

If, instead of this fireplace, the common stove be adopted, it should be placed above the air passage, *f* (*Fig.* 19), which may be commanded by a valve or register in the floor, so as to admit or exclude air. (See *Figs.* 23 and 35.)

(6.) *Stove Warming.*—When the school-room is warmed by a common stove, a most effective ventilator for throwing out foul air is one opening into a tin tube which encloses the smoke-flue at the point where it passes through the roof, as represented in *Figs.* 20, 21, 23, 27, and 33. Warm air naturally rises. If a portion of the smoke-flue be enclosed by a tin tube, it will warm the air within this tube, and give it a tendency to rise. If, then, a wooden tube, *A* (*Fig.* 20), opening near the floor, be made to communicate, by its upper extremity, with the tin tube, *B*, an upward current will take place in it, which will always act whenever the smoke-flue is warm.

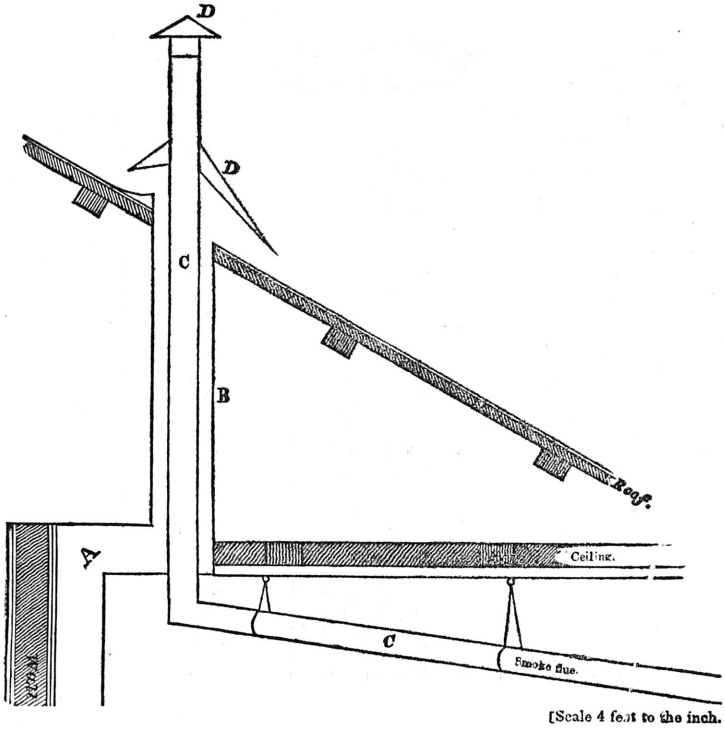


Fig. 20.—EXAMPLE OF VENTILATING APPARATUS WHERE A STOVE IS USED.

A. Foul air box, 1 foot square, or 24 inches by 6, covered by the pilaster, and opening at the floor, in the base of the pilaster.
B. Round iron tube, 15½ inches in diameter, being a continuation of the air box, through the centre of which passes,
C. The smoke-flue, 8 inches diameter.
D. Caps to keep out the rain.

NOTE.—But even when under the best intentions, ventilating flues are provided, these are generally utterly inefficient. This has been often proved, and re-affirmed, after careful trials, in the New York official reports. In connection with every flue there must be artificial appliances for compelling the air to rise. Only two kinds of appliances are known: Revolving turrets, or similar mechanical contrivances, at the top of the flue—or some slight heating arrangement at its bottom, to warm and rarify the air. A very simple and absolutely successful plan is to conduct a small pipe through the main ventilating flue, which shall act as a draught-pipe, to a small stove in the basement. Even a small gas stove would answer, as only the slightest increase of temperature is needed to start the current. (See note to section 2, chapter vii.)

(7). *Hot Air Heating.*—As heating by hot air is more generally adopted, we give in *Fig.* 21 a transverse section of two stories of a school-house thus heated,

and exhibiting the interior arrangements, maps, master's desk, clocks, blackboard, seats, hot air and ventilating apparatus, &c. The flues for hot air to the upper floor should be conveyed in the flues and enclosed in the partition. *Fig.* 22 gives a lateral section of the ventiducts or foul air flues, showing the manner in which the flues are packed together, and carried up separately from the floor of each room until they discharge into the common ejector, *c*, in the apex of the roof. (See also *Fig.* 27.)

Fig. 22.

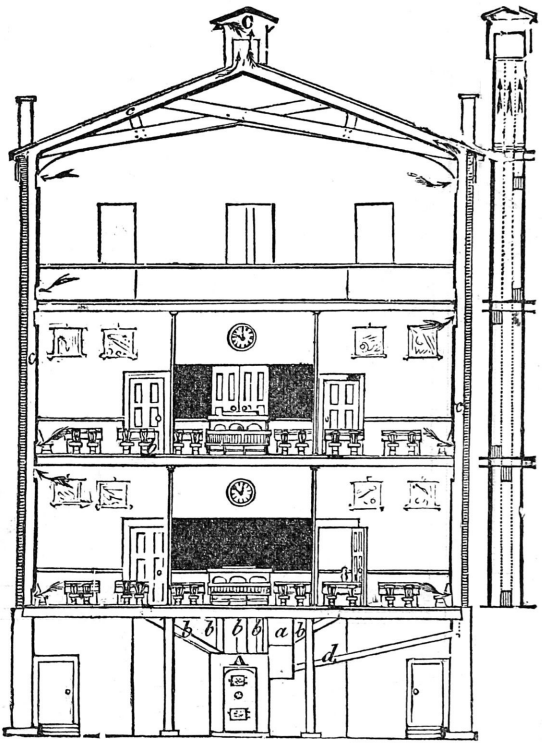


Fig. 21.—Section of a School-House, showing System of Heating and Ventilation.

A. Hot air furnace.
a. Cold air ducts.
bbbbb. Hot air ducts to the register in the floors.
c. Foul air ducts—the passage into and through which is indicated by an arrow.
d. Smoke-flue.

(8.) *Another Mode.*—A simpler form of heating and ventilation is given in *Figs.* 23 and 27. The stove is not the ordinary kind, but is a form of heater. The cold air is brought in under the floor from outside, as indicated by the arrow, and passing round the heated stove, is thrown of at either side through two ducts. The smoke-pipe is carried (high enough to prevent any injurious radiation of heat upon the heads of the pupils below) to the opposite end of the room, where, after passing through the wall, it enters the ventilating flue, which commencing at the floor (see direction of the arrows), is carried up through the attic, and out above the roof. The heat of the smoke-pipe produces a lively current of air in the upper portion of the ventilating flue, sufficient to draw off the lower stratum of air near the floor, and at the same time diffuse equally through the school-room the fresh air which is introduced from outside and warmed by the heater at the opposite end of the room.

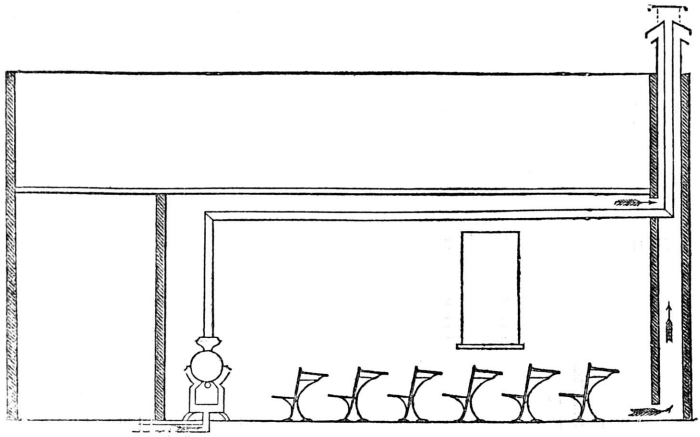


Fig. 23.—Section of Single School-House, showing a simple mode of Heating and Ventilation.

(9.) *The Problem of Heating and Ventilating.*—A school-house requires not warmth only, or ventilation only, but the two in combination, each efficient, thorough, and ample. The air for respiration must be perfectly fresh, comfortably warm, always in movement so imperceptible as not to produce draughts. The system should be so entirely under control that, when the temperature of the external air changes suddenly, that of the internal air may be regulated accordingly, and on no account allowed to become stagnant or unwholesome. The apparatus should be capable of warming the building within a short time of the lighting of the fires, so that when the children first arrive the effects may already be at their maximum.

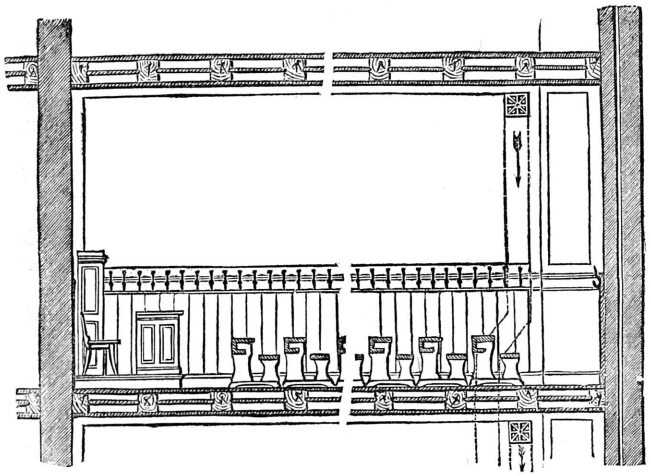


Fig. 24.—Section of School-Room (No. 1) showing German System of Ventilation.

(10.) *These Desired Results may be Attained* in any one of several different ways, according to the building to be treated; but, whatever the course pursued, there is one great principle applicable alike to every system possible to be devised, which we must strongly insist upon at the outset, viz.: that of *demand and supply.* The removal of heated and vitiated air from a room by means of a flue is often supposed to be ventilation. It is only a part—a necessary part—of

ventilation. To be of use, such a flue requires that fresh air of at least equal volume shall be admitted to the room at the same time. In all those systems which attempt to warm the air of a room without allowing any of the warmth or air to escape, ventilation is entirely lost sight of. Calculating the movement through the inlets to be at the rate of 150 feet per minute, *from 15 to 20 cubic feet of air per child per minute* is required to pass into the school-room in a ceaseless stream. To provide an effective system of proper ventilation involves sometimes a cost so considerable that the true principles of ventilation are in danger of being sacrificed, and attention to school hygiene not attempted in a mistaken zeal for defending the purse-strings.

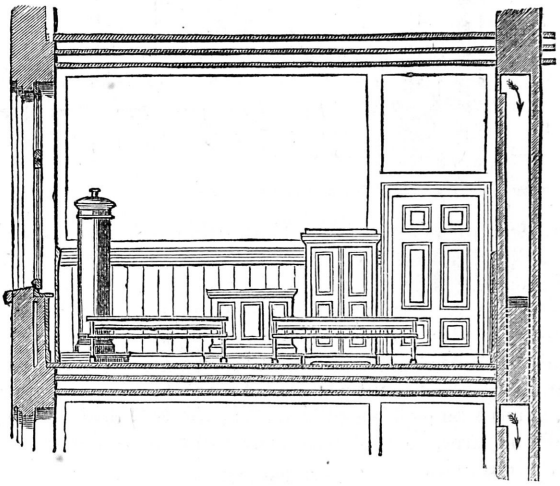


Fig. 25.—Section of School-Room (No. 2) showing German System of Ventilation.

(11.) *A Large Outlay at First Cannot be Avoided*, if we would have thorough warming and thorough ventilation effectually combined; for, if the foul air be continuously extracted, and fresh air continuously admitted, the arrangements for warming the latter must be of great power, and for removing the former of great extent. True economy dictates that only such methods as are sound in principle, healthful in practice, easy of management, and therefore suitable for a school-house, should be adopted.

(12.) *Ventilation must be Ample.*—In applying any system of artificial warming to a large school-house we must be careful that the ventilation is ample, and that a condition of stagnated air is impossible. This can only be effected with certainty by gathering together all the outlet flues to one common shaft, placed in a central position in the roof. (See *Figs.* 20, 21, 23, 27 and 33.)

(13.) *The German System of Ventilation* depends too much on the open window as an auxiliary. The modern system of heating is often by hot water pipes, connected with a coil placed in a cylindrical stove, and extending into the various rooms. The whole heating apparatus is in the rooms, and thus economy of fuel and heat is secured. We give two examples, in *Figs.* 24 and 25, with the ventilators in the walls.

CHAPTER IX.

ILLUSTRATIONS OF THE BEST PLANS OF VENTILATING SCHOOL-ROOMS.

1.—Official Regulations in regard to Ventilation of the School-Room.

The Ontario Official School Regulations require a school-house (with separate rooms where the number of pupils exceeds fifty), the walls of which shall not be less than ten feet high in the clear, and which shall not contain less than nine square feet on the floor for each child in the section or division; so as to allow an area in each room, for at least one hundred cubic feet of air for each child. It shall also be sufficiently warmed and ventilated, and the premises properly drained.

NOTE.—Thus, for instance, a room for fifty children would require a minimum space for 5,000 cubic feet of air. This would be equal to a cube of the following dimensions in feet, viz.: 25 x 20 x 10, which is equivalent to a room 25 feet long by 20 wide and 10 feet high. Physicians of experience declare that fifty children require 100,000 cubic feet of fresh air hourly, or 2,000 cubic feet per hour for each child. Our official regulation is therefore far below the medical standard.

The Regulations also require that Public and High School Inspectors, in examining into the condition of the school-house, should see:

Space for Air.—Whether the required space of nine square feet for each pupil, and the average space of one hundred cubic feet of air for each child, have been allowed in the construction of the school-house and its class rooms.

NOTE.—*Ventilation* becomes easy as soon as it is known that it is embraced in these two essential operations, viz.: 1st, to *supply fresh air;* 2nd, to *expel foul air.* It is evident that fresh air cannot be crowded into a room unless the foul air is permitted to pass freely out; and certainly the *foul air will not go out* unless fresh air comes in to fill its place. It is useless to open ventilating flues when there is no means provided to admit a constant supply of fresh air from without.

Temperature.—In winter the temperature during the first school hour in the forenoon or afternoon, should not exceed 70°, and 66° during the rest of the day.

2.—American Modern System of Ventilation Illustrated.

The Massachusetts State Board of Health publish a number of illustrations of school ventilation, prepared by Mr. A. C. Martin, of Boston. (See pages 50-55.) In discussing the subject, Mr. Martin thus writes:—

"All know that the condition of the air in most school-rooms an hour after the session has commenced, is very bad, so bad as to induce a morbid condition of the system, impairing the mental vigour of both teachers and scholars. The cause of the trouble is commonly stated to be the presence of carbonic acid in the air which we exhale. * * * According to the popular idea, it is only necessary to make a hole somewhere in or near the ceiling to let it off, and thus the room is properly ventilated. This theory of ventilation makes no provision whatever for a supply of fresh air in those school-rooms (no small proportion of the whole number) which are warmed by stoves. In cases where furnaces are used, they are commonly regarded as sources merely of heat; seldom as the means of a supply of *fresh air.* Registers are placed somewhere in the floor, but their size and disposition are left to convenience or to the discretion of the furnace dealer, whose sole aim is to furnish *heat,* not air. True, some air must make its way through the hot-air pipes; but as soon as the temperature of the room is so high as to be too warm for comfort, the register is closed, thus shutting off entirely any supply of fresh air except what may creep in through the crevices around

the doors and windows. If further relief from heat or close air becomes necessary, the windows are let down a little from the top. The result of this is that the cold air rushes in and fills the bottom of the room, causing dangerous draughts for those who sit near the windows, and cold feet for everybody. * * * As we have seen, the carbonic acid gas exhaled from the lungs is looked upon as

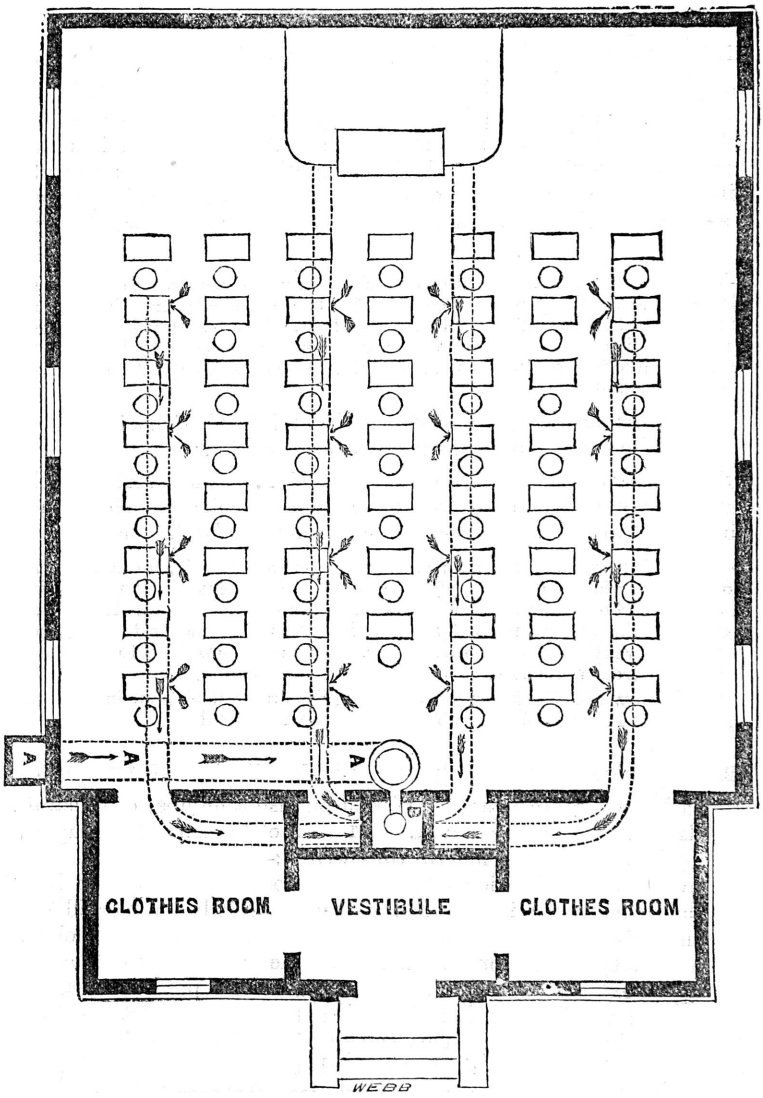


FIG. 26.—GROUND PLAN OF VENTILATED SCHOOL-HOUSE.

the principal evil. But so far from its being the principal evil in vitiated air, * * * we must seek further for sufficient causes for the foul condition of the air in an occupied room. We shall discover in it not only this deleterious acid, but in still greater proportion the watery vapour and the animal matter thrown off by both lungs and skin. The amount of watery vapour given off by the lungs and skin has been variously estimated at from twenty to forty ounces in

the twenty-four hours, or about six to twelve grains (troy) per minute. This vapour contains animal matter which seems to putrefy almost immediately after being thrown into the air. It is the source of the vile odour in an ill-ventilated room, and, in its effects on the health, is far more dangerous than carbonic acid gas, which is now generally considered as acting rather as an obstructor of respiration than a positive poison. * * * Still another element of evil must be counted in the clothing of children of the poorer classes, which is worn and kept

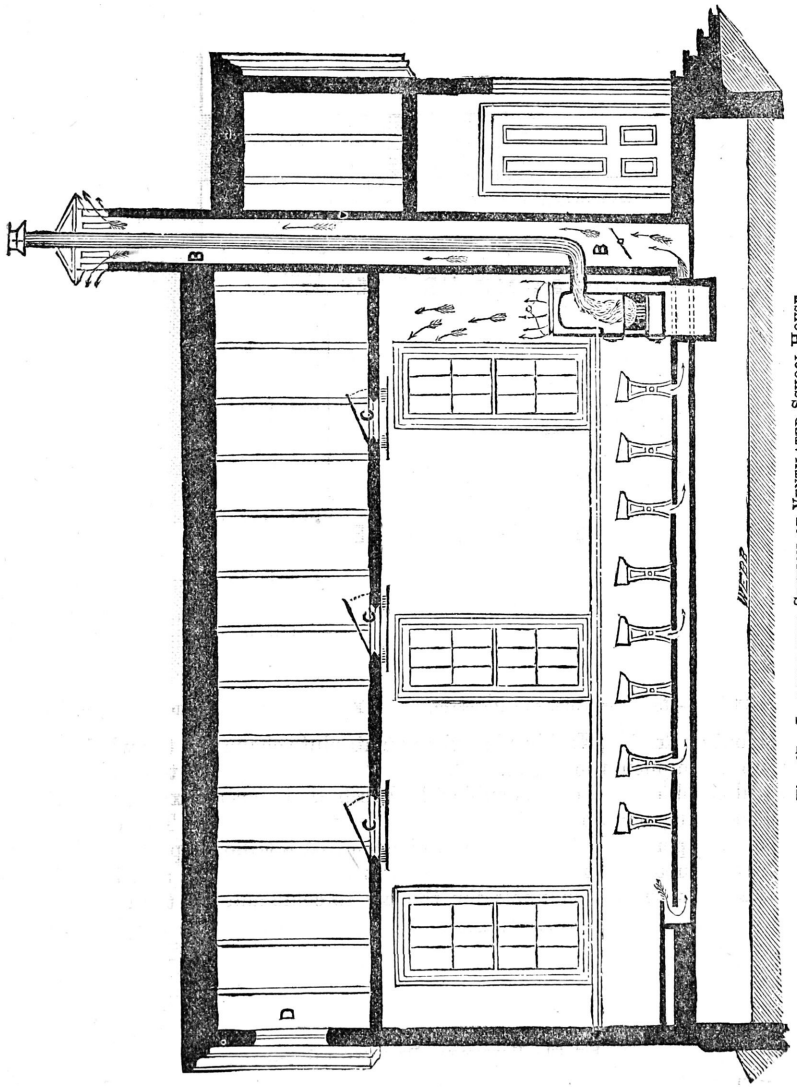


Fig. 27.—Longitudinal Section of Ventilated School-House.

in homes that have never known an airing. It is easy to detect, in some school rooms, the odours resulting from the different occupations of the children's parents mingled with the scent from the frying of the family doughnuts or the smoke of the paternal tobacco-pipe. What science hints of the germs of disease in the air about us, might startle the most careless; but such details are unnecessary

* * * in regard to the simple question, how we can best ventilate and warm our school-rooms, in which the children daily spend five or six hours, the teachers, often seven or eight. The children are at an age when respiration is most active, and when nature demands an ample supply of air of the purest quality. We are, then, forced to conclude from the nature of the evil and from the imperative necessity of its entire removal, that no remedy can be successful which does not ensure a full and complete renewal of the air in the room as often as it

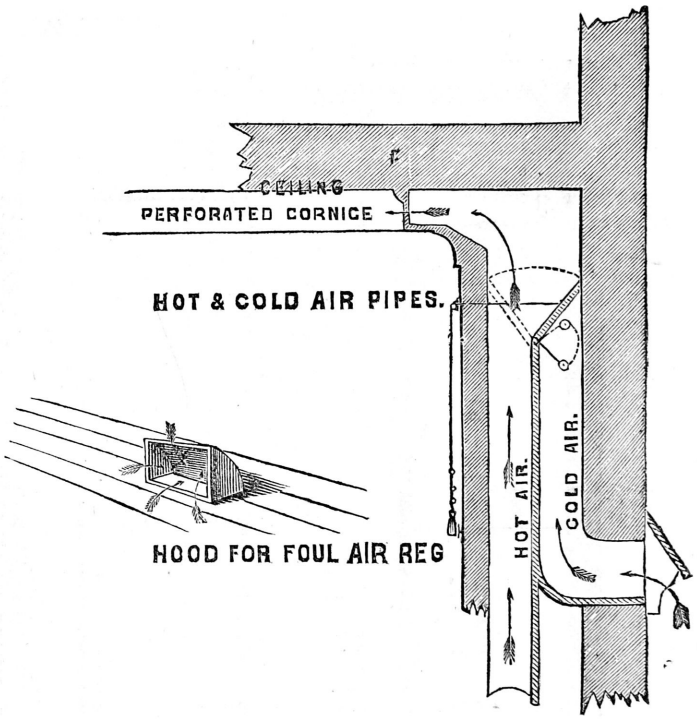


Fig. 28.—Hood for Foul Air Register. Fig. 29.—Hot and Cold Air Pipes.

becomes foul or dead. Nothing less than an absolute change of the whole volume of air can accomplish the object. * * * Can we plead too strongly for a thoughtful consideration of this subject? Fresh air is not a luxury, not even an essential comfort, but an absolute necessity for the children. The duty of providing it is imperative. The cost is to be counted a trifle in proportion to the good to be gained. Let the school-houses at least be planned and built, in the first instance, with free channels for the air to come and go, then the item of

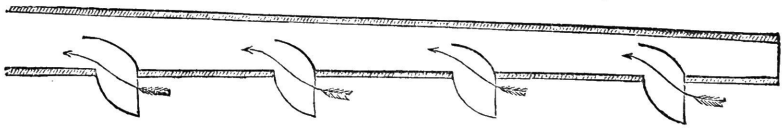


Fig. 30.—Horizontal Duct, with Openings.

ventilation will make small show in the construction accounts. When the blessing of ventilation is fully understood, the most grumbling of tax-payers will admit that money spent for it was never better invested. Then shall it no longer be said that teaching is more wearing than any other profession requiring the same actual labour, but teachers and scholars shall work without over-fatigue or listlessness in their fresh, sweet school-rooms.

EXPLANATION OF THE ILLUSTRATIONS.

"*Figs.* 26 and 27 show the plan and section of a small country school-house for fifty-six scholars. The room is heated by a stove, surrounded by an envelope. This casing will prevent the direct radiation of the heat which makes the seats near by so uncomfortably warm. But its main purpose is to aid in heating the fresh air which comes in by a duct (marked A, *Fig.* 26) made under the floor, with an opening beneath the stove. It is precisely similar to the "cold-air box" of a furnace, and should be made large and have a valve for regulating the supply of fresh air. The cold air from out of doors is thus warmed by the stove and rises up within the envelope to the top of the room, where it is diffused along the

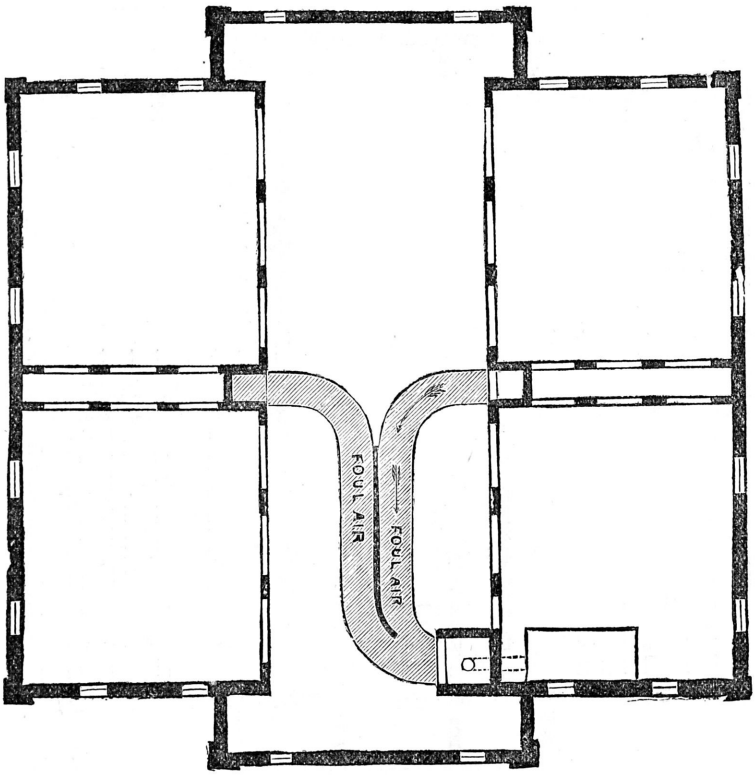


Fig. 31.—Plan of Basement of Ventilated School-House.

ceiling and thence is drawn down by the action of the ventilating ducts. Of these there are four horizontal ones, shown by the dotted lines. They may be made between the floor timbers, and should be as smooth as possible, with the angles rounded where a change of direction is necessary. Each of them has four inlets (shown by the pairs of curved arrows), making for the room sixteen outlets for foul air. These openings into the ducts should be protected by a raised hood placed under the seat with a wire guard over it (see *Fig.* 28). Moreover the ducts should have partitions under each opening (see *Fig.* 30), to insure a flow of air through each of them. These ducts are all connected with the vertical shaft at B, *Fig.* 27. The smoke-pipe from the stove is carried up through its whole height, so that the heat radiated from it may be utilized in rarefying the air in the shaft, in order to help the draught.

"The sizes of foul air registers, ducts and shafts, are calculated as follows:—

"There are fifty-six scholars, each requiring fifteen cubic feet of air per minute, which makes for the whole room 840 cubic feet, or fourteen cubic feet per second. For ventilation in early fall or late spring, when it is too warm for fires and too cold for open windows, we can obtain a velocity of three and a half feet per second in the shaft by the aid of a small stove placed in the bottom of it. Therefore the shaft must have a cross section of four square feet, in order at that velocity to draw off the required fourteen cubic feet per second. Each horizontal duct must pass one-quarter of fourteen cubic feet per second, or three and a half cubic feet, with a velocity of about two and a half feet per second. A cross-section must then be one and one-fourth square feet, or twelve by fifteen inches. Each foul-air register will be required to pass one-fourth of three and a half cubic feet

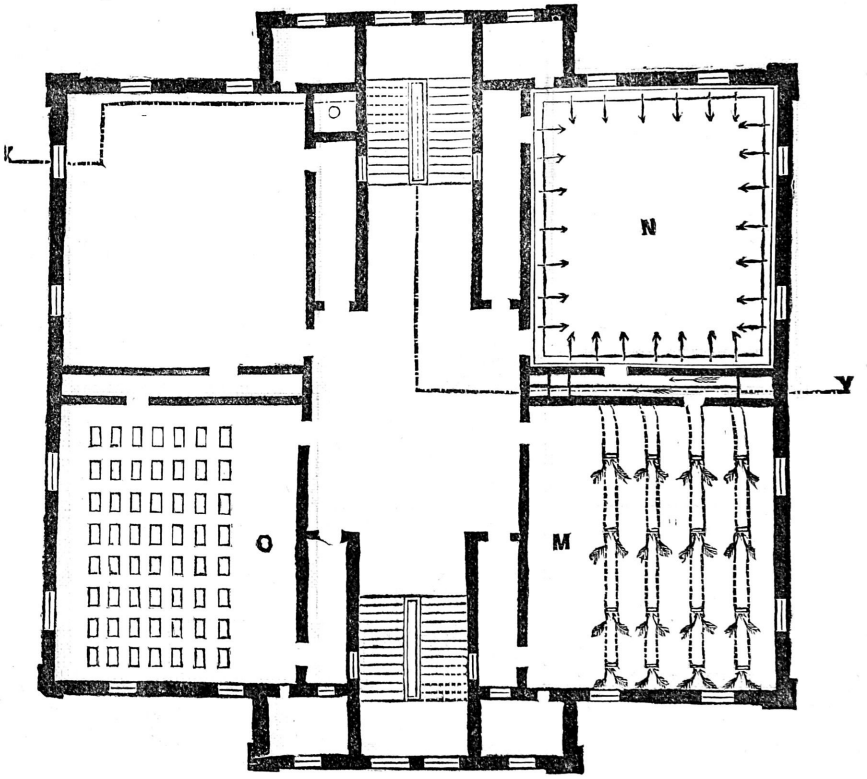


Fig. 32.—Plan of First and Second Floors of Ventilated School-House.

per second, with a velocity of two feet. Its area must then be .4375 square feet, equal to sixty-three square inches, or eight by eight inches. The outflow of air can be increased or diminished by the use of a valve in the shaft, by which its withdrawing power can be controlled. In case more fresh air is required than that supplied through the envelope of the stove, when the valve in the fresh-air duct is wide open, openings (C, *Fig.* 27) are made through the ceiling into the attic, in which is a window (D) which can be raised and lowered by means of a cord below. The drawing power of the ventilating shaft will at once determine an influx of cold air which should be directed and diffused along the ceiling. Should a furnace be used to heat such a room, the ducts for withdrawing the air should be precisely the same as in the plan. The hot-air flues should be carried up to the ceiling, with passages for cold air beside them in order to temper the heat if

desired. (See *Fig.* 29.) The valve can be held by the cord in any position required, so as to admit all cold or all hot air, or any proportion necessary. (The figure shows the cold air entirely cut off.) The power of the current in the vertical shaft will secure the upward flow of the cold air.

"*Figs.* 31 and 32 represent the basement and first and second stories of an eight-room school-house. In such a building there is generally a large hall in the third story, which prevents carrying the vertical ducts up through the roof; therefore it is more convenient to carry the foul air down into the basement by ducts connected with a ventilating chimney, which should be large enough to ventilate the whole building, including the large hall. *Fig.* 33 shows the secondary collecting ducts under the basement floor, and their connection with the bottom of the chimney.

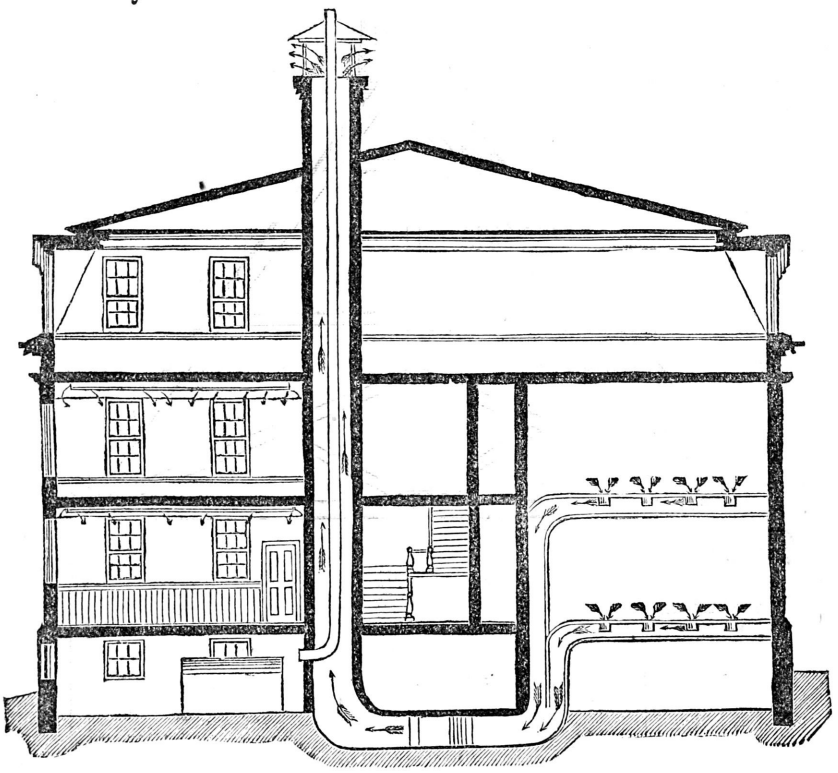


Fig. 33.—Transverse Section of Ventilated School-House.

"The calculations for this case are precisely like those for one room. The minimum velocity of the flow of air in the chimney should be about six feet per second. It may be increased by steam coils or a fire in the bottom, to nine, or, in cold weather, even twelve feet per second.

"In room M (*Fig.* 32) the horizontal ducts are shown with the foul-air registers. Room N shows the distribution of the fresh air through a hollow cornice made for the purpose. (See *Fig.* 29.) Room O shows the position of the desks.

"*Fig.* 27 is a section taken on the line X—Y of the plan (*Fig.* 32), and shows the primary and secondary collecting ducts and the main shaft."

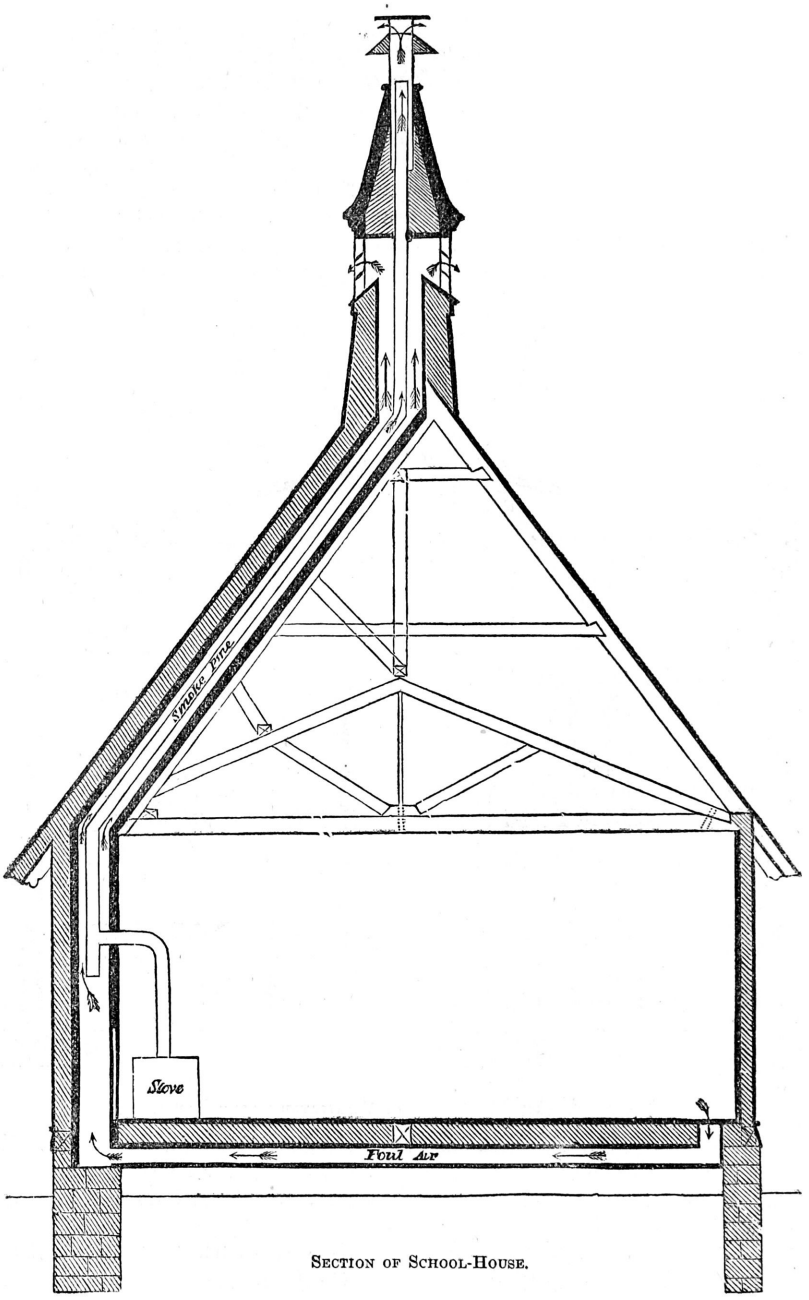


Fig. 34.—Showing General Arrangements for Heating and Ventilating.

3.—New Brunswick Official Plan of Ventilation.

The following are an outline of specifications applicable to the New Brunswick illustrations of Heating and Ventilation, which we insert :—

SPECIFICATIONS FOR VENTILATION AND HEATING.

The ventilating shaft to be finished above roof as shown in *Fig.* 34 (page 56), the sides to have openings fitted with Louvre slats; the slats on one side, and one centre post, to be removable, and this post to be fixed in place with screws. The roof to be shingled, and to have a galvanized smoke cowl 12 inches in diameter, securely fixed and made tight to roof, as shown in *Figs.* 33 and 34.

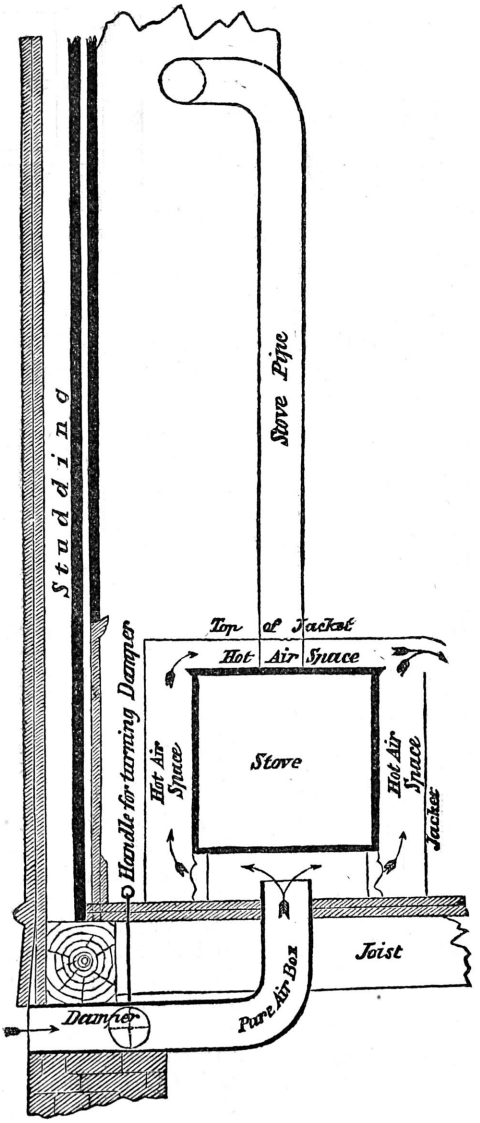


Fig. 35.—SECTION THROUGH STOVE, &C., SHOWING PURE AIR PIPE, OR BOX, AND JACKET.

Provision to be made in *each* school-room, *and class-room*, for drawing off the foul and cold air by means of 8 in. by 12 air-tight wooden or other tube secured to the underside of the floor joists (*Figs.* 35 and 36, pages 57 and 58), and fitting

air-tight into *each* ventilating shaft; *each* foul air-tube to have an opening into room at the end opposite entrance into ventilating shaft (*Fig.* 39); this open-

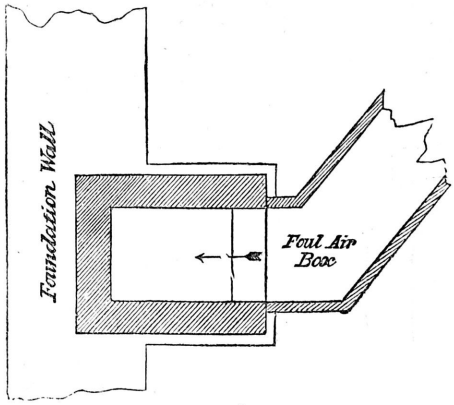


Fig. 36.—Section of Plan at bottom of Ventilating Shaft.

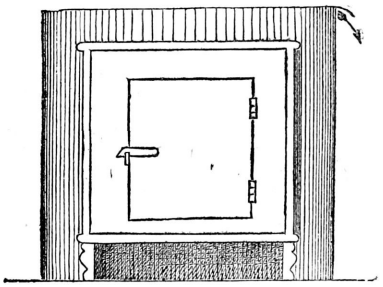


Fig. 37.—Elevation of Front Part of Stove, showing fitting ofjacket.

ing to be made in the floor close to the base-board, and fitted with a damper or register to open or shut at pleasure, and connected air-tight with the tube under the joists. (*Fig.* 35.)

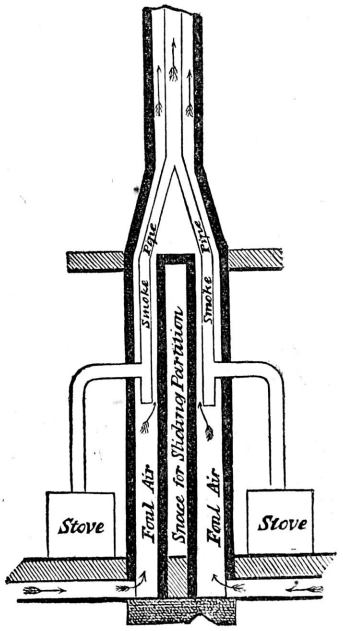


Fig. 39.—Plan and Section of Double Ventilating Shaft for two School-Rooms.

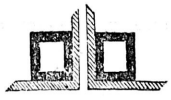


Fig. 40.—Plan and Section of Ventilating Jacket

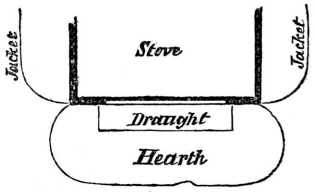


Fig. 38.—Plan of Front Part of Stove, showing fitting of jacket.

A circular opening to be made in the ceiling of *each* school-room and fitted with register, having a cord carried above ceiling joists and in the wall to platform, so that the teacher may open and shut at pleasure. A clay, sheet iron, galvanized iron, or other uninflammable pipe, to be provided for supplying PURE AIR to *each* stove, connecting with the outer air through the foundation wall (*Figs.* 35 and 36), and carried up through the floor, directly under and to within 3 inches of the bottom of the stove. This pipe to be fitted with a damper with rod coming through the floor close to the base-board, to regulate supply of air. (*Fig.* 35.)

Each stove is to be fitted with a common sheet iron or galvanized iron jacket (*Fig.* 35), leaving a space of 6 inches on all sides between it and the stove, except about the door and draught (*Fig.* 38), where it is to be turned in all around close against the stove. This jacket to fit tight to the floor, and to have a cover open 3 inches for the escape of hot air into the room on one side only, that next the teacher's desk; the cover to project over the opening and to bend downwards. The jacket is to be carried up to the cover on the side above the stove door (*Fig.* 37), and also on the other two sides; the stove pipe to pass through the cover or jacket, and to be fitted tight into the smoke-flue.

CHAPTER X.

ESSENTIAL PRINCIPLES OF SCHOOL ARCHITECTURE.

1.—Conditions to be Observed in School-House Construction.

In erecting school-houses, it should be borne in mind that the essential conditions to be observed in their construction are: that they should be convenient, adapted to the purpose to which they are put, and that they should afford abundant facilities for warmth, light, and proper ventilation and shelter.

Mr. Johonnot, in his *"Country School Houses,"* adds the following excellent advice:

We might class with these another scarcely less important, viz., durability. Hence the strength and stability of walls, the tightness of roof and outside covering, are matters of prime interest; and if neglected in the outset, no subsequent expenditure of skill or labour can provide a remedy.

To secure these results, attention should be specially paid to two things:

(1.) *The materials used should be excellent in quality.*

It is a false economy that consents, under any circumstances, to use inferior materials. There may be, in the beginning, a small saving of cost, but the result will be premature decay, and consequent expense for rebuilding. The greatest care should be taken to procure bricks properly burned, straight-grained timbers for frames, sound roof-boards and siding, floor-boards without knots, shingles of the first quality, and fresh-burned lime. These precautions cannot be too strongly urged. A single stick of bad timber will sometimes ruin a whole building; and many a brick wall has fallen in consequence of using lime which has been too long exposed to the action of the air. The money annually expended in repairs occasioned by the use of poor materials, is more than triple that increase of the first cost which would have entirely obviated the difficulty. *Every part of the materials should be carefully examined by competent judges, and all except the very best, rejected.*

(2.) *The work should be well done.*

Job-work, as it is usually termed (often another name for work miserably performed), cannot be too earnestly deprecated. With the best of materials, a careless or unskilful workman will construct a worthless building. Lumber of the best kind may be worse than wasted by a slovenly manner of framing and adjusting it. Shingles poorly laid will be followed by leaks, which must seriously damage the plaster and inside finish; they should be laid in mortar. Foundations insecurely built will rack and destroy every other part of the building. Window-frames imperfectly constructed, siding and floors loosely laid, and doors

with yawning joints, all allow the entrance of the cold and storms, and thus become the source of unnecessary expenditure for fuel, as well as of serious injury to the entire structure. Lath and plaster badly put on, last but a short time, and constant patching presents an unsightly appearance, besides being the cause of annoyance and expense. Surely no further specification is needed to satisfy the most reluctant, that the truest economy demands such an expenditure for labour in the outset as shall secure the best possible construction. Faults in workmanship should be carefully provided against, and every part of the work should be subjected to the closest scrutiny.

(3.) *Evils of False Economy.*—But workmen are not alone to blame for improper construction. It is quite as often the result of false economy or parsimony on the part of trustees. The estimates of mechanics are often cut down without an intelligent reason, upon the assumption that they are not made in good faith. In consequence, the workmen, who perhaps are forced by circumstances to undertake the job, are obliged to slight their work to save themselves from absolute loss. The injury resulting therefrom does not end with the work imperfectly done, but it has a direct tendency towards a regular system of deception on the part of both employer and workman. Let those having charge of the construction of school buildings beware of offering a premium for *inferior* work by paying less than *good* work is worth. Let them remember that the "labourer *is* worthy of his hire," and that to extort labour for less than its value is only a safe and legal species of robbery.

(4.) *Rules of Taste as Regards Form.*—In the erection of every school-house particular care should be taken to observe the rules of taste as regards form. In the rural parts of the country, where a small and plain building only is demanded, we need to consider proportion and symmetry alone, the other principles of architecture applying chiefly to larger and more pretending structures. If this is done, if our school-houses all conform to these two fundamental laws, they cannot fail of becoming strong educational influences in the right direction. The advantages, in this regard, of obeying the principles of architecture in the construction of school-houses may be summed up in a few words:

1. If the building is an object of beauty, the very sight of it inspires emotions of pleasure.
2. It adorns and beautifies the landscape of which it forms a part.
3. It becomes an attractive place to children, and does not repel them by its deformity.
4. It practically teaches ideas of proportion and symmetry, and new and exalted conceptions of beauty of form.
5. It throws over property the shield of beauty, and so checks and finally eradicates the rudeness, which is stimulated in children to destructiveness, by deformity.
6. It forms one of those influences which have most power over the heart and affections, directly aiding the teacher in the most difficult and important part of his work.

2.—Important Matters to be Considered in School Buildings.

(1.) *Health.*—The preservation of health is a matter of prime importance in the erection of every school-house. Everything else—including cost, comfort, and convenience—should be subordinated to this. To accomplish this, great care should be taken in the following particulars:

(2.) *The Situation* should be at a distance from all sources of malaria. (See section 1 of chapter xii.) The foul breath of decaying vegetation, or of stagnant water, becomes a fruitful source of disease and death. Unseen and unnoticed, it

insidiously does its work, and spreads the atmosphere of the charnel-house as far as its influence extends. The diseases seeming to be epidemic, which sometimes break out in schools, may often be traced to some neighbouring swamp or marsh, or heap of rotting vegetables. (On this point, see especially clauses (7) and (8), sec. 1 of chapter v.) Some manufactures also generate disagreeable gases, which, breathed for any considerable time, are deleterious in the extreme. The school-house should be placed at a distance from all these sources of disease. Again, it should be situated away from railways, factories, the noise and dust of the street. Let the location, if possible, be where it may be free from these annoyances, and where the purest air may be obtained. (See section 3 of chapter xii.)

(3.) *The Size of the School-Room* is a consideration of great importance. Every pupil should have sufficient room to sit and move without being confined or jostled by any one else. Packing children close together, so that the breath and atmosphere of each is shared with all his neighbours, is an unmitigated evil, if not a crime. The rules laid down on this subject in the official regulations are as follows: The vitality of the air is exhausted by breathing, and a constant supply of fresh air is necessary to preserve life and health. Air, absolutely pure, is essential to the highest degree of health. Rendered partially impure by breathing, it will sustain life; but then all the machinery of the body becomes clogged, and the brain is so enfeebled as to be unable to perform its functions. Every person contaminates, and renders unfit for use, at least five cubic feet of air per minute. A school-room twenty by thirty feet in size, and ten feet high, would contain six thousand cubic feet of air. Forty scholars would consume this, and render it unfit for sustaining the bodily functions, in just thirty minutes. (See section 1 of chapter v.)

NOTE.—*In every school-house without proper means of ventilation, there is a slow and subtle poison which enters the blood and brains of the pupils, and saps the very foundation of life.*

To sum up: Each school-house should be sufficiently large to allow every pupil: 1. To sit comfortably at his desk. 2. To leave it without disturbing any one else. 3. To see explanations on his lessons, and to recite, without being incommoded or incommoding others. 4. To breathe a wholesome atmosphere. For the accomplishment of this last, not less than 150 cubic feet of air should be allowed for every pupil.

(4.) *Platform and Shelves.*—The master's platform should be raised about eight inches; and the end of the room occupied by him, if a small school-house (or a separate room in large ones,) should be filled with shelves for a library, and for philosophical apparatus, and any collection of natural curiosities (such as rocks, minerals, plants shells, etc.,) which may be made in the neighbourhood, or obtained elsewhere. The shelves may be conveniently divided by pilasters into three portions—the middle one for books, the others for apparatus and collections. On one of the pilasters may be a clock; on the other a barometer and thermometer; on shelves in the corners, the globes; and over the library, in the centre, may be the time-table. One of the pilasters may form part of the ventilating tube. The space for the platform, shelves, &c., between the front range of desks and the north wall, should be from 7 to 10 or 12 feet, according to the size of the room and the number of pupils contemplated. By means of a large movable black-board this space may be, in case of need, divided into two, so that two classes may recite at a time.

(5.) *Entry, &c.*—The outside porch or entry should be lighted; and the room off it should be furnished with hooks or pins, for the accommodation of hats, bonnets, and cloaks.

(6.) *Light.*—The windows should be on the east side of the room, and on the left of the pupils. Windows on the north, although they admit too much cold in winter, give an agreeable light. From the south the light is too intense; and

if the light come from behind, the head and body of the pupil, interposed, throw the book into their shadow. The windows should be set high enough to give an uninterrupted light, and prevent pupils sitting at their desks from seeing persons or objects on the ground without. (See section 14 of chapter xii., and 1 of chapter iv.) The windows should be furnished with blinds or curtains, and should be made to open from the top as well as from the bottom.

(7.) *Heating.*—The common modes of warming school-houses is by means of furnaces or stoves. The fireplace is, of course, preferable with reference to health, and by a little pains in the construction, may almost equal the stove in economy of fuel. (See *Figs.* 18 and 19, and section 2 of chapter viii.)

(8.) *The Construction of Seats and Desks.*—For the health of the pupil, as well as for his comfort, the height of the seats ought to be so graduated as to enable him to set his feet squarely on the floor. A contrary custom often produces much suffering, and a distortion of the lower limbs. Seats without backs should never be permitted in a school-room. To relieve the overstrained muscles, unnatural postures are assumed, and a crooked spine is a very probable consequence.

(9.) *Proper Attention to Cleanliness.*—As health can not be preserved without habits of personal neatness, so it is useless to inculcate these upon pupils while the dirty condition of the room they are obliged to occupy forbids the acquisition or preservation of those habits. *Verbum sap.*

3.—Special Hints on School-Building.

(1.) *Number to be Accommodated.*—Before a school-house is planned, the number of children who are likely to occupy it; the number of classes into which they ought to be grouped; whether the school should be "mixed," or the boys and girls taught in different rooms; are points that require to be carefully considered and determined beforehand, in order that the arrangements of the school may be designed accordingly.

(2.) *Rooms for Separate Teachers.*—Every class, when in operation, requires a separate teacher, be it only a monitor acting for the hour. Without some such provision it is impossible to keep all the children in a school actively or usefully employed at the same time. Where assistants or monitors are employed at the public expense, it becomes of increased importance to furnish them with all the mechanical appliances that have been found by experience to be the best calculated to give effect to their services.

(3.) *Concentration of Attention.*—The main end to be attained is the concentration of the attention of the teacher upon his own separate class, and of the class upon its teacher, to the exclusion of distracting sounds and objects, and without obstruction to the head master's power of superintending the whole of the classes and their teachers. This concentration would be effected most completely, if each teacher held his class in a separate room; but such an arrangement is not, in the case of small schools, unless folding doors or sliding partitions be used, practicable. The school-room, if single, should, therefore, be planned and fitted to realize, as nearly as may be by these means, the combined advantages of isolation and of superintendence, without destroying its use for such purposes as may require a large apartment.

(4.) *Best Shape of Room.—The best shape is an oblong.* Each class, when seated in a group of desks, can be isolated from the rest of the school by a curtain or sliding partition or door—its teacher standing in front of it, where the vacant floor allows him to place his easel for the suspension of diagrams and the use of the black board, or to draw out the children occasionally from their desks and to instruct them standing, for the sake of relief by change of position. The seats at the desks *and* the vacant floor in front of each group are *both*

needed, and should therefore *be allowed for* in calculating the space requisite *for each class.*

(5.) *Combination of Classes.*—By drawing back the curtain between two groups of desks, or sliding back the partition or door, the principal teacher can combine two classes into one for the purpose of a gallery lesson; or a gallery may be substituted for one of the groups. For simultaneous instruction, such a gallery is better than the combination of two groups by the withdrawal of the intermediate curtain, partition or door; because the combined length of the two groups (if more than fifteen feet) is greater than will allow the teacher to command at a glance all the children sitting in the same line. It is advisable, therefore, always to provide a gallery; but this is best placed in a class-room by itself.

4.—Rules to be Observed in Planning a School.

The reasons of the following rules will be readily inferred from these preliminary explanations, and the annexed plans have been prepared to illustrate the official rules as regards the arrangement of the buildings and the internal fittings of schools and class-rooms:

(*a*) In planning a school-room, it must be borne in mind that the capacity of the room, and the number of children it can accommodate, depends not merely on its area, but on its area, its shape, and the positions of the doors and stoves or furnace.

(*b*) The best width for a school-room intended to accommodate any number of children between 48 and 144 is from 20 to 25 feet. This gives sufficient space for each group of desks and seats, for the teachers to stand at a proper distance from their classes, and for the classes to be drawn out, when necessary, in front of the desks, around the master or assistant.

(*c*) A school not receiving infants should be divided into the number of classes prescribed in the programme of studies. (*The varying capacities of children between seven and thirteen years old will be found to require at least thus much subdivision.*)

(*d*) Desks and seats, graduated according to the ages of the children, should be provided for all the scholars in actual attendance, and therefore a school-room should contain at least *four* groups.

(*e*) An allowance of 18 inches per child on each desk will suffice for the junior classes, but not less than 22 inches for the senior classes; otherwise they may be cramped in writing.

(*f*) The desks should be *very slightly* inclined, with a groove and flat space at the top for pencils, pens, &c.

(*g*) As a general rule, no row of desks and seats should be more than 12 feet long; and no group should contain so many desks and seats that the teacher would have to raise his voice to a high pitch, as this becomes exhausting to himself, while at the same time it adds inconveniently to the general noise.

(*h*) Each group of desks should be separated from the contiguous group, either by an alley 18 inches wide, for the passage of the children, or by a space sufficient for drawing or withdrawing the curtains, sliding partition, or door.

(*i*) The curtains, when drawn, should not project more than 4 inches in front of the foremost desk. An alley should never be placed in the centre of a group or gallery, and the groups should never be broken by the intervention of doors, etc.

(*j*) Where the number of children to be accommodated is too great for them to be arranged in one room without overcrowding, an additional school-room should be built, and placed under the charge of an additional teacher, who should, however, be subordinate to the head-master.

(1.) The walls of every school-room and class-room, *if ceiled at the level of the wall-plate*, should be at least 12 feet high from the level of the floor to the ceiling; and if the area contain more than 360 superficial square feet, 13 feet; and if more than 600, then 14 feet.

(2.) The walls of every school-room and class-room, *if ceiled to the rafters and collar-beam*, should be at least 11 feet high from the floor to the wall-plate, and at least 14 feet to the ceiling across the collar-beam.

(3.) The whole of the external walls of the school and residence, *if of brick*, should be at least one brick and a half in thickness; and *if of stone*, at least 20 inches in thickness.

(4.) There should be no opening wider than an ordinary doorway between an infants' and any other school-room, as it is necessary to stop the sound of the infant teaching.

(5.) An infant school should always be on the ground floor and, if exceeding 80 children in number, should have two galleries of unequal size, and a small group of benches and desks for the occasional use of the elder infants.

(6.) The class-rooms should never be passage-rooms from one part of the building to another, nor from the school-rooms to the playground or yard.

(7.) The class-rooms should be on the same level as the school room.

(8.) The class-rooms should be fitted up with a gallery, placed at right angles with the window.

(9.) Infants should never be taught in the same room with older children, as the noise and the training of the infants disturb and injuriously affect the discipline and instruction of the older children.

(10.) The sills of the windows should be placed not less than 4 feet above the floor.

(11.) Each window should be made to let down or open.

(12.) The doors and passages from the school-rooms to the privies must be separate for the two sexes. So must also be the privies themselves. If they cannot be constructed entirely apart from each other, there should be between them a thick, or deadened, wall, so as to form a sufficient obstacle to sound as well as sight. The privies should be sub-divided, having a door and light to each sub-division. (See plans given in chap. iv, page 24.)

5.—A School-House should be Adapted to its Object.

Dr. R. C. Kedzie, of the Michigan Agricultural College, in his well-directed labours in behalf of reform in school-house architecture, says:—

The first demand of architecture is that the building shall best secure the objects for which it is erected. This is the first and principal aim of true architecture. The form and appearance of the building, the amount and kind of ornamentation, are matters of secondary consideration. To reverse this order—to determine the form and appearance first, and then let the uses of the building accommodate themselves to the building as best they can—is to consult pride, and not to follow architecture. To erect a lofty building to catch the public eye, regardless of the best interests of the scholars, is an imposition, if not a crime.

6.—No Girls' School-House should be more than Two Stories high.

If our school authorities have determined to erect a school-house with one or two stories, and thus save our scholars from the disastrous effects of excessive stair-climbing, let us strengthen their hands in this good work. What is the testimony of the oldest and most thoughtful teachers of our State in regard to the influence of excessive stair-climbing? That it is evil, and only evil, and that

continually. Hear them: "Stair-climbing very frequently gives rise to female complaints, or aggravates the condition already existing. Many girls ask to be excused from writing and drawing (on the third floor) from this cause." "Stair-climbing is very injurious to many girls, especially as the period of puberty approaches, and following this period. *It has been a great damage to the schools.*" "If my opinion is of any consequence, I would say that if the West would imitate the East in lofty buildings, they must provide *elevators*, and keep them in constant use." "I approve, most emphatically, of all you said in regard to stair-climbing. My views have agreed with yours for the past twenty years." "I am very glad to give my testimony against lofty structures for school purposes." "I am glad of the opportunity of entering an emphatic protest against lofty school buildings." The testimony of teachers whose opinion is of any value is uniform on this subject. To disregard such testimony, and let the question of symmetry determine the form of our school buildings, is not wise. Let us have higher ideas for school architecture. Let the first and great thought be the *health, comfort, and safety of our scholars;* and then secure such architectural effects as shall not be destructive of these objects. Grant that the carrying out of these ideas would "introduce a new style of architecture," it must be remembered that the modern school-house is comparatively a new field in architecture. It is not to be moulded after the type of classic temples, with their lofty columns and majestic proportions; *for these, so far as use was concerned, were all one-story.*

CHAPTER XI.

THE INTERNAL ARRANGEMENTS OF SCHOOL-HOUSES.

1.—Ruskin on the Decoration of School-Rooms.

Hitherto, as far as I know, it has either been so difficult to give all the education we wanted to our children, that we have been obliged to do it, if at all, in schools with cheap furniture in bare walls; or else we have considered that cheap furniture and bare walls are a proper part of the means of education; and supposed that boys learned best when they sat on hard forms, and had nothing but blank plaster about and above them whereupon to employ their spare attention; also, that it was as well they should be accustomed to rough and ugly conditions of things, partly by way of preparing them for the hardships of life, and partly that there might be the least possible damage done to the floors and forms, in the event of their becoming, during the master's absence, the fields or instruments of battle. All this is so far well and necessary, as it relates to the training of country lads, and the first training of boys in general. But there certainly comes a period in the life of a well-educated youth, in which one of the principal elements of his education is, or ought to be, to give him refinement of habits; and not only to teach him the strong exercises of which his frame is capable, but also to increase his bodily sensibility and refinement, and show him such small matters as the way of handling things properly, and treating them considerately. Not only so, but I believe the notion of fixing the attention by keeping the room empty, is a wholly mistaken one; I think it is just in the emptiest room that the mind wanders most; for it gets restless, like a bird for want of a perch, and casts about for any possible means for getting out and away. And even if it be fixed, by an effort, on the business in hand, that business becomes itself repulsive, more than need be, by the vileness of its associations; and many a study appears dull or painful to a boy, when it is pursued on a

blotted deal desk, under a wall with nothing on it but scratches and pegs, which would have been pursued pleasantly enough in a curtained corner of his father's library, or at a latticed window of his cottage. Nay, my own belief is, that the best study of all is the most beautiful; and that a quiet glade of the forest, or the nook of a lake-shore, are worth all the school-rooms in Christendom, when once you are past the multiplication table; but be that as it may, there is no question at all but that a time ought to come in the life of a well-trained youth, when he can sit at a writing-table without wanting to throw the inkstand at his neighbour; and when also, he will feel more capable of certain efforts of mind with beautiful and refined forms about him than with ugly ones. When that time comes, he ought to be advanced into the decorated schools; and this advance ought to be one of the important and honorable epochs of his life.

I have no time, however, to insist on the mere serviceableness to our youth of refined architectural decorations, as such; for I want you to consider the probable influence of the particular kind of decoration which I wish you to get for them—namely, historical painting. You know we have hitherto been in the habit of conveying all our historical knowledge, such as it is, by the ear only, never by the eye; all our notions of things being ostensibly derived from verbal description, not from sight. Now, I have no doubt that as we grow gradually wiser—and we are doing so every day—we shall discover at last that the eye is a nobler organ than the ear; and that through the eye we must, in reality, obtain, or put into form, nearly all the useful information we have about this world. Even as the matter stands, you will find that the knowledge which a boy is supposed to receive from verbal description is only available to him so far as in any underhand way he gets a sight of the thing you are talking about. I remember well that, for many years of my life, the only notion I had of the look of a Greek knight, was complicated between recollection of a small engraving in my pocket Pope's Homer and a reverent study of the Horse Guards. And though I believe that most boys collect their ideas from more varied sources, and arrange them more carefully than I did, still, whatever sources they seek must always be ocular; if they are clever boys, they will go and look at the Greek vases and sculptures in the British museum, and at the weapons in our armouries—they will see what real armour is like in lustre, and what Greek armour was like in form, and so put a fairly true image together, but still not, in ordinary cases, a very living or interesting one. Now, the use of your decorative painting would be, in myriads of ways, to animate their history for them, and to put the living aspect of past things before their eyes as faithfully as intelligent invention can; so that the master shall have nothing to do but once to point to the school-room walls, and forever afterward the meaning of any word would be fixed in the boy's mind in the best possible way. It is a question of classical dress—what a tunic was like, or a chlamys, or a peplus? At this day you have to point to some vile wood-cut, in the middle of a dictionary page, representing the thing hung upon a stick; but then you would point to a hundred figures, wearing the actual dress, in its fiery colours, in all actions of various stateliness or strength; you would understand at once how it fell around the people's limbs as they stood, how it drifted from their shoulders as they went, how it veiled their faces as they wept, how it covered their heads in the day of battle. *Now*, if you want to see what a weapon is like, you refer, in like manner, to a numbered page, in which there are spearheads in rows, and swordhilts in symmetrical groups; and gradually the boy gets a dim mathematical notion how one cimeter is hooked to the right and another to the left, and one javelin has a knob to it, and another none: while one glance at your good picture would show him,—and the first rainy afternoon in the school-room would forever fix in his mind,—the look of the sword and spear as they fell or flew; and how they pierced, or bent, or shattered—how men wielded them, and how men died by them. But far more than

this, it is a question not of clothes or weapons, but of men; how can we sufficiently estimate the effect on the mind of a noble youth, at the time when the world opens to him, of having faithful and touching representations put before him of the acts and presences of great men—how many a resolution, which would alter and exalt the whole course of his after-life, might be formed, when in some dreamy twilight, he met, through his own tears, the fixed eyes of those shadows of the great dead, unescapable and calm, piercing to his soul; or fancied that their lips moved in dread reproof or soundless exhortation. And, if for but one out of many this were true—if yet, in a few, you could be sure that such influences had indeed changed their thoughts and destinies, and turned the eager and reckless youth, who would have cast away his energies on the race-horse or the gaming-table, to that noble life-race, that holy life-hazard which should win all glory to himself and all good to his country—would not that, to some purpose, be "political economy of art?"—*Ruskin's Modern Painters.*

2.—A Plea for Beautiful School-Rooms.

Happily for coming generations, the old notion has passed away, that *shelter* is the chief element in school architecture. In the memory of our fathers it was thought enough if, externally, the school-house had four sides, a floor and a roof; and internally, a fire-place and a row of benches. There was no attempt to make the school such an attractive place that children would find their greatest enjoyment there. The homes, however, from which many of these children came were made pleasant in various ways. White walls, tidy furniture, carpets, music and pictures were there to make home a pleasant spot—all the pleasanter, perhaps, when contrasted with the dreary school-room.

Now, however, school architecture studies *beauty* as well as *utility;* and there is a general recognition of the truth that beauty has high and essential uses. Had we no need but for clothing and food, there might be some ground of distinction between the beautiful and the useful; but so long as we have an inner nature yearning for culture and development, we must have and use both to satisfy the needs of our divine being. In respect to true manhood, a flower garden may be more truly useful than a potato field, an oil painting than a blank cheque, a piano than a locomotive.

In human culture, the most potential forces are intangible ones. They proceed from unrecognized sources, and their ministrations are so unconscious that they scarcely seem to have any existence. In the work of school discipline, he governs best who seems not to govern at all. The true disciplinarian is a centre from which proceed forces silent in their operation, and potential in their results, and potential in proportion as they are unobserved. Such a person knows that his school is orderly, but how or why, he can not tell. Neither do pupils themselves know. There is some invisible, intangible force at work upon heart, mind and muscle, and to this force no resistance can be made, because its very existence is unnoticed and unknown. This "unconscious tuition," as Dr. Huntingdon calls it, resides in *things* as well as in persons; and it is to a consideration of this fact that we wish to direct attention. The very appointments of a school-room may invite disorder or prevent it—they may either co-operate with the teacher in securing good discipline, or they may counteract and neutralize his best efforts in this direction.

In our "Plea for Beautiful School-Rooms," we have in mind not only the modest school-houses by the country road-side, but also the costly and beautiful buildings in our towns and cities. In all these much has been done in the direction of good taste and beauty at public expense, but opportunity has been wisely left for individual enterprise and taste. School taxation usually provides a beautiful exterior, as well as light, warmth, white walls and varnished furni-

ture within; but it does not furnish carpets, pictures, flowers and other ornaments necessary to make the school-room a truly beautiful place. It is probably as well that all these things are not provided at public expense. Why is it that school property is so wantonly destroyed? Before the rights of such property will be respected, there must be in the school-room a feeling of personal ownership; and this feeling can be established in no other way so successfully as by a real investment in something bought for the common good. Hence we say that in providing ornaments for the school-room, they should be bought by teachers and pupils, and not in such a way as to leave the impression that their ownership is fictitious, and that they can be injured without individual loss.

The first step towards the work under consideration is to arouse a lively interest among pupils; and this calls for some tact on the part of the teachers. Have pupils pleasant homes? Why are they so pleasant? Why have their parents bought pianos, carpets, elegant furniture, books and pictures? How much time do they spend in those beautiful parlours? How much in the school-room? If so much is done to make a room pleasant in which they spend only a small part of their time, ought not something to be done to beautify the school-room in which they pass so many hours, weeks, and terms? Such conversation will usually give the right *direction* to pupils' thoughts; and when this is done, the work is easily carried forward.

The thing of all others which must be done at the very first is to secure absolute cleanliness in everything which can be effected by broom, soap and water, or paint. It is useless to talk of pictures and carpets, while floors, woodwork and ceilings are begrimed with dirt. It is certainly a source of sweet satisfaction to draw a paint brush over surfaces which can be redeemed in no other way. As stain after stain disappears under your magic touch, you experience a feeling of wonderful comfort; and you realize as never before that cleanliness is next to godliness.

If, as in most school-rooms, there is a rostrum, or platform, for the teacher's table, it will add very greatly to the appearance of things to have it neatly carpeted. There is probably no one thing which gives so decided a parlour-like air to a school-room as this. There will now be need of money; and it may be profitable to speak of some ways of raising funds. In many cases moderate amounts can be raised by requesting each pupil to contribute to the proposed object. If there is the right *sentiment* in school, the matter can be managed in this way without difficulty. Where larger amounts are required, a very pleasant way is to invite the members of the school to meet at some convenient place in a social way, with the expectation that each one shall pay a small sum towards the object in view. The circumstances must be very peculiar in which one or both of these methods will not succeed.

Next in order we would mention a picture. Its character and price must be determined by the grade of the school and the amount of money to be expended. There are hundreds of beautiful engravings which cost but little, but which give an air of comfort and elegance to the school-room. Our advice is, *buy pictures of some sort, good ones if you can; but of any degree of merit rather than none at all.*

In work of this nature an all important element of success is *patience*. Do not be disheartened if there is no immediate response to your appeal. We know of a case where an attempt was made, in the early part of the term, to interest pupils in this matter; but it seemed to be to no purpose. Patience had its sure reward, for on the very last day of the term a beautiful painting was hung upon the wall of the room, procured by voluntary contributions.

The pleasure derived from one improvement, or success, will prepare the way for another; and so the work will go on, till the school-room—once dingy and

unlovely—has been transformed into a beautiful drawing-room, as attractive as the home parlour.

Another element of culture, is music. This is one of the most efficient governing forces which can be employed in school discipline. 'A school-room without music is not a fit place for a child; and when we reflect that five out of every six children can sing, we see no excuse for such neglect.—*Michigan Teacher.*

3.—Æsthetics in the School-Room.

The Creator has so ordered His work that sky and sea, blade, bud and flower, all animate and inanimate things, sing forth their lessons of beauty unceasingly. Who hath ears to hear them, may hear and be made glad. Beauty and use are so commingled in nature there is neither inferior nor superior. The useful is only then most useful when added to the beautiful; and the beautiful is most beautiful when conjoined to the useful, and, with it, looking toward a purpose.

It seems the extreme of folly, even though life be "a warfare," or "a vale of tears," to ignore the existence of so much that is to compensate us for both. Even a little clay wrought by the hand of the Master is sufficient to open the blind eyes to the infinite loveliness everywhere. Possibly every teacher may secure the anointing of, and so get such a love for beauty into the deep places of the soul, that he or she, too, may work miracles, transforming by his or her plastic touch unsightly or unlovely things into things goodly and to be desired. At any rate, every school-room furnishes abundant opportunity to test the ability to do this.

All general effects are produced by the most careful attention to details. No woman of taste takes up her residence in a house without studying the minutiæ of its possibilities. The relation of wall to carpet, of both to furniture, the effects of light and shade, the distribution of ornament, are all carefully considered. But the same woman, as teacher, does not always use her sense of beauty to make the most of her school-room. The school-house is a shop—a place in which to work, and from which to flee as early as possible. Thus she makes herself the servant of her work. School duty is her antagonism, and it is victor by the ruling of the clock on the wall. As soon as one so puts her soul into her surroundings as to make them the complement of herself, she makes for herself a place more to be desired than all others. So it is not difficult to see how little skilful labour would make the school-room delightful, and install the teacher mistress of the situation.

There are in every school-room possibilities in the arrangement of furniture which may be made use of to produce pleasant effects. The table, the chairs, the stove, the maps and charts, all should be made to contribute to this end. A table-spread, even a clean towel or a newspaper, will serve to cover the defects of an old table, and make it presentable. Broken and rickety furniture must go out of sight. Better a clean whole stool, than never so elegant a chair in dilapidation. In warm weather an ill-looking stove is easily converted into a pretty flower-stand by some forest boughs, or some asparagus, with bouquets and pots of flowers, which the pupils will bring if encouraged to do so. If it is winter some stove polish will make it look new and tidy. The stove of a school-room is often the sum of all villanies, æsthetically. It is made the receptacle for bits of apple, remnants of lunch, pieces of paper, and all the inevitable débris of school. The hearth serves for a spittoon, and the zinc is soiled with ashes, chips, and melting ice and snow. There is no need of such an insult to the good taste of the school.

Teachers may make a great deal of the effects of light and shade in their rooms if they study them. Pupils are made restless, and both children and teacher

become irritable by a light too intense glaring upon them. Then, to shade the sunny windows and to open those on the shady side, would be to introduce comfort and quiet. Again, on a dark or cold day, to open up the lightest and sunniest side, to get all the sunshine and warmth possible into the house, is to bring in inspiration and joy. *One cannot teach the best school without window curtains or blinds.* The material is not so important as the service they render in adapting the light to the comfort of pupils and teacher. I know a teacher who, in the first school she taught, made hers of newspapers, ornamented at the lower border with devices wrought with scissors, and fastened them up with hammer and nails! Nevertheless, they were capital extempore curtains, and helped wonderfully to teach the school.

Much can be done toward making a room pleasant by a skilful seating of pupils. There are harmonies of proportion and colour to be observed. A girls' school always seems brighter than a mixed school, and a mixed school brighter than a boys' school. The colours of the dress of girls give warmth to the room in winter, and the light clothing of summer gives an air of freshness and coolness. The eye requires that the pupils shall be graded from rear to front according to size. A hap-hazard arrangement in this regard is never satisfactory.

It is fortunate for the school if the teacher writes well. When the boards are kept black and in good condition, the teacher's work is well done upon them, and the pupils are constantly reminded of their duty in this direction. Nothing is more really ornamental in a school-room than a good board covered with well-written work—problems, copies, abstracts of lessons, etc. Much model work of this sort should stand upon the board all the time, that unemployed children may have something to copy upon their slates.

Thus far I have said nothing of ornamentation; but every teacher can do something in this respect. Pretty hanging-baskets can be made at absolutely no expense. Pots of flowers and mosses can be had for the taking care of them. The world is full of pretty, cheap pictures. They may be taken from any of the first-class illustrated papers. One who is looking for them will find an abundant supply. Some medium-sized picture frames can be procured, and then by changing the pictures from time to time the school will always have something new at no expense. One of the most successful primary teachers I know brings every week into her school a new object of interest. It may be a picture, or a hanging basket, or a bracket and vase—it is something which the children enjoy, and in the bringing of which they see an effort to make them happy. She takes an early opportunity to have a conversation upon it, and then gives it to the school until she has occasion to replace it by some other object of interest. I know another who is constantly planning pretty drawings for her black-board. She makes a practice of having something new upon the black-board every Monday morning. Her pupils have learned as they come in to look for the pleasant surprises she prepares for them. Still another has several pictures which are owned a month each by classes of pupils. A card suspended beneath the picture gives the names of the for-the-time owners. One of them belongs to the pupils who are perfect in attendance for a month; another to the twenty who have stood highest in their lessons for a month; and a third to pupils whose deportment has been without criticism for a specified time. In this way every child has something to work for. One cannot get perfect lessons, perhaps, but can come to school regularly, or can be perfect in conduct. Each child is likely to have a share in one or other of the pictures. If no one earns them they are taken down and put away. So every one is working not only for himself, but for the school. In this way the ornaments of the school are made not only silent ministers to happiness, but positive forces in the school-room.

But, after all, the soul of the teacher has greatly to do with the beauty of the school. A light glows in the face of the conscientious, gentle, sympathetic teacher,

which illumines all the room with its brightness. In the reflection of her own character she sees in the seats truthfulness, confidence, respect and love. And so the spiritual beauty sanctifies and glorifies all the beauty secured by ornamentation—by any and every device in material things.—*Miss Lathrop.*

4.—Admirable Suggestions on the Construction of School-Rooms.

Although the direct instruction of the pupils is rightly regarded as the principal purpose of the primary school, yet every earnest and intelligent teacher will feel that it is his duty to devote much attention to the formation of habits of order, cleanliness, and neatness, as well as to the cultivation of a taste for the refined and beautiful.

The children attending our schools will be the parents of the next generation, and upon their inclinations and habits will depend the character of their homes and the tenor of their lives. If their homes are to prove comfortable, cheerful, attractive—in a word, homelike—we must let slip no opportunity of arousing and encouraging a love for order and tidiness, and a dislike of that which is ill-regulated and slovenly.

Children spend no small portion of their time in school. Every one knows that they are greatly influenced by the example of the teacher and the public opinion of the school, but many think little of the effect produced by the appearance of the room in which they are taught. Yet the room exerts a positive influence on every pupil. A boy or girl coming from a slovenly dwelling will be attracted and benefited by frequenting a clean and pleasant school; while one that is repulsive and dirty may positively undermine the beneficial influence of a respectable and cheerful home.

Trustees of schools would do well to erect them on healthy and suitable sites, and in an attractive style.* A handsome edifice is not necessarily more costly than an ugly one, and even if the expense is somewhat greater, it would be more than counterbalanced by the pleasure afforded to the eye.

It can be easily shown that the interior of school-buildings can be adapted to purposes of moral education and æsthetical culture; and in doing so we must necessarily enter into very simple details. A first and essential requisite is *cleanliness.* The floors of every room ought to be swept twice a day if possible, and they should be frequently scoured. Before sweeping, the maps should be rolled up, and all tablets and pictures turned or covered. Desks, forms, apparatus and window ledges should be dusted as soon as the dust has subsided. If the desks are varnished, all ink spots can be removed by a wet towel; and if they are not, the stains can be taken out by a solution of oxalic acid. Earthenware ink-wells are the most suitable, as they can be easily washed. Children should be taught not to dip their pens too far into the ink, and to avoid shaking any excess of it over the floor. So, also, they should be told not to throw upon it scraps of waste and dirty paper.

The school-windows should be frequently cleaned, both inside and outside, and all broken panes should be replaced.

The upper part of the walls ought to be covered with a light colour-wash: a belt of black-boards should occupy the centre; and the lower part should be

* "The situation in which the school-house is erected is by no means of slight importance. It is desirable to avoid the neighbourhood of any place of public resort, where the children would be exposed to the influence of bad example. The noise of a much frequented street or highway, arising from the passage of wheels over the pavement, from the cries of street-hawkers, etc., is the source of serious interruption to the school. The vicinity of any noxious trade; of a marsh or stagnant pool; of streets known to be frequently infested with fever, is liable to objection on sanitary principles. as well as the choice of a low site, from which there is no sufficient drainage.

"Bleak and unhealthy situations on the other hand, and sites on a dry, sandy soil, where the school-houses are exposed to concentrated radiation, with little ventilation, are not unfrequently chosen in rural districts, exposing the children, during many months in the year, to noxious natural influences, which often cannot be removed by artificial means."—*Minutes of the English Privy Council on Education, 1839-40, p. 71.*

wainscoted or painted. When the room is scoured the walls should be dusted, and cobwebs should be removed as soon as they are seen.

To diminish the dust of the school-room, scrapers ought to be fixed outside the doors, and kept in efficient repair. Mats, also, should be placed in the entrance-lobby, and the pupils must be directed to use both. The employment of mats will involve some expense, but the outlay will be amply repaid by the formation of a desirable habit.

In the lobby, or in some suitable recess, cap and cloak racks ought to be fixed, and a monitor should he held responsible for the neatness of its appearance. A large but inexpensive umbrella-stand would be a welcome addition.

Open fire-places, when used, ought to be guarded by neat and strong fenders. All ashes should be removed, and the general appearance should be as tidy as in a well-regulated home.

Every school should be provided with sufficient and separate offices, and these ought to be kept scrupulously clean and in perfect repair. They should be separated from the rest of the playground by a wooden, or, what is better, a brick partition. They should be shaded with trees.

The *orderly appearance* of the school-room is next in importance to its cleanliness. To maintain it, it is essential that all apparatus be kept in repair. Blackboards, easels, and stands, when broken, should be mended; and maps, if torn from their rollers, should be repaired without delay—"a stitch in time saves nine." Notices and time-tables should be re-written as soon as they are injured or dirty; and damaged charts and pictures should be replaced. It is desirable that chalk and dusters should be kept in boxes provided for the purpose, instead of being placed on window-sills or other ledges.

In some schools children are tacitly permitted to cut their names in the desks, and to make chalk and pencil marks on the walls. Such destructive and mischievous practices ought to be put down with a strong hand. School apparatus should be held as sacred as household furniture; and training of this kind is peculiarly valuable, apart from its influence in the class-room. Those of us who are in the habit of visiting dismantled edifices, castles, churches, and buildings with which important events are associated, are intensely annoyed at the damage done by thoughtless people, many of whom probably acquired a love for cutting and carving initials on these buildings from school habits; and there is little doubt that interesting places have been closed to the public from this vandalism of ours.

The *embellishment* of the school-room finds no place in the thoughts of many teachers. Even some who insist on scrupulous cleanliness will not attempt anything further. We think that in all cases maps ought to adorn the walls, for they serve a two-fold purpose: they diminish the bareness of the school-room, and an acquaintance with the contour of continents and the topography of countries is most unconsciously acquired. If the maps were fixed on rollers, like window-blinds, they could be easily rolled up at the close of each day and whenever the school is being swept.

Besides maps, we would add diagrams to illustrate lessons in natural philosophy: pictures of animals, trees, plants and fruits, well-drawn representations of the homes and customs of foreign countries, sheets of ornamental penmanship, and an illuminated copy of the Lord's Prayer. A set to illustrate the manners and customs of the Israelites, is published by the Religious Tract Society, and the brightness of their colouring renders them peculiarly attractive. Excellent pictures are also published by the Christian Knowledge Society. By covering the diagrams and pictures with a pure varnish, they will last for years, and will be readily cleaned. In all schools where figure or map drawing and illuminating are taught, some of the best specimens should adorn the walls; and if it were

esteemed an honour, the cleverest pupils would present some of their productions. When soiled, others should be substituted.*

We have often thought that a series of cheap, well-executed portraits of eminent men, placed in inexpensive frames, ought to grace our school-walls; and we should be glad to find them generally in use. Even fern cases and aquariums would not be out of place. To a popular school, where the teacher took a pride in making it attractive, many gifts, we feel sure, would be presented by those who appreciated his efforts to improve the taste of his pupils.

The playground should be covered with gravel or asphalt, and wherever large enough it should be edged with flower-beds. These could be easily kept in order by the master and some of the senior pupils. The cost would be trifling, for seeds and flowers sufficient to make a beautiful display would be presented by the parents. Evergreens should be interspersed, as they would make the border look comely even in winter. None but those to whom the master granted the privilege would be allowed to touch the flowers, and this restriction would be a healthy educational influence.

What a contrast to this picture is presented by some school-rooms which we have in mind! There may be seen dirty floors, desolate-looking walls, damaged apparatus, tattered maps, broken panes—everything to repel, nothing to attract. However much knowledge is imparted in such schools, they reflect discredit both on teachers and committees, for they are insensibly developing habits which will frustrate no small part of the benefits resulting from intellectual instruction, and will be inimical to the happiness of all who are brought under their sway.—*English Educational Record.*

5.—Effect of the Structure of School-Houses on Mental Habits.

There are but very few who seem to realize that the structure of the school-room has anything to do with the formation of the mental habits of the children, confined day after day, within it. There is a vague idea that the mind of the child must, necessarily, conform to certain principles, of its own accord and by the force of its own action, no matter what may be its surroundings. This is a great mistake. Surrounding influences have as much to do in forming the mental habits of the child as in shaping the course of manhood. And where is the man whose habits—physical, mental or religious—have not been very materially affected by his surroundings in life?

The most common fault, I think, in the structure of school-houses, is what is termed the "long seat" system. This is very common in our rural districts. Children are huddled together, six or eight on a seat, and then required to study! It is impossible. I do not believe that one in ten of those who call themselves men and women, could study under the same circumstances. How can children study, when they are necessarily interrupted every few minutes? Every class that is called to recite creates a perfect confusion throughout the school. One or two, leaving a seat, disturb all the others on that seat.

Suppose a scholar to be studying a lesson. The powers of his mind are just being concentrated on it, and he is beginning to *think*, when, all of a sudden, "Let me out," or "Let me in," scatters his thoughts to the winds. Again and again he resumes his study, and as often he is interrupted. Is it surprising that a *child*, under such circumstances, can not hold his mind to his lesson? Not one man in ten, nor one child in a hundred, can be taught the habit of mental concentration and continual application, with such surroundings.

But what is a school for, if it be not to teach children to think? The mere knowledge of the branches pursued is but a secondary matter. It is the develop-

* All these pictures, diagrams and illustrations, can be procured at the People's Depository, Toronto.

ment and power of mind that we should strive to secure. And whatever means the teacher needs to enable him to turn out men and women of mental strength and correct moral culture, should be cheerfully furnished. And when the expense of a good, convenient school-room is no more than that of an inconvenient one, surely it is a great wrong, by mere indifference, to deprive the children of that means of improvement.

Will not school trustees look more closely to this matter? Many schools are losing much, yearly, for the want of a few dollars in bettering the internal structure of their school-house. I heard a teacher remark, last week, "If those seats had been "fixed" last fall, I could have earned for the school, from average attendance, fifty dollars more than I have done." Ten dollars would have "fixed" the seats, and there would have been a gain by the school of at least forty dollars. This is not an isolated case. A man can always do more with a good tool than he can with a poor one.—*H., in Pennsylvania School Journal.*

6.—How the School Room may be made Neat and Comfortable.

It is very pleasant to go through many of our school-rooms and notice the care which has been taken to make everything comfortable and cheerful. The light has been so arranged that the eye is neither dazzled by glare nor wearied by gloom; ventilation has been secured in proper kind and degree, so that headache cannot often be complained of there; the desks are adapted in height to the size of the sitter, and the chairs have comfortable backs; pictures are on the walls, an attractive library is accessible, and the polished brass and glass, in the case of apparatus, add to the general effect. Yet where the school-rooms are not comfortable and cheerful, much can be done to improve them, and this with but little expense. At all events *something* may be done to make the place *seem* comfortable and cheerful.

1st. Arrange the desks and seats in some way, so that each pupil can find support for his back and rest for his feet.

2nd. "Tinker" the window frames, so as to be able to lower the upper sash a few inches. Get curtains, if there are no blinds; they will not cost much.

3rd. Cover all holes and ink-spots in the wall with white paper, or otherwise; but cover up no dirt which can be washed off. Let the floor be clean and the windows clear.

4th. Tack engravings on the walls, the best you can find; wood-cuts, from newspapers, are better than nothing. Inland boys like ships and steamers, and sea scenes generally; while boys who live near the coast prefer hunting scenes and rocks and woods. Maps of the country, the state, the county, town, ward and block are desirable.

5th. On the ceiling, draw neatly—in charcoal if you can do no better—the solar system. Make the sun in red chalk; give the planets their relative size and orbits; let a bushy, red-tailed comet enliven the sketch. On the side wall draw a long black line, five and a half yards long, to represent a rod; divide the line into yards, one of the yards into feet, and one of the feet into inches. In various spaces, otherwise unoccupied, draw, distinctly, a square yard, a square foot, a cubic foot, an equilateral triangle, and other similar outlines. Let the walls be covered with instruction and amusement for the eye. At first, these figures will attract attention from studies; but in a few days the novelty will have worn off, and although they may attract, they will not distract.

What a change comes over the dreary old room! What a change over the scholars!

There are many *little* matters which affect the success of a teacher's daily duties. Is the black-board warped, and cracked, and scratched? Take it down, screw a

"cleet" on the back, putty up the crack, and paint it black again. There is no expenditure here of anything but a little labour, except for the paint, and that may be made trifling if a few cents' worth of lampblack, a little camphene, a flannel rag, and ingenuity are used. Perhaps the chalk is "scratchy." Buy some crayons, if you can; if not, make them yourself. Your boys will help you; and, in a few hours, at an expense of half a dollar, you can make enough to last for a whole term, and the improvement will pay you for your trouble. Have a ledge on the bottom of the black-board, to catch the falling chalk-dust, and to hold "the cleaner." The cleaner may be a stick two inches square and six long, wrapped around with canton flannel or lambskin.—*Root's "School Amusements."*

CHAPTER XII.

THE SITE AND POSITION OF THE SCHOOL-HOUSE.

1.—Choice of the School Site.

The school site should, of course, be chosen in the manner pointed out in the School Act, viz.: in rural sections, by the trustees and ratepayers; but in cities, towns and incorporated villages, by the trustees alone. (See chapter vii, Part I, of Dr. Hodgins' School Law Lectures, on Rural School Sites; and chapter xvi. of Part II, in regard to City, Town and Village Sites.)

2.—Size of Site in Cities, Towns and Villages.

In cities and large towns it is often difficult to obtain school grounds of proper size, in convenient localities, without great expense, and their dimensions must, therefore, within proper limits, depend on circumstances. It might be remarked, however, that it would be better for pupils to walk a considerable distance, than that the limits of their play-ground should be so narrow as not to admit free exercise for the whole school.

3.—Accessibility of Schools in Rural Sections.

A central site, even considered in reference to population, should be, to some extent, controlled by accessibility. Some pupils may reside at a short distance, in a straight line, from a proposed site, yet an intervening stream or swamp, etc., may render miles of travel necessary to reach it. Some, on the other hand, may live twice as far off, yet, having none of these impediments to contend with, may reach the school with less actual walking than the former. The apparent distance of each class in a straight line from the school, is therefore not always to be regarded, but the actual distance to be travelled, taking into account the natural barriers in the way. Impediments of this kind ought always to be taken into view, in the first sub-division of a school section; and, if possible, they should be made the boundaries between schools. But where this is impracticable, they must be taken into full account in the selection of the site. Where the territory attached to a school is traversed by a large stream or high ridge, if there be a bridge over the one or gap in the other, the vicinity of either will be, in point of mere accessibility, a fit location for the school. Territory level in its surface and undivided by considerable streams, is generally traversed in opposite directions by a system of public roads. If advantage be taken of these facilities of travel, the accessibility of the site may be greatly promoted. On the whole, a central position, like accessibility, consists in promoting the convenience of the greatest possible number of pupils. (See Division 1 and 3, of Chapter iii.)

4.—Official Regulations in regard to Site.

The official regulations require that the site for a school shall be—

(1.) An acre in extent, but not less than half an acre, so as to allow the school-house to be set well back from the road, and furnish play-grounds within the fences. A convenient form for school grounds will be found to be an area of ten rods front by sixteen rods deep, with the school-house set back four or six rods from the road. The grounds should be strongly fenced, the yards and outhouses in the rear of the school-house being invariably separated by a high and tight board fence; the front grounds being planted with shade trees and shrubs. For a small school, an area of eight rods front by ten rods deep may be sufficient, the school-house being set back four rods from the front.

5.—Regulations in regard to School-House and Grounds.

The official regulations also prescribe that there shall be—

(2.) A school-house (with separate rooms where the number of pupils exceeds fifty), the walls of which shall not be less than ten feet high in the clear, and which shall not contain less than nine square feet on the floor for each child in attendance, so as to allow an area in each room for at least one hundred cubic feet of air for each child. It shall also be sufficiently warmed and ventilated, and the premises properly drained.

(3.) A sufficient fence or paling round the school premises. (See *Fig.* 45, page 79.)

(4.) A play-ground, or other satisfactory provision for physical exercise, within the fences, and off the road.

(5.) A well, or other means of procuring water for the school.

(6.) Proper and separate offices for both sexes, at some little distance from the school-house, and suitably enclosed. (See chapter iv.)

6.—Duty of Public School Inspector in these Matters.

The regulations provide that in his inquiries in these matters, the Inspector is especially directed to see whether the law and regulations have been complied with in regard to the following matters (should he discover remissness in any of them, he should at once call the attention of the trustees to it, before withholding the school fund from the section, with a view to its remedy before his next half-yearly visit):

(1.) *Size of Section.*—As to the size of the school section, as prescribed by the School Law.

(2.) *School Accommodation.*—Whether the trustees have provided "*adequate accommodation for all children of school age* [*i.e., between the ages of five and twenty-one years, resident*] *in their school division,*" [*i.e.*, school section, city, town or village] as required by the School Act.

(3.) *Space for Air.*—Whether the required space of nine square feet for each pupil, and the average space for one hundred cubic feet of air for each child, have been allowed in the construction of the school-house and its class rooms. (See regulation 2, above.)

(4.) *Well; Proper Conveniences.*—Whether a well or other means of procuring water is provided; also, whether there are proper conveniences for private purposes of both sexes on the premises; and whether the regulations in regard to them are observed.

7.—Laying out of the School Grounds.

The size of school lots must in some measure be determined, within the regulations, by the facility with which land in desirable situations can be obtained. But in all cases, whatever may be the size of the grounds, they ought to be laid

out and prepared with a view to both convenience and taste. Provision should be made for suitably placing the separate offices, well, and woodsheds, etc. The ground at the rear of the building should be fitted for the foot-ball, and any other games that the boys happen to become interested in. The whole should be enclosed by a neat fence.

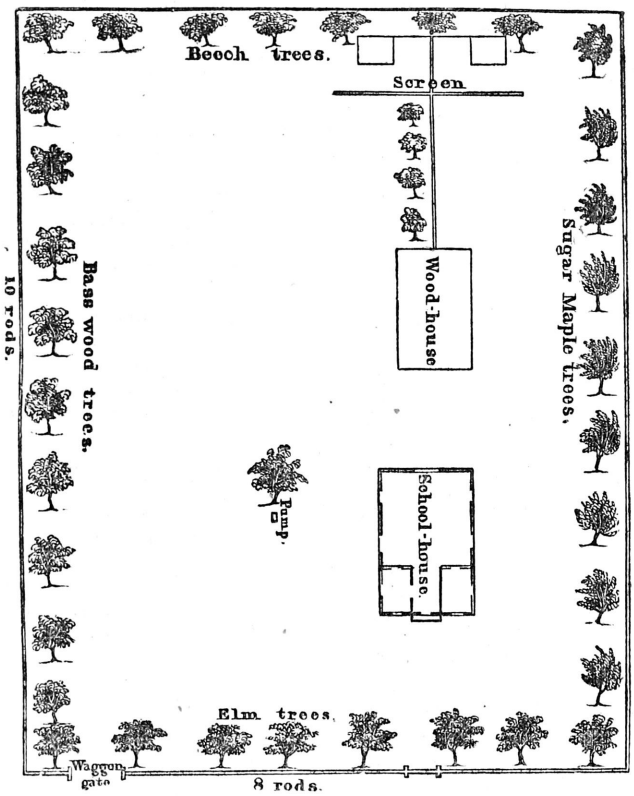


Fig. 41.—Block Plan of School Grounds, etc.—No. 1.

Note.—These block plans are merely suggestive. They are not all that could be desired. The interior fences should separate the boys' and girls' play-grounds completely, as in the block plans Nos. 2, 3 and 4.

8.—Influence of the School-House Surroundings on the Pupils.

Every thing around, as well as within, a school-house should be attractive to the eye and improving to the taste of the pupils. It is in connection with the school-house that they receive many of their earliest and most durable impressions. Those impressions should be on the side of neatness, virtue and cheerfulness. This is not likely to be the case where the site of the school-house is in a noisy, dirty thoroughfare of the city, or in a low, damp, or bleak, unsheltered place in the country; nor if all attention to comfort and decency be neglected in the internal furniture and out-door arrangements of the house itself. How different will be the associations, impressions and feelings of a pupil where the house and grounds are provided as required by the law and regulations, from those of a pupil attending school where the house is dirty and comfortless, where the play-grounds are the highway or the street, and where indecencies are almost imposed as a necessity, from the absence of the requisite provision against them.

9.—Situation should be Retired, Dry and Pleasant.

In the engraving (*Fig.* 46), it will be observed that the situation is represented as retired, dry and pleasant; that the ground is made smooth, and sown with grass, planted with shady trees, tastefully arranged in groups, and around the sides, and protected by a neat and substantial inclosure. In the rear of the building the school grounds are divided by a high and close fence, each portion appropriately fitted up and provided with suitable conveniences, the one assigned for the exclusive use of the boys, and the other for that of the girls. The entire premises exhibit an aspect of seclusion, neatness, order, propriety and cheerfulness, and the absence of everything calculated to defile the mind, or wound the most sensitive modesty.

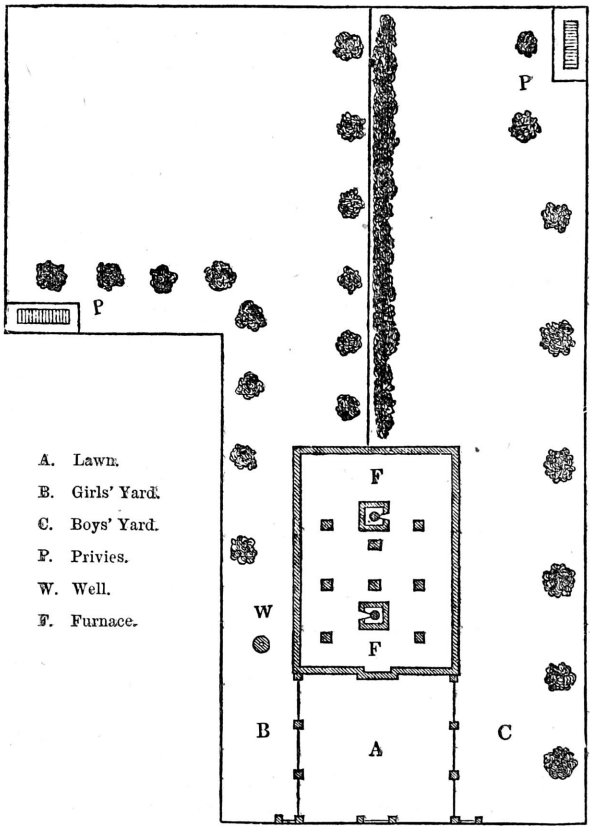


Fig. 42.—Block Plan of Grounds, etc.—No. 2.

Note.—This plan is better arranged than the others in regard to the fences and privies.

Note. — Shade trees should not only be planted singly but in groups, under which may be erected rustic seats, where, on hot summer days, a part or the whole of the school may spend an hour in study, instead of being confined all day in the school-room. Who can blame a boy, in a cheerless room, for cutting holes in the plank bench before him, and catching flies to imprison there? Better do that than sit aching all day. A child would sit in a grove studying for an hour, more willingly and more profitably than in the school-room. The outdoor air and scenery quickens thought. Christopher North, while composing articles for *Blackwood*, used to sit sometimes during all the summer night under a favourite tree in front of his house, engaged in deep thought, and the next day would commit his thoughts to paper.

10.—Grounds to be Planted with Shade Trees.

School grounds should be plentifully supplied with shade trees. If otherwise suitable, a spot should be chosen for the school-house upon which some large forest trees are already standing, or the border of a wood might be selected, which could be easily thinned out. It takes a long time before trees newly planted will assume that stateliness and beauty possessed by the forest trees.

11.—Shape and Slope of the Grounds.

As a general rule, the most dry and beautiful grounds are those which slope towards the south or from the front of the school-house, which should always have its front in that direction. The inclination should, where practicable, be gentle, though perhaps for purposes of play, level grounds would be the most suitable. They should never slope in the opposite direction, if it could be avoided, as a northern exposure is more cold. The shape should, if possible, be rectangular, the length extending north and south, and bearing the proportion to the breadth of about three to two. A school lot containing half an acre, might be one hundred and eighty feet by one hundred and twenty-one; and one containing an acre, two hundred and forty-two by one hundred and eighty feet.

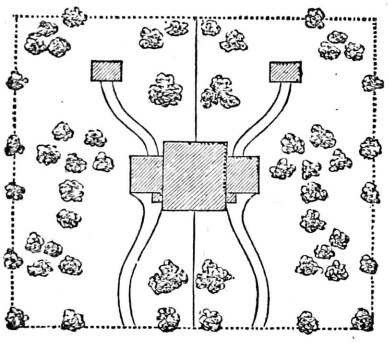


Fig. 43.—Block Plan of School Grounds.—No. 3.

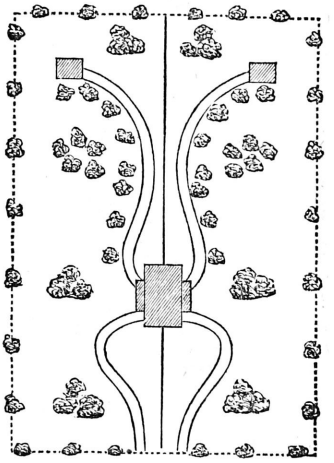


Fig. 44.—Block Plan of School Grounds.—No. 4.

These plans are strongly recommended as admirably adapted to secure the objects most desirable to be attained in the laying out of school grounds. They combine in their arrangements complete separation of the sexes in their play-grounds, and yet furnish each with "ample room and verge enough" for enjoyment and recreation. They also combine, in the curved lines of the sidewalks and the rows and clumps of shade trees, beauty of style with privacy and utility. The out-offices for boys and girls are also quite separate and secluded, which cannot fail to promote delicacy and refinement.

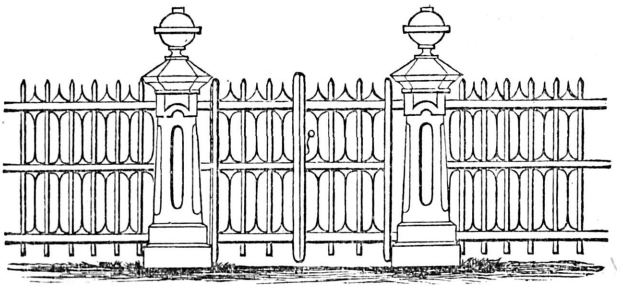


Fig. 45.—Example of Neat and Handsome School Paling.

In *Fig.* 45 we give an example of a handsome style of a school fence or paling. The gates should be built strong, and so arranged as to shut themselves. See also style of school fence shown in *Fig.* 46.

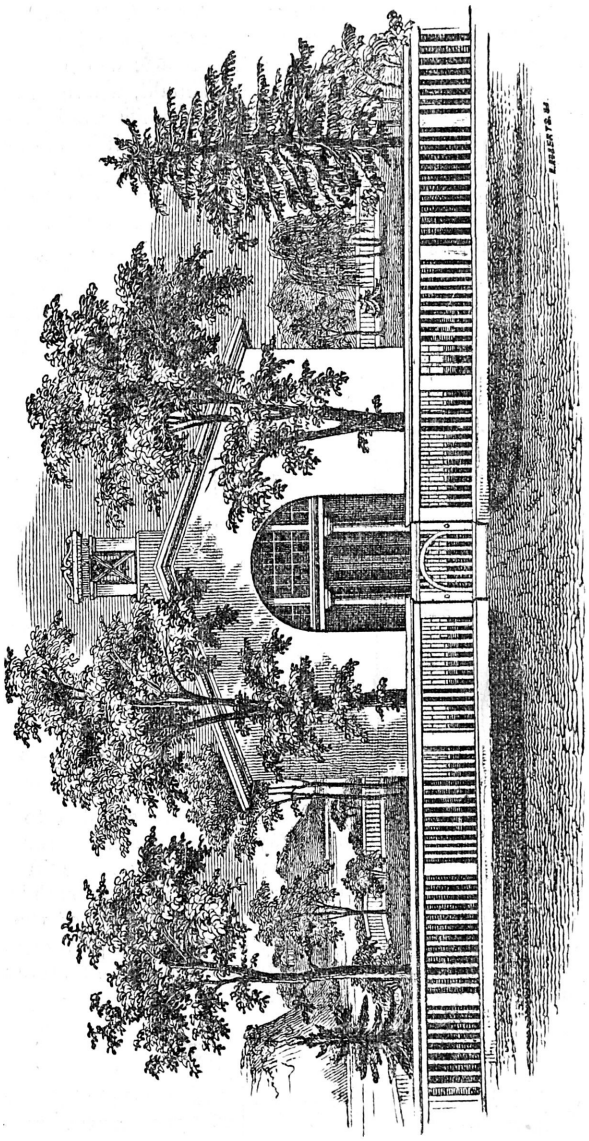


Fig. 46.—Front View of the School-house, with Shrubbery, as Shown in the Perspective.

12.—Arrangement of the School Grounds.

As the front of the grounds will probably border on a highway or street, it will be better, in order to escape noise and secure uninterrupted attention to study, to place the school-house in the back part of the grounds, on a line extending lengthwise through the centre of them. A planked walk should extend from the gate to the school-house. A close and high board fence should extend from behind the house to the centre of the fence at the back end of the grounds. Walks might also extend on a line with the front of the house to both sides. The two spaces thus cut off should be private, in mixed schools, one for boys and one for girls; and the large space in front be enjoyed by both in common.

The former might be laid out in grass plots, with shrubbery and beds for flowers, and the latter, especially in towns and cities, should be paved or boarded, or covered with sand or gravel. The hardened soil would answer well except in damp or wet weather. There should be shade trees in all parts of the grounds, as under them pupils could read or study without interruption; while others, wishing to watch the game or engage with the players, could do so.

13.—Gymnastic Play Ground.

As no school is complete without "satisfactory provision" being made (as required by the official regulations) "for physical exercise," we insert plans Nos. 5 and 6 (Figs. 47 & 48), showing how this arrangement can be easily carried out.

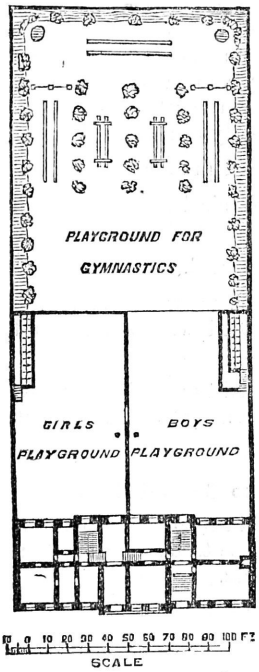


Fig. 47.—Block Plan of Gymnastic and other Play Grounds.—No. 5.

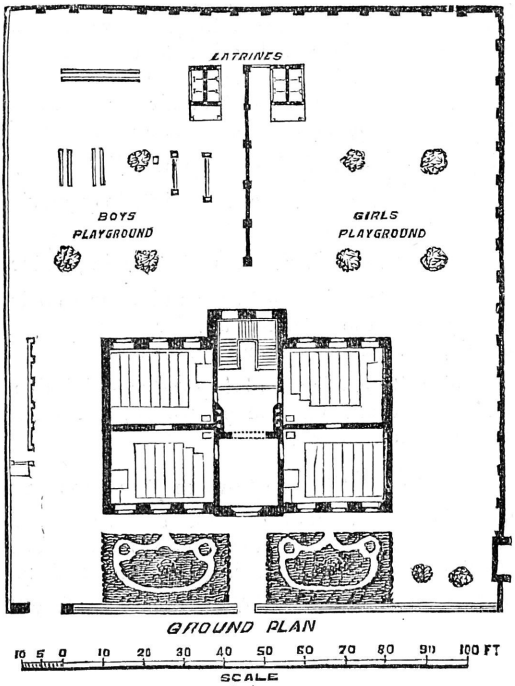


Fig. 48.—Block Plan of School-House and Grounds.—No. 6.

14.—Position of the School-House.

It is very desirable that the front of the school-house be towards the south; that the north end be occupied by the master's desk; that the desks be so placed that pupils as they sit at them, will look towards the north. Some of the advantages of this arrangement are, that the pupils will obtain more correct ideas upon the elements of geography, as all suppose the reader to be looking northward; that the north wall, when having no windows, will exclude the severest cold of winter; that the pupils will look towards a dead wall, and thus avoid the great evil of facing a glare of light—or, if a window or two be allowed in the north wall, the light coming from that quarter is less vivid, and therefore less dangerous, than that which comes from any other; lastly, that the door being in the south end, will open *towards* the winds which prevail in summer, and *from* the cold winds of winter. If, from necessity, the house must front northward, the master's desk should be still in the north end of the room, and the pupils, when seated, should look in that direction. (See section 1 of chapter iv.)

CHAPTER XIII.

INTRODUCTORY REMARKS ON SCHOOL-HOUSE CONSTRUCTION.

1.—Official Rules to be Observed.

The following general rules are taken from the official regulations:—

(1.) *Size of Site.*—A site of an acre extent, but not less than half an acre.

(2.) *Size of Rooms.*—A school-house (with separate rooms where the number of pupils on the roll exceeds fifty), the walls of which shall not be less than ten feet high in the clear, and which shall not contain less than nine square feet on the floor for each child in the section, so as to allow an area in each room for at least one hundred cubit feet of air for each child.* The rooms must also be sufficiently warmed and ventilated, and the premises properly drained.

(3.) *Fence.*—A sufficient fence or paling round the school premises (page 79.)

(4.) *A Play Ground,* or other satisfactory provision for physical exercise, within the fences, and off the road.

(5.) *A Well,* or other means of procuring water for the school.

(6.) *Separate Offices.*—Proper and separate offices for both sexes, at some little distance from the school-house, for each other, and enclosed with a high and secure fence. (See chapter iv, page 24.)

(7.) *Furniture, Maps and Apparatus.*—Suitable school furniture and apparatus, desks, seats, blackboards, maps, presses, and books, &c., necessary for the efficient conduct of the school.

2.—General Directions to Trustees in regard to School Site.

(1.) The school ground should, in the rural sections, embrace an acre in extent, and not less than half an acre, so as to allow the school-house to be set well back from the road, and to furnish play-grounds within the fences.

(2.) A convenient form for school grounds will be found to be an area of ten rods front by sixteen rods deep, with the school-house set back four or six rods from the road.

(3.) The grounds should be strongly fenced; the yards and out-houses in the rear of the school-house should be separated by a high and tight board fence; the front ground should also be planted with shade trees; shrubs and flowers in their season.

(4.) Various simple plants, required for illustration in the lessons on botany, might be cultivated near the school-house. Flowers, beautiful in themselves, have a most delightful and humanizing influence on children and youth, who should be taught to care for and preserve them from harm on the school premises.

* Thus, for instance, a room for fifty children would require space for 5,000 cubic feet of air. This would be equal to a cube of the following dimensions in feet, viz.: 25 × 20 × 10, which is equivalent to a room 25 feet long by 20 feet wide and 10 feet high. In England the official rules governing schools require that the interior walls of a grammar school, if ceiled to the level of the wall-plate, must be 12 feet high; if the area be more than 360 superficial feet (that is, a room 18 × 20 feet) the wall must be 13 feet high; if the area be more than 600 superficial feet (that is, a room 20 × 30) the height must be 14 feet. If the room be ceiled to the rafters and collar beam the walls may be 11 feet high from the floor to the wall-plate, and at least 14 feet to the ceiling across the collar beam. In Holland also, a building cannot be used for school purposes, public or private, without an inspection and certificate of fitness. Any one conducting a school, in a building declared by the district inspector to be unsuitable, is liable, for the first offence, to a fine of from two to four guineas a week; and for a second, to a double fine and imprisonment of a week or a fortnight.

3.—General Directions to Trustees in regard to the School-House.

(1.) The school-house should be *but one story high.*

(2.) A separate room must, according to the official regulations, be provided for every fifty pupils enrolled in the school. By means of sliding doors or movable partitions these separate rooms might be thrown into one, so as to accommodate all the pupils of the school at prayers or on special occasions.

(3.) Provision should be made for a gallery room in every school. (See plans given in the chapter on the interior fitting of a school-room.)

(4.) Separate entrances with outer porches to the school-room for boys and girls should invariably be provided. (For plans of porches see next page.)

(5.) The entrance porches should be external to the school-house.

(6.) The school-rooms must be well ventilated, as required by the official regulations. (For plans and suggestions, see chapter ix.)

(7.) The light should be admitted to the school and class-room at the left of the children, and either from the east or north, but in no case should the children face it.

(8.) The window sashes should be made to move up and down on pulleys, and the sills should be about four feet above the floor.

(9.) The external doors of a school-house should open outwards.

(10.) Each school-house should be provided with a bell.

(11.) If the house be brick, care should be taken to make the walls hollow, otherwise the walls will be damp inside. (See note to description of *Fig.* 81. See also chapter x.)

4.—Things to be Remembered in Planning a School.

Mr. Robson, in his (English) "School Architecture," justly remarks:—"The school-architect should remember at the outset that he is building for children varying in age, size, and studies, and therefore requiring different accommodation; for children engaged sometimes in study and sometimes in recreation; for children whose health and success in study require that they should be frequently and every day in the open air for exercise and recreation, and at all times supplied with pure air for respiration: for children who are to occupy it in the hot days of summer and the cold days of winter; and this for different parts of the day in positions which become wearisome if the shape and relative positions of the seats and desks have not been studied for comfort in every respect, and which may affect symmetry of form, quality of eyesight, and even duration of life; for children whose manners, morals, habits of order, cleanliness, and punctuality, temper, love of study and of the school, cannot fail to be in no inconsiderable degree affected by the attractive or repulsive situation, appearance, out-door convenience and in-door comfort, of the place where they are to spend a large part of the most impressionable period of their lives. This place, too, it should be borne in mind, is to be occupied by teachers whose own health and happiness are effected by most of the circumstances above alluded to, and whose best plans of order, classification, discipline, and recreation may be utterly baffled or greatly promoted by the manner in which their school-houses are constructed and furnished." (See chapter v.)

5.—Examples of Porches and Entrance Doors for School-Houses.

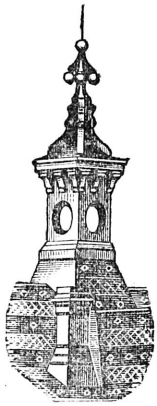


Fig. 49 (CUPOLA).

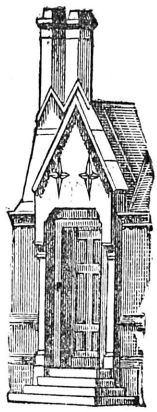


Fig. 50.

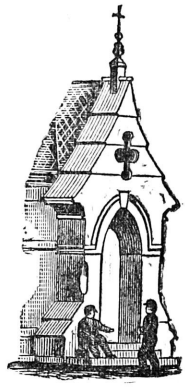


Fig. 51.

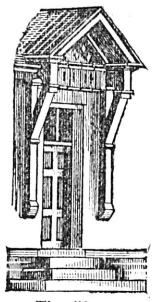


Fig. 52.

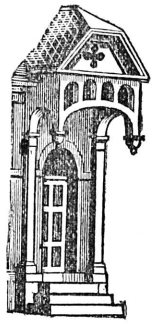


Fig. 53.

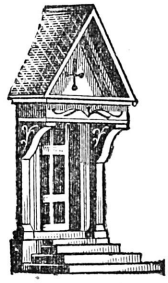


Fig. 54.

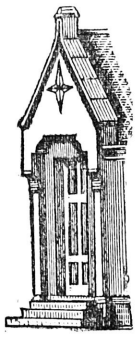


Fig. 55.

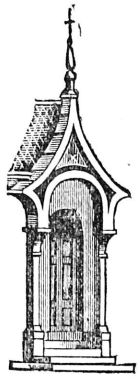


Fig. 56.

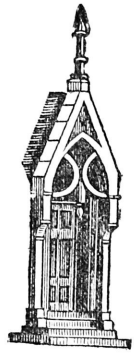


Fig. 57.

We insert above eight examples of the different kinds of porches and entrance doors for school-houses. They present a great variety of style, and will aid trustees and others in making a selection of a neat and tasteful entrance to the school-house. It will be remembered that the law of Ontario requires all doors of large buildings and schools to open *outwards*.

6.—Example of Specifications to be Signed by the Contractor.

Mason.—The materials of the walls should be brick, and the cellar walls built up above the level of the ground, eighteen inches thick [with cellar doorway (if desired), and window openings secured with iron guards]. A cut stone [or oak] door sill will be required for the front door, twelve inches on the top face [if stone] and eight inches rise. The walls from the surface of the ground upwards will be of brick; the outside four inches to be the best quality dark stretchers, with the joints smoothly struck; the thickness of the wall at the base and pilasters will be sixteen inches; in the recesses twelve inches, being a nine inch wall spread on the base, making an opening of three inches in the centre of the wall; the two surfaces to be bonded together with alternate headers every fifth course; the projection of the base to be finished on the top with headers, The flues will be made eight by twenty-four inches, thoroughly and smoothly pargeted and topped out on the roof for ventilators. The work to be done in a substantial and workmanlike manner, with mortar composed of clean, sharp sand and wood-burnt lime. Plastering on the interior will be done in the same manner as the last; the jambs of the windows will be plastered and the angles rounded.

Carpenter Work and Materials.—The flooring joists will be eight by fourteen inches, and ceiling joists two by twelve, placed sixteen inches between centres, and the flooring joists strengthened with two lines of lattice bridging, well secured to the same; a raising piece will be spiked on the ceiling joists, and the rafters heeled against it; alternately the rafters will be continued over the wall, forming cantilevers to support the eaves; those from the gables will be framed into the outer rafter. The rafters will be framed and one and a half inch plank collar beams well spiked across the same. The rafters will be lathed and covered with the best white pine shingles, butted and jointed. A bell turret will be built according to the plan. The window frames will be made plank front or casing, and double hung. The sash and shutters to be made and hung as usual on the flank and back of the building; but on the front, inside shutters in one pair to each window will be made and hung to open against the wall, and recesses in wall will be made to receive them; the sub-sills of the windows will be made of heart pine. A circular transom sash will be made over the front door. The doors will be made and secured as usual, excepting that in the partition between the lobby and clothes rooms folding doors will be made and hung, so that they may be opened into one room for recitation or class purposes. The closets will be shelved in the usual manner, and the platform for the teacher's desk made with eight inch rise. Wainscoting, black-board, inside dressings and jambs of doors, pinrails and hooks in recitation rooms, slats in main room for maps, cellar door and steps, and outside steps (of wood), and privy and fencing, will be done in the best manner.

Painting and Glazing.—The wood work usually painted will receive three coats in plain colours, with pure white lead and linseed oil. The sash all to be glazed with the best glass; the size of the glass will be thirteen by sixteen inches, eighteen lights in each frame on the side and back; the front frames to have twelve lights each.

General.—All the materials and workmanship to be of the best quality, and everything to be furnished, requisite to complete the building in all its parts, in a substantial and workmanlike manner, and to the satisfaction of the trustees.

NOTE.—See "Suggestions for Specifications."

CHAPTER XIV.

PLANS OF ONE-STOREY SCHOOL-HOUSES IN THE RURAL SECTIONS AND SMALL VILLAGES.

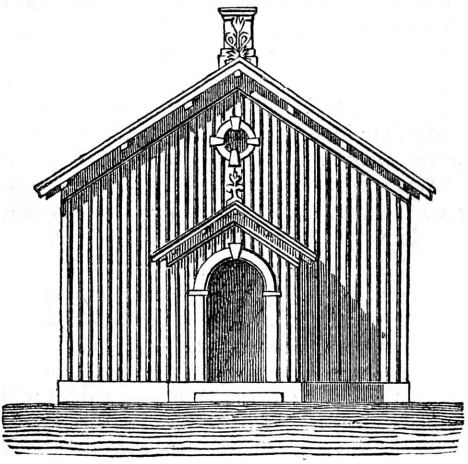


Fig. 58.—Design No. 1, End Elevation.*

The interior arrangements of this plan resemble many of the others; but in this, an outside lobby is made at the entrance (*Fig.* 59,) which gives an additional room inside (B) for the purposes of a library or recitation.

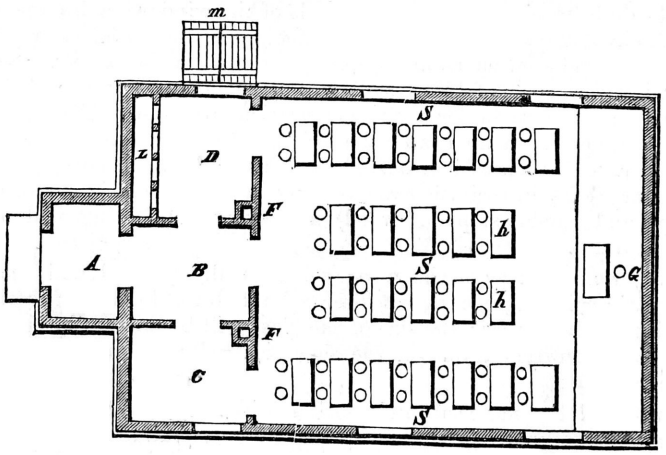


Fig. 59.—Ground Plan adapted to Figs. 57, 59 and 71.

A. Outside porch.
B. Entrance.
C. Girls' bonnet room.
D. Boys' cap room.
FF. One a smoke flue, the other a ventilator, brought together in the loft and topped out together.
G. Teacher's desk on a long platform.
hh. Seats for two pupils.
L. Library.
m. Entrance to the cellar.
SS. Passages or aisles.

* These designs, with one outward door only, are not to be preferred, but they are inserted rather to give variety in the *style* of school-houses, than to be strictly followed. The double entrances, shown in *Figs.* 79, etc., especially in *Fig.* 88 and following plans, are much to be preferred.

Suggestions for Specifications.—In framing either of these buildings (*Figs.* 58 and 60), it will be done so that the weather-boarding can be put on vertically. The rafters will be twenty inches between centres, with a collar beam of one and a half inch plank, well spiked across each, and the heel of the rafter notched out to rest upon the plate; the front part projecting and forming the support to the eave, and that portion of the rafter will be planed, as will also the projecting pieces supporting the roof at the gables. The weather-boarding will be planed, and beveled, and strips three inches wide firmly nailed over the joints.

The carpenter work, including black-board, will be the same as others, excepting where the change in the plan makes it necessary; and the materials also of the

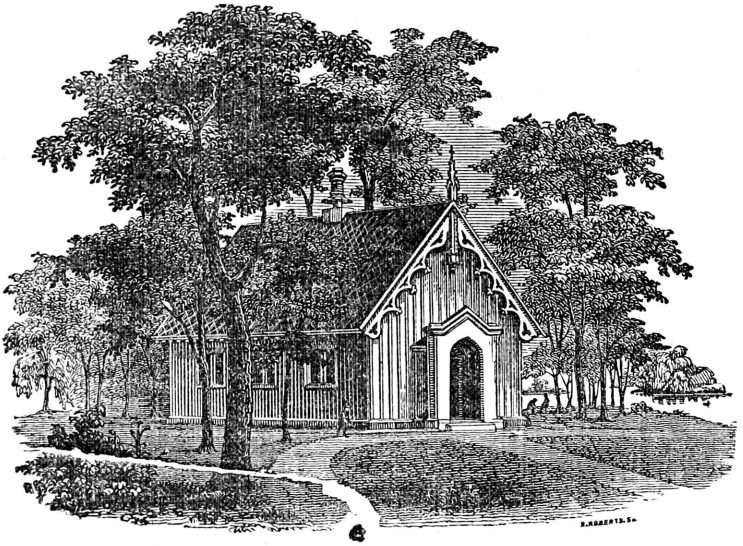


Fig. 60.—Design No. 2.—End and Side Perspective, with Ground, etc.

best quality. The masonry will also be as the first, with the same arrangement of cellar window and cellar entrance; the plastering also in like manner; the

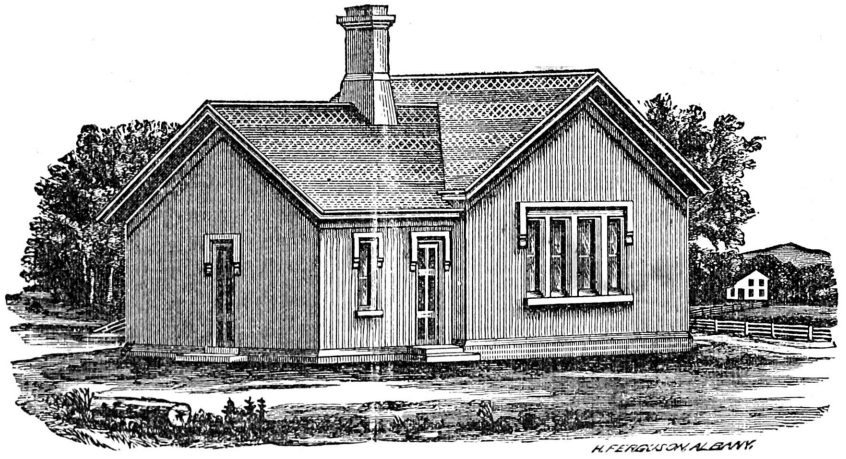


Fig. 61.—Design No. 3.—Adapted to Ground Plan, Fig. 62.

painting also the same, with glass of the same size and number in each frame. A well and privy, also fencing, as required by the regulations, all complete to the satisfaction of the trustees. (See *Figs.* 4 to 17, pages 24-27.)

Fig. 60.—Design No. 2 is in a neat and tasty style of architecture. Any rectangular plan will suit it; and the principles of light and ventilation may be fully carried out in this as in other plans. The principal light is from one large mullioned window in the rear end. The side openings are for air in summer, not glazed, but closed with light shutters. The ventilator, as shown on the ridge of the roof of the building, may be of any required size, and should have a cap to exclude water. This cap may be pushed up or let down by a rod affixed to the under edge, and lying against the smoke pipe. Height may be gained in the roof by framing with collar beams set up 4 or 5 feet above the eaves. The sides, if not of brick or stone, may be boarded vertically, as seen in *Figs.* 58 & 60.

Fig. 61.—This school-house may be either wood or brick, but it represents a clap-boarded one, with a simple cornice. The doors are so arranged that one may be used for boys and the other for girls. One of the outer porches shown on page 84 should be erected over each door. The ground plan given in *Fig.* 62 is adapted to this elevation.

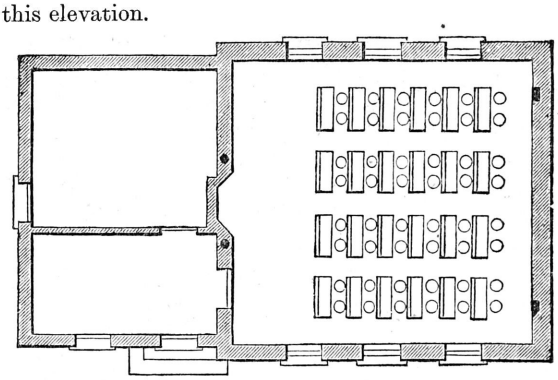


Fig. 62.—Ground Plan adapted to Figs. 61 and 63.

In this ground plan (*Fig.* 63), designed for fifty children, there are two entrances. The one for boys, in the rear of the building, may also be used as the door through which the wood may be brought in. The room may be divided and used as a boys' entrance and place to hang up their hats and coats, and also as a wood room. There is an indentation in the wall, designed for an open fire-place, with ventilating shafts in either side, at the black dots in the wall.

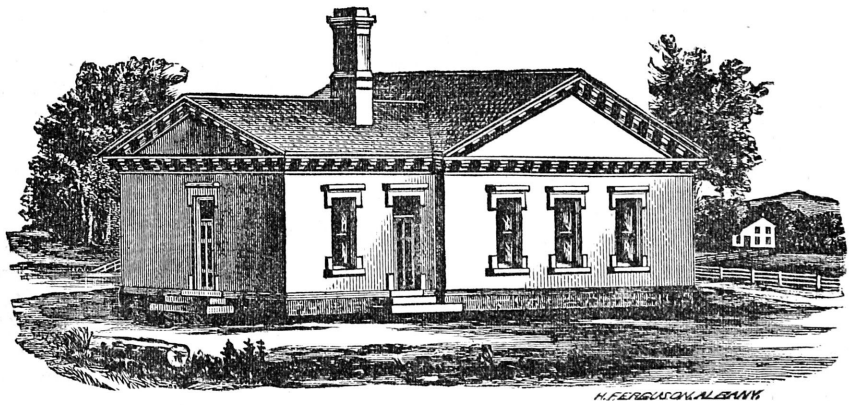


Fig. 63.—Design No. 4.—Adapted to Ground Plan, Fig. 62.

This school-house (*Fig.* 63) may be either brick or wood. It differs from the elevation (*Fig.* 61) in the rich style of cornice and the arrangement of the windows, which are single. The ground plan (*Fig.* 62) is adapted to this eleva-

tion. The entrance doors, &c., are the same. A porch should be erected over the doors. (See page 84.)

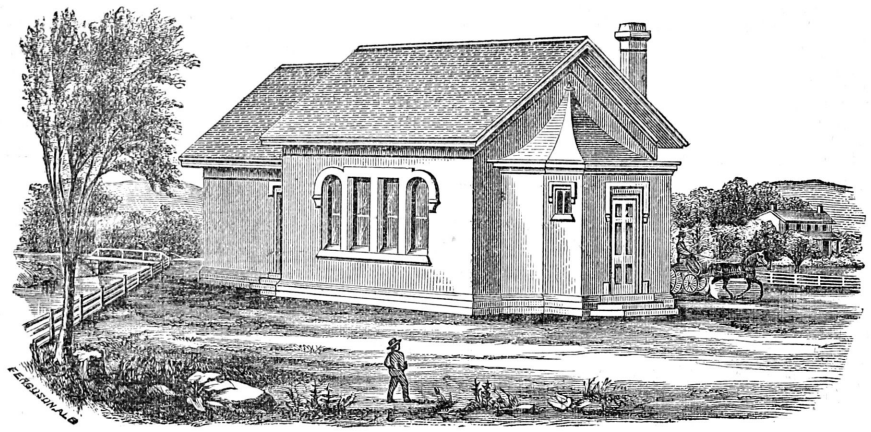


Fig. 64.—Design No. 5.—Adapted to Ground Plan in Fig. 65.

A small school can be well accommodated by a plan like that represented in *Fig.* 64. It consists of a school-room with a single porch in front, and a wood-house in the rear. The room represented contains seats for twenty-four pupils, but by increasing the length three feet there will be room for one more row of seats, and for thirty pupils, and by increasing its width four feet, it will contain still another row of desks, and seats for forty pupils.

The porch is a single room, but of sufficient size for a lobby for cloaks and hats. The stove is to be placed in one of the niches near the entrance in front, while the other niche may be used for a library. The ventilators in this, as in all the designs, are placed in the rear of the room, but each one is connected with the chimney by a tube under the floor. (See *Figs.* 27 and 33, pages 51 and 56.)

The wood-house in the rear serves the double purpose of back hall or entry-way, and a place of storage for fuel. The doors upon the sides should open

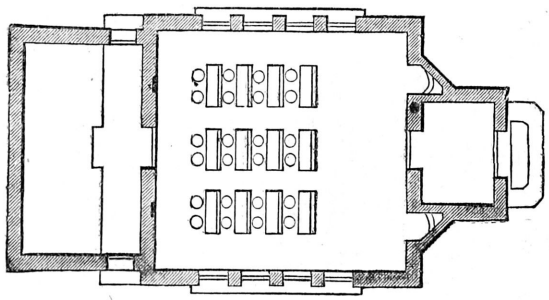


Fig. 65.—Ground Plan adapted to Designs in Figs. 64, 66, 67 and 68.

respectively into the boys' and girls' play-grounds. The front part of the wood-house should be provided with a platform upon a level with the school-house floor, at least four feet wide.

This general plan is superior, in having back as well as front entrances, so that access may be had to the play-grounds and outbbuildings without disturbance to classes, or to the general order of the school-room. The movements of pupils are not so conspicuous as they would be if, in their entrance and exit, they were always obliged to pass through the front door.

Fig. 64 represents a simple and inexpensive building of wood or brick, with projecting eaves that give to it an appearance of comfort and solidity. The porch is finished with a tent-roof, to obviate the necessity of a gable under a gable. It is lighted by small windows in the sides, as the height of the roof would hardly admit of a head window over the door. The windows are grouped together, and the whole design produces a very pleasing effect.

If a larger house is built upon this plan, the outside appearance may remain the same by simply increasing all the parts in proportion. If three feet be added to the length, no other change need be made; but if the addition is made to the width, the porch should be enlarged in proportion.

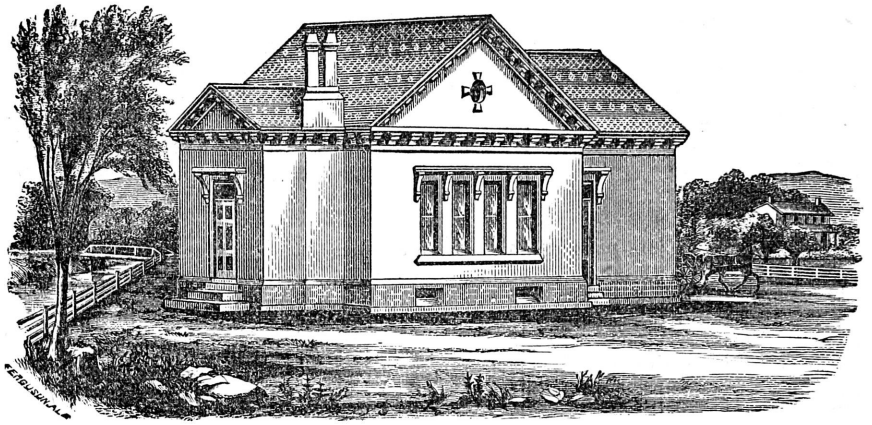


Fig. 66.—Design No. 6.—Adapted to Ground Plan in Fig. 65.

Fig. 66.—In this design the roof of the main building is placed at right angles with the roof of the porch, and of the wood-house, giving a nice architectural effect to the group. The cornices of the three parts are upon the same level, and an ornamental cornice extends across the gable. This feature may be omitted. In case the gable cornice is omitted, the cornices of the porch and

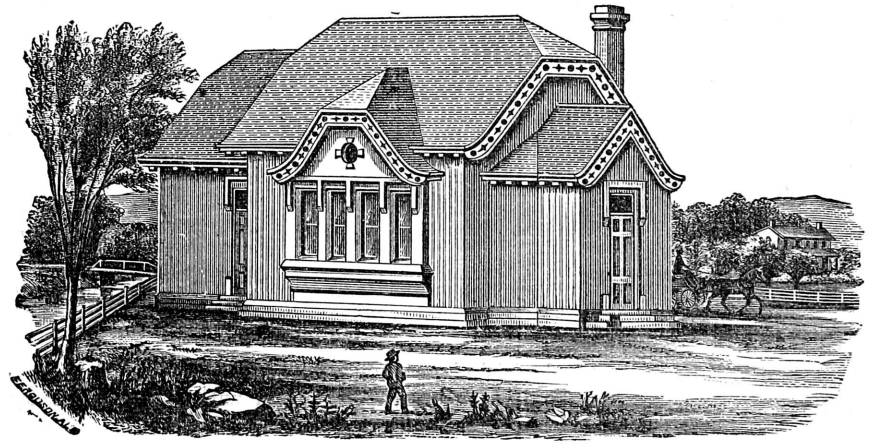


Fig. 67.—Design No. 7.—Adapted to Ground Plan in Fig. 65.

wood-house should drop below that of the main building. The porch is lighted by a headlight above the door. The materials of this building may be either brick or wood. The exterior, as shown in *Fig.* 67, may be battened or clapboarded.

Fig. 67.—This design is more ornamental. The corners of the gable are cut off (of which we do not approve), and a small gable is erected over each of the large windows in the sides. The porch is finished with a common gable. The ornamental filagree work of the gables may be omitted, if desired, and the cornice made wide and plain, like that of *Fig.* 61. The only extra cost of this design is raising the gables over the windows, and in cutting down the corners of the roof, the whole of which ought not to exceed a few dollars. This design is represented as finished with battens, but clapboards may be used, or the house may be built of brick. The superior appearance of this design will more than warrant the additional expense.

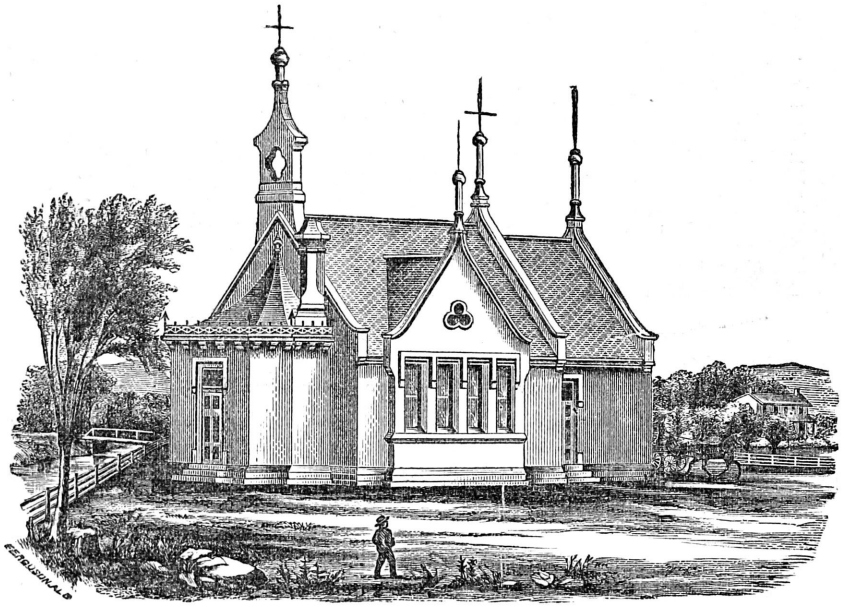


Fig. 68.—Design No. 8.—Adapted to Ground Plan in Fig. 65.

Fig. 68.—In villages and country places near cities, where the dwellings are of fine architectural appearance, the school-house should be in harmony with the surroundings, and there is a demand for ornamental designs. Design No. 4 has been prepared to meet this demand. The style is chaste and neat, and not expensive. The steep gables all terminate in minarets or pinnacles. An ornamental bell-tower surmounts the front. The porch has an ornamental tent-roof, sloping down from the front gable. Gables are erected above the side windows, and a beautiful ornamental chimney extends upward from one side of the porch. The material may be brick or stone, the finish of the gables being a stone coping instead of a cornice. This coping may be made of wood with a covering of tin.

Fig. 69 gives the plan of a very beautiful rustic school-house and grounds. This design for a school-house intends to exhibit a model of fitness and close economy. The principles of fitness are, 1. Ample dimensions, with very nearly the least possible length of wall for its inclosure, the roof being constructed without the beams, the upper and lower ends of the rafters being held by the wall plates and frame at the foot of the lantern. The ceiling may show the timber work of the roof, or it may be plastered. 2. Light, a uniform temperature, and a free ventilation, secured by a lantern light, thus avoiding lateral windows (except for air

in summer,) and gaining wall-room for black-boards, maps, models, and illustrations. Side window are shown in the view, and may be made an addition by

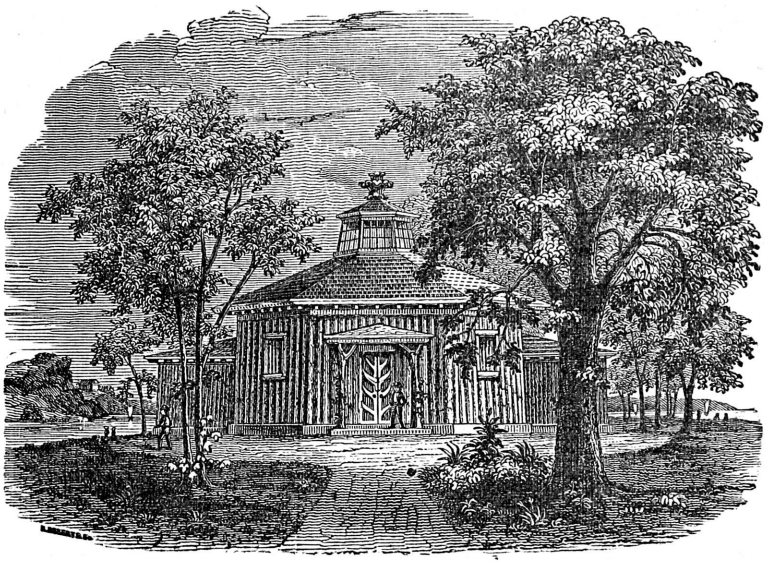


Fig. 69.—Design No. 9.—Perspective and Grounds of an Octagonal Rustic School-house.

those who doubt the efficiency of the lantern light. (The lantern is not only best for light, but is essential for a free ventilation.) With such a light, admitted equally to all the desks, there will be no inconvenience from shadows. The

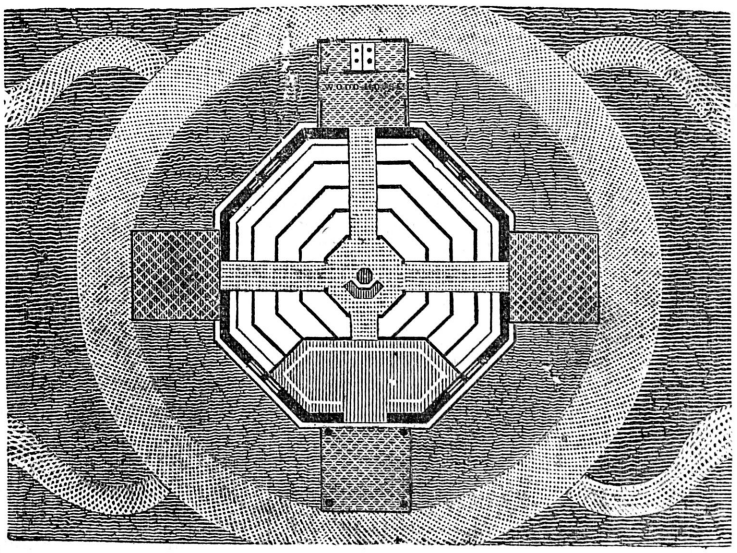


Fig. 70.—Ground Plan of an Octagon Rustic School-house and Grounds with Walks.

attention of the scholars will not be distracted by occurrences or objects out of doors. There will be less expense for broken glass, as the sashes will be removed from ordinary accidents. The room, according to this plan, is heated by a fire in

the centre, either in a stove or grate, with a pipe going directly through the roof of the lantern, and finishing outside in a sheet-iron vase, or other appropriate cap. The pipe can be tastefully fashioned, with a hot-air chamber near the floor, so as to afford a large radiating surface before the heat is allowed to escape. This will secure a uniform temperature in every part of the room, at the same time that the inconvenience from a pipe passing directly over the heads of children, is avoided. The octagonal shape will admit of any number of seats and desks, (according to the size of the room,) arranged parallel with the sides. The master's seat may be in the centre of the room, and the seats be so constructed that the scholars may sit with their backs to the centre, by which their attention will not be diverted by facing other scholars on the opposite side, and yet so that at times they may always face the master, and the whole school be formed into one class. The lobby next to the front door (*Fig.* 70), if made large, may serve for a small recitation room.

The inside wall of this lobby may show like a screen eight feet high, and the space above be open to the school-room. This screen-like wall may be hung with hats and bonnets, or the triangular space next the window may be inclosed for this purpose. The face of the octagon opposite to the porch has a wood-house attached to it, serving as a sheltered way to the girls' privy beyond. A second privy can be erected some distance away for boys. The wood-house is open on two sides, to admit of a cross draught of air, preventing the possibility of a nuisance. Other wing-rooms may be attached to the remaining sides of the octagon, if additional inconveniences for closets, library, or recitation rooms be desired.

The mode here suggested of a lantern in the centre of the roof for lighting school-houses, is so great a change from the usual plan of lighting that it requires full and clear explanations for its execution, and plain and satisfactory reasons for its general adoption, and of its great excellence in preference to the common mode. They are as follows, viz:—

(1.) A skylight is well known to be far better and stronger than light from the sides of the building in cloudy weather, and in morning and evening. The difference is of the greatest importance. In short days it is still more so.

(2.) The light is far better for all kinds of study than side light, from its quiet uniformity and equal distribution. At certain seasons of the year a movable curtain will be found desirable to prevent too strong a glare of light from being poured down.

(3.) For smaller houses the lantern may be square, a simple form easily constructed. The sides, whether square or octagonal, should incline like the drawing, but not so much as to allow water condensed on its inside to drop off, but run down on the inside to the bottom, which should be so formed as to conduct it out by a small aperture at each bottom pane of glass.

(4.) The glass required to light a school-room equally well with side lights would be double what would be required here, and the lanterns would be secure from common accidents, by which a great part of the glass is every year broken.

(5.) The strong propensity which scholars have to look out by a side window would be mostly prevented, as the shutters to side apertures would only be opened when the warm weather would require it for air, but never in cool weather, and therefore no glass would be used. The shutters being made very tight, by calking in winter, would make the school-room much warmer than has been common; and being so well ventilated, and so high in the centre, it would be more healthy.

(6.) The stove, furnace, or open grate, being in the centre of the room, has great advantages, from diffusing the heat to all parts, and equally to all the scholars; it also admits the pipe to go perpendicularly up, without any inconvenience, and

it greatly facilitates the ventilation, and the retention or escape of heat, by means of the sliding cap above. (See *Figs.* 27, 33 and 34, on pages 51, 55 and 56.)

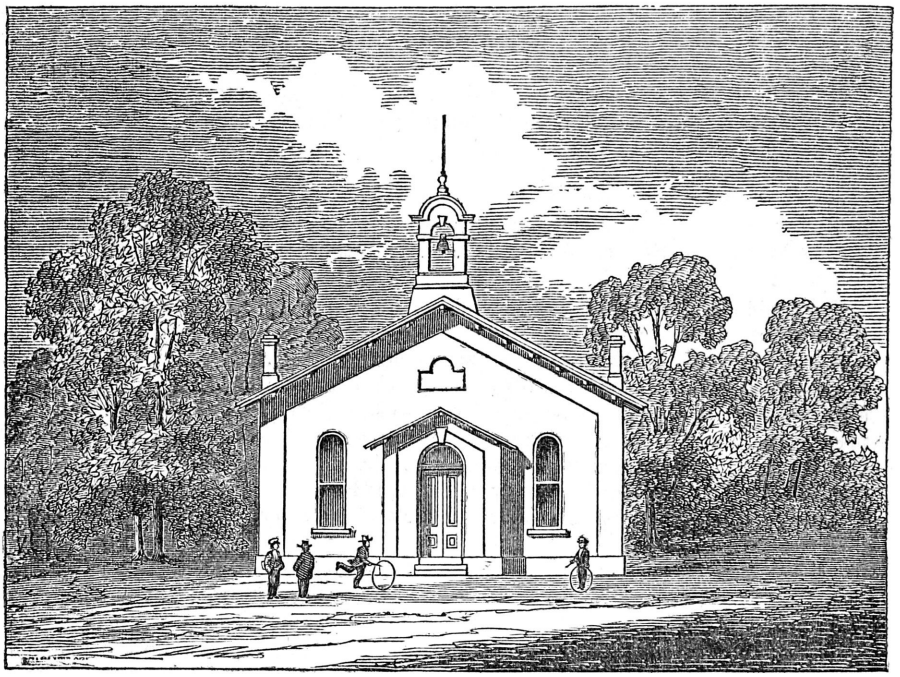


Fig. 71.—Design No. 10, with Grounds, etc.—Adapted to Ground Plan in Figs. 59, 72 and 78.

This plan is designed for a small village or thinly settled rural vicinity. The platform and blackboard should be extended to the book closets, on each side of the teacher's desk, to take the place in the plan of the two seats for four pupils each. This building, as shown in the plan, is surrounded with trees, shrubbery, &c.

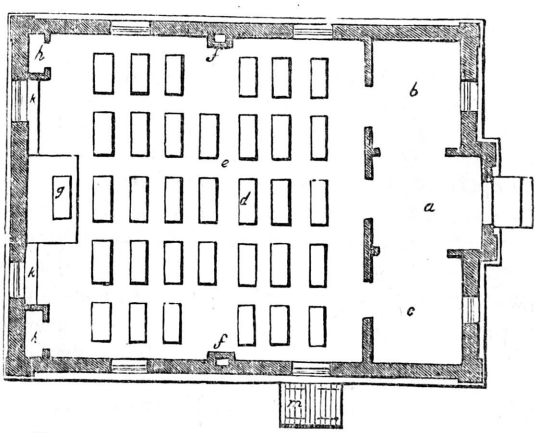


Fig. 72.—Ground Plan, adapted to Figs. 58, 60 and 77.

a. Lobby and entrance for both sexes.
b. c. Boys' and girls' clothes room.
d. Seats for two pupils each.
e. Passages two feet wide.
f. Flues, one intended for smoke and the other for ventilation
g. Teacher's desk on a platform.
hh. Closets for books, &c.
k. Seats for four pupils each.
m. Entrance to the cellar (if desired).

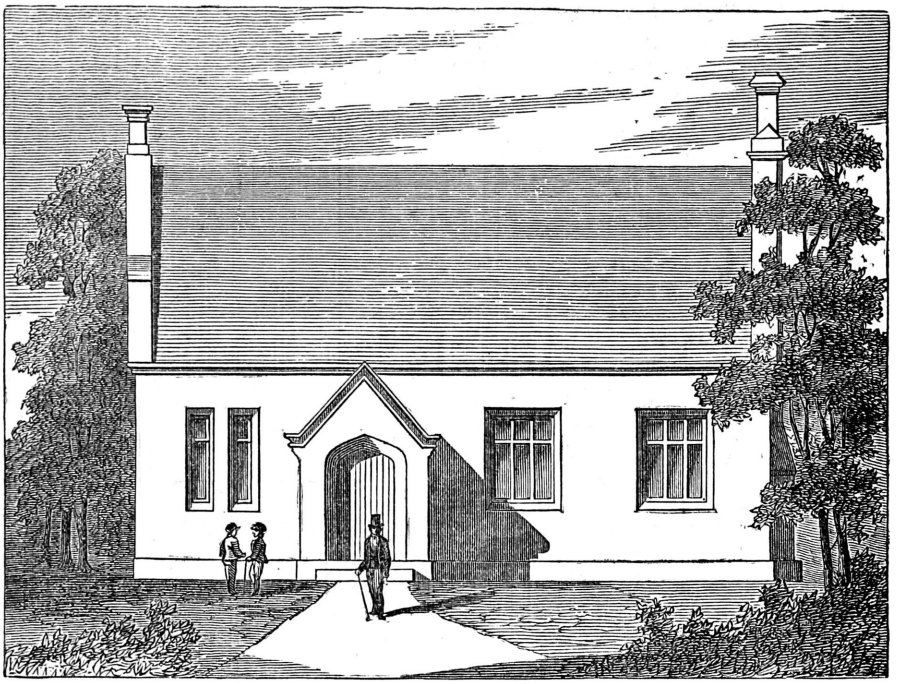


Fig. 73.—Design No. 11, Side Perspective, with Grounds, etc.—Adapted to Fig. 74.

This plan is designed for fifty pupils, but can be arranged for forty-eight or

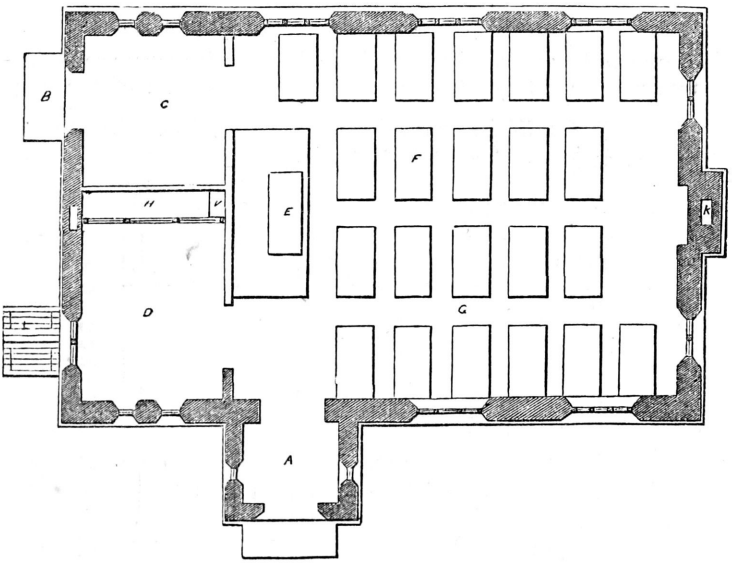


Fig. 74.—Ground Plan, adapted to Design No. 11, Fig. 73.

A. Outside porch and girls' entrance.
B. Boys' entrance.
C. Boys' clothes room.
D. Girls' clothes or gallery room.
E. Teacher's desk on a platform, 4 by 9 feet.
F. Seats for two pupils each.
G. Passage 2 feet wide.
H. Library.
K. Chimney flue.
L. Cellar entrance.
V. Ventilator.

fifty. It may be of stone, brick or wood. The size is twenty-three by thirty-four feet, and pitch of roof eleven feet; the story twelve feet in height in the clear, with a side porch; the walls of undressed stone or brick or wood.

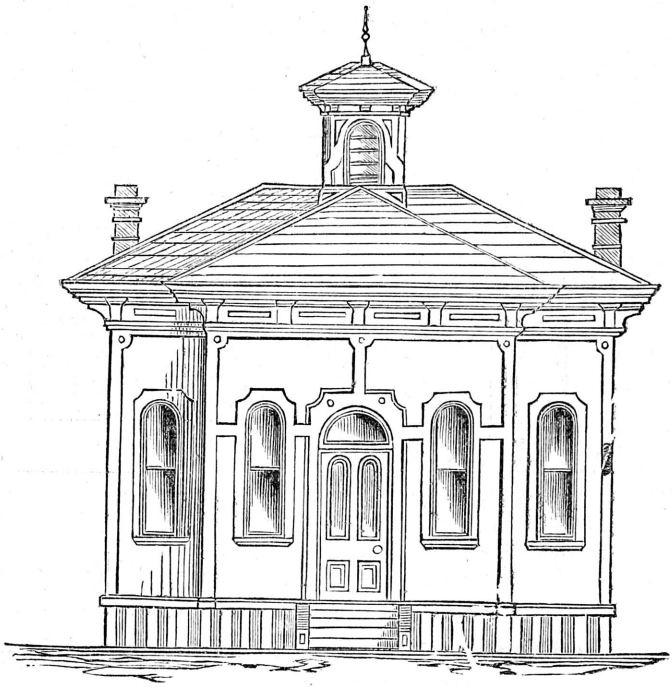


Fig 75.—Design No. 12.—Adapted to Ground Plan in Fig. 76.

The cellar will be excavated under the building, with entrance, &c., and foundation trenches for the porch two feet below the surface of the ground. In

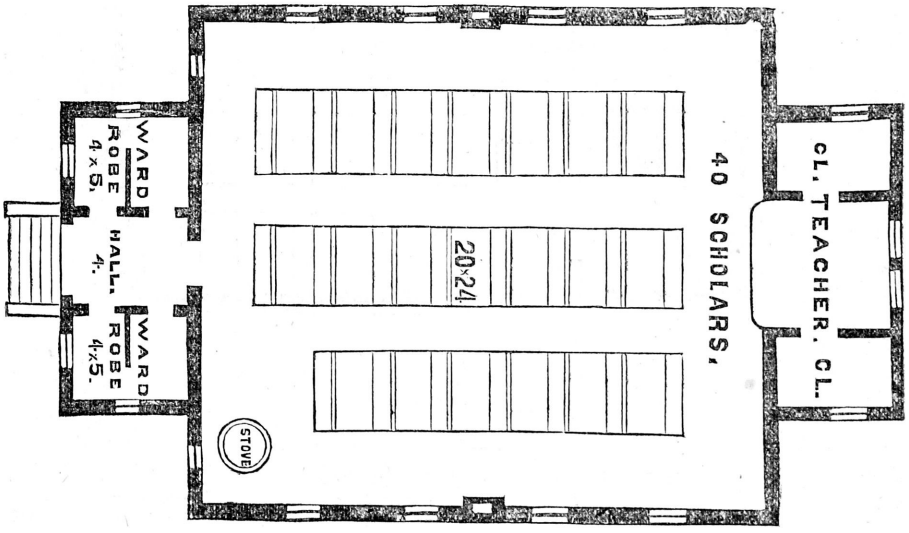


Fig. 76.—Ground Plan, adapted to Design No. 12, Fig. 75.

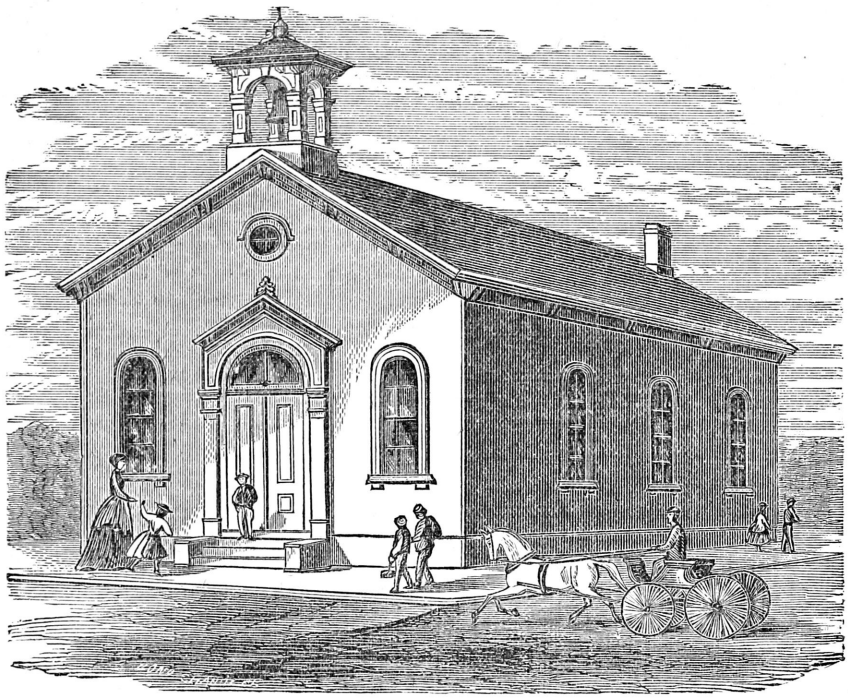


Fig. 77.—Design No. 13.—Front and Side Perspective, adapted to Fig. 78.

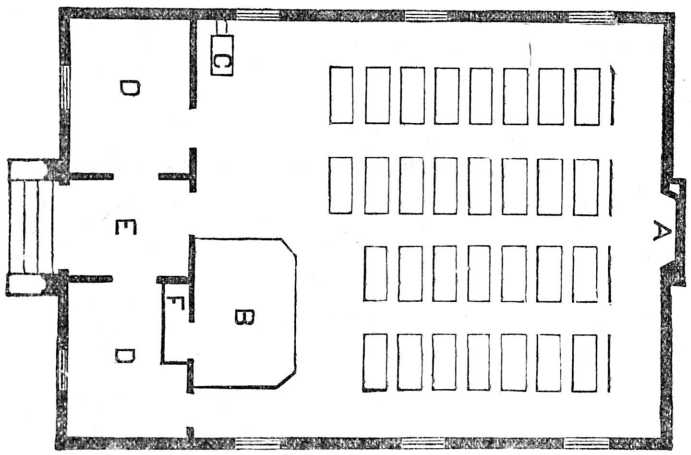


Fig. 78.—Ground Plan adapted to Figs. 58, 60, 71 and 77.

A. Fire place and Ventilating Flue.
B. Teacher's Platform.
C. Stove and Air Duct.
DD. Bonnet and Cap Rooms.
E. Entrance Hall.
F. Map and Apparatus Closet.

E is the front hall, with door opening directly to the school-room. This door is for teachers and visitors only (never for pupils as a rule). To the right and left from this hall are the rooms D D—one for boys and one for girls, from which they pass, respectively, through another door to the school-room, thus avoiding the crowding and confusion of turning back to enter the school-room from the hall. As an invariable rule, boys and girls should have separate entrances into the school-house. In this respect all of these Designs are defective; but this defect can be remedied in the construction of the buildings themselves.

B is the teacher's platform, and F a map, or the teacher's private closet.

C is the stove, the pipe going to the right, and turning at right angles through the centre of the room to the chimney, A, which has a small fire-place, with hearth, and register for the outlet of cold and impure air.

regard to the details of the mason and carpenter's work, they can be determined upon by the trustees, and inserted in the specifications. The specifications given on page 85 will be a guide in this respect. The details of seating and warming will be given in another chapter.

Fig. 75 is a neat and elegant design for a small school-house in a village or rural section. The only objection to it is, the single entrance door to the building. The building has an outside porch and a bell turret. The former is well lighted. The "hall" is rather narrow, but the "wardrobe" room on either side, for boys and girls, is very convenient. The pupils, on entering the "wardrobe" from the hall near the outer door, should, however, be able to pass on through it into the school-room direct; but instead of that they have to come into the hall again, and thence into the school-room. In doing so, as shown in the plan (*Fig.* 76), the pupils from either "wardrobe" have to meet at the same place in the hall, thus leading to confusion, if not sometimes to unseemly jostling and crowding. This error should be corrected in erecting the building (as is shown in *Fig.* 78), and the two doors into the hall now should be closed up. In passing through the "wardrobe" room, the pupils can hang their caps and bonnets on clothes pins fastened to the short partitions which extend across the room.

The school-room, *Fig.* 76, is 20 by 24 feet, and is designed to accommodate 40 (but, if extended, it might be made to seat 50 or 60) pupils. The teacher's platform and two closets are at the opposite end of the room. One of the closets might be converted into the teacher's private room or library, and the other might be used as a passage way out into the rear yard, as desired.

Design No. 13 presents an illustration of a neat school-house suitable for a rural school section. The objection to it is the single entrance. It is therefore better suited for the purpose of a church. The interior is arranged as follows:—

In some parts of the country the small number of pupils in the section is given as an excuse for a miserable school-house. The fact of a limited number of pupils may be a sufficient reason for the construction of a small school-house, but not for a poor one. The educational wants of a small section and of a small number of children are just as pressing as though the territory and the number were indefinitely increased, and a neglect to supply them is just as detrimental in the one case as in the other. If this excuse were a good one, the inspector would be justified in withholding the public funds on the same ground.

But, again, it is argued that the smaller sections are often too poor to erect a respectable and comfortable school-house. It may be that many of the sections are poor; and in that case they are far too poor to subject their children to exposures and consequent disease, and so a good school-house becomes indispensable. Each school section that receives public money is morally bound to provide all the appliances necessary for the proper expenditure of the money so obtained; and the poorer the section the greater is the necessity for all possible means for moral and physical advancement.

In this design two entrances are provided in front, each of which opens into a room which is at once an entry-way and a lobby for clothes. The space between the two entry-ways can be used for recitations, and a room may be finished in the basement, or added to the rear for the storing of fuel.

The design is well adapted to sections in which the attendance is large during one portion of the year, and small at other times. The recitation-room gives an opportunity for the employment for an extra teacher, as required by law, when the school has an average attendance of over fifty pupils. The front and back walls of the school-room, between the two doors, should be occupied by blackboards. The stoves are placed in the front corners of the room, and the ventilators in the opposite corners. This room is supplied with two back entrances opening respectively into the boys' and the girls' play-grounds.

Fig. 79.—This design represents a plain but neat and substantial frame building. The roof has the plain wide, projecting cornice and eaves which protect

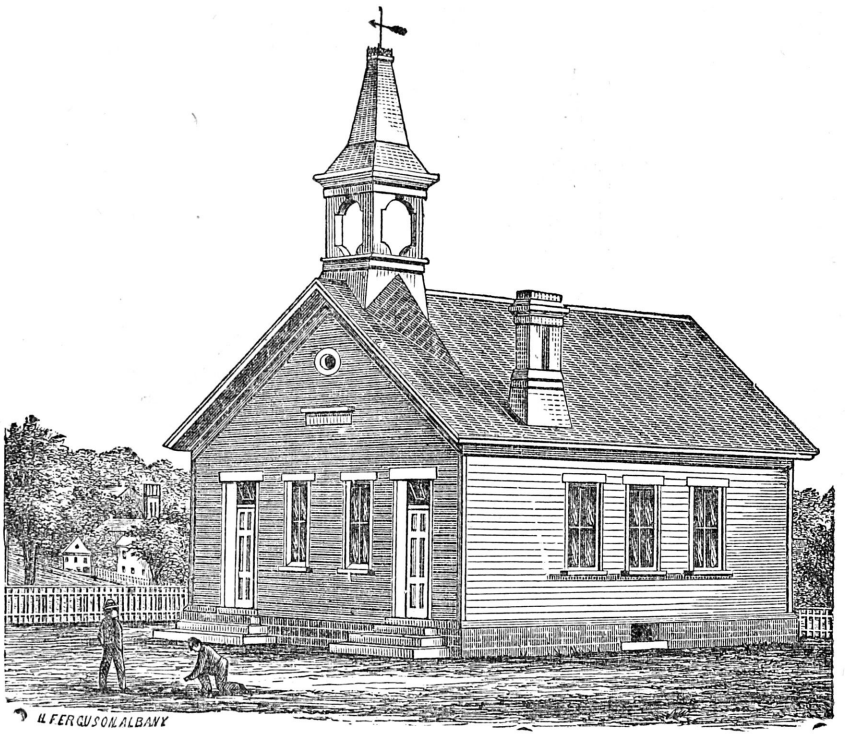


Fig. 79.—Design No. 14.—Adapted to Fig. 80.

the walls of the building, and at the same time give it an appearance of comfort and solidity. The finish may be of battens, or it may be of clap-boards, as in

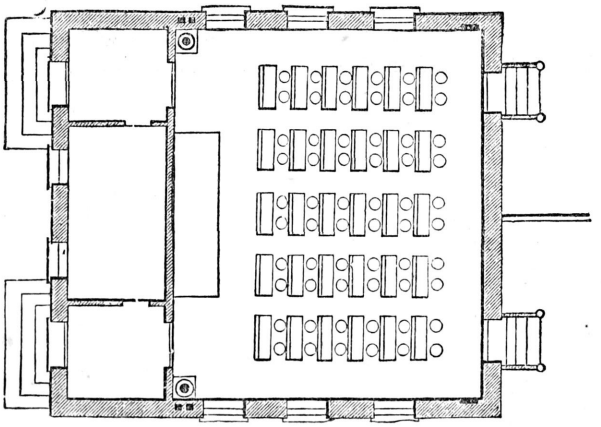


Fig. 80.—Ground Plan adapted to Figs. 79, 81, and, with modification, to 84 and 86.

the engraving, or, substantially, the same building may be made of brick. This school-house is represented as standing on a side hill which slopes downward and

backward from the house. In situations of this kind the back entrance may be omitted, and the basement may be fitted up for a wood-room. The nearly square form of this school-house, the perfectly plain finish, the arrangement of everything beneath a single roof, and the entire lack of ornamentation, render this one of the cheapest buildings which can be erected. With outside porches for the

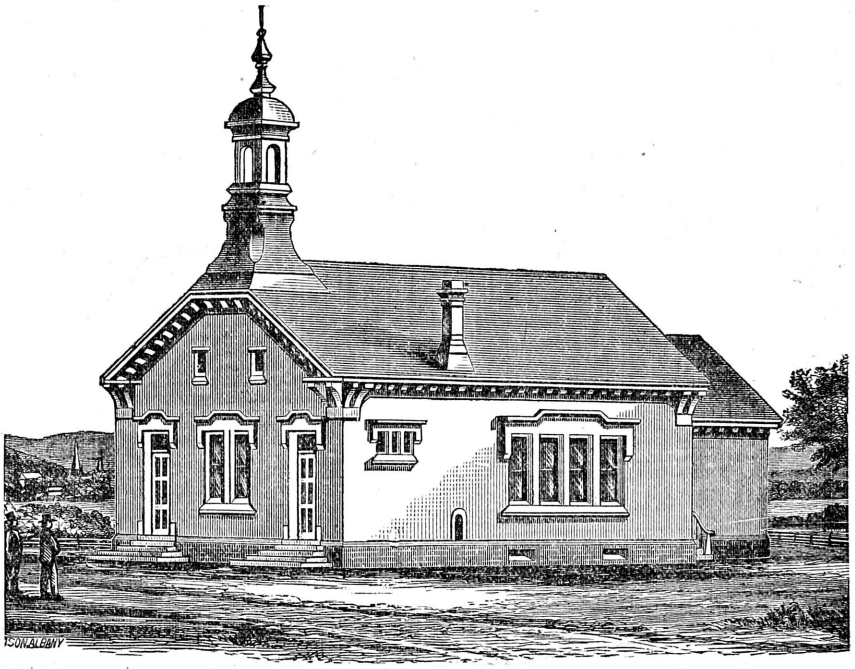


Fig. 81.—Design No. 15.—Adapted, with modifications, to Figs. 80, 82 and 83.

entrances the plan can be recommended, but not otherwise, as they are a necessity. If anything cheaper is attempted and the porches omitted it will be by the use of poor materials, by scrimping just proportions, or by diminishing the size, so as to deprive pupils of their due proportion of pure air, and of their freedom of movement. In either case the interests of the school will suffer, and present saving will be effected at a fearful future cost to the children.

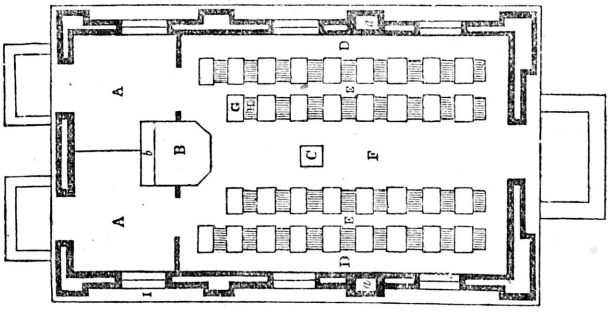


Fig. 82.—Ground Plan adapted, with modifications, to Figs. 79 and 81.

Design No. 15.—This is a very neat and tidy-looking school-house. The style and finish of the doors, windows and eaves are superior to those of the others, though the cupola is a little too small.

The building is but a slight variation from Design No. 14. The corner of the gable has been cut off, and the form of the cupola changed; but otherwise it is substantially the same. It also requires the outside porches. The finish in the engraving is made to represent brick, but wood or stone may be used.

NOTE.—In the erection of brick walls, care must be taken to have the walls hollow, or formed so that a space of air may be confined within them, otherwise the walls will be damp and the room unhealthy. The precaution should also be taken to have the foundation laid in hydraulic cement as high as the water-table to prevent the moisture of the ground from permeating the entire walls of the building. The effect of the moisture is not only deleterious to health, but combined with the action of frost, it has a tendency to crack and destroy the walls of the building.

The side windows nearest the front, the four side windows, and two in the rear (not shown in the plan) should all be furnished with substantial inside blinds. Outside blinds go soonest to decay, and they are so inconvenient, that they will often fail to be opened or shut when they should be.

NOTE.—We would again repeat here that pupils should never be seated opposite to the window, as such an arrangement cannot be otherwise than injurious to the eyes of the pupil, since the strong light is constantly shining in to them. Pupils should always be seated with their backs or sides to the windows. There should be no window in front of them; but, if any, they should be windows facing north, and not those facing south. If from the structure of the lot or the house this arrangement is impossible, the window should be muffed or otherwise permanently darkened or shaded. (See page 41.)

We give two additional ground plans which may be adapted, with some slight variations required by the nature of the site, &c., to the designs Nos. 14, 15, 16, etc.

Design No. 16, *Fig.* 84, represents a handsome ornamental brick or stone building, with a slate or other substantial roof. The cupola, like that in *Fig.* 81, is made to grow out of the structure itself. The windows and doors have pointed gothic arches, and over each of the windows a gable has been erected, which gives

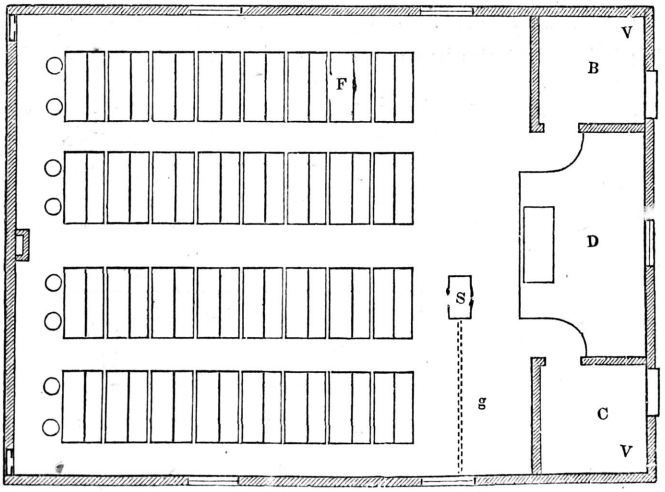


Fig. 83.—GROUND PLAN, ADAPTED, WITH MODIFICATIONS, TO FIGS. 79, 81, 84 AND 86.

them a tasteful finish. The whole grouping produces a very pleasant effect; and the design, as well as that of Designs 17 and 18, would make an excellent and handsome school-house, or a small but elegant church.

NOTE.—In erecting structures of this kind, great care should be taken to make the foundation secure. The underpining should be laid in hydraulic cement, and every precaution should be taken that the whole foundation should be of sufficient strength to support the weight which must rest upon it.

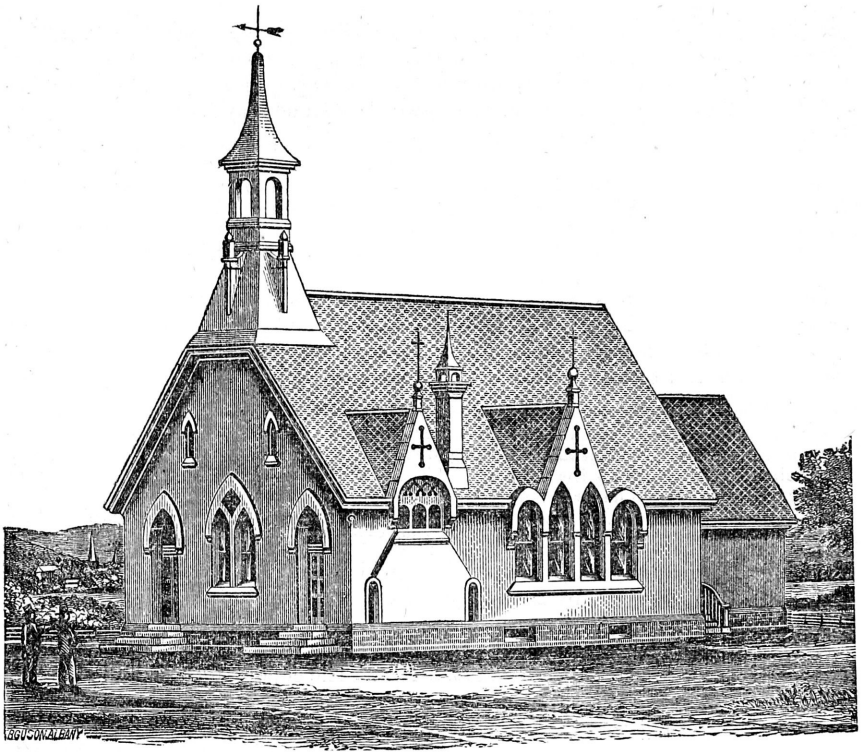


Fig. 84.—Design No. 16.—Adapted to Figs. 80, 82 and 85.

Note.—This design might also be used as a Sunday school room for a church, and for a variety of other public school purposes. The roof should be covered with slate.

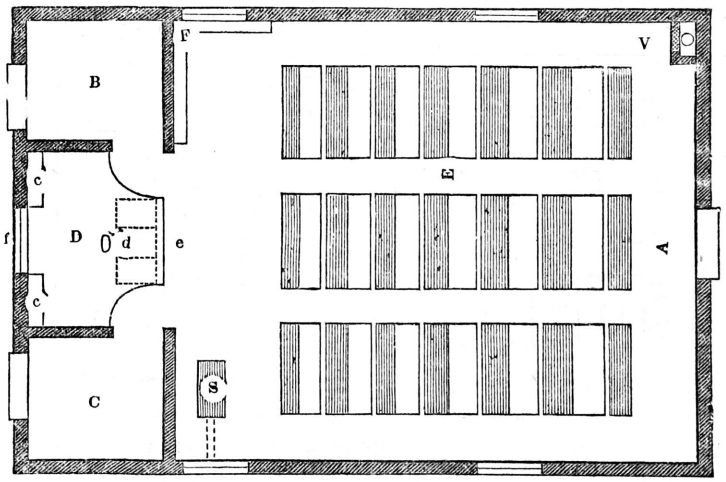


Fig. 85.—Ground Plan adapted, with modification, to Figs. 79, 81, 84 and 86.

Design No. 17, *Fig.* 86, represents a plainer structure (of brick or stone) than the preceding one, and it has been varied by the introduction of plain arched windows and corner buttresses, which give the building a strong and substantial appearance. The cupola, too, differs from that shown in the preceding design,

being a square structure supported by a projecting framework beneath, in keeping with the general architecture of the house.



Fig. 86.—Design No. 17.—Adapted, with modification, to Figs. 80, 82, 85 and 87.

Note.—The window heads and sills should be of cut stone; but a fine effect may be produced by making the arches of brick and stone, or white and red brick laid alternately. The string-course at the base of the window caps may, from motives of economy, be omitted, and the windows finished in the ordinary manner. The buttresses should always terminate in pinnacles, or otherwise the structure would appear bald and unfinished.

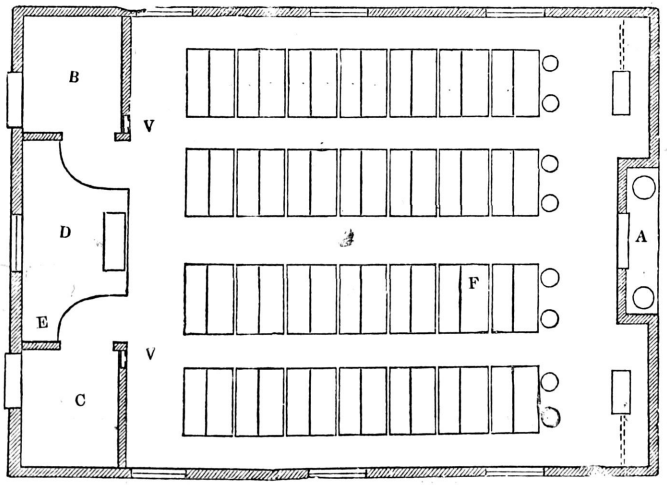


Fig. 87.—Ground Plan, adapted, with modifitations, to Figs. 79 and 81.

A. Rear entrance.
B. Girls' do.
C. Boys' do.
D. Teacher's platform.
E. Library.
S. Ventilating stove.
V. Flue for ventilation.
F. Seat and desk, with iron ends.
g. Cold air duct.

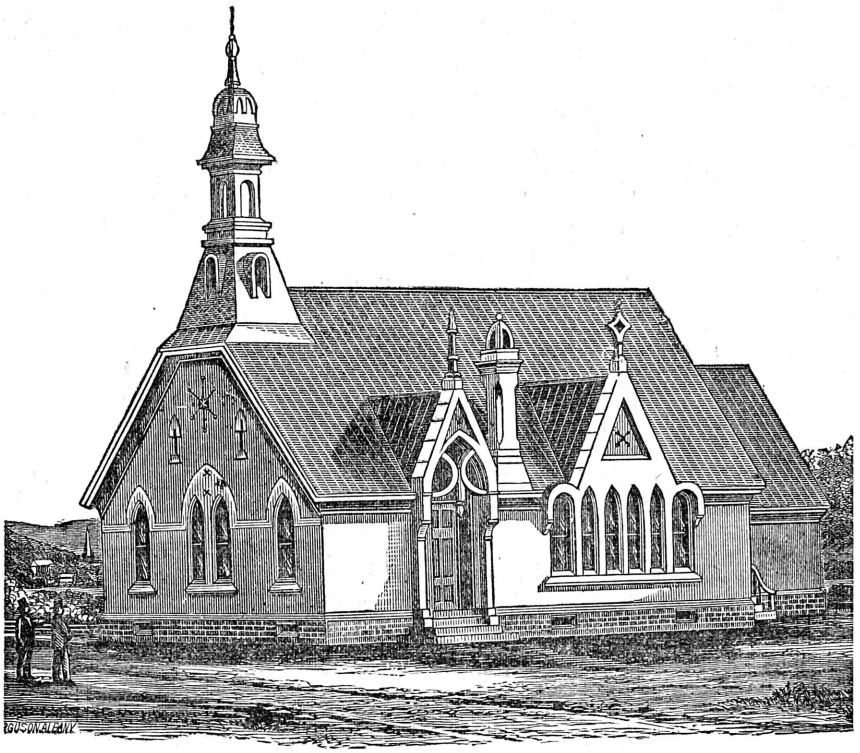


Fig. 88.—Design No. 18.—Adapted to Fig. 89.

This Design, in its general features, resembles No. 16, *Fig.* 84, but the entrance doors are at the side and not at the front. This is a decided improvement, as

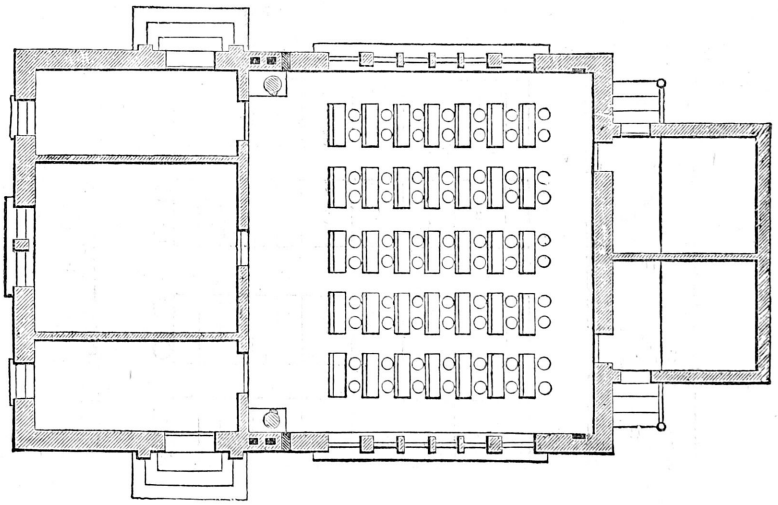


Fig. 89.—Ground Plan adapted to Figs. 88 and 90.

it completely separates the boys and girls, and thus secures quiet and orderly demeanour, and greatly promotes the discipline of the school. The window and

door gables are elegant in design, and are finished in the simple stone copings. The porch, too, is neat, but any of the designs given on page 84 can be substituted for the one in the engraving. The cupola, like that shown in *Fig.* 84,

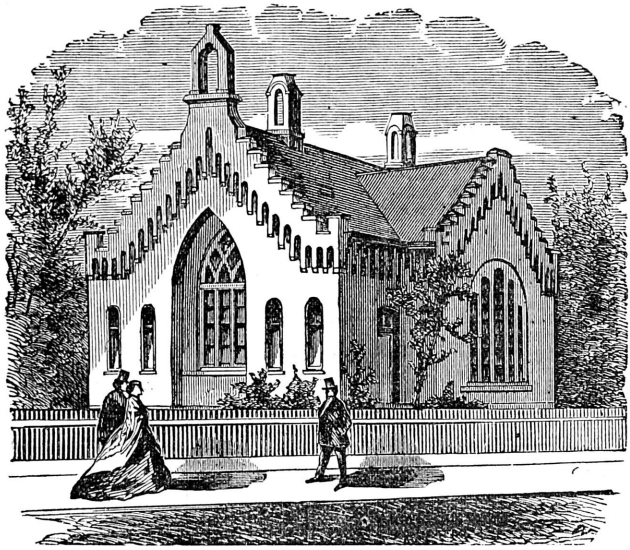


Fig. 90.—Design No. 19.—Adapted, with modification, to Fig. 88.

grows out of the structure, and is an integral part of it which cannot be omitted without destroying the general symmetry of the design. The materials of the building may be brick or stone. The pointed arches of the door and window heads give a handsome finish to the building, which fit it admirably for a village school. The design can also be adopted to a church structure.

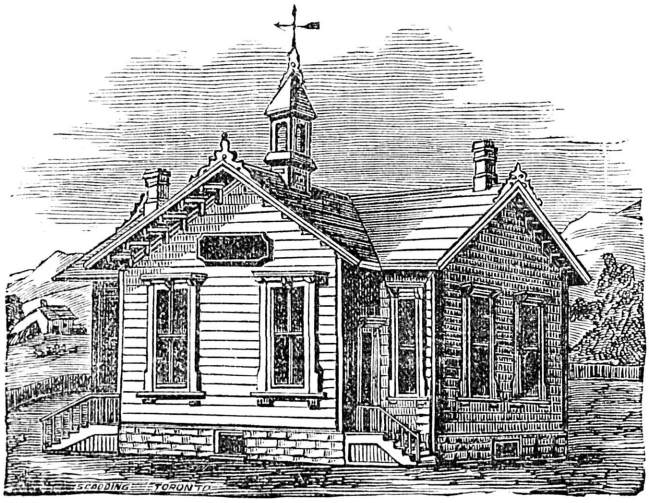


Fig. 91.—Design No. 20.—Adapted to Fig. 92.

The ground plan, *Fig.* 89, is fitted for the Design shown in *Fig.* 88, but with a little modification it can easily be adapted to Design No. 16, *Fig.* 84, and the others. The rooms in front and rear of this building fit the plan admirably for a school with a gallery room and an assistant teacher.

This Design (*Fig.* 90) differs entirely from the preceding one, and presents a neat and tasteful appearance. The material may be brick or stone. The ground plan given in *Fig.* 89 can, with modifications, be adapted to this Design.

Fig. 91 presents a neat, plain design for a rural school or small village. It can be of wood, and clapboarded. The structure should rest on a substantial stone foundation. as shown in the engraving (Design No. 20).

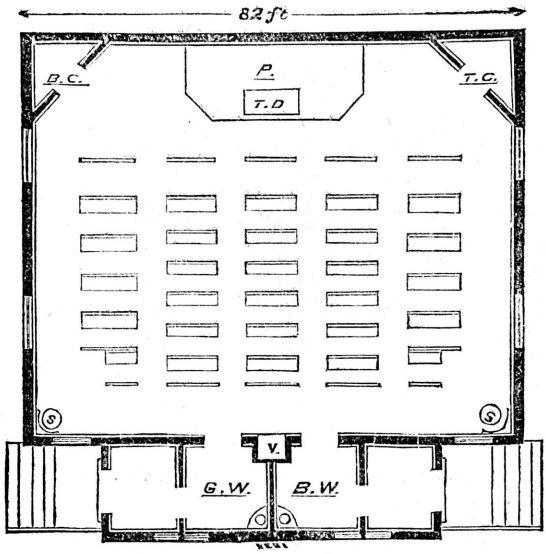


Fig. 92. –Ground Plan adapted to Design No. 20, and, with modifications, to Design No. 19.

Fig. 92 furnishes a compact ground plan for Design No. 20, *Fig.* 91. It secures the very desirable advantage of separate entrances for boys and girls.

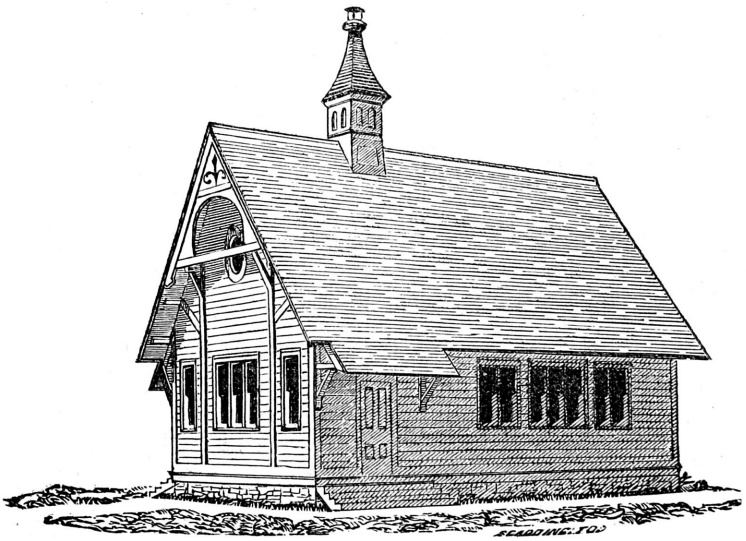


Fig. 93.—Design No. 21.—Adapted, with modification, to Fig. 91.

Fig. 93 represents one of the designs for rural school-houses prescribed by the New Brunswick Provincial Board of Education. The gables in the Design are

ornamented with rafters, collars and arches, supported on framed brackets. The Design can be adapted to the ground plan shown in *Fig.* 92, or to the block plan, *Fig.* 94.

NOTE.—The rafters and collars should be 4 inches by 7, champered and cut at the ends; the brackets should be framed with the same sized timber; the arches should be 3 inches thick, built of 1-inch stuff, and moulded on the edge. The spandrels should be filled in with inch boards, pierced with jig-sawed pattern.

Fig. 100, on page 110, is an enlarged and modified design of this style of school-house, and is admirably adapted to the purposes of a school with two departments. The style of finish, material, etc., are the same as in *Fig.* 93. The covered porches in both will be found to be a great protection in wet weather. It would be better, however, if they were entirely enclosed.

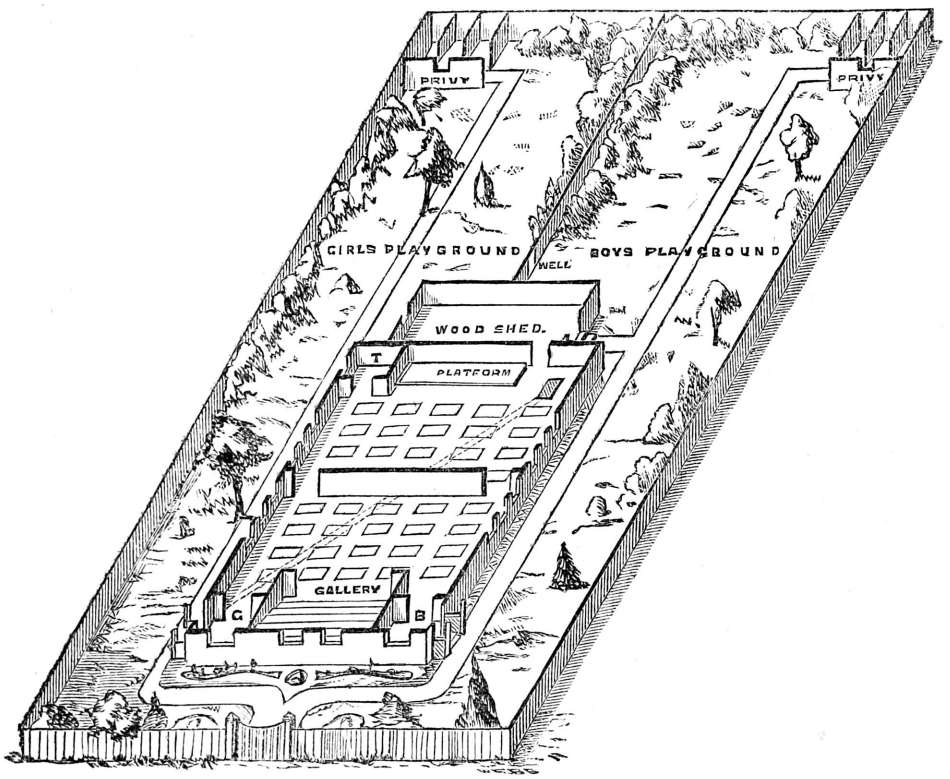


Fig. 94.—BLOCK PLAN OF SCHOOL-HOUSE AND GROUNDS, ADAPTED TO DESIGN NO. 21, FIG. 93.

B. Boys' entrance. G. Girls' entrance. T. Teacher's closet.

The block plan shown in *Fig.* 94 gives an admirable bird's-eye view, not only of the interior of the school-house itself, but also of the play-grounds, walks, fences, privies, well, trees and shrubbery, etc. It will be seen that by placing the entrances at the sides, not only are the confusion and jostling of boys and girls in the same passages avoided, but also an excellent gallery room (which is so essential an addition to every school-house) is secured. The position of the teacher's platform, wood-shed, well, etc., and the division of the school-room for two teachers, are readily seen in this block plan.

DESIGN NO. 22.—This is another very plain and cheap structure of wood, finished with clap-boards. The bell-tower gives dignity to the building, and should not

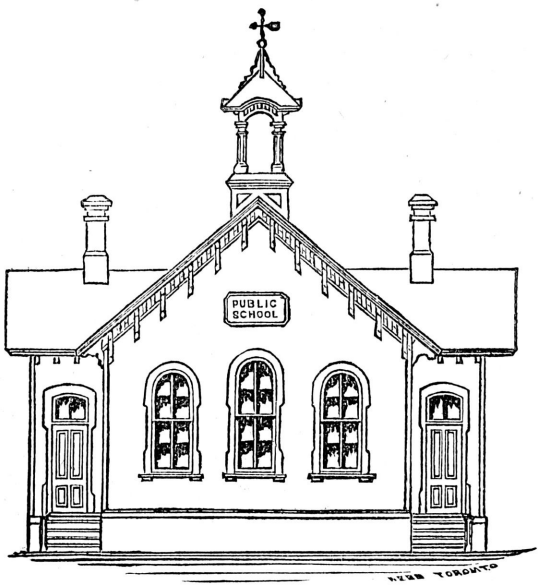


Fig. 95.—Design No. 22.—Adapted to Fig. 96.

be omitted, neither should the outer porches which the plan lacks. The roof is of the ordinary pitch, and may be covered with slate, or shingles laid in mortar.

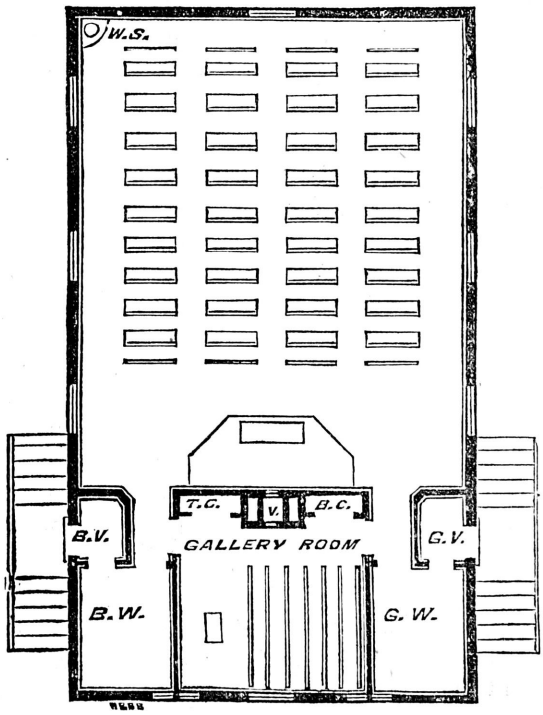


Fig. 96.- Ground Plan adapted to Design No. 22 Fig. 5.

Note.—In finishing wood structures in this manner, the clapboards should be laid with but little exposure to the weather. This arrangement gives tighter joints, and makes the building much warmer. In some places buildings designed for habitation are covered with a coating of tarred paper before the siding is laid, and this renders them almost air-tight. This covering is recommended for school-houses built in our northern climate, and in exposed situations. By its use the school-room will be made more comfortable, and a large saving in fuel effected.

REFERENCES.

G.W. Girls' wardrobe.
B.W. Boys' wardrobe.
G.V. Girls' vestibule.
B.V. Boys' vestibule.
B.C. Book closet.
T.C. Teacher's closet.
W.S. Wood stove.
V. Ventilating shaft.

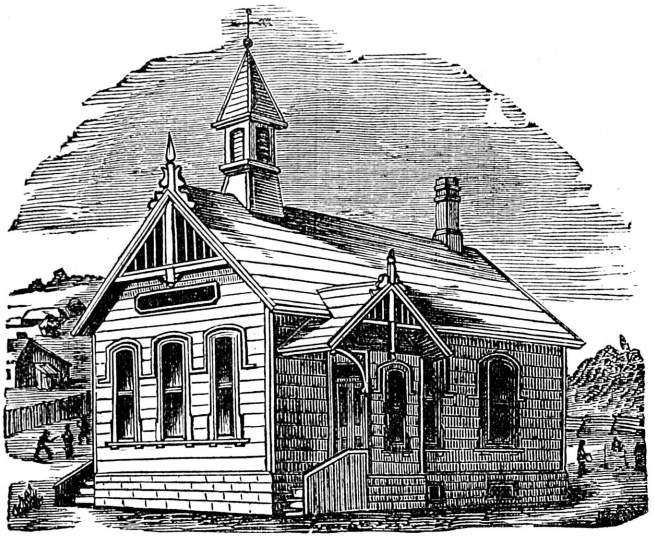


Fig. 97.—Design No. 23.—Adapted to Ground Plan, Fig. 96.

This Design is somewhat similar to that shown in *Figs.* 91 and 95; but the

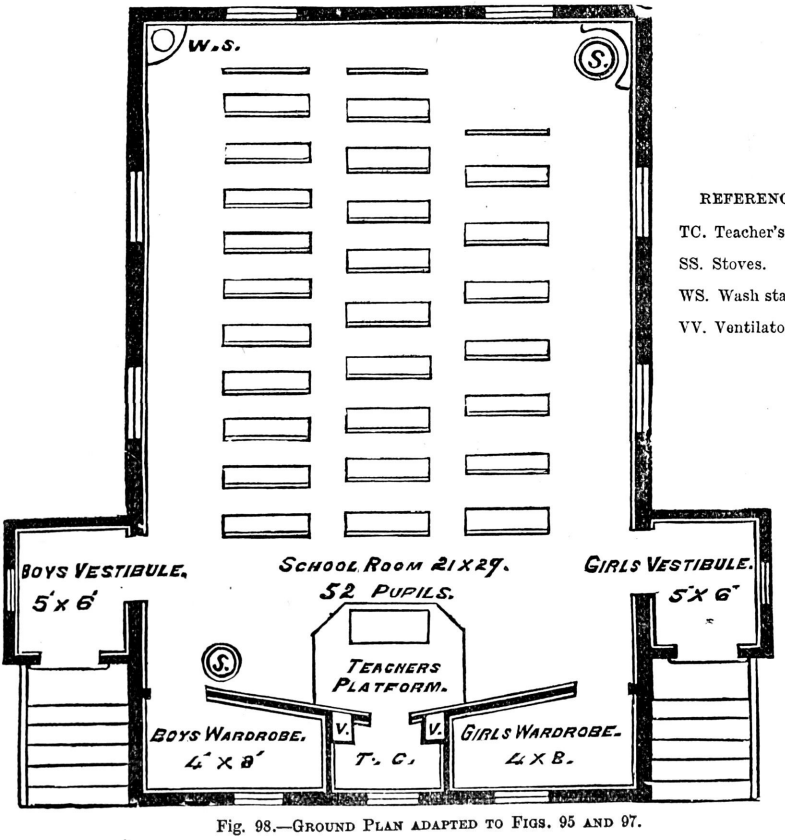


Fig. 98.—Ground Plan adapted to Figs. 95 and 97.

arrangement of the entrance doors and windows is somewhat different. It has a projecting porch, which is a great improvement, and protection in wet weather,

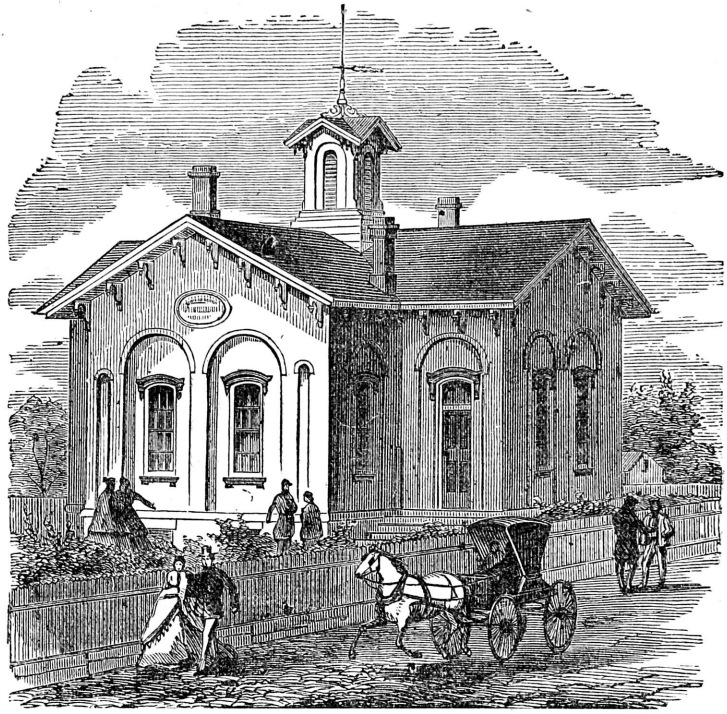


Fig. 99.—Design No. 24.—Adapted, with modification, to Figs. 96 and 98.

This Design is somewhat similar, in form and outline, to that shown in *Figs.* 90 and 95. It is given as another example of a neat village school-house.

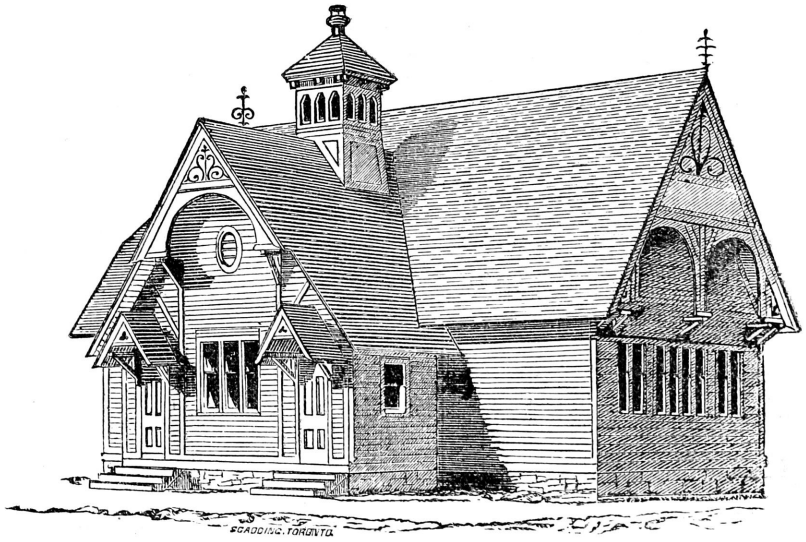


Fig. 100.—Design No. 25.—Adapted, with modification, to Fig. 96.

This Design (No. 25) is another of those plans adopted by New Brunswick Provincial Board of Education. It is a neat and tasteful structure.

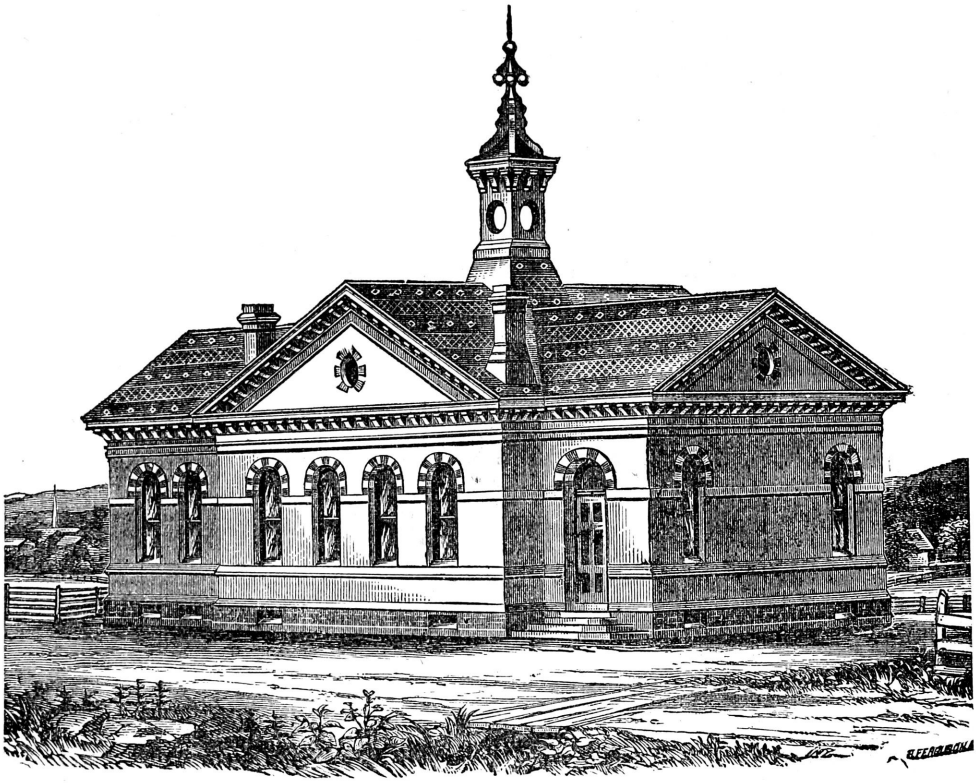


Fig. 101.—Design No. 26.—Adapted to Fig. 102.

Design No. 26 represents a very handsome town or village school-house, of

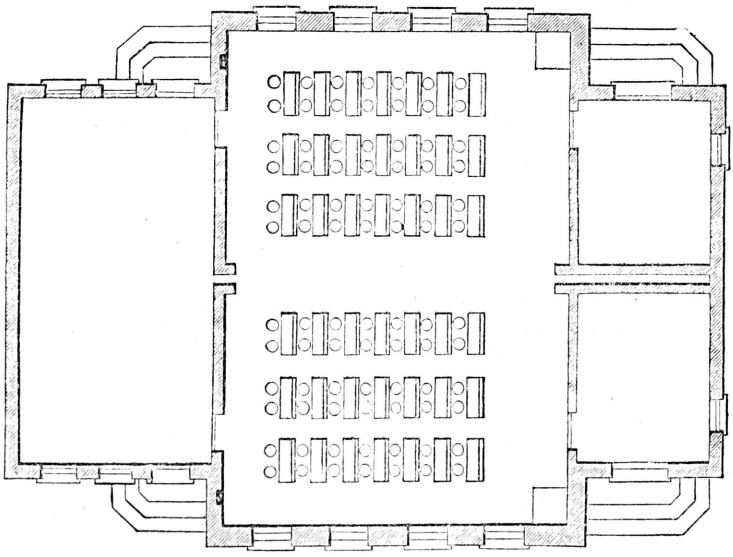


Fig. 102.—Ground Plan, adapted to Fig. 101.

tasteful proportions and finish. It may be built of brick or stone. In either

case the door and window caps should be of a different coloured stone or brick alternately (as the case may be). The roof of the main building (running lengthways) is at right angles to that of the transverse section which carries the cupola. There are four gables, and a neat and ornamental cornice runs across them, as well as up to the apex of the roof.

The ground plan (*Fig.* 102) is arranged so as to provide either for one long school-room or two smaller recitation rooms, which can be separated by two sliding doors, for which provision, it will be seen, is made in the wall of the two entry ways (or coat and cloak room). The room in the rear can either be converted into a small recitation or gallery room.

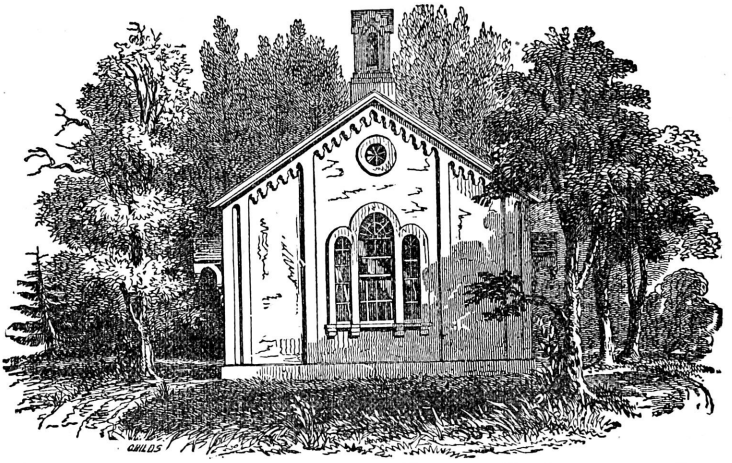


Fig. 103.—Design No. 27.—End Perspective of a School-House with Two Departments. (See *Fig.* 104.)

This engraving represents the end elevation of a primary and secondary school-

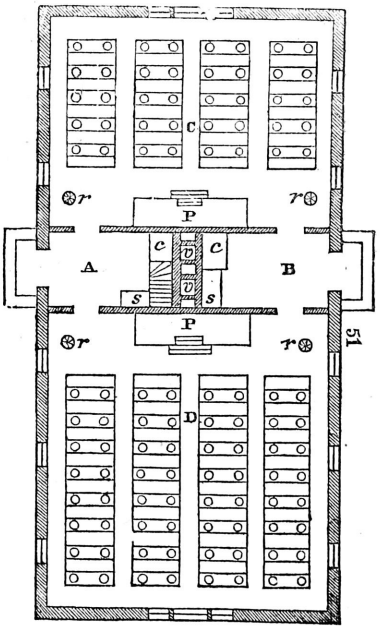


Fig. 105.—Ground Plan adapted to Fig. 103.



Fig. 104.—Design for Window.

Note. — Instead of the triplet window shown in Design No. 27, a modification like that shown in *Fig.* 104 can be adopted.

REFERENCES.

AB. Boys' and girls' entries.	*cc.* Book closets.
C. Primary department.	*rr.* Registers for hot air.
D. Secondary department.	*ss.* Lavatories.
PP. Platforms for teachers.	*vv.* Flues for ventilation.

house, or a school with two departments under two teachers, for 130 pupils

The school-house stands back from the highway, on an elevated site—as school-house sites ought always to be—and for neatness of design and convenience of arrangement is not surpassed, we believe, by any similar structure in Canada. It has two departments on the same floor. The style of the building is very neat and tasteful, and has something of the Tuscan cast in it. The entrance doors of the boys and girls are respectively on either side of the building. There are five prettily shaped arched windows in either side—three on one side and two on the other side of the entrance door. Their size and appearance are the same as that of the centre either side. The handsome characteristic projection over each door may be seen in the engraving. The belfry and double chimney issuing from the centre of the roof are neatly designed. The triple window inserted in either end of the building give it a scholastic appearance. The gable is slightly ornamented, and is furnished with a circular ventilating window, as seen in the engraving. The trees and shrubbery around the school-house give it an air of cheerfulness and repose—so essential in contributing to the health, the comfort, and the success of the pupils and masters.

The foregoing ground plan of the school-house (*Fig.* 103) is designated to afford accommodation for a primary and secondary department, or boys' and girls' school, in the same building. C is the primary, and D the secondary depart-

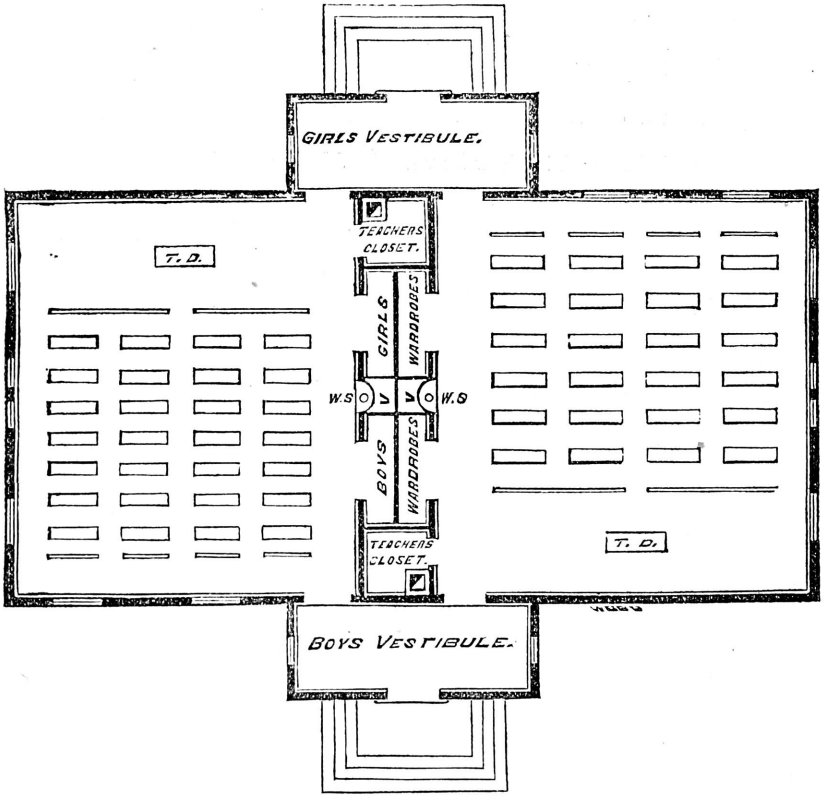


Fig. 106.—Ground Plan, adapted, with modifications, to Fig. 103.

ment. The room C is 25 feet wide by 25 long, with desks and seats attached for 60 pupils. The room D has desks and seats for 70 pupils. The seats for the younger pupils are placed immediately in front of the teachers' desks, and are slightly lower, in their elevation above the floor, than those in the rear of the school-room.

This plan (*Fig.* 106) is an enlarged adaptation to Design No. 27. It is differently arranged from the one shown in *Fig.* 105.

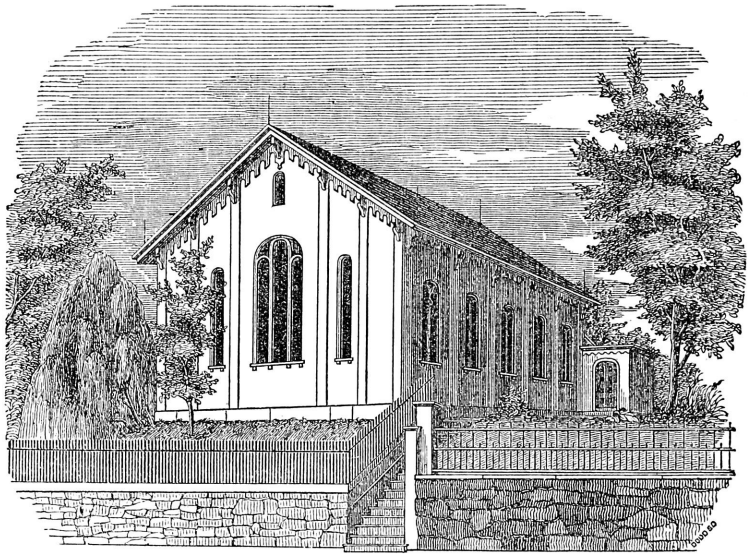


Fig. 107.—Design No. 28.—For a Primary and Secondary School-House.

This Design is inserted to show how a school-house can be erected on a sloping bank in a city or town.

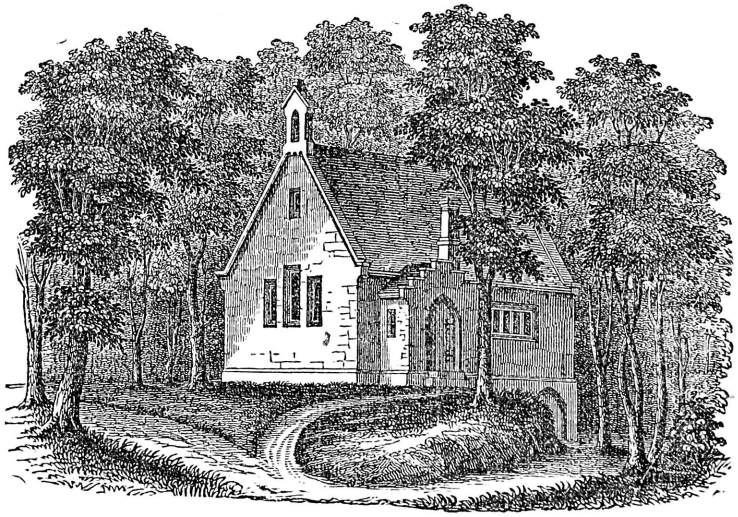


Fig. 108.—Design No. 29.—End and Side Perspective of a Primary School, with Grounds.

Fig. 108 represents a village school-house. It is situated in a grove, on a little knoll, which admits of a basement room in the rear, designed for a library or other room. This specimen of Elizabethan architecture is not common in Canada. In many neighbourhoods it is a matter of economy to build of stone, and where this is the case the style of architecture should be adapted to the material.

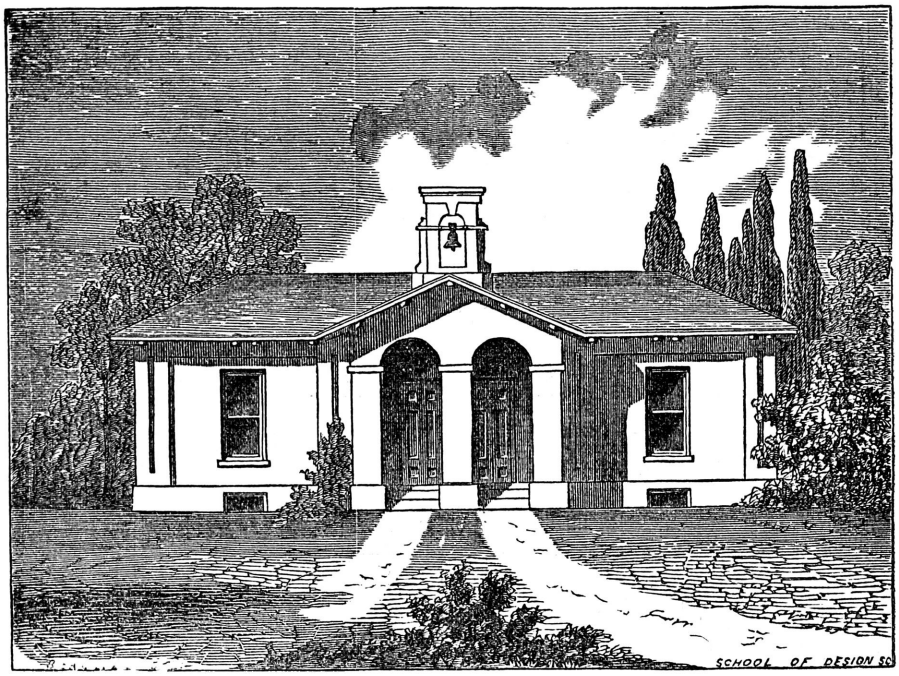


Fig. 109.—Design No. 30.—For a Boys' and Girls' School, adapted to Fig. 110.

This is a complete as well as useful building of its class. The double entrances

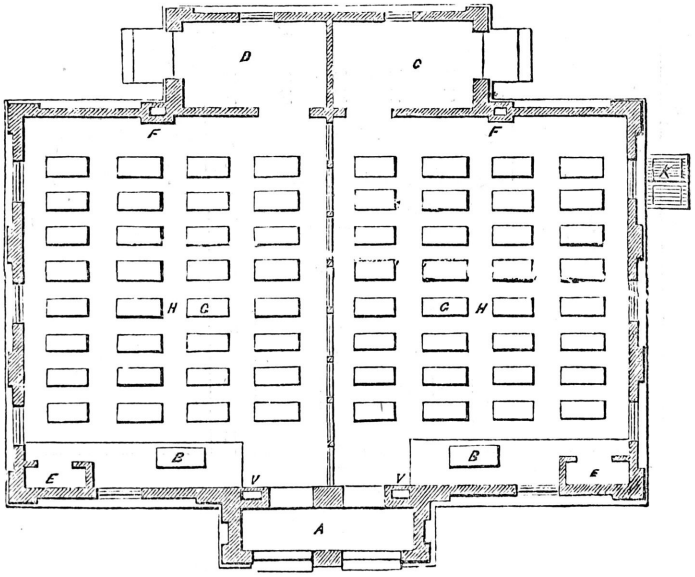


Fig. 110.—Ground Plan of Design No. 30.

A. Outside porch and entrance for teachers.
BB. Teachers' desks and platforms.
CD. Boys' and girls' entrance and clothes room.
EE. Closets for books, &c.
FF. Smoke flues.
GG. Seats for two pupils each.
H. Passages two feet wide.
K. Entrance to the cellar.
VV. Ventilating flues.

to each room—one in front and one in rear—will be found very convenient. If

the apartments designated as "boys'" and "girls'" clothes rooms (*Fig.* 110) be used for recitation purposes, their entire privacy may be effected by using the front entrances for ordinary purposes during school hours. There is also here a long platform, which, if placed on the opposite side of the room where there are no windows, will both give greater black-board space and afford a safer and more pleasant light to the pupils' eyes, without any increase of cost. The teachers' entrances are shown in the front perspective (*Fig.* 109.) The bell is an indispensable requisite to the school, and with its neat belfry forms quite an ornament to this building.

CHAPTER XV.

PLANS FOR CITY, TOWN AND VILLAGE PUBLIC AND HIGH SCHOOLS.

1.—Those with Two Storeys.

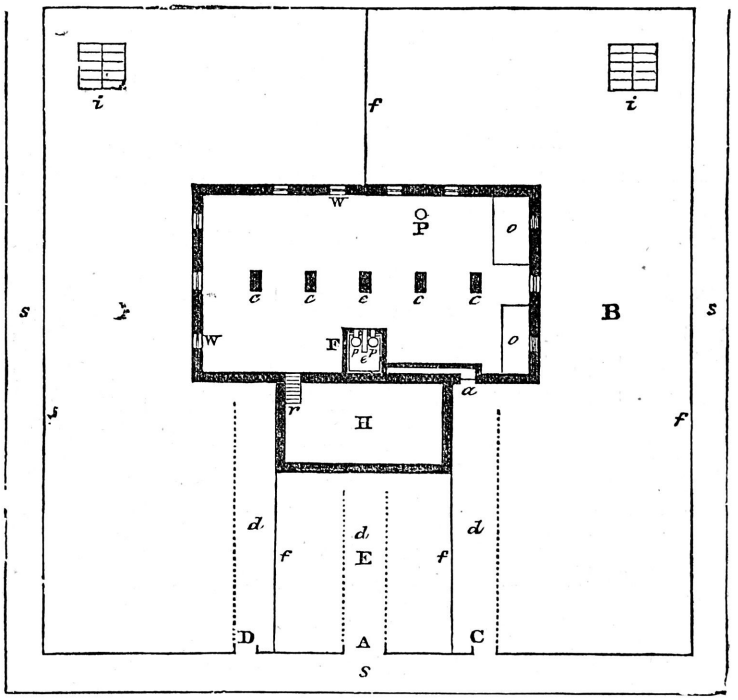


Fig. 111.—Block Plan of Grounds and School-House for a Public or High School.

Note.—From the remarks which we have made in section 6, on pages 64 and 65 of this book, it will be seen that school-houses of more than one storey are not desirable for girls. In cities and towns, where land is expensive, it is scarcely possible to avoid having them. In constructings the stairways in such buildings, care should be taken to lessen the evils by following, as closely as possible, the suggestions made on the subject in connection with *Fig.* 115, on page 120. Where school-houses of more than one storey are erected, the ground floor should *invariably* be reserved for the girls' school (as in Design No. 35, page 127). On this point we lay considerable stress, for the reasons given on page 64.

The grounds around the school-house, as given in this block plan, are enclosed, and divided into two separate yards and a lawn by substantial close board fences, *f*,*f*,*f*,*f*,*f* (*Fig.* 111), neatly made, and painted white. The boys' play-ground, B, and the girls', G, are large; the lawn, E, is designed to be planted with trees and shrubbery. The gravelled sidewalks, *s*, *s*, *s*, running on three sides of the lot, should be shaded by rows of elms, maples, or other trees, set near the curb-stones (see Design No. 31). The gates, A, C, D, and the gravelled walks, *d*, *d*, *d*, lead to the front and the two side doors of the school-house. The out-buildings, *i*, *i*, should be arranged with a large number of separate apartments on both sides, and well ventilated. Each should have a door, and the building itself surrounded with evergreens.

In the block plan of the projection, H, the stairway, *r*, leads to the cellar, which should be 8 feet in the clear, and extend under the whole of the main building. The cellar should be well lighed, having eight windows, *w*, *w*. The windows can be hung on pulleys or with hinges on the upper side, fastened with hooks and staples at the lower edge. This arrangement will keep the cellars well ventilated at all seasons. The openings for the admission of fuel into the boxes, *o*, *o*, should be furnished with sheet-iron shutters, fastening on the inside. The school-house is required to be provided with a supply of good water, obtained from a well outside the building. The water can then be brought in by a pump, P.

The horizontal section of the furnace, F, merely shows the block plan. (See *a*, in transverse section of the house, *Fig.* 115.) The cold air is designed to pass through *a* (block plan) to the air-chamber, where it can be warmed by the fires in *p*, *p*—two cast-iron cylinders, 14 inches in diameter. The evaporator, *e*, is

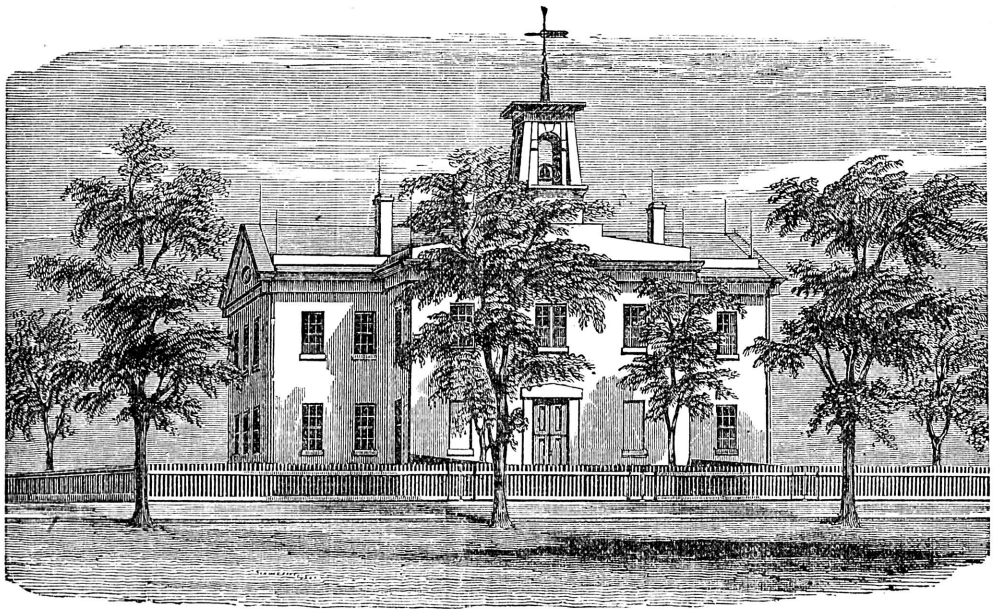


Fig. 112.—Design No. 31.—Front Perspective, with Trees, etc., adapted to Fig. 113.

designed to hold about fifteen gallons of water, to be kept in a state of rapid evaporation, thus supplying the air-chamber with an abundance of moisture. In the plan and construction of the various parts of the furnace, special pains should be taken to remove all danger of fire. The furnace should be covered with stone, thickly coated with mortar or dead ashes, and the under side of the floor above lathed and plastered, not only above the furnace, but at least ten feet from it in every direction.

The cellar walls and the stone piers, *c*, *c*, *c*, *c*, *c*, should be well pointed, and the whole inside, including the wood work overhead, neatly whitewashed, so as to give the apartment a neat and pleasant appearance, in case it should be used as a play-room in wet weather.

This design is for a school-house of two storeys in height, having two school-rooms on the ground floor, and one large one in the second storey, besides a large cellar for a furnace, and play-room in wet weather in case there should be no play-shed on the premises. The grounds should be planted with trees, and the building itself adorned with a belfry, and protected with lightning rods, as shown in the perspective.

In the ground plan (*Fig.* 113) there are three entrances to the building: the front, A, for teachers and visitors, and the two side doors, B for boys, and G for girls, leading into the entries, F, C, C. The front is a large double door, as

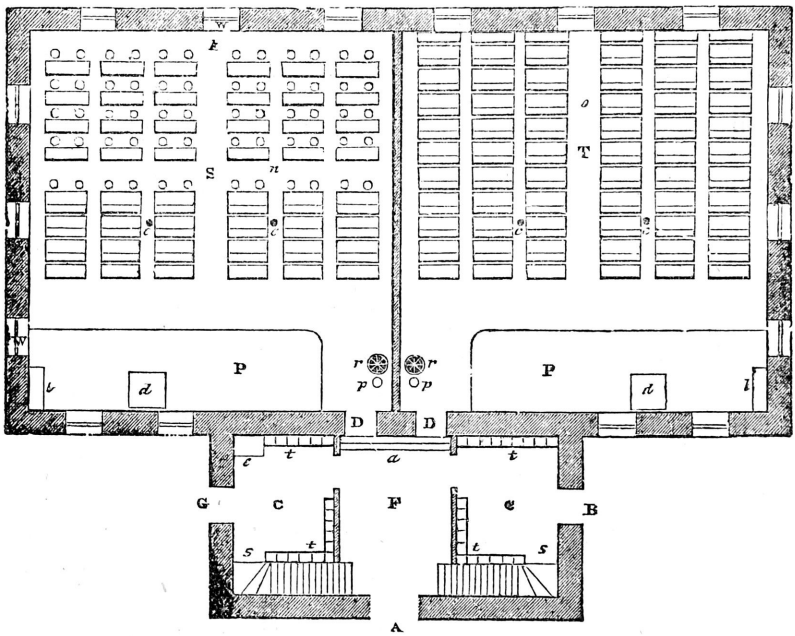


Fig. 113.—Ground Plan of Girls' School, adapted to Design No. 31.

shown. At all the outside doors there should be at least four scrapers at each door. Pupils belonging to the schools on the ground floor pass in through the doors, B, G, into the rooms C, C, where they can leave their caps, bonnets, &c. There are also stands in these rooms at *t*, *t*, *t*, *t*, for umbrellas. Passing from C, C, into the central hall, F, the pupils ascend two steps at *a*, through the doors, D, D, into the school-rooms, S and T.

The seats and desks in the rooms, T and S, will be described at length hereafter. A section of these seats and desks may be seen in the transverse section (*Fig.* 115). The small iron posts, *c*, *c*, *c*, *c* (about $2\frac{1}{2}$ inches in diameter), are designed to support the floor above, and are placed, as shown, against the ends of the seats, so as not to obstruct the passages at all. On the platforms, P, P, are shown the tables for the teachers, and the closets, *l*, *l*, for brushes, &c. Blackboards, painted upon the walls, can extend from the doors, D, D, to the windows. They should have the lines of a stave painted on one end, to aid in giving instruction in vocal music.

The rooms might be warmed by heated air, admitted through registers, *r*, *r* (*Figs.* 113 and 114), from the furnace below, *a* (*Fig.* 115), from which the tin

pipes *p, p* (*Fig.* 113), and *e, e* (*Fig.* 115), can convey the air to the school-room in the second storey. Each room should be provided with two ventilators (one above and one below), opening into flues leading into the attic, from which the impure air can escape at the circular windows in the gables, as shown in the Design, *Fig.* 112.

The school-room in the second storey (*Fig.* 114) is large, and with a coved or arched ceiling (see transverse section, *Fig.* 115). Two ventilators should be placed in the crown of the arch, about 20 feet apart.

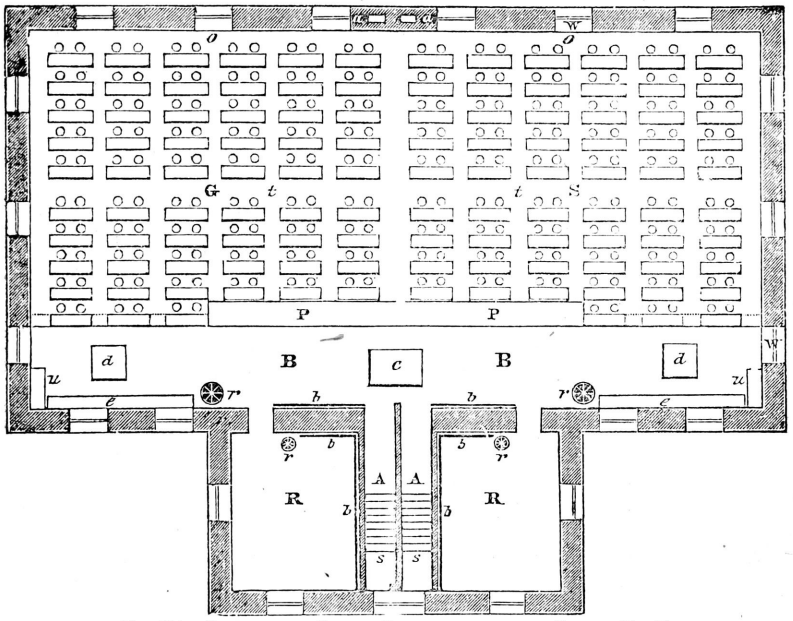


Fig. 114.—PLAN OF THE SECOND STOREY, ADAPTED TO DESIGN No. 31.

The entrances to the second storey school-room are by two short flights of stairs on a side; from the lower entries to *s, s* (*Fig.* 114), and thence to A, A, at the top of the stairs to the doors opening into the school-room. (See also *Fig.* 115.)

The master's table, *c*, as well as the tables *d, d*, for the assistants, are designed to be moveable. The large area, B, B, should be 14 inches above the floor of the room; *u, u*, are large closets at the ends, filled up with shelves, &c., for the use of the teachers.

The school-room and the recitation rooms, R, R, may be warmed by heated air, admitted at the registers, *r, r, r, r, r*, all of which are to be connected with the furnace in the cellar, by large tin pipes or conductors.

The black-boards, painted upon the hard finished walls, are indicated by the lines, *b, b*, in the recitation rooms, and by *b, b*, along the walls behind the master's table, extending on each side to the windows beyond, *e, e*. The long benches, *e, e*, are used for seating *temporarily* new pupils on their entering school, until the master can assign them regular seats; also, for seating visitors at the quarterly examinations. The broad step, P, P, may be used for some class exercise on the black-boards. The passage, *t, t*, running the whole length of the room, affords great facility in the movements of pupils to and from the recitations and other class exercises. The master's class can recite in the space *o, o*, at the back of the room. The windows, W, W, should be hung with weights, and furnished with inside blinds.

Fig. 115 exhibits a *section* of the building as if it were cut through the centre. It shows, in an *end view*, the projection, belfry, rooms, seats, desks and cellar.

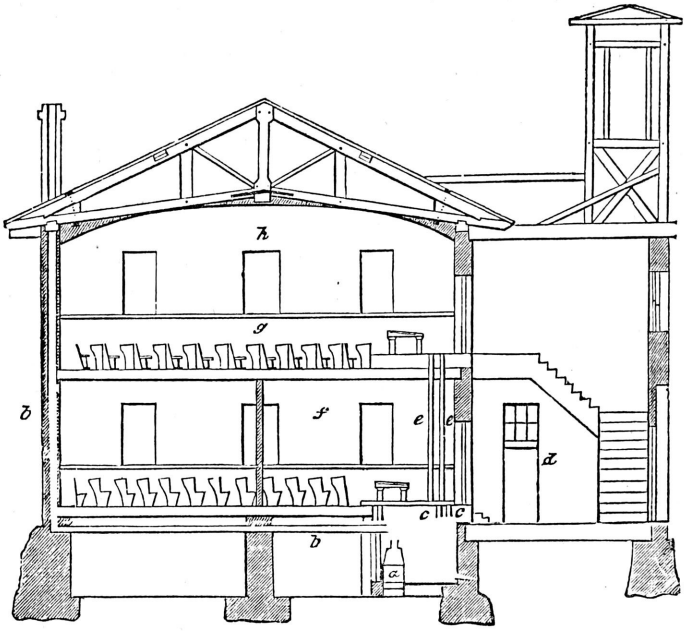
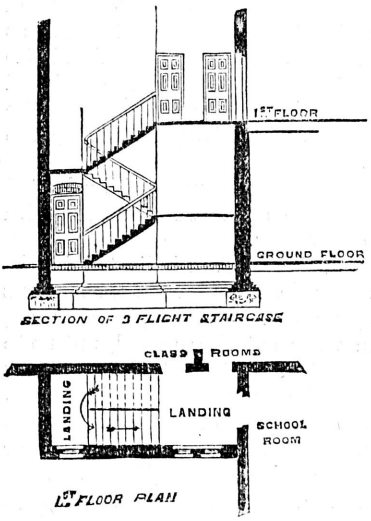


Fig. 115.—Transverse Section of Design No. 31, showing structure of Stairway.

An imperfect view of the warming apparatus is presented, giving merely an outline of the plan of its construction. The smoke pipe, connected with *a*, the heater, passes off in the direction of *b*, *b*, to the chimney. The short tin pipes, *c*, *c*, conduct the warm air into the lower rooms; and the long ones, *e*, *e*, convey it to the rooms in the second storey. On each side of the projection, over the door, *d*, is a window, lighting the outside entry, and also the middle entry by another window over the inside door. The end view of the seats and desks do not represent the different sizes very accurately, but sufficiently so to give a correct idea of the general plan.



Figs. 116 & 117.—Section and Plan of Stairways.

In the construction of school-houses of more than one storey, great care should be taken to make the staircases leading to each storey easy and roomy, so that in the event of a panic there should be abundance of room for egress. *Figs.* 115, 116 and 117 are designed to illustrate different forms of the "short flight" plan—the only kind of stairway suited for schools.

Note.—As the staircases are to be used by children, the "risers" of the steps should not exceed six inches. The steps themselves should be at least a foot wide. No "winders" should be used under any circumstances. The landings should be wide. Both sides of each flight should be provided with a wooden hand-rail. The stairs themselves should not be less than four feet wide. "Short flights," "low risers," "broad steps," and "double staircases," to each upper floor, are indispensable in the construction of every school-house of more than one storey in height.

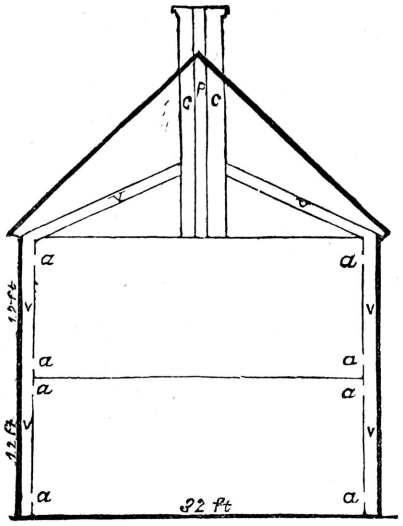


Fig. 118.—Section of a Two-storey House, showing Plan of Ventilation.

Fig. 118 illustrates, in a modified form, the mode of ventilating a two-storey school-house, and is inserted to call attention to the subject. Fuller particulars (with numerous illustrations on the subject) will be found in chapter ix, pages 49-58. Too much attention cannot be paid to this important subject, for the reasons given on the pages indicated, which are full of warning. School trustees and others, having to do with the erection of school-houses, should not, under any circumstances, overlook or neglect these warnings.

REFERENCES.

aa. Openings in wall of school-room.
cc. Vertical air shafts.
p. Chimney shaft.
vv. Ventilating shaft.

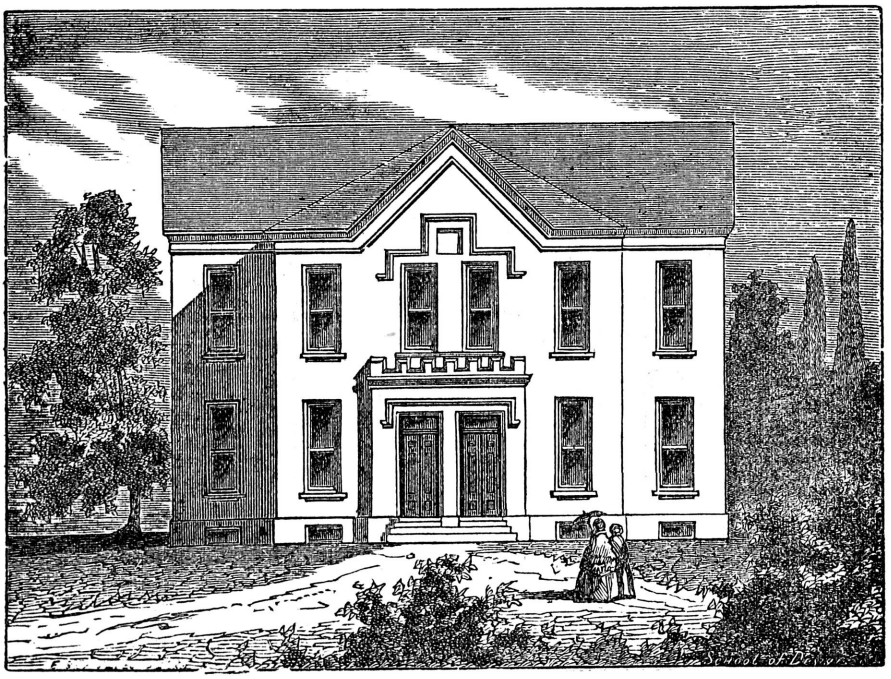
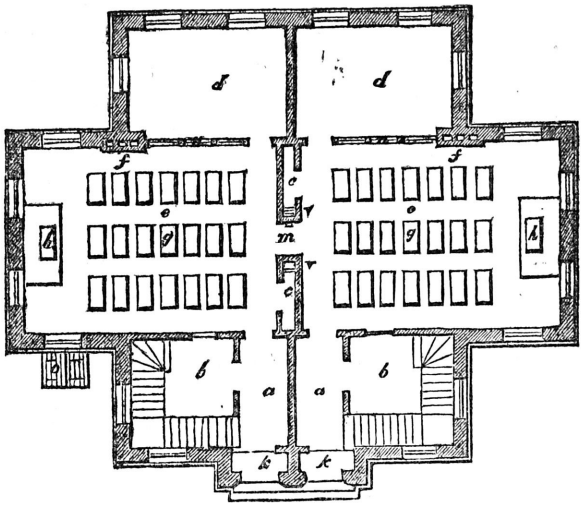


Fig. 119.—Design No. 32.—Front Perspective (with Grounds) of a House adapted to Fig. 120.

Fig. 119 furnishes a design of a neat and substantial edifice. The style is plain and inexpensive. The chief objection to it is, that the entrances for boys and girls are too close together. The arrangement of the school-room plans is very good, and can be made to comfortably accommodate from two hundred to two hundred and fifty pupils. This number will fully employ six teachers—one master and five assistants for the whole building; or, one master and two assistants for each floor. The communicating doors between the main rooms,



REFERENCES.

aa. Boys' and girls' halls.
bb. Cap and cloak rooms.
cc. Closets for books, &c.
dd. Class or gallery rooms.
ee. Passages, 2 and 3 feet wide.
ff. Flues for warm air, &c.
gg. Seats for two pupils each.
hh. Teacher's desks.
kk. Boys' and girls' porches.
m. Passage for teachers.
nn. Glass partitions.
o. Cellar door.
vv. Ventilating flues.

Fig. 120.—Ground Plan and Plan of First Floor, adapted to Fig. 119, or modified, to Fig. 121.

and the glass partitions between the main and class-rooms, admirably favour this arrangement. While two of the teachers on each floor are conducting recitations

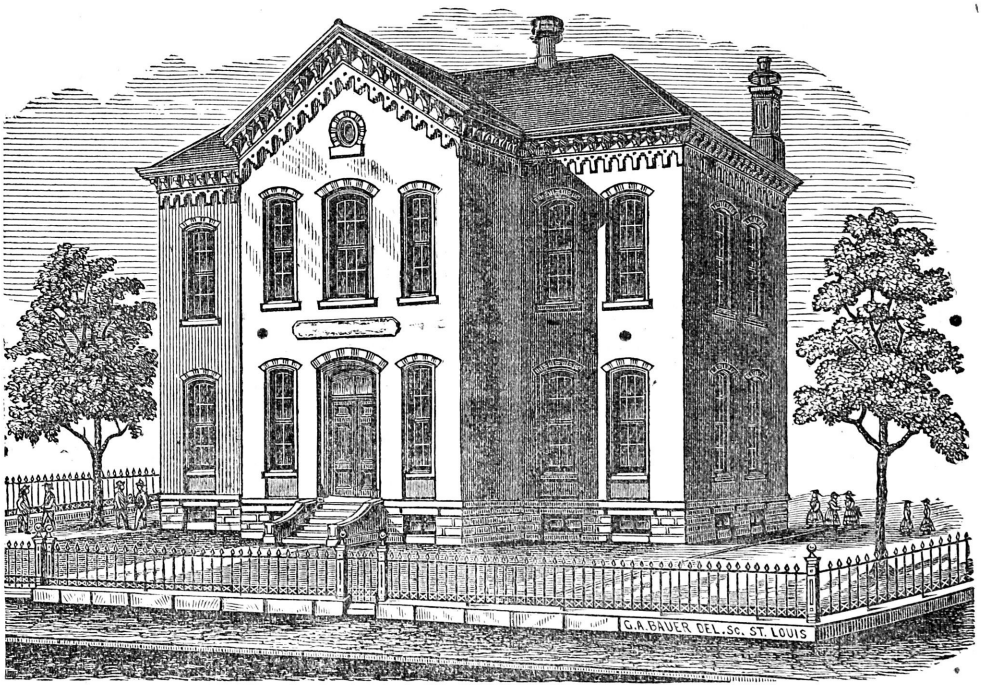


Fig. 121.—Design No. 33.—Perspective View of School-House, adapted to Figs. 120, 122 and 123.

in the class-rooms, the third can preserve order and promote the studies in the two main rooms, which will be, at the same time, fully in view of the teachers in the class-rooms.

Note.—In schools of this rank the largest provision of black-board should be made. Five feet in height of the partitions between all the class-rooms, commencing two feet from the floor, and the whole length of the partitions, should be devoted to this purpose. The wall

or partition at the back of the book closets, and that opposite the stairs, in each main room, as shown on the ground plans of both storeys, should also have the same height of blackboard surface. The material in this building may be stone or brick; and, for the arrangements of the interior, reference is made to the plans and explanations of the same.

Fig. 121 represents a four-room building, adapted for a village or town school. The central part of the building projects boldly forward, so as to give room for a double flight of stairs, arranged symmetrically, and, at the same time, to serve as vestibule, hall, or lobby, as well on first as on the second floor. The exterior is pleasing, and its construction, though simple, can be complete and substantial. The first floor is reached by steps at a height of four feet above the ground line.

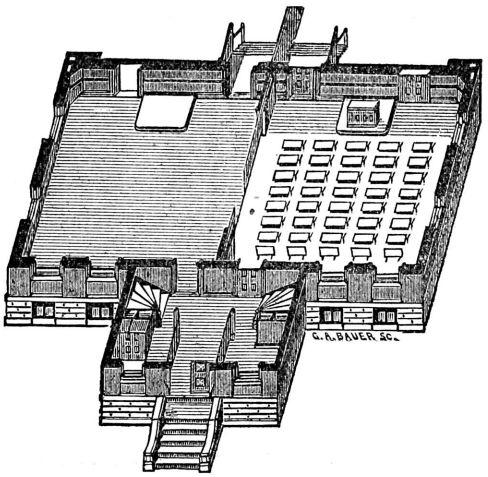


Fig. 122.—Bird's-eye View of the Ground Floor, adapted to Fig. 121.

The school-house proper embraces on each floor two adjoining rooms, separated by large sliding doors, which enables a joining of the two classes in exercises which may be common to both. Seats for sixty-four pupils can be placed in each room, leaving a liberal amount of space for aisles between and around the rows of seats.

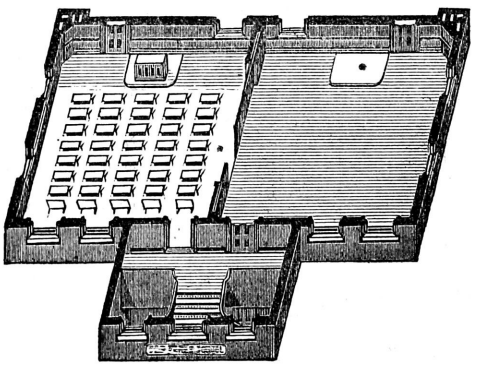


Fig. 123.—Bird's-eye View of the First Storey, adapted to Fig. 121.

Note.—The height of storeys (as shown in the engraving) in the clear is fifteen feet. The masonry, from the ground to the height of the first floor, is, as shown, faced with rusticated rangework. The walls should be of the best brickwork, and respectively two bricks and one and one-half brick thick in the first and second storeys.

The two bird's-eye views of the ground floor and first storey of this building furnish an admirable illustration to the spectator of the appearance of the school-

rooms in each flat of the building, and realize to the eye what they are like in reality. One can see at a glance the position of the desks, seats, presses, stairs, &c., of each room and passage. They will thus enable the trustees to see where these things can be placed, and will aid their imagination in determining beforehand their appearance in the proposed school building.

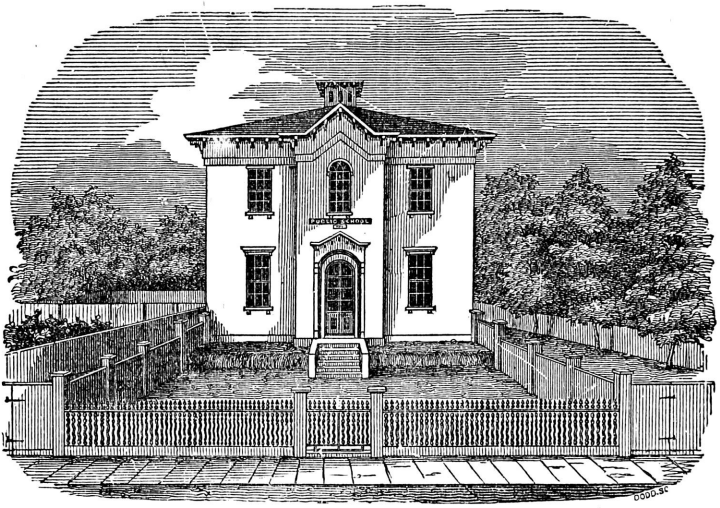
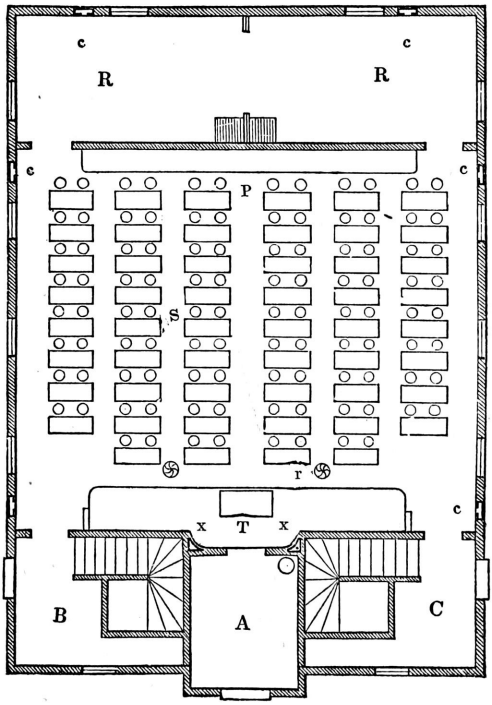


Fig. 124.—Design No. 34.—Perspective View, with Fence, Grounds, &c., adapted to Figs. 125 and 126.

The perspective of Design No. 34 is pleasing in its general effect. The engraving represents a school-house set back (as it ought always to be) from the road,



REFERENCES.

A. Front entrance for masters, &c.

B. Boys' entrance, with mats, scrapers, hooks for clothes, &c.

C. Girls' entrance, with do. do.

RR. Recitation rooms, or galleries.

P. Platform for recitation, with a blackboard in the rear.

S. Passages between seats.

T. Teacher's platform.

cc. Flues for ventilation in the outerwall.

xx. Flues for ventilation.

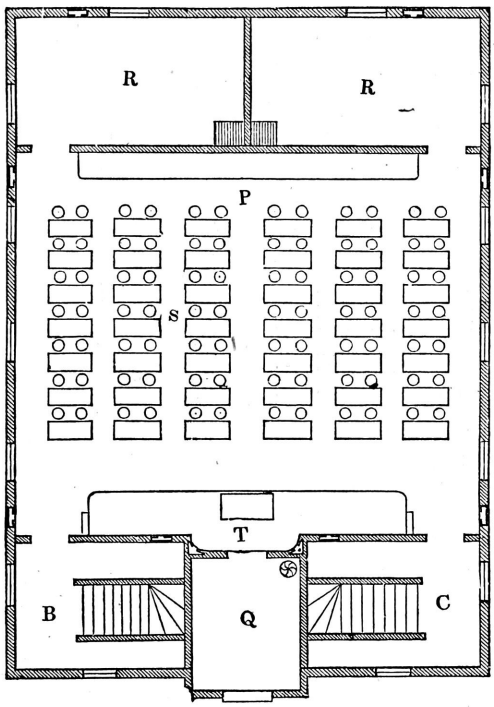
r. Hot air registers.

Note.—The room, RR, in the rear can be divided by a sliding door in the centre, as indicated in in the plan (*Fig.* 125).

Fig. 125.—Ground Plan of Girls' Department, adapted to Fig. 124.

with grounds and fence in front, and trees and shrubbery in the rear. The entrances for boys and girls are at the sides, as will be seen in the ground plan (*Fig.* 125).

This ground plan (*Fig.* 125) will be found well adapted to the purposes of a girls' department of town school. The recitation or gallery rooms (RR) will be found a great convenience.



REFERENCES.

B. Teacher's landing.

C. Boys' landing.

P. Platform for recitation, with blackboard.

Q. Library and apparatus.

RR. Recitation, or gallery, rooms.

S. Passages between seats.

T. Teacher's platform.

NOTE.—The rooms, RR (*Fig.* 126), can be separated by a folding door, if desirable, as shown in the plan given in *Fig.* 125.

Fig. 126.—PLAN OF SECOND FLOOR, ADAPTED TO FIG. 124.

Fig. 126 is the counterpart of the ground floor, and will be found equally well adapted for the boys' department of a town school.

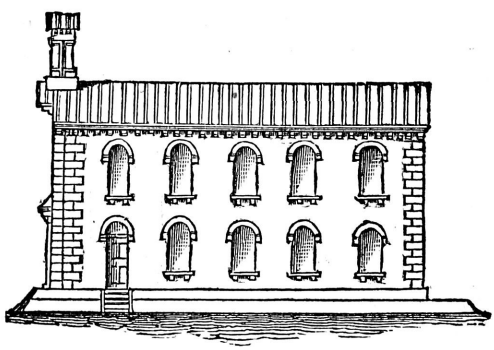


Fig. 127.—DESIGN NO. 35.—SIDE ELEVATION OF A TWO-STOREY SCHOOL-HOUSE, ADAPTED TO FIG. 123.

(On a reduced scale.)

Fig. 127 represents a design for a handsome public or high school-house. It is a very chaste and ornamental building, and in excellent keeping with the

correct proportions requisite in a school-house of this description. The corners of the building may be either in hewn stone, or red or white brick.

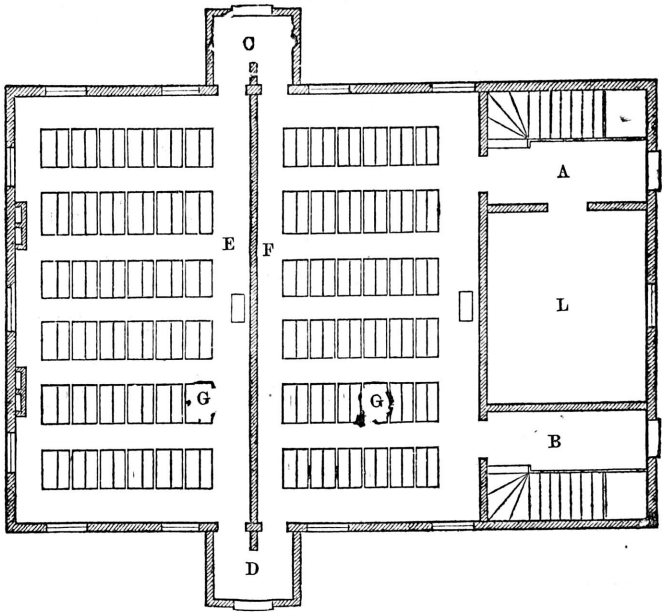


Fig. 128.—Ground Plan of Girls' Department, adapted to Fig. 127.

AB. Staircases for boys to secondary school, U.
CD. Entrances for girls to primary, E, and intermediate school, F.
E. Primary school-room.
F. Intermediate school-room.
G. Seat and desk attached, for two pupils.
L. Gallery room.

Fig. 128 represents the ground plan of a double school-room for a primary and secondary girls' school. The division will be found desirable.

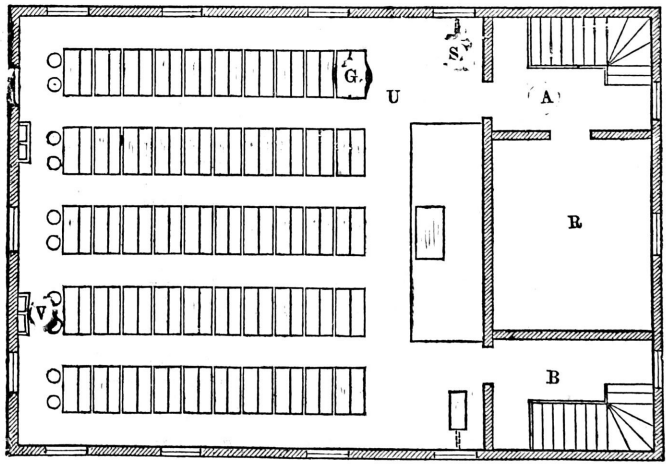


Fig. 129.—Plan of First Floor, for Boys, adapted to Fig. 127.

AB. Boys' landings to school-room.
G. Desk and seat for two pupils.
R. Gallery room.
S. Stove.
U. School-room.
V. Flue for ventilation.

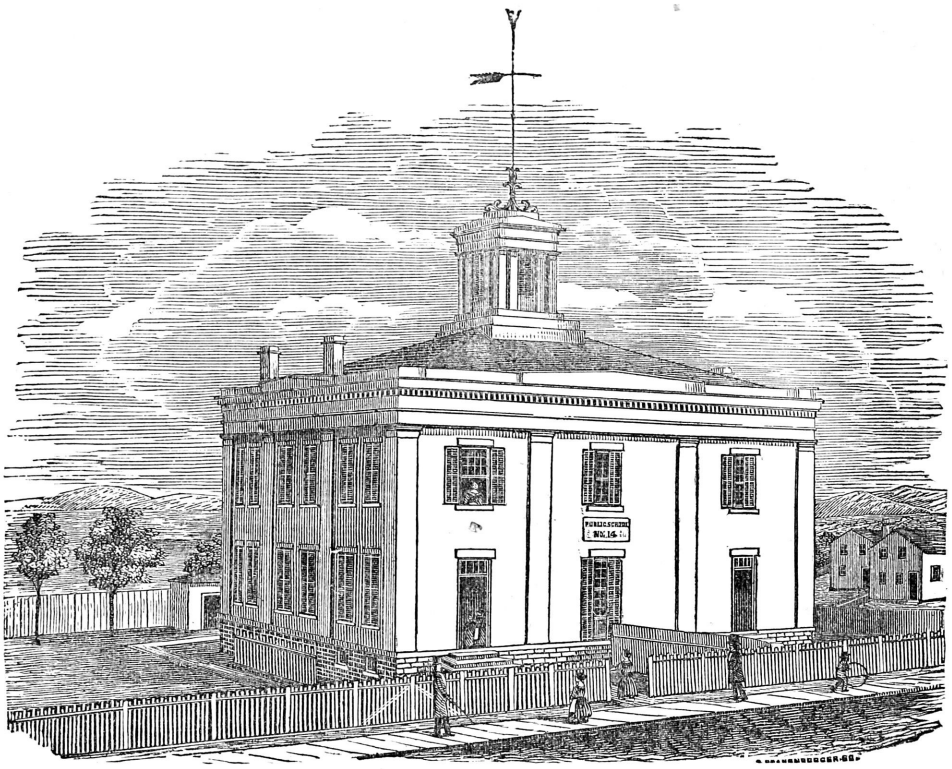
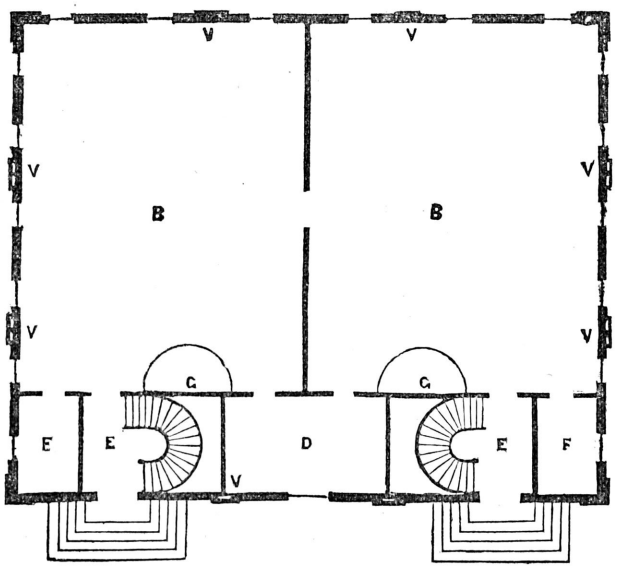


Fig 130.—Design No. 36.—Adapted to Figs. 131 and 132.

Design No. 36 is a very plain but compact school-house, adapted to both boys



REFERENCES.

B. Girls' primary and intermediate rooms.

D. Gallery room.

EE. Boys' & girls' entrances

FF. Teachers' rooms.

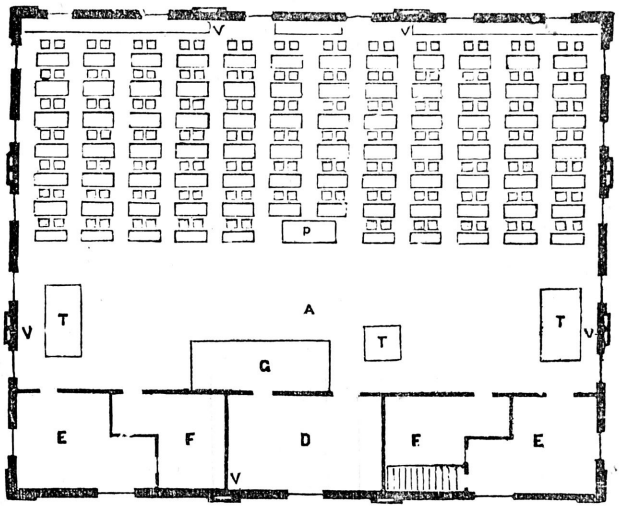
GG. Teachers' desks.

VV. Ventilating registers.

Fig. 131.—Ground Floor, adapted to Fig. 130.

and girls. The ground floor should be appropriated to the girls' school, and the first, or upper floor, to boys. (See suggestions in section 6, page 64.)

This ground plan (*Fig.* 131) is adapted to Design No. 36 (*Fig.* 130), and suited to the girls' department of a public or high school. (See section 6, chapter ix, page 64.)



REFERENCES.

A. Boys' principal school-room.

D. Library or teacher's room.

EE. Class-rooms.

FF. Lobbies.

T. Drawing tables.

G. Teacher's desk.

P. Piano-forte.

VV. Ventilating registers.

Fig. 132.—First Floor, adapted to Fig. 130.

The first floor (*Fig.* 132) is adapted to the boys' department of a public or high school.

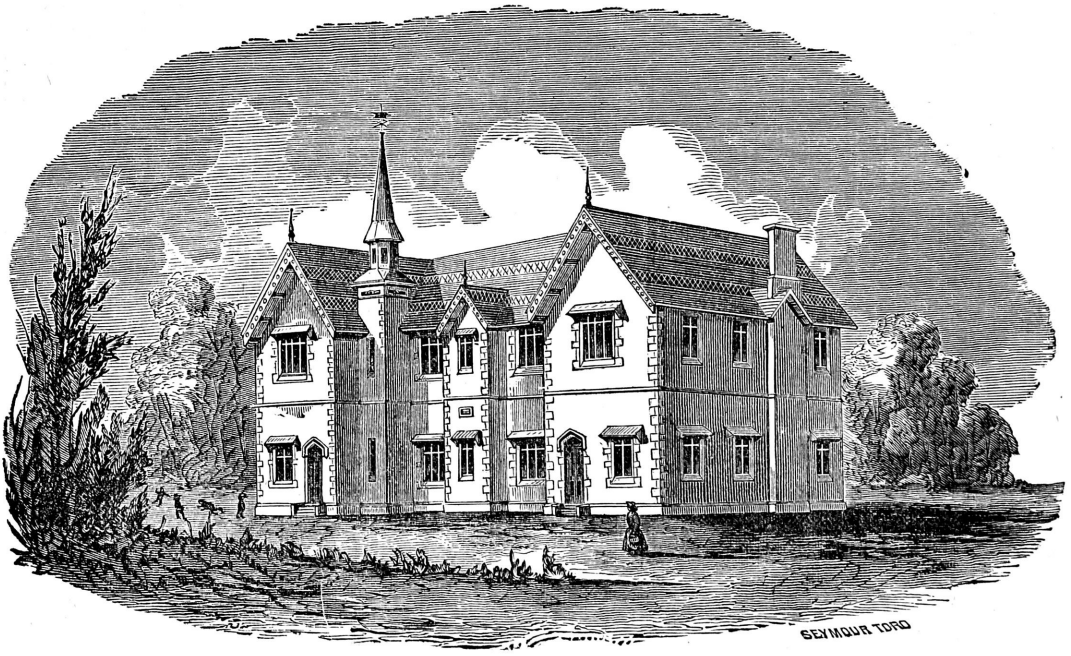
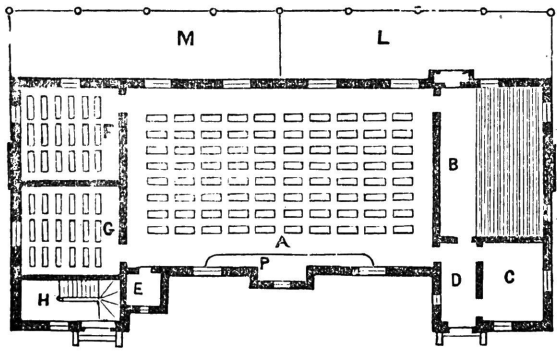


Fig. 133.—Design No. 37.—Adapted to Figs. 134 and 135.

Design No. 37 is suitable for a brick or stone school-house. The style is old English. If the material be red brick, the angles and window and door openings

can be finished with white brick or Ohio sand stone; if in rough stone, the dressings may be in Ohio sand stone or other dressed stone. In this Design it will be seen that the roof overhangs, thus affording protection for the walls. The windows are covered with hoods, which shade them, making the light free from the glare of sunshine.

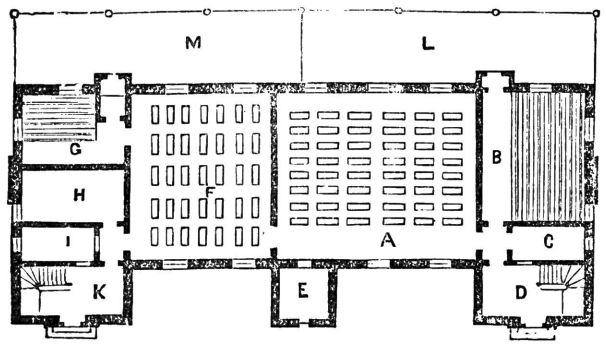


REFERENCES.

A. Principal school-room.
B. Gallery room, for girls.
C. Girls' cloak room.
D. Girls' entrance.
E. Library room.
FG. Separate class-rooms.
H. Stairway to boys' school.
LM. Covered portico.
P. Teacher's platform.

Fig. 134.—Ground Plan (Girls' School), adapted to Fig. 133.

In the ground plan (*Fig.* 134), the suggestions made in section 6, of chapter xi, on page 64, can be carried out—the ground floor being devoted to the girls' school, and the upper floor to the boys. The attention of trustees and others is specially called to these suggestions. The arrangements on this ground floor are good, and the space is well and wisely economized.



REFERENCES.

A. Principal school-room.
B. Gallery for boys.
C. Cap room.
D. Teacher's staircase.
E. Book or library room.
F. Assistant's class-room.
G. Small gallery room.
H. Teacher's room.
I. Cap room.
K. Staircase.
ML. Covered veranda.

Fig. 135.—First Floor, (Boys' School) adapted to Fig. 133.

The first floor in this plan is well arranged for boys of various ages. The two gallery rooms (B and G) will be found of great service in teaching the younger children, and in effectually utilizing the services of assistant teachers and monitors.

Note.—The school-house, of which *Figs.* 133, 134 and 135 are illustrations, was erected at Simcoe, Norfolk County, in 1858, from designs by Messrs. Messer & Jones, Toronto.

This Design (*Fig.* 136) represents what may be considered as an old-fashioned style of school-house. It is, however, compact, and comparatively inexpensive. The four entrances provided are most necessary in so large a building. The arrangements for ventilation are good. The Designs shown in *Figs.* 84, 86 and 88 can, with advantage, be substituted for this Design. (See pages 102-104.)

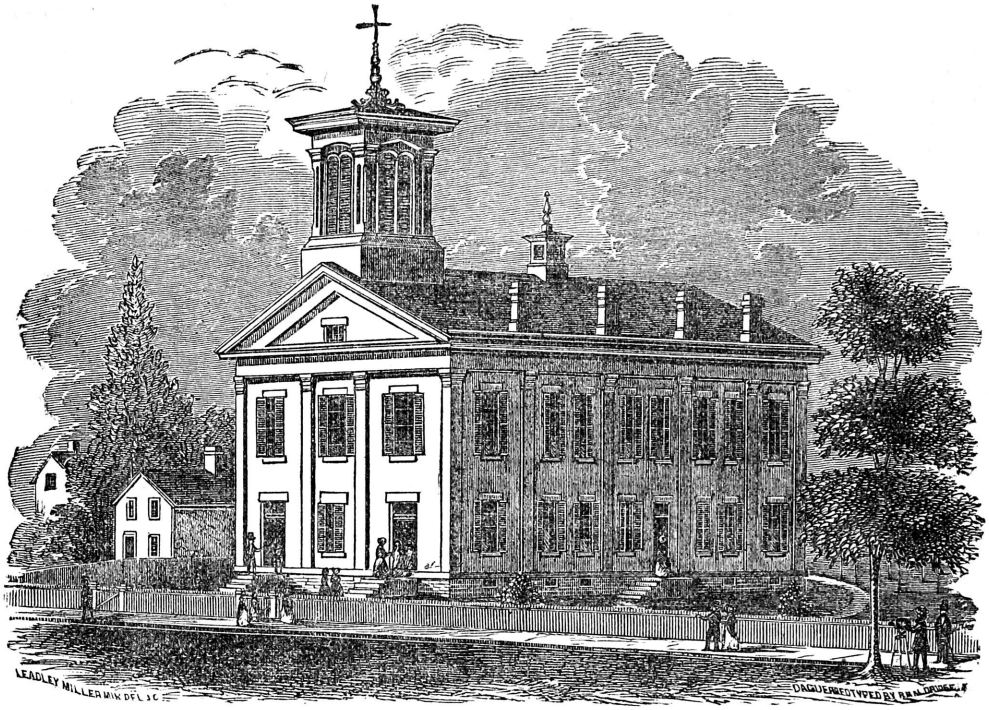
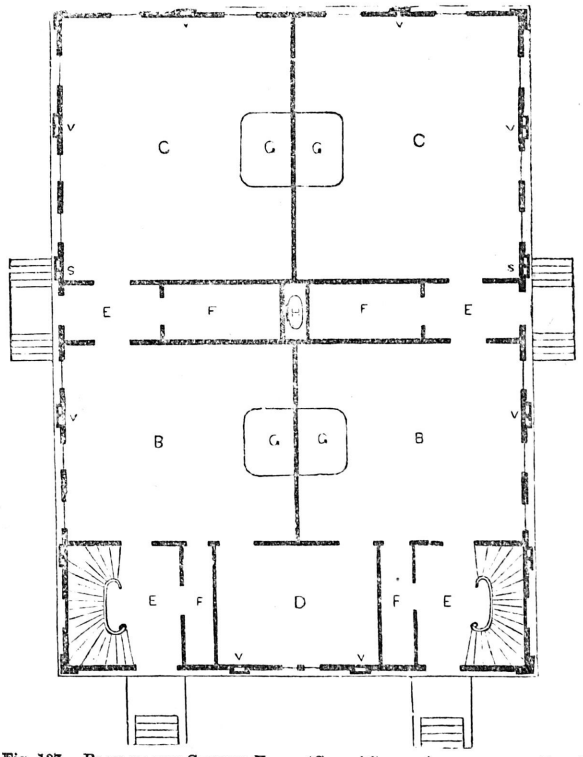


Fig. 136.—Design No. 38.—Perspective of School-House, Fence, and Grounds, adapted to Fig. 137.



REFERENCES.

BB. Smaller class-rooms for girls.

CC. Larger class-rooms for girls.

D. Gallery or small class-room.

EEEE. Boys' and girls' separate entrance halls.

FFFF. Cap and bonnet rooms.

GGGG. Teachers' desks.

H. Furnace register.

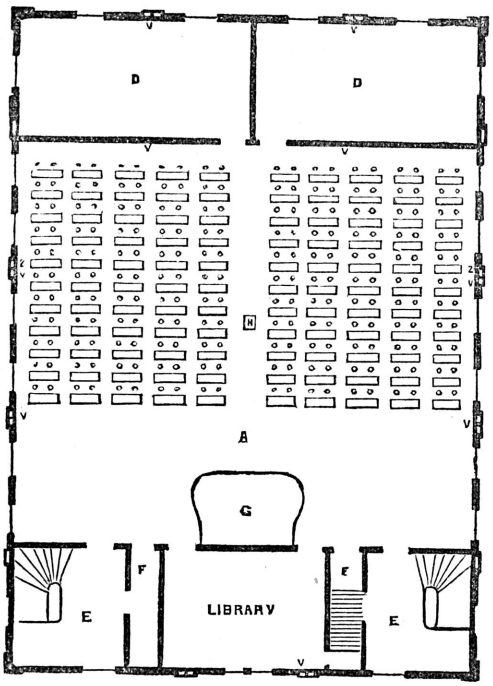
SS. Smoke flues.

VVVV. Ventilating shafts.

Fig. 137.—Plan of the Ground Floor (Girls' School), adapted to Fig. 136.

The ground plan of this Design (*Fig.* 137) is very well arranged, there being no less than four distinct entrances to the school—one, indeed, to each room. This is a great desideratum in the construction of large school-houses; and, in case of a panic, such an arrangement would greatly facilitate safe and speedy egress, from the building, of the pupils.

The plan is designed for two primary, or a primary and intermediate school—the primary below and the intermediate above—or the building may accommodate a girls' primary and intermediate school below, and a primary and intermediate boys' school above, in each of which can be comfortably accommodated as many children as one teacher can instruct.



REFERENCES.

A. Boys' school-room.
L. Library and teacher's room.
DD. Gallery or recitation rooms.
EE. Landings.
FF. Wardrobes.
G. Teacher's desk.
H. Furnace register.
VVV. Ventilators.

Fig. 138.—PLAN OF THE FIRST FLOOR, ADAPTED TO FIG. 136.

Fig. 138 shows the plan of the upper storey of this school. The gallery or recitation rooms in the rear of the building, are so arranged that classes make the least possible disturbance in passing to and from the main school-room. The library room in rear of the master's desk is sufficiently commodious for a recitation room, if desired, in addition to the other purposes for which it is designed, and may be used for that purpose if necessary. With slight alteration in the arrangement of doors, and one or two other points easily remedied, a school-house for the accommodation of 500 pupils could not be better arranged. The rooms, D, D, can be used with good effect either as gallery or ordinary recitation rooms. The former is indispensable in a school. Plans and details for fitting up gallery rooms, will be given in another chapter.

The general idea of Design No. 39 is admirable. It provides not only for the three regular grades of schools in the same building, all so arranged as to be within the full control of the principal teacher, but it affords considerable class room, great facility of entrance and egress (which is most desirable), and a fine assembly hall up stairs. Designs shown in *Figs.* 84, 86 and 88, as already intimated, can readily be substituted, with advantage, for this one.

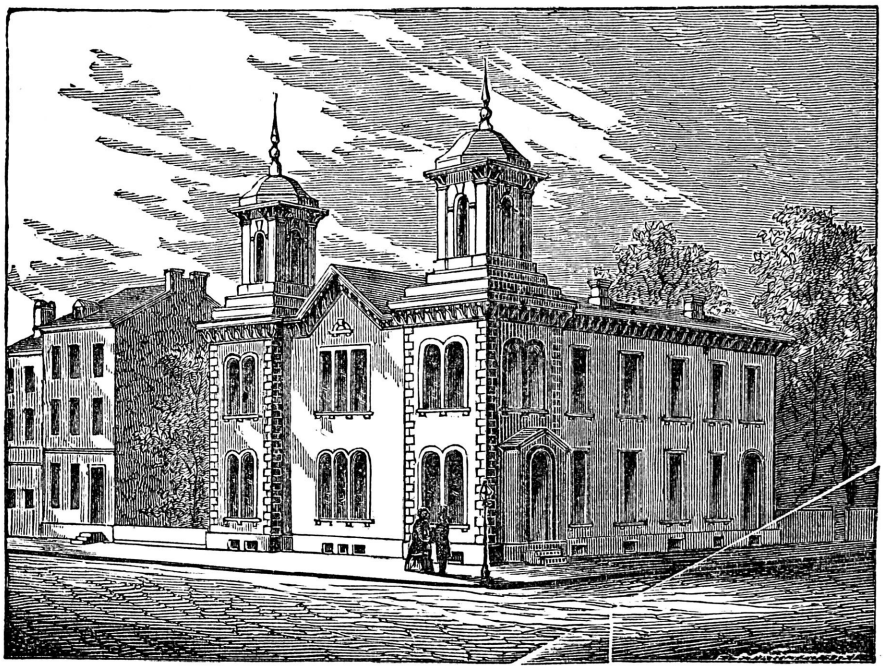
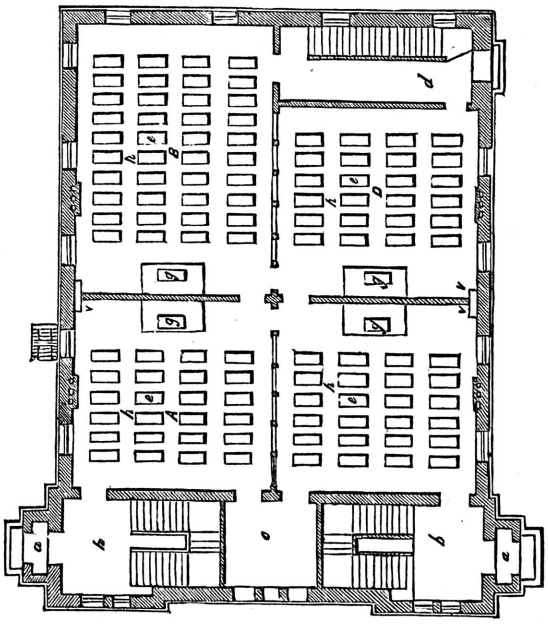


Fig. 139.—Design No. 39.—Front Perspective of School, adapted to Figs. 140 and 141.



REFERENCES.

ABCD. Girls' school-rooms.

aa. Outside porches for boys and girls.

bb. Cap and cloak rooms for boys and girls.

c. Teachers' gallery, or library room.

d. Entrance to rooms B and D, and to boys' upper room.

e. Seats for two pupils each.

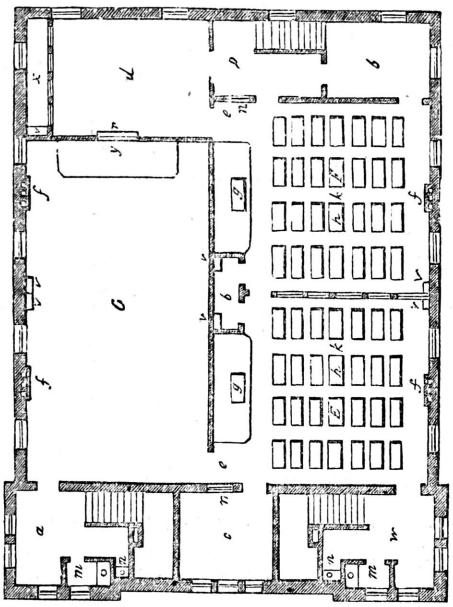
gggg. Teachers' desks.

hhhh. Passages two feet wide.

vvvv. Ventilating flues.

Fig. 140.—Ground Plan adapted to Fig. 139.

To secure readiness of entrance to room B (*Fig.* 140), there should be a stairway and outside door, as there is to room D.



REFERENCES.

EF. Boys' school-rooms.

G. Lecture room.

a. Lobby and entrance to lecture room.

b. Cap room for boys.

b. (between teachers' desks) Teachers' closet.

cd. Class or gallery rooms.

ee. Passages.

ffff. Hot air flues.

gg. Teachers' desks.

hh. Seats for two pupils each.

l. Closets for books, &c.

mono. Lavatories.

vvvv. Ventilating flues.

w. Girls' clothes room.

x. Closet for library and apparatus.

Fig. 141.—Plan of First Floor, adapted to Fig. 139.

If the plans as given are adopted, the following are the specifications prepared to accompany them :—

Specification.—The building will be fifty-five by seventy-six feet, with two towers projecting slightly from the line of the building. The first and second storeys will be each fifteen feet in the clear; pitch of roof, nine feet; and elevation of first floor, two feet six inches. The walls will be of stone, stuccoed on the exterior, and laid off in blocks in imitation of cut stone [or brick]. The eave and cornice and cupola, from the level of the eave, will be of wood, and painted and sanded in imitation of cut stone. The covering of the roof will be of tin (slate, or shingles laid in mortar), as also the base of the cupola and roof of the same, and of the porches. The exterior walls in the cellar will be twenty-four inches, the first storey twenty-two, and the remainder twenty inches thick; the walls forming the front stairways will be of brick, thirteen inches first storey, nine inches second. Piers will be built in the cellar of stone or hard brick, for the support of the iron pillars, 27 inches at the base, and tapering upwards to 18 inches at the top, for the support of the glass partition which runs longitudinally through the building, and for the support of the floors of joists. The flooring joists of the first and second storeys will be three by fourteen inches; and in addition, a camber-rod will be run through them. The roof will be constructed as in the plan aforesaid. The window frames the same, excepting that all the shutters will be hung inside.

This building will require (as suggested) four flights of stairs, with wall rail, &c. The glass partition in the first storey will also require iron posts. The partition separating the school-rooms E and F, in the second storey, will also be of sash, without the iron posts. The partition forming the lecture rooms, and all others, will be three by six inch scantling. Lavatories for the pupils and for the teachers will be constructed where shown in the plan, and connected with sufficient and properly-constructed sinks or wells.

Note.—See remarks (with sections) on the construction of stairways, on page 120.

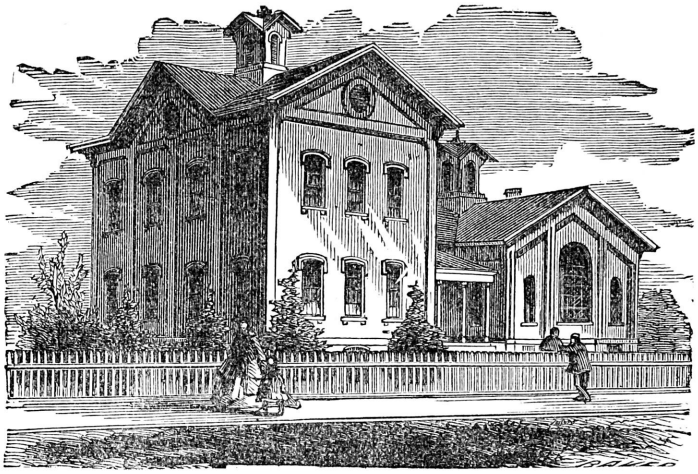


Fig. 142.—Design No. 40.—Perspective View of Two-storey School-House.

Design No. 40 presents the exterior view of another style of a two-storey school-house. It has the advantages of a double school-house on the ground floor. The small building in the rear, connected with the main building, will be found especially useful. A plan of the ground and first floors can be specially prepared to suit circumstances and wants of the school.

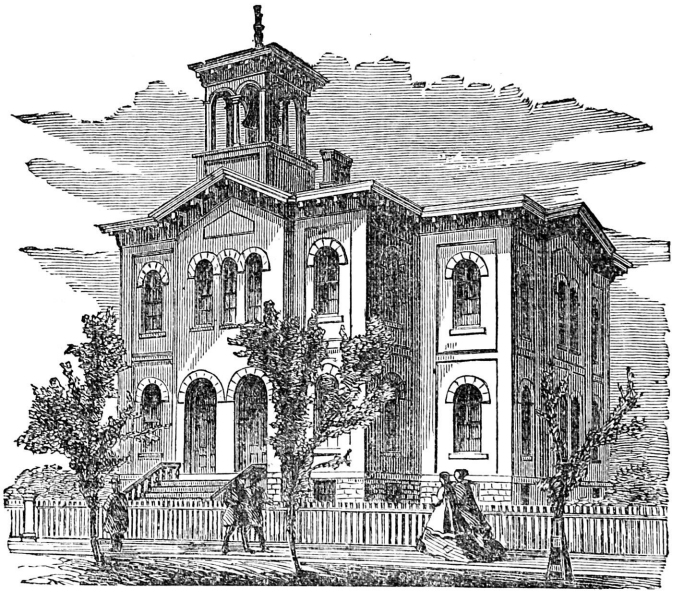


Fig. 143.—Design No. 41 —Adapted, with modifications, to Figs. 144, 145 and 146.

Design No. 41 represents a very handsome school-house for a city or town. The type is modified Italian. The building is surmounted by a neat belfry, which gives an appropriate finish to the school-house.

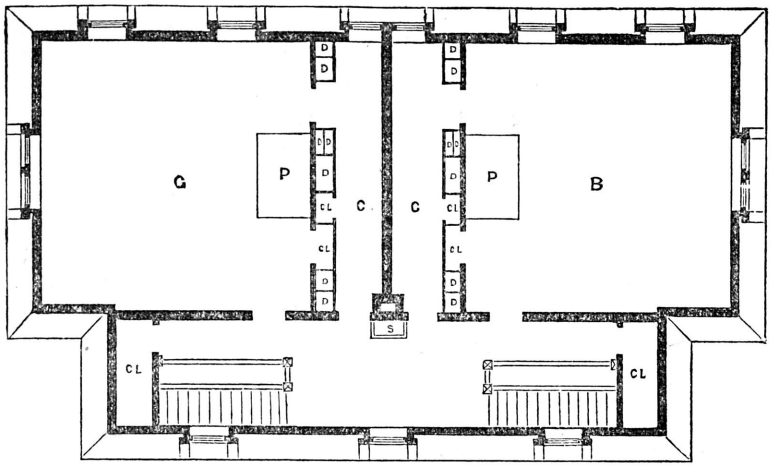


Fig. 144.—Basement Plan adapted to Fig. 143.

Fig. 144 represents a basement plan adapted to the Design shown in *Fig.* 143. In it can be placed the furnaces, as at PP. Wood or coal can be stored in the rooms BGCC, the passages, etc., or they can be used for other purposes of the school, janitor's residence, etc.

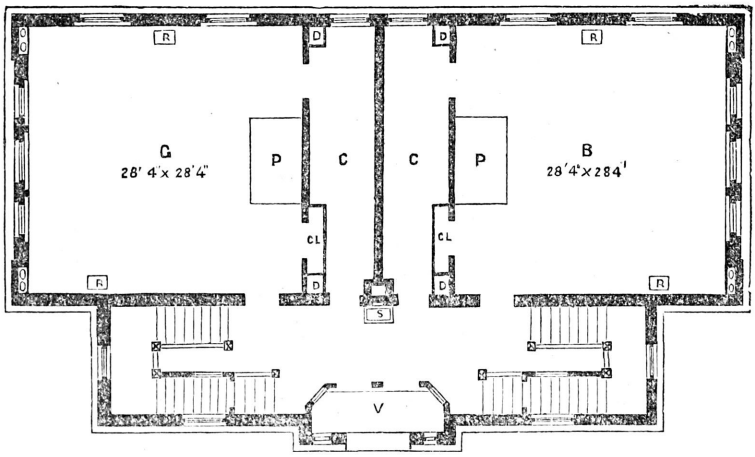


Fig. 145.—Plan of the Ground Floor, adapted to Fig. 143.

Fig. 145 shows a plan of the ground floor adapted to Design No. 41. B and G are the school-rooms; CC, passages; PP, teachers' platforms; DD, ventilators; RRRR, registers; Cl Cl, closets; S, stove in the hall; V, main entrance. The interior arrangements for this style of school-house are very good. They can, however, be modified to suit particular cases, and the circumstances of various localities.

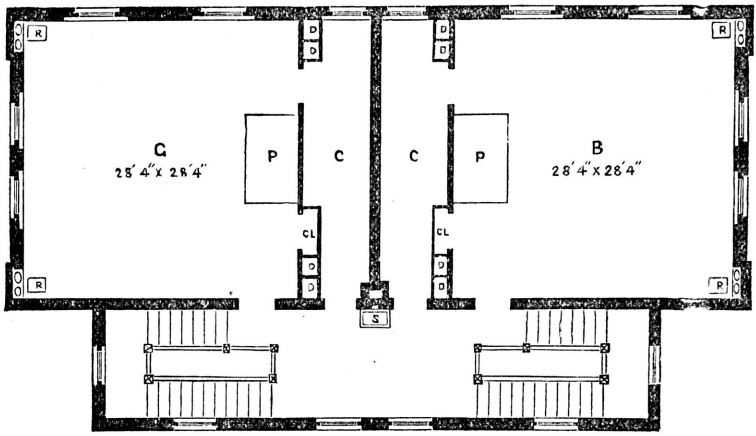


Fig. 146.—Plan of the First Floor, adapted to Fig. 143.

Fig. 146 represents the first floor on second storey, adapted to Design No. 41. The same letters are used to designate the different parts of the room, etc.

Note.—These plans can also be adapted to four-storey school-houses, as may be seen further on.

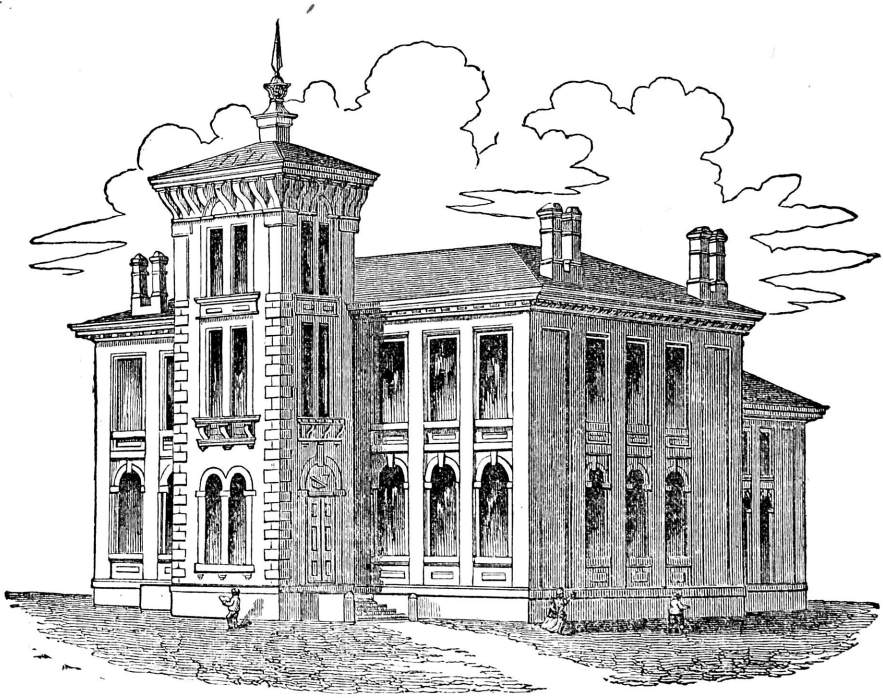


Fig. 147.—Design No. 42.—Adapted, with modifications, to Figs. 107 and 110.

This Design, No. 42, represents one of the Toronto City Ward Schools, erected in 1854. In general outline it is somewhat like the preceding Design. With some modifications, plans 107 and 110 can be adapted to it.

Design No. 42 is a plain and substantial structure, and has separate entrances for boys and girls, which we regard as an essential feature of all school-houses—large or small.

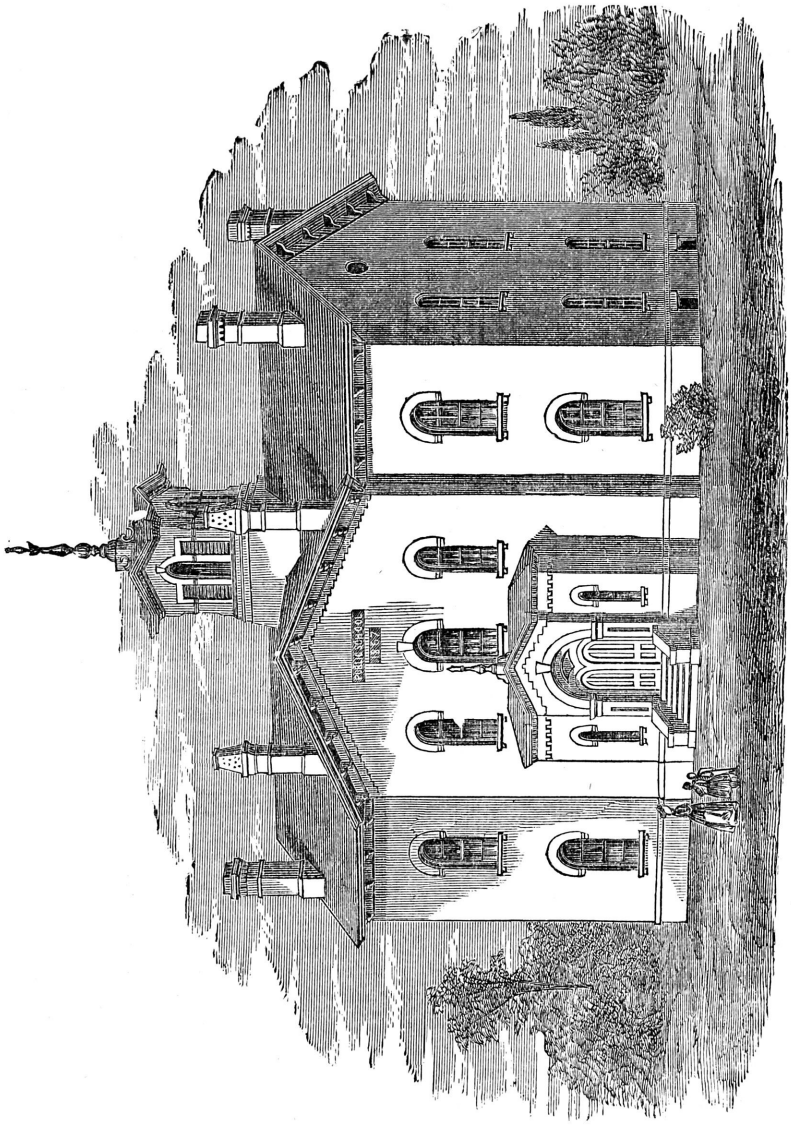


Fig. 148.—Design No. 43 for a Public School.—Adapted to Figs. 122, 145 and 149.

Design No. 43 is a plain and inexpensive two-storey building, adapted to an ordinary town school. The single entrance for boys and girls, as we have frequently intimated, is decidedly objectionable. (See pages 83, 97, 98 and 104). A school-house like that shown in *Fig.* 148 was erected in Madison, Wisconsin, in 1867. The interior plans given on pages 96, 115, 118, 122, 123, 124, 135 and 138 may, with a little modification, be adapted to this design. The belfry is an attractive addition to the appearance of this school-house.

NOTE.—The bell should always be rung a reasonable time before the commencement of the exercises, to enable pupils, by increased speed, to be in their seats in due time; and the ringing of it, at the close of the fore and afternoon session, will enable parents within its sound to know whether that loitering on the way home, which should not be permitted, has been practised. It need scarcely be stated, that it is the teacher's duty to be in the school some time before the regular exercises commence, and to be the last person in it after they close. If he practice this duty rigidly himself, and also hold his pupils responsible for the propriety of their behaviour on the way to and from school, he will soon find that their promptness and regularity will increase. The official regulations on this subject require the teacher to be in his school-room at a quarter to nine o'clock in the morning.

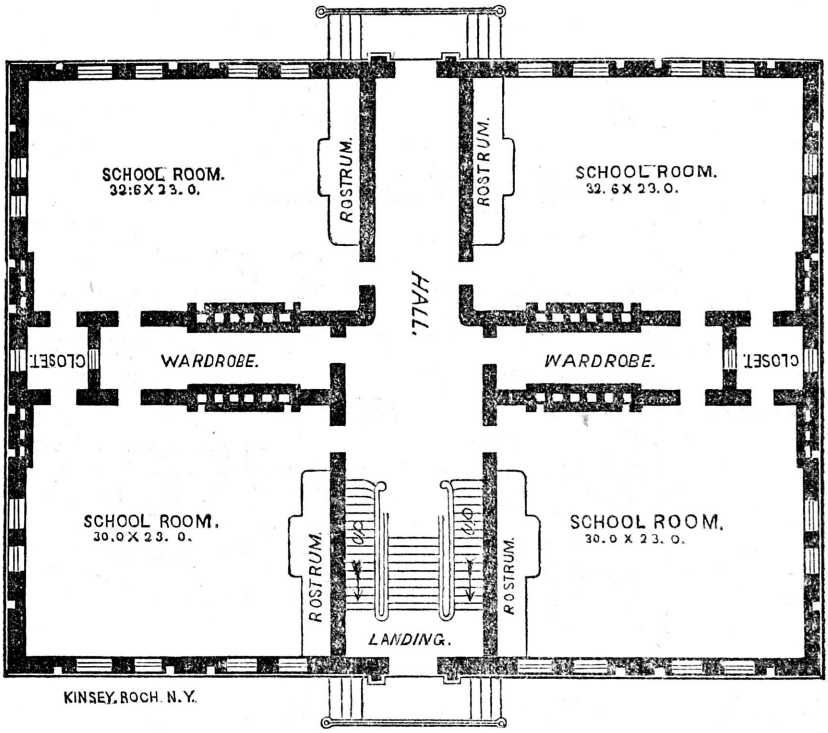


Fig. 149.—GROUND PLAN AND FIRST FLOOR, ADAPTED TO FIG. 148.

Fig. 149 is identical with *Figs.* 204 and 205, and may easily be adapted to Design No. 43. The plans on pages 122 and 123 are, however, better adapted to the design. Either of them, with very little modification, can be rendered available. This plan, with *Figs.* 203, 204 and 205, were prepared for the "Genesee School" in Rochester, N.Y. The interior arrangements are convenient, while the facilities for ventilation, as indicated by the number of flues on either side of the "wardrobe" passage in the plan (*Fig.* 149), are all that could be desired. The staircases are wide, and the school-rooms are of a reasonable size. The two rear school-rooms are two feet longer than those in front. The plan of the grounds should be so arranged that the girls could conveniently enter at the front door, and the boys at the rear. Their play-grounds should also be separated by a high board fence, and the out-offices should be placed quite apart. We have already referred to these matters on page 27, and think attention to them essential in the construction of school-houses, especially for boys and girls of a larger growth than those attending mere primary schools.

CHAPTER XVI.

DESIGNS FOR CITY AND TOWN SCHOOLS.

Three-storey Buildings.

We now proceed to give in this chapter a number of plans adapted to three-storey school-houses, not that we approve of them, but as in large cities and towns land is difficult to acquire, they are a necessity.

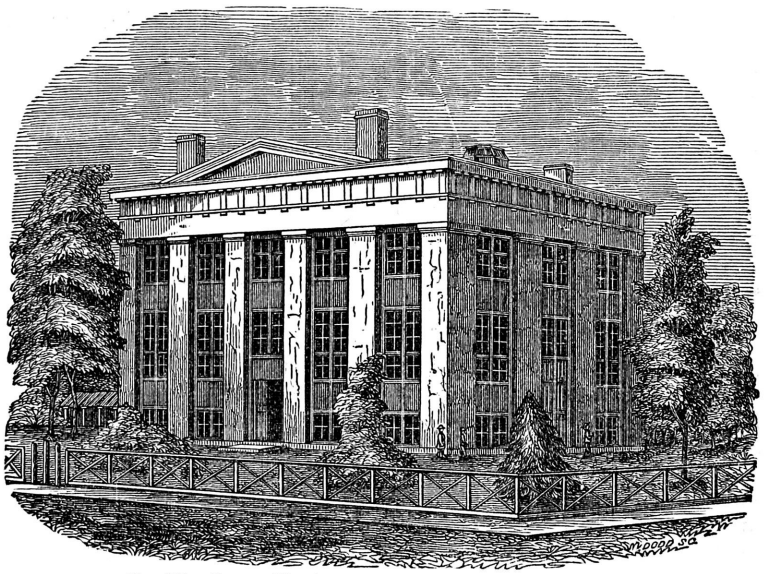
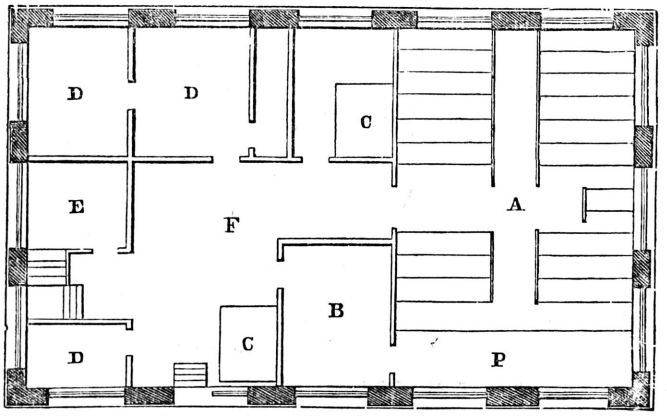


Fig. 150.—Design No. 44.—Adapted to Figs. 151, 152 and 153.

Fig. 150 represents a large, square, compact, three-storey school-house, with



REFERENCES.

A. Lecture room and chapel.

B. Laboratory.

CC. Furnaces.

DDD. Janitor's rooms.

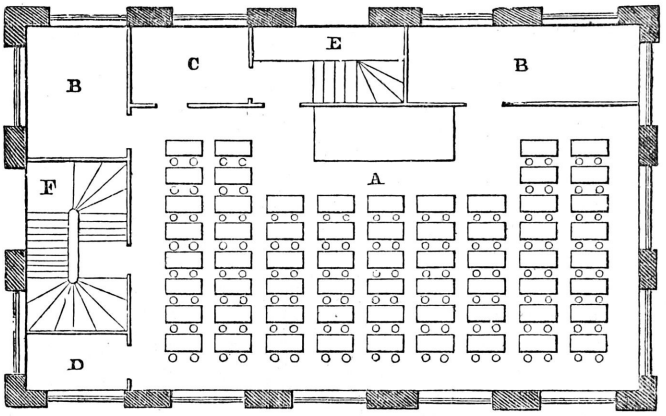
E. Entry.

F. Hall.

Fig. 151.—Plan of the Basement, adapted to Fig. 150.

two entrances—one to the girls' school, on the ground floor, and the other to the boys' school, on the first floor, as shown in *Fig.* 152.

The basement (*Fig.* 151) contains a lecture room, A (which may serve also as a chapel for the girls' school), with comfortable seats to accommodate conveniently 200 pupils. A laboratory, B, adjoins the lecture room, with which it communicates by a door at the end of a platform. The remainder of the basement floor is occupied by the furnaces for warming the building, and by the rooms of the janitor.



REFERENCES.

A. Girls' large school-room.

BB. Small recitation rooms.

C. Teacher's room.

D. Closet for apparatus.

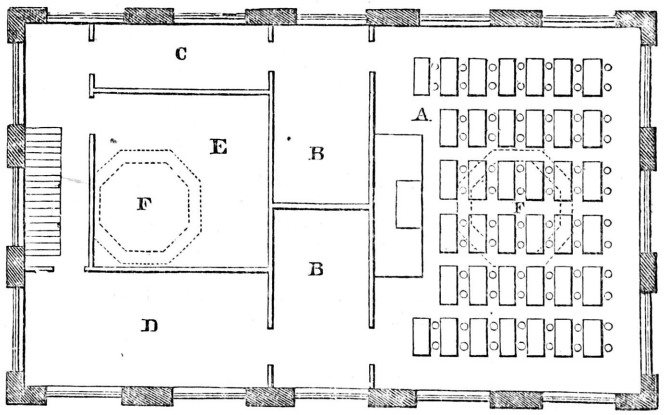
E. Entrance for boys.

F. Entrance for girls.

Fig. 152.—Plan of First Floor, adapted to Fig. 150.

The first floor (*Fig.* 152) is occupied by the girls' department, and consists of a large school-room, with two recitation or gallery rooms, B, B, entries, etc.

The building can be thoroughly and uniformly warmed by two furnaces in the basement, and a change of air can be secured by ventilators at the top of the rooms, and also near the floor, opening into flues which are carried up in the chimneys. (See *Fig.* 27.) The warmth imparted by the smoke which passes up in the adjoining flues, secures a good draft. In the upper storey additional means of ventilation can in summer be furnished by the skylights, which can be partially opened.



REFERENCES.

A. Boys' large class room.

BB. Recitation rooms.

C. Teacher's room.

D. Primary department or gallery room.

E. Library, lighted by skylight.

F. Skylight in ceiling.

Fig. 153.—Plan of Second Floor, adapted to Fig. 150.

On the second floor (*Fig.* 153) will be found a gallery room, D, a library, hall, E, and room occupied by primary department, A. There is a large sky-light in the centre of the larger boys' school-room, F, and another in the library on the second floor, F.

Fig. 154 represents the perspective front view of a public or high school house, erected on a sloping site. (See also *Fig.* 107.) In such a school-house there may be a *primary department* in the basement storey for small children, both male and female, taught by one or more teachers. The first floor may be appropriated to an *intermediate school*, or second department, with separate apartments for boys and girls. The second floor may be appropriated to the

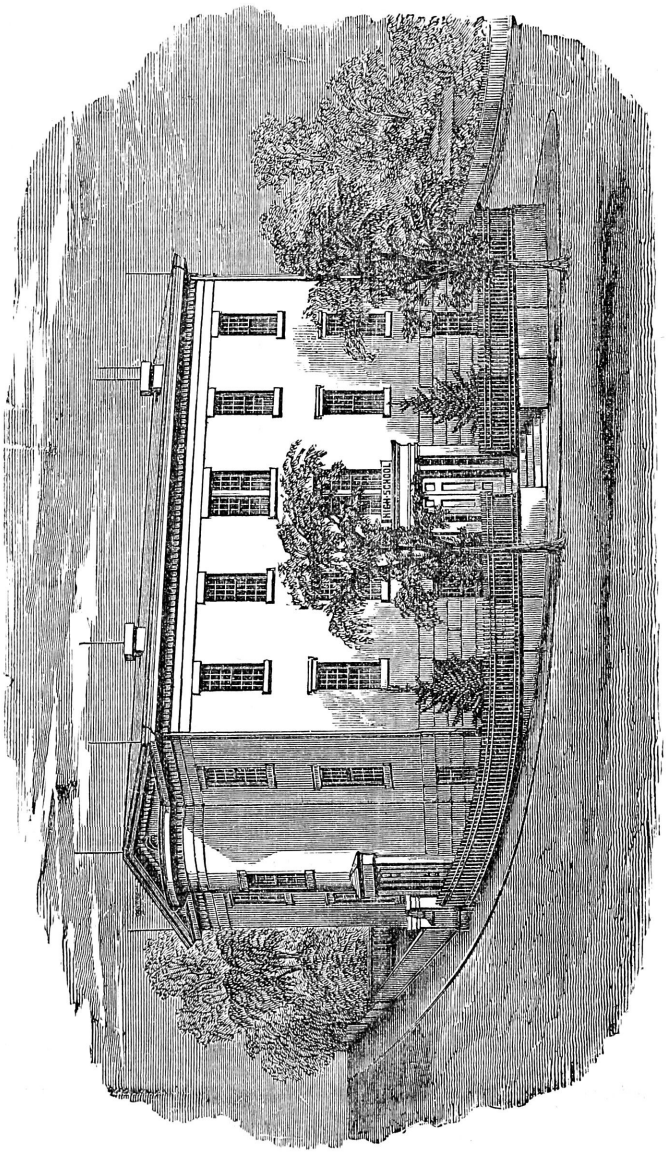


Fig. 154.—Design No. 45.—Perspective View of a School on a Sloping Site. (See Figs. 155 and 156.)

or highest department of the school—taught by the head master of the whole establishment. As the pupils advance through the prescribed courses in the lower departments, they should be advanced to the next higher department, and so on, until they complete the course of instruction in the school.

This school-house occupies an elevated and sloping situation. It is a specimen of plain but tasteful architecture; and every school-house should be attractive in its very appearance—emblematical of what is taught within. The fence, the grounds, the trees, should be such as to please the eye, improve the taste, and excite cheerful feelings. The yards around this building are enclosed by a handsome fence. (See *Fig.* 45, page 79.) The grounds are planted with trees.

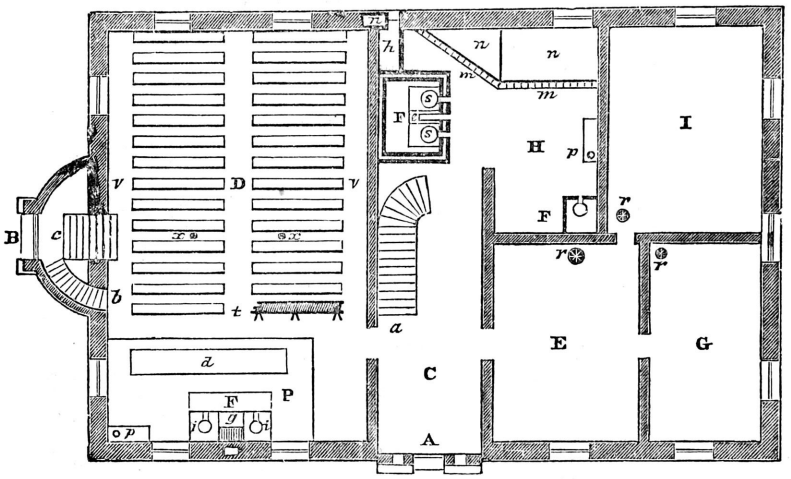


Fig. 155.—Plan of the Basement Floor, adapted to Fig. 154.

The school being designed for both boys and girls, an entirely separate entrance is provided for each department. The front door at which the girls enter has a neat appearance, with double columns (thus providing for large side lights) and a heavy ornamented cap. The words "High School" may be seen over this door. The door in the circular projection, fronting on another street, is the entrance for boys.

The rooms in the basement floor should be separated from each other by solid brick walls. The pupils, in the girls' department, entering the house at A (*Fig.* 155), pass into the large lobby, C, from which they can go to all parts of the building appropriated to their use.

The furnace room, H, should have a brick floor, and should be kept in as good order as any other parts of the house. The wood boxes, *n*, *n*, and the furnace, F, should be so constructed that, with an ordinary degree of care, the room may be kept as clean as any of the school-rooms. In this room, at *m*, *m*, provision is made for setting up umbrellas. It resembles a ladder placed in a horizontal position, and should be fastened to the ceiling on one side, and supported on the other by substantial posts of oak or other strong wood, turned in a tasteful style and let into the floor. The pump, *p*, accessible to all in the girls' department, should be connected with a neat sink, lined with lead, and should afford an abundant supply of the best water. The rooms, E, G and I, can, if desired, be appropriated as offices of the school trustees, inspector, masters, etc.

The large lecture room, D, on the left-hand side of *Fig.* 155, is furnished with a sufficient number of seats (a specimen of which is shown at *t*) to accommodate the pupils. On the platform, P, is a long table, *d*, made convenient for experimental lectures in chemistry, natural philosophy, etc., having pneumatic troughs for holding gases. At F (*i*, *g*, *i*) are suitable provisions for furnaces, etc., required in the preparation of chemical experiments. The pump, *p*, with a sink like the other (in room H), is used exclusively by the pupils in the boys' department.

At all lectures and other exercises in this room, the girls, entering at *a*, occupy the seats on the right of the middle aisle. The boys, entering by descending the short flight of stairs, *b*, are seated at the opposite side of the room. This arrangement is deemed advisable in order to obviate the objections sometimes made against having a school for boys and girls in the same building. The departments are thereby kept entirely separate, except in exercises in vocal music and occasional lectures. The boys enter the house at the end door, B, on the basement floor, and by a short flight of stairs they reach the first storey at *e* (*Fig.* 156).

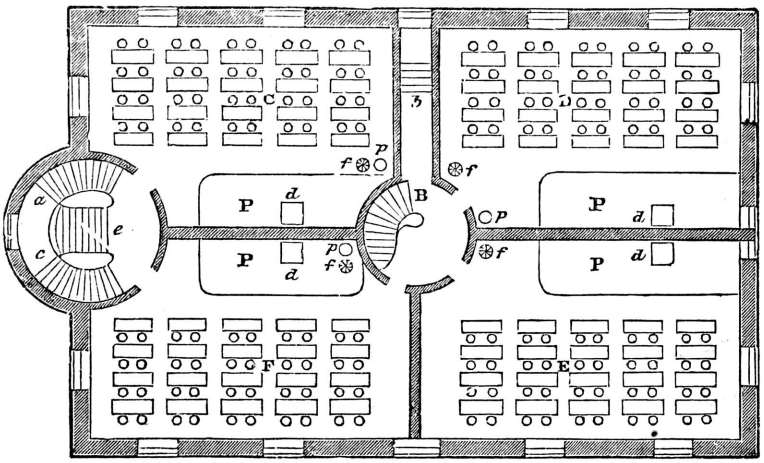


Fig. 156.—PLAN OF THE GROUND FLOOR, ADAPTED TO FIG. 154.

The three rooms, D, E and F (*Fig.* 156), are appropriated to the department for girls. They are easy of access to the pupils, who, ascending the broad flight of stairs (at *a*, *Fig.* 155) terminating at B (*Fig.* 156), can pass readily to their respective rooms.

As the course of instruction in this school may occupy three years, the room D (*Fig.* 156) is appropriated to the studies of the *first* year, E to those of the *second*, and F to those of the *third*. In each room there are three sizes of seats and desks, but the arrangement in all is uniform—the largest being at the back of the room.

On the raised platforms, P, P, P, P (*Fig.* 156), are the teachers' tables, *d*, *d*, *d*, *d*, designed to be covered, and furnished with four drawers each. The registers, *f*, *f*, *f*, *f*, admit the warm air from the furnace, and the pipes, *p*, *p*, *p*, conduct it into the rooms in the upper storey. The passage, *b*, leads into the playground, which is ornamented with a variety of shrubbery. The door near *e*, leading from the room F (*Fig.* 156), is used only for teachers and visitors, except when the two departments assemble in the hall. In the room C the girls' primary class pursue the studies prescribed for the first year. The other rooms in this department for boys may be in the next storey.

Pupils ascending from the area *e* (*Fig.* 156), by two circular staircases, land on the broad space *a*, *c*, from which, by a short flight of stairs, they reach the second storey. This second storey is divided into three school-rooms—two of the smaller of which, separated from the third by a cross partition, are fitted up precisely like the rooms C and F, in *Fig.* 156, and are immediately over them; and the third is fitted up like D (*Fig.* 155), only that it is furnished with three rows of seats instead of two, and has three seats and desks on each side of, and parallel to the ends of, the teacher's platform.

One of the smaller rooms in the second storey can be appropriated to the middle class, and the other to the junior class of pupils. The arrangement of the seats and desks are the same as in the other rooms, except that they are *movable*—being screwed to a frame not fastened to the floor. The cross partition, referred to above, should be composed of four very large doors, hung with weights in such a manner that they may be raised into the attic, thus throwing the whole upper storey *into one large hall*—an arrangement by which one room can be changed into *three* and three into *one*, as occasion may require. On all public occasions, such as quarterly examinations and annual exhibitions, the rooms are thus thrown together, and the seats and desks turned so as to face the large platform in the principal school-room.

In erecting a building, such as we have described, in which the school-rooms are necessarily placed one over the other, care should be taken to deaden the noise overhead. This may be done by filling up (with proper precautions) the spaces between the joists of the floors with tan bark, cork shavings, or some other compact light substance.

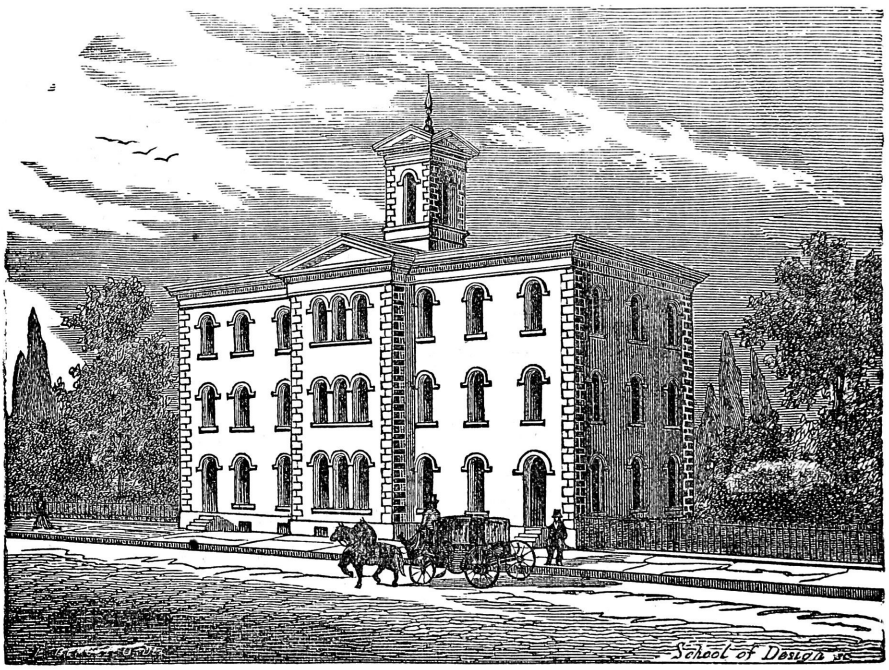


Fig. 157.—Design No. 46.—Adapted to Fig. 158.

Fig. 157 represents a building three storeys high; but, a school building should rarely exceed two storeys in height. In all the passages and school-rooms, the doors should open outward, as required by the law of Ontario (not inwards, as is generally the case), so as to admit of easy egress in case of fire, accident, panic, etc. The plan of its first and second floors is as follows:—

The four corner rooms on each floor are, in effect, class rooms, separated from the main room in the centre or principal school-room by glass partitions, so as to have them under the constant supervision and control of the first master. (See *Fig.* 158.)

Under this system of government and instruction, for which a glazed partition throughout, and the wide central passages, afford full facilities, each storey would require five teachers—a master and four assistants; and each would thus consti-

tute one large school. The two class rooms on the second storey will be found very suitable for recitation purposes, if either or both of those storeys be appropriated to pupils of an advanced grade. It is very desirable, however, to have a gallery room on each floor for convenience in teaching object lessons.

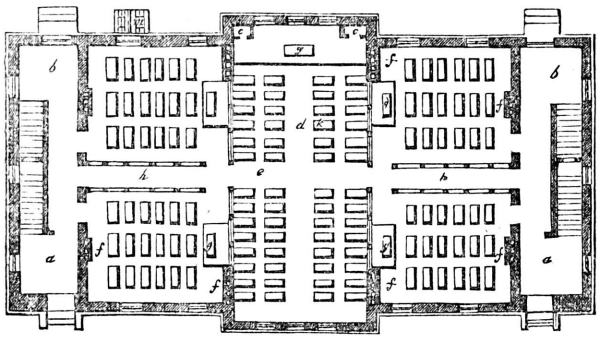


Fig. 158.—Plan of the First Floor, adapted to Figs. 157 and 159. (See also Fig. 134.

a. Boys' entrance and stairs to second and third storeys.
bb. Girls' entrance and clothes rooms.
cc. Closets on the teachers' platforms.
d. First master's class room and passage.
e. First master's class room and passage.
f. Flues for warm air or gas, and ventilation.
g. Master's desk.
hh. Passages.

The first storey is for girls; the second for boys, and is nearly similar to the first storey. Both open directly into the yard at the back of the building, and neither of them into the street; but a gate should lead from them to the street. The design is very neat and handsome. The building can be of brick or stone.

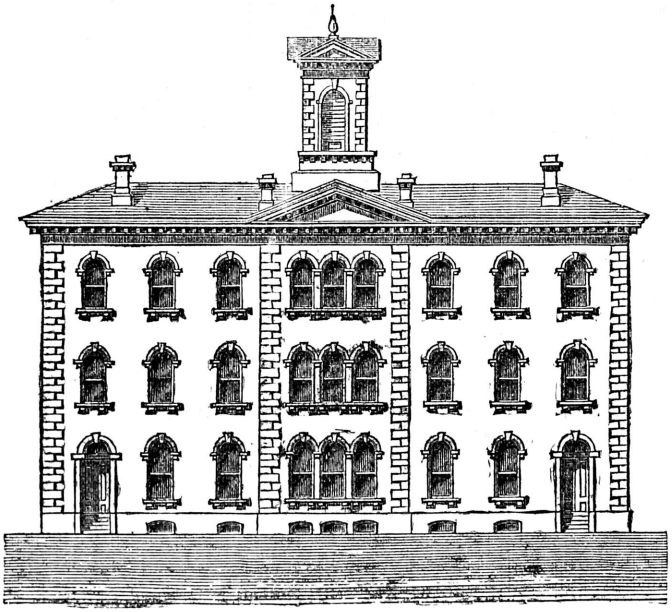


Fig. 159.—Design No. 47.—Geometrical Elevation of Fig. 157, adapted to Fig. 158.

This building (Fig. 159) is three storeys high, divided into class rooms, by glass partitions; the first story being intended for girls and the second for boys. It

is intended to be of stone, and stuccoed; but if brick is more economical, it would answer equally well.

Specification.—This Design represents a building forty-seven by ninety-two feet; three storeys high—first and second fourteen, and third thirteen, feet each in the clear; pitch of roof seven feet, and height of the first floor two feet six inches.

In this building the two transverse partitions are to be supported by piers in the cellar, the girders to bear on the top of the piers and the walls of the flank; and the joists, arranged longitudinally, to be doubled under the other glass partitions. If the building should be built of stone, the walls will be—cellar 24, first storey 22, and second 20 inches thick; but if of brick, they will be respectively 24, 22, and 18 inches thick. The door and window sills, and the platforms and steps, are to be of cut stone.

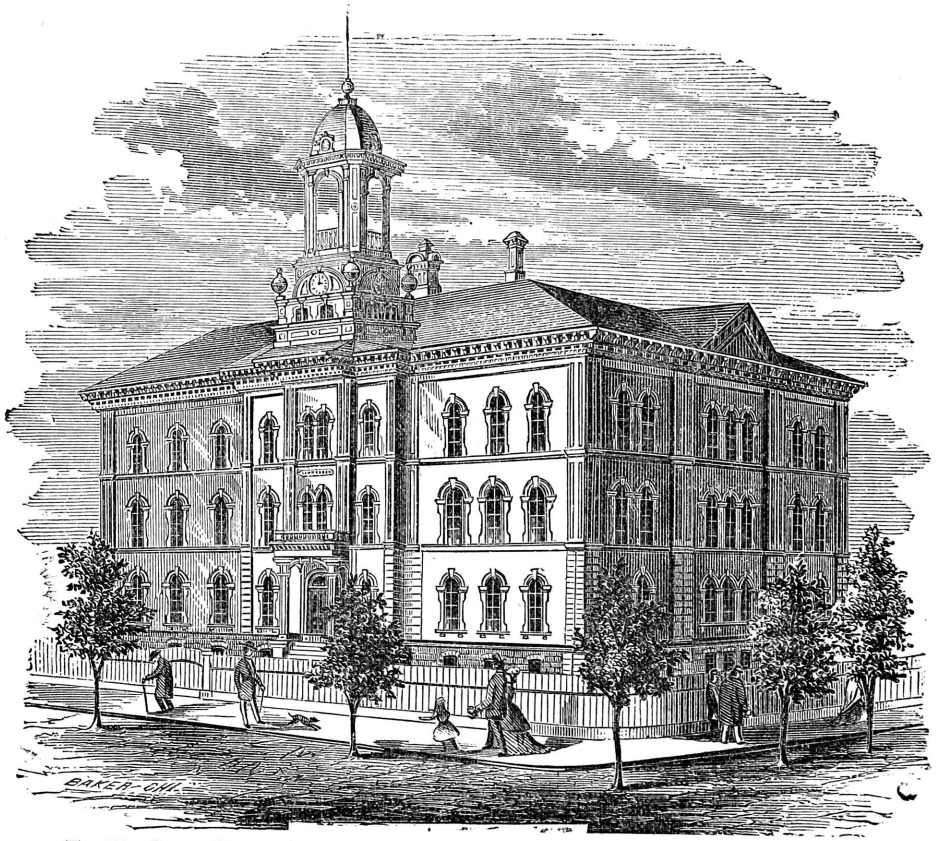


Fig. 160.—Design No. 48.—For a High School or Collegiate Institute, adapted to Figs. 161, 162, 163 and 164.

Fig. 160 is a modification of Designs Nos. 46 and 47, and is more elegant in its style (which is Italian modified) than either of them, especially in the cupola and general appearance of the building. The engraving represents the central school-house erected in Adrian, Michigan. It is a large and compact building, and, as a high school or collegiate institute, would be a great ornament in any city or town. The following interior plans can, with a little modification, be adapted to this Design:—

Fig. 161 is the plan of the basement adapted to Design No. 48. It, with the

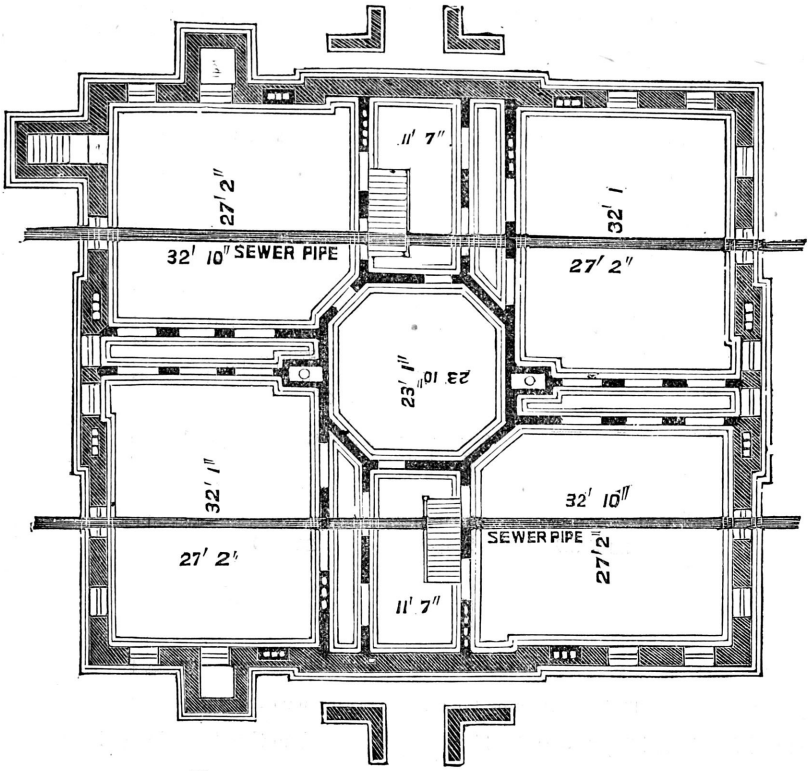


Fig. 161.—Plan of Basement, adapted to Fig. 160.

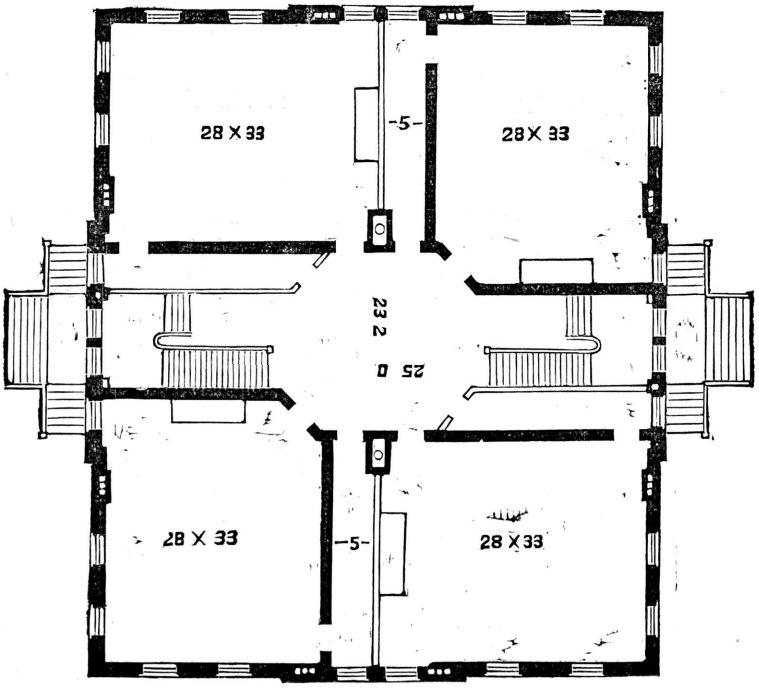


Fig. 162.—Ppan of Ground Plan, adapted to Fig. 160.

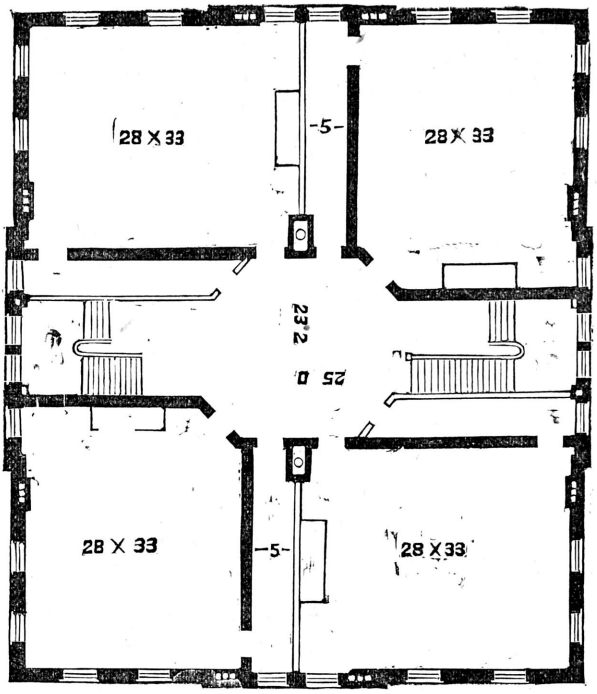


Fig. 163.—Plan of First Floor, adapted to Fig. 160.

plans in *Figs.* 161, 162, 163 and 164, were submitted to the American Educational

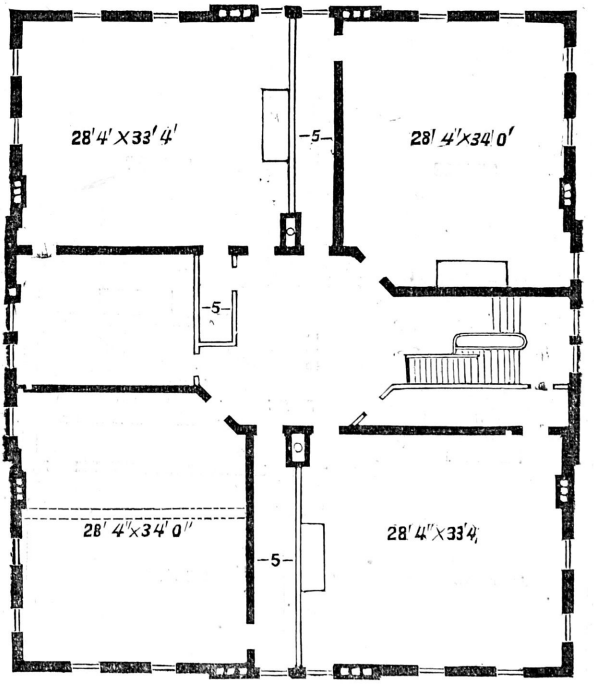


Fig. 164.—Plan of Second Floor, adapted to Fig. 160.

Association, in 1873, by Hon. A. J. Rickoff, of Cleveland, Ohio. He claimed for the plans several points of excellence, viz.:—(1.) The light was admitted on the side of the school-room which is to the left of the pupils. (2.) That by standing at or near the doorway, the teacher may have a view of the pupils, whether they were in the school-room, in the cloak rooms, or passing out or to and fro in the halls. (3.) Each school-room has a hat or cloak room attached, which is in every case to the left of the teacher as he stands on the platform facing the pupils. (4.) That each cloak room has a large window, and a doorway directly opposite, by means of which it can be thoroughly aired at any time. (5.) The direct entrance from the hall to the school-room is at the left of the teacher. (6.) That there is an unbroken space for a black-board behind the teacher's desk. (7.) That the three windows on the one side of each room, and the doors directly opposite (with two windows behind the pupils), afford ample means of airing and assisting to ventilate the school-rooms in warm, sultry weather. (8.) That there are two ventilating shafts, having foul air ducts leading into them from several parts of each room, and heated by the iron flues of the furnace.

NOTE.—These "points of excellence" will be found discussed at some length on pages 28-59. In referring to the best mode of lighting a school-room, see page 41.

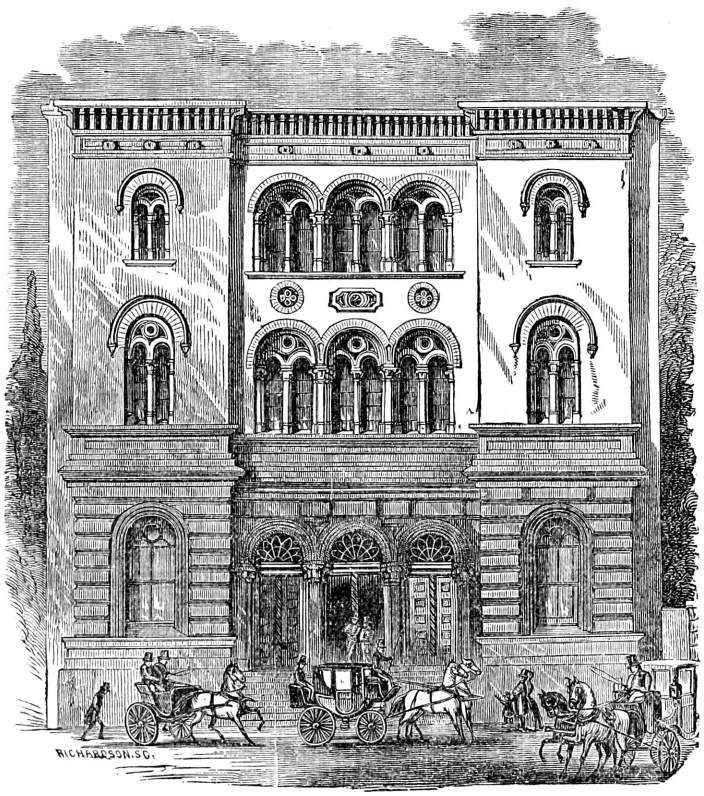


Fig. 165.—DESIGN No. 49 —FRONT PERSPECTIVE OF A CITY HIGH SCHOOL, OR COLLEGIATE INSTITUTE.

Fig. 165 represents a front perspective of a very elegant building. The style is Norman gothic, and introduces a new departure in the architecture of city school-houses. The design is also adapted to a building for a public library. The ground plan (*Fig.* 145) can, with some modifications, be adapted to this design.

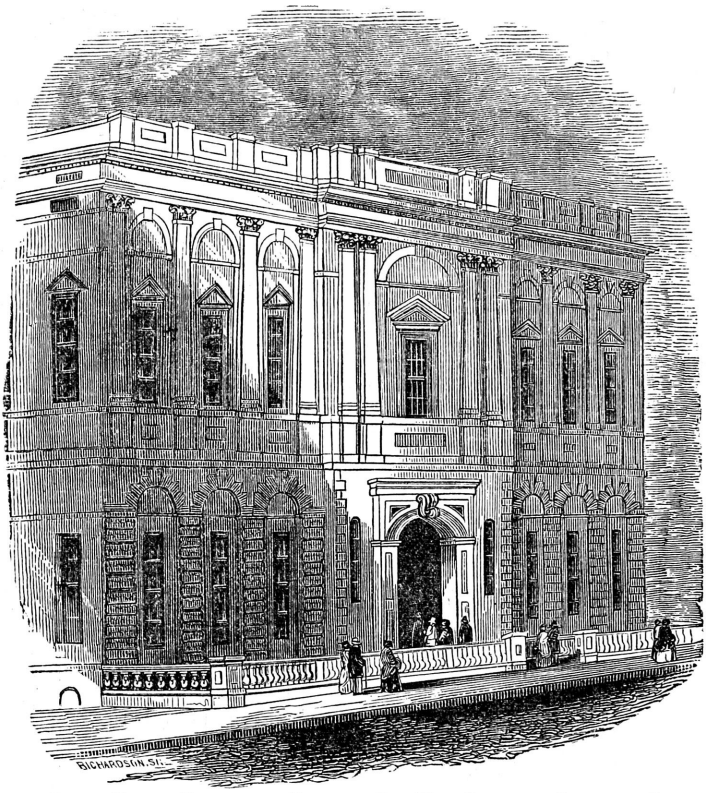


Fig. 166.—Design No. 50.—Perspective View of a City High School or Collegiate Institute.

Fig. 166 is a design in the Italian style of architecture, and is inserted for variety. It is plain and substantial, and adapted to a stone building.

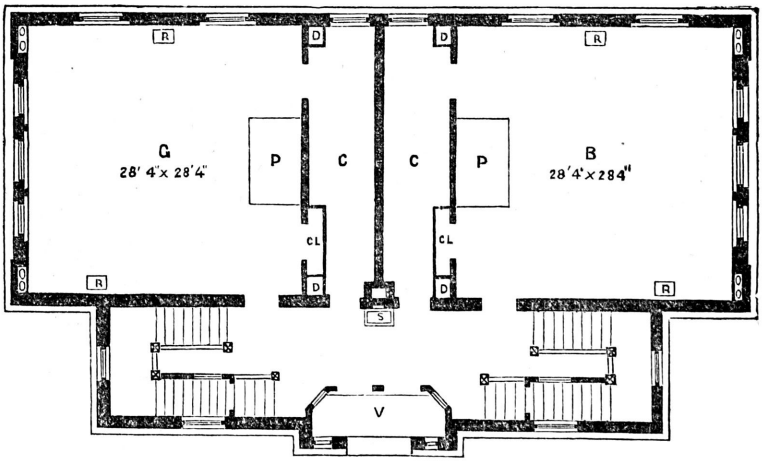


Fig. 167.—Plan of a Ground Floor, with Modifications adapted to Design No. 50.

Fig. 167 gives an interior plan which, with some modifications, can be adapted to Design No, 50. The plans on pages 154-156 can be more readily adapted to it.

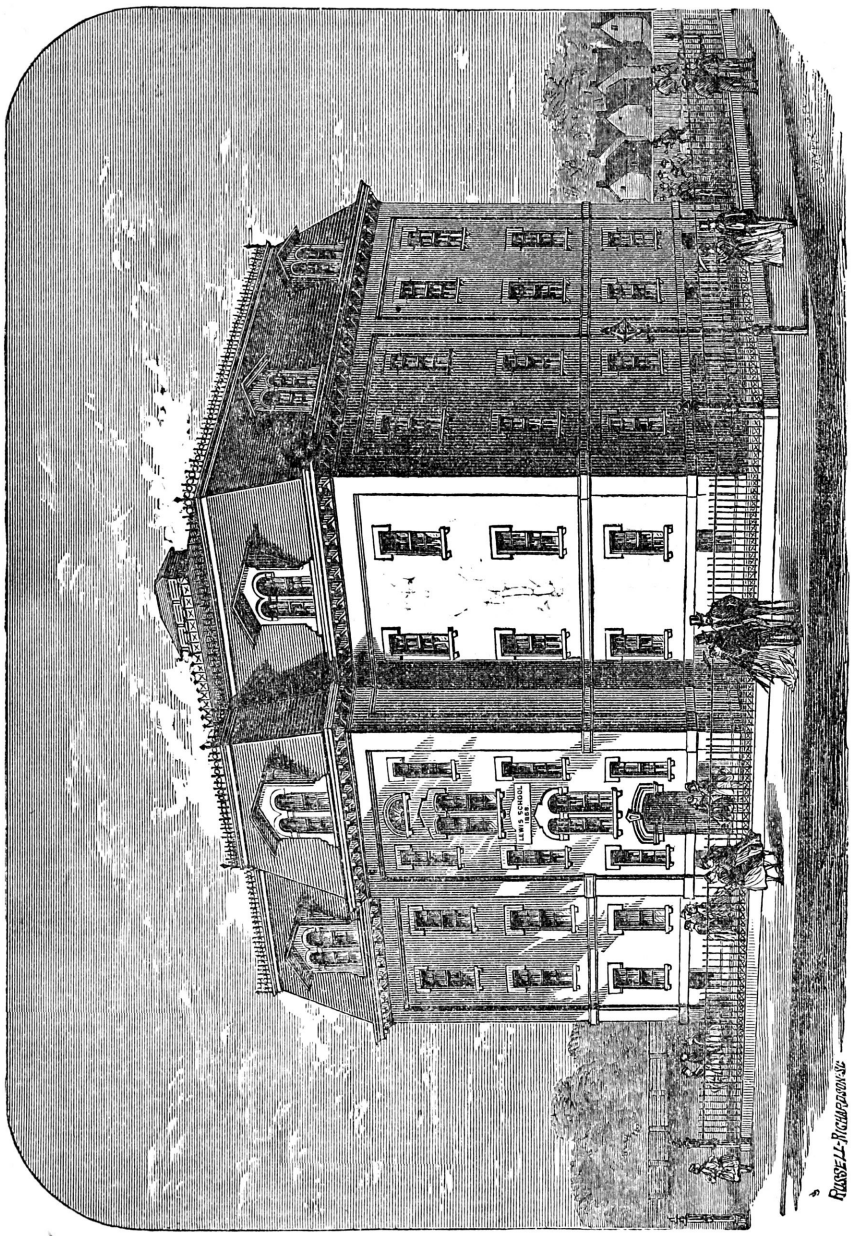


Fig. 168.—Design No. 51.—For a City High School or Collegiate Institute, adapted to Figs. 169, 170 and 171.

Fig. 168 represents a very compact, though plain, elegant and substantial high school house or collegiate institute for a city. The engraving is that of the Lewis Grammar School, Roxbury, now part of the city of Boston, Mass.—a city which is famous for good schools and for admirable school-houses, adapted to all classes of the community. The building has two entrances—one in the front for girls, and one in the rear for boys. The general plan of the ground floor is followed throughout in the other storeys.

We give, in the following pages, several plans of school-houses which have been erected in Boston. They are chiefly designed for high schools; but in all of them neither expense has been spared in their erection, nor have they been stinted in those appliances which contribute so largely to the success and efficiency of the instruction given in them. This we hold to be a wise economy, which we trust our school trustees in Ontario will study with advantage.

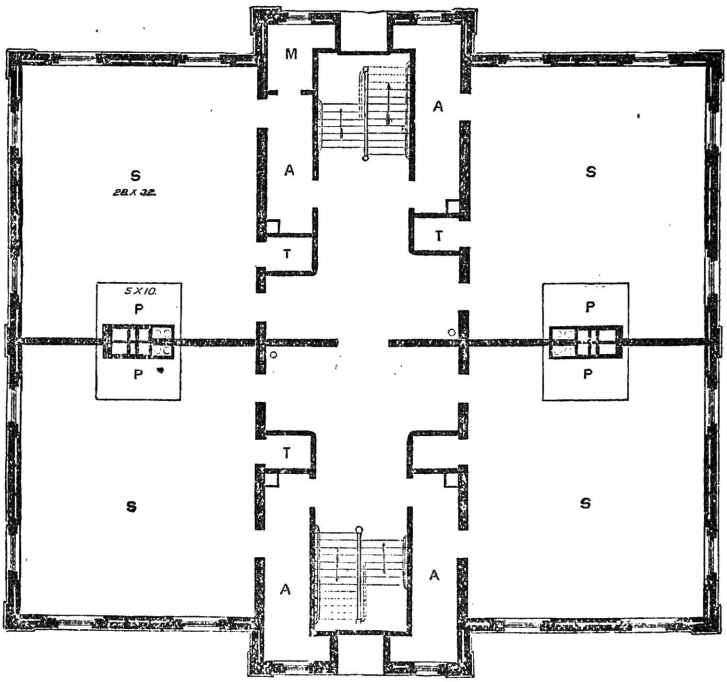


Fig. 169.—First, Second, and Third Storeys, adapted to Fig. 168

AAAA. Clothes closets.
M. Master's room.
PPPP. Teachers' Platforms.
SSSS. School-rooms.
TTTT. Teachers' closets

Fig. 169 represents the general plan of the interior of the building. In each of the three storeys there are four school-rooms, with a large cap and cloak room and teacher's closet attached to each. In the mansard roof there is room for a large exhibition or general assembly hall for the whole school. The building can be heated by four hot-air furnaces, as shown in the plan of the basement. The master's room may also be put in communication with all the other rooms, by means of bells or speaking tubes. Each school-room may be made to accommodate about 55 pupils, which are as many as any one teacher can advantageously manage. There is provision in each room for ventilation, as will be seen by reference to the flues in the rear of each of the teachers' platforms, and also adjoining the teachers' closets (T, T, T, T). The stairways are wide, and of easy access. (On this subject, see remarks and illustrations on page 120).

The building is well proportioned, and the white brick with which the four walls can be faced, and the white granite or red brick trimmings, produce a pleasing contrast. In localities where stone abounds, the building could be erected of stone, with either brick facings, as indicated, or different coloured stone on the corners, and door and window trimmings.

The engraving shown in *Fig.* 170 is another of those fine, large, substantial buildings erected in the capital of Massachusetts, for grammar school purposes.

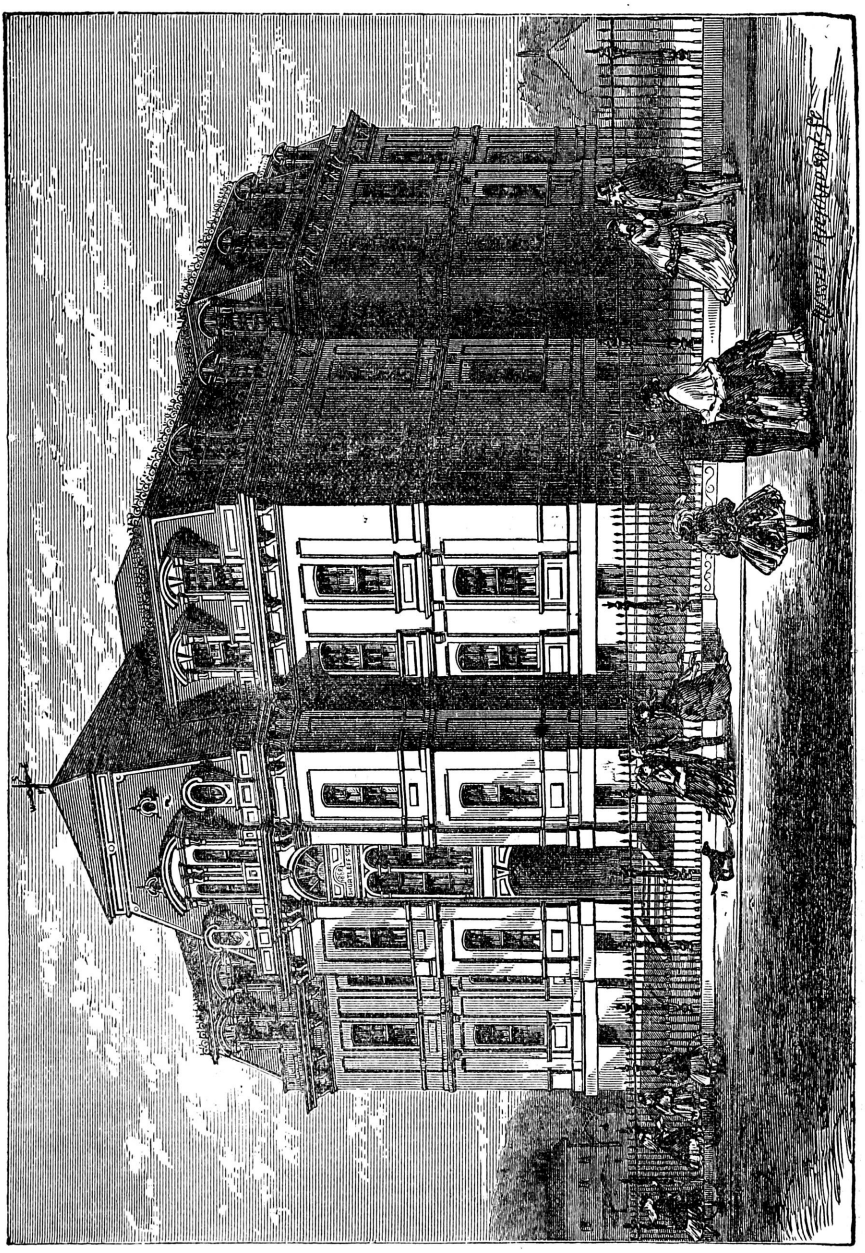


Fig. 170.—Design No. 52.—For a Collegiate Institute, adapted to Figs. 171, 172 and 173.

The Design, No. 52, is a perspective of the Shurtleff Grammar School, in South Boston, Mass. It is a very handsome building, and admirably arranged inside, as will be seen by reference to the following plans. There are two entrances—one at the front for girls, and one at the rear for boys. The style

is neat and elegant, and the building is compact and massive. Such a building may be either in brick or stone, with the dressings of the doors and windows in white or coloured stone, or white or red brick. There are four handsome fronts, or façades, with central projections in each. The windows are Lutheran enriched, and the entablatures crowning the walls are quite massive and elegant in outline.

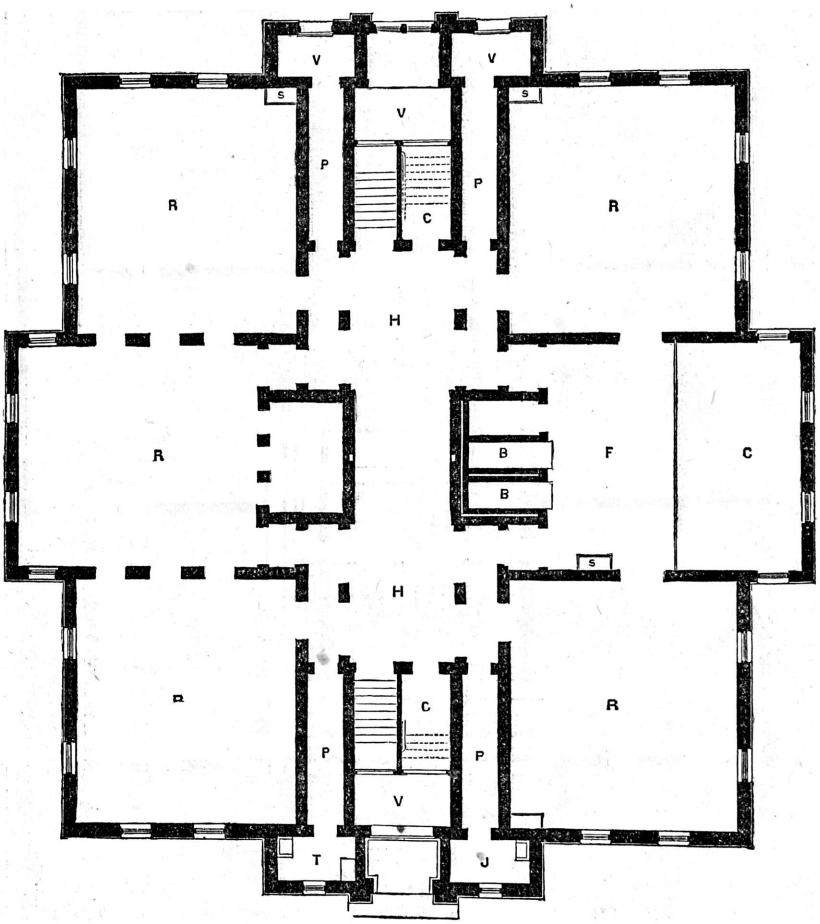


Fig. 171.—Basement Plan, adapted to Fig. 170.

BB. Boiler furnaces.
C. Fuel room.
CC. Stairways.
D. Janitor's room.
F. Boiler room.
HH. Central hall.
J. Closet.
PPPP. Passages.
RRRRR. Play rooms for wet weather.
SS. Water taps.
T. Closet.
VVVV. Closets.

This basement (*Fig*, 171) is well planned, and contains play rooms for wet weather; boiler, fuel, and janitor's rooms. Each of these play rooms is furnished with a water tap and sink (see S, *Fig*. 171). There are two stairways of good width, and a passage way, or hall, on either side of the stairs. If necessary, one or more of the rooms, R, R, may be appropriated to the janitor, leaving still three good-sized play rooms for wet weather. The basement walls should not be less than twenty-four inches thick of solid stone masonry. The upper walls, for the first storey, should be eighteen inches, and for the other storeys fourteen inches. (See note on page 156.) The interior walls should be solid.

In the following plan (*Fig.* 172) we have a compact arrangement of six adjoining class rooms, yet none of them having any communication with each other.

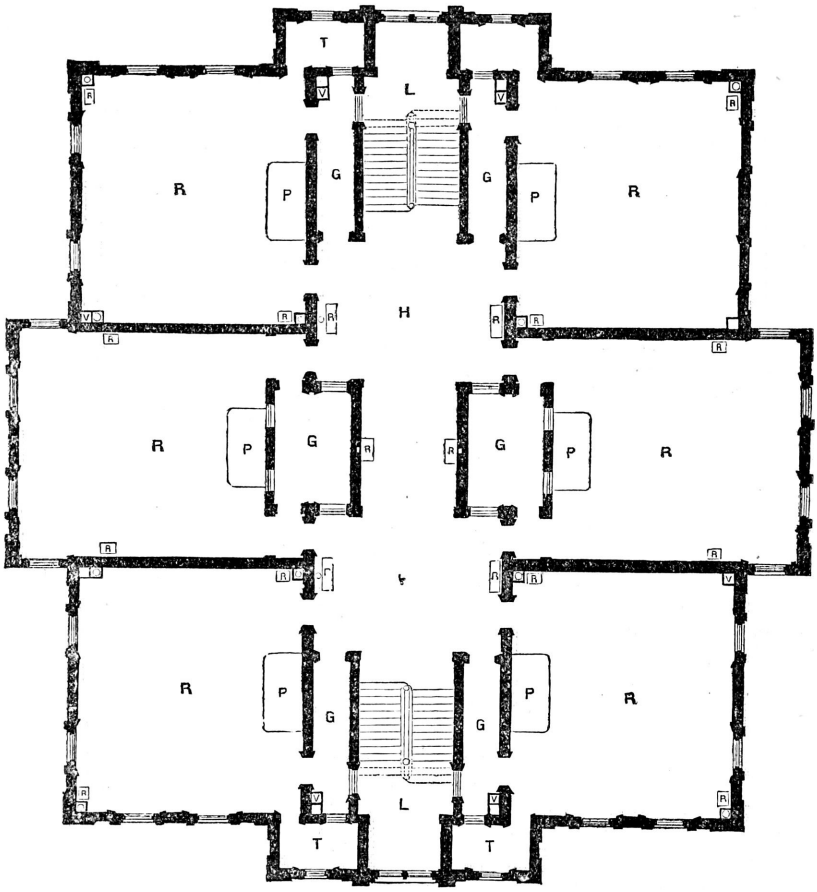


Fig. 172.—PLAN OF FIRST AND GROUND FLOORS, ADAPTED TO FIG. 170.

GGGG. Wardrobe passages.
GG. (In centre) Cloak rooms.
HH. Central hall.
LL. Front and rear entrances.
PPPPPP. Teachers' platforms.
RRRRRR. Class rooms.
RRRRRR. Registers.
TTT. Teachers' closets.
VVVVVV. Ventilators.

Fig. 172 exhibits a compact arrangement of the first and second floors. The six school-rooms on these floors are most convenient in regard to size and their relative position. Each room, as will be seen, is well lighted—those at the angles on two sides, and those in the centre at the ends only. The pupils all face inward toward the blank wall, so that no light falls directly on their eyes—an arrangement much to be commended, and, in the opinion of medical men, essential. On this subject the attention of trustees and others concerned is specially directed to the remarks on this important subject, as given on page 41, which see. As each class room is separate and distinct in itself, its exercises can be carried on without reference to, or interruptions from the proceedings of, the others. Each room, too, it will be seen, has two entrances (and exits)—which will be found very convenient, as both sides of the room can be filled or emptied simultaneously. Thus neither crowding nor confusion can arise in the room among the pupils, where the school is under the ordinary discipline of a good teacher.

NOTE.—In regard to the construction of the walls, we would say that the outer walls should not be less than eighteen inches thick up to the top of the first storey, and fourteen inches thick, up to the top of the second storey. The walls of the third storey may be twelve inches. The mansard roof portion may be of two by four, or four by four scantling.

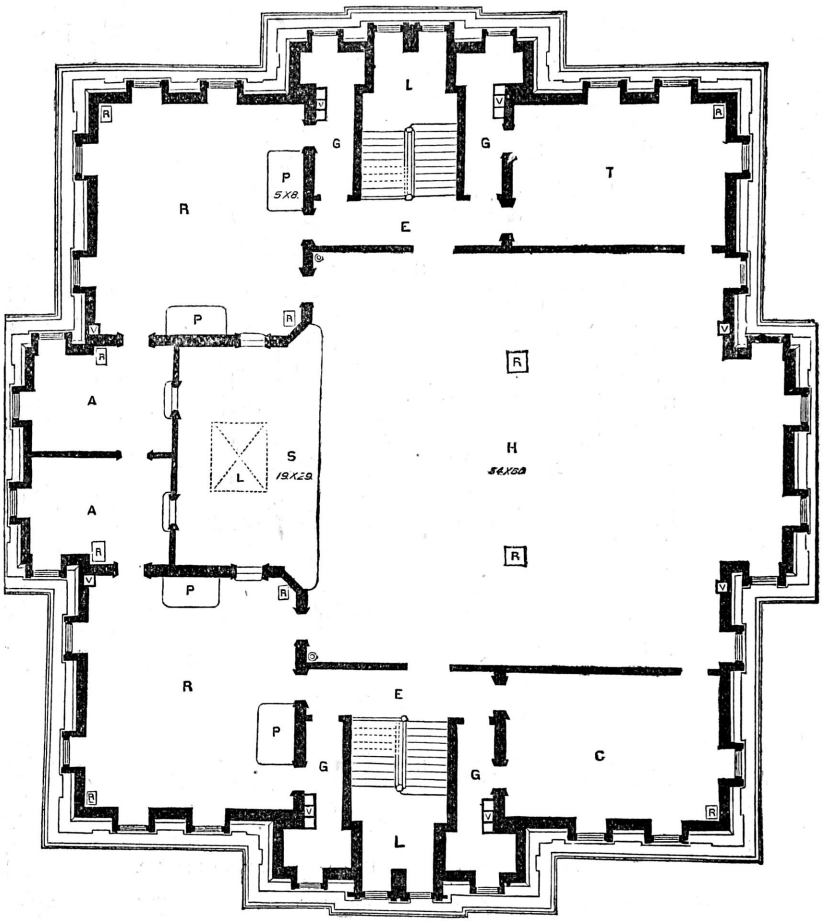


Fig. 173.—PLAN OF THIRD FLOOR, OR MANSARD ROOF STOREY, ADAPTED TO FIG. 170.

AA. Teachers' rooms.
C. Library.
EE. Landings.
GGGG. Passages.
H. Assembly hall.
L. Lantern (above platform).
LL. Stairway lobbies.
PPPP. Platforms.
RR. Class rooms.
RRRR. Registers.
S. Assembly hall platform.
T. Apparatus room.
VVVV. Ventilators.

Fig. 173 represents a most convenient plan of the mansard storey. It has a large assembly or examination hall, with two class rooms at the angles, which may be applied to other purposes, as may be thought desirable. This assembly hall is admirably constructed, and well lighted; the platform is large and convenient, and may be available for "declamation" exercises or other purposes.

NOTE.—The whole of the interior of this building is admirably planned. The only defect in it is one which we have frequently pointed out, and that is, the comparatively insufficient means of egress from the building in case of sudden alarm or panic among the pupils. There should at least be one more stairway in the building. (See remarks on page 120.)

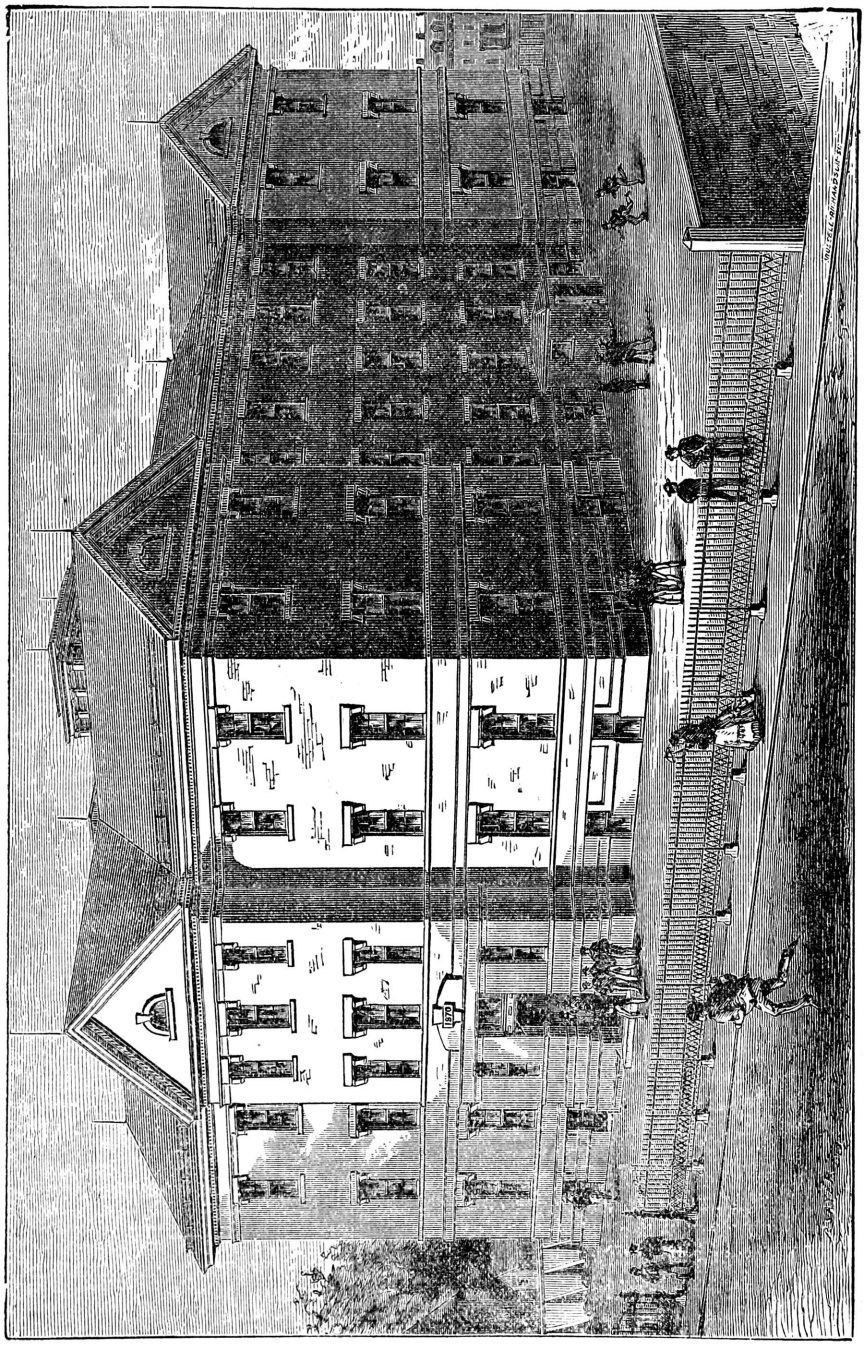


Fig. 174.—Design No. 53.—For a Collegiate Institute in a City, adapted to Figs. 175 and 176.

Design No. 53 represents a plain, massive building, adapted to a large high school or collegiate institute. It is an engraving of the Sherwin Grammar School, erected in Boston, Massachusetts, in 1870, and one of its superior schools.

NOTE.—The following interior plans contain the same number of class rooms as the preceding ones, but they are differently arranged, thus giving room for choice.

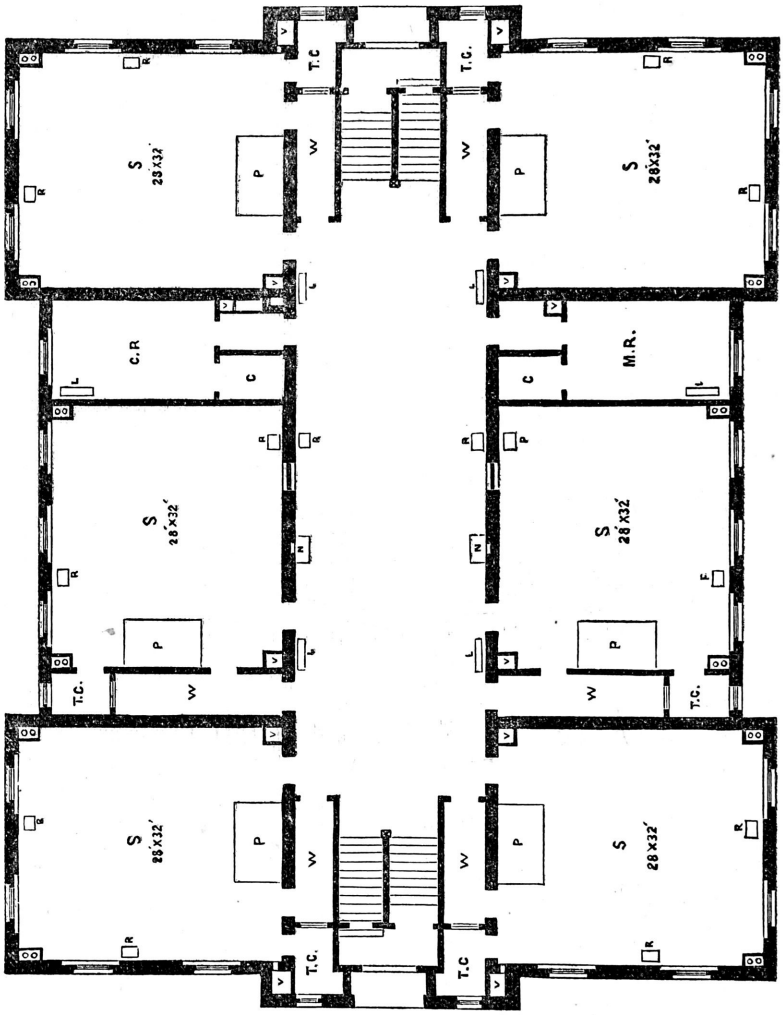


Fig. 175.—PLAN OF FIRST AND SECOND FLOORS OF DESIGN NO. 53.

CC. Closets.
CR. Library room.
LL. Tables.
MR. Apparatus room.
NN. Water taps.
PPPPPP. Teachers' platforms.
R. Registers.
SSSSSS. Class rooms.
TC TC TC TC TC TC. Teachers' closets.
VVVVVV. Ventilators.
WWWWWW. Wardrobes.

This plan (*Fig.* 175) is admirably arranged. There are two entrances to this school—one for boys and one for girls—besides a large, wide hall, which is a great improvement. On either side of this hall there are three class rooms.

It will be noticed that each recitation room has its own wardrobe for pupils, and closet or private room for the teacher. Each room has also its warm air register, platform for teacher, and ventilators. It will be thus seen that the school-rooms are complete in themselves in all of the necessary details. In such an arrangement of a school, order and discipline can be readily maintained by a teacher having ordinary ability to govern, and the harmony of the school promoted.

NOTE.—This attic storey differs in arrangement from that shown in *Fig.* 173, and in some respects is scarcely as convenient or well planned. It, however, affords variety.

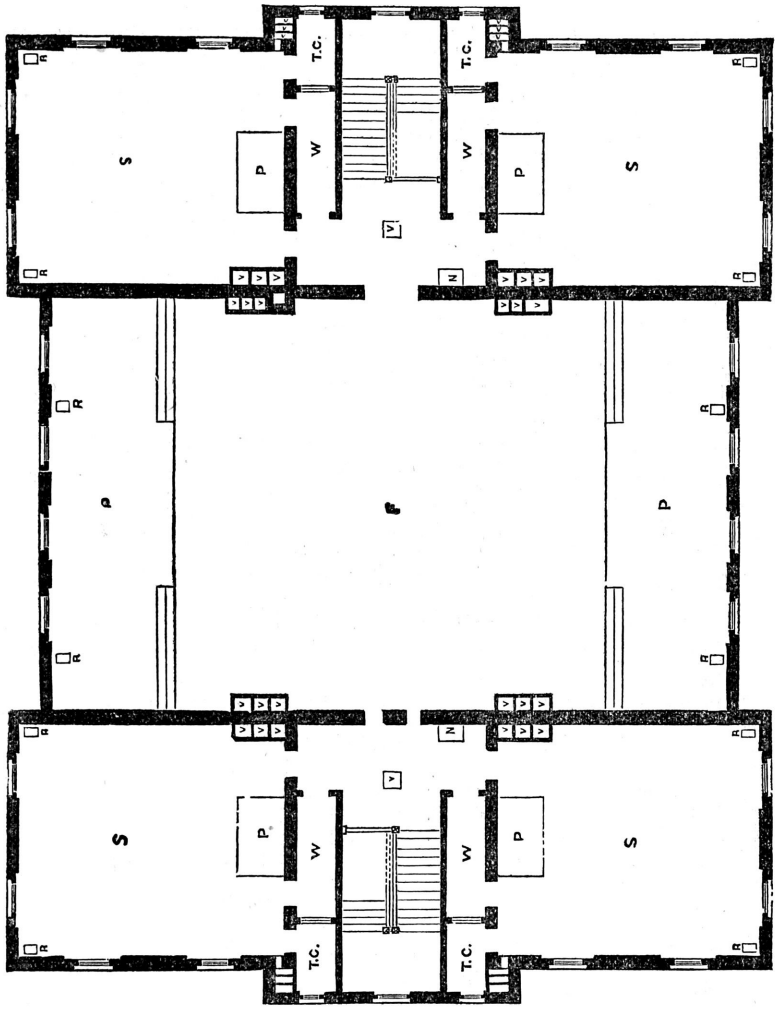


Fig. 176.—PLAN OF THIRD FLOOR OF DESIGN NO. 53.

F. Large assembly hall.
NN. Water taps.
PP. Large platforms.
PPPP. Teachers' platforms.
RRRR. Registers.
SSSS. Class rooms.
TC TC TC TC. Teachers' closets.
VVVV. Ventilators.
WWWW. Wardrobes.

The plan of the third floor (*Fig.* 176) of this building is arranged so as to have one large assembly room, with four good-sized class rooms—one at each angle of the building. The advantage of such an arrangement as this is, that the pupils of the whole school can be readily assembled in the large hall for the opening religious exercises of the day (or for examination at the close of the quarter). From this large hall, on ordinary school days, the pupils can file off without confusion into their respective class rooms, S, S, S, S. In this way regularity and order can be easily maintained in the school. There are, as will be seen in the plan, two sets of stairways, thus facilitating easy egress from the floor.

NOTE.—Strictly speaking, the following Design should have been placed among those of two storeys, on page 138; but the mansard or attic floor makes a third storey.

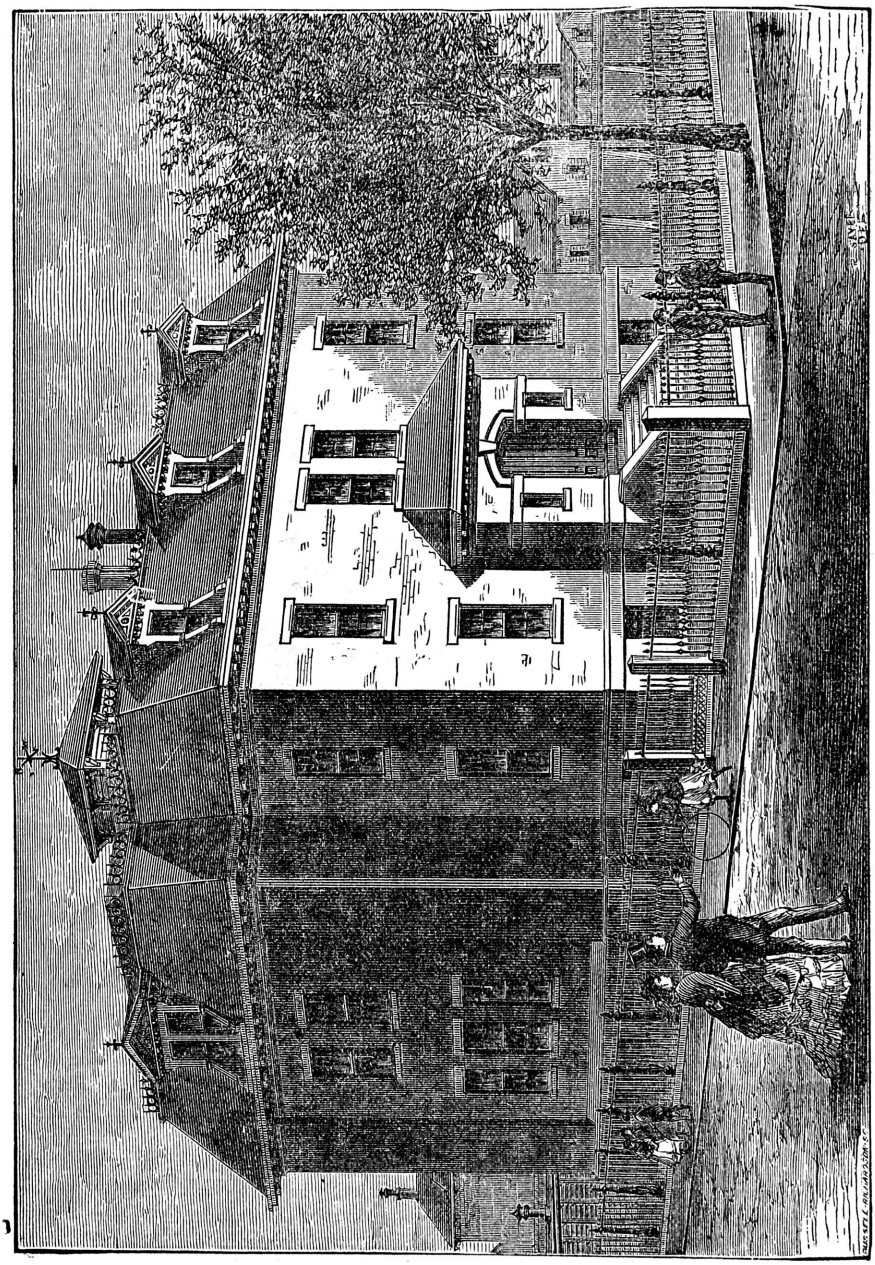


Fig. 177.—DESIGN NO. 54.—FOR A CITY OR TOWN PUBLIC OR HIGH SCHOOL, ADAPTED, WITH MODIFICATIONS, TO FIG. 153.

Fig. 177 represents a plain, substantial brick building, adapted to a public or high school in a town. The engraving is that of the Capen Primary School, erected in South Boston, Massachusetts. The interior plans adapted to it will be found on pages 135, 136, and 150, *Figs.* 144, 145, 146, and 167.

The following engraving (*Fig.* 178) is that of the Haven School-house, in Chicago, Illinois. It is not equal to the Boston schools in appearance, however.

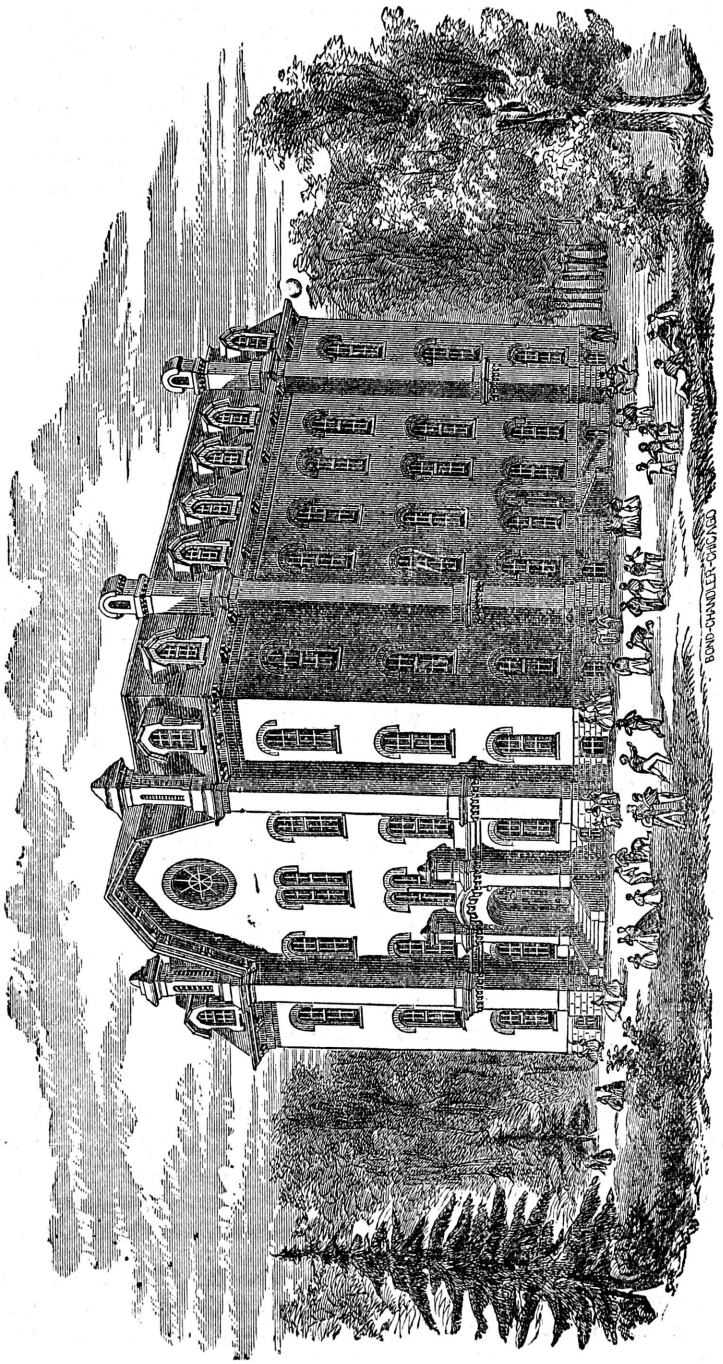


Fig. 178.—Design No. 55.—City High School or Collegiate Institute, adapted to Figs. 179, 180, 181 and 182.

With the exception of the clumsy finish of the front gable of Design No. 55, this perspective would be well adapted to a high or large central school or collegiate

institute for a city. It represents a building three storeys high, besides a basement and an attic. The plans here shown (*Figs.* 179, 180, 181 and 182) are of the basement, ground floor or principal storey, second floor, and of the attic, the latter of which (*Fig.* 182) contains a large hall, D, for the drawing classes of the school, with closets for apparatus, teachers' closets, and wardrobes attached; and a gymnasium, E, in which the smaller pupils of the school may exercise in inclement weather. The basement is mainly divided into four large rooms, with corridors and stairways; one of the rooms can be used for fuel, and the balance as a place of recreation for pupils in bad weather. The principal or ground floor (*Fig.* 180) has four school-rooms, each having a wardrobe and teacher's closet

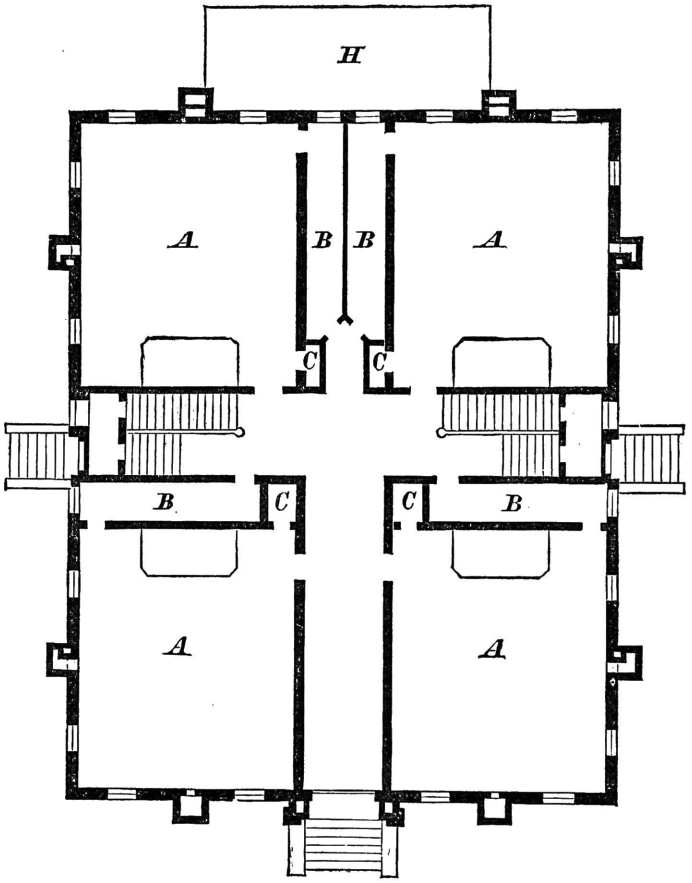
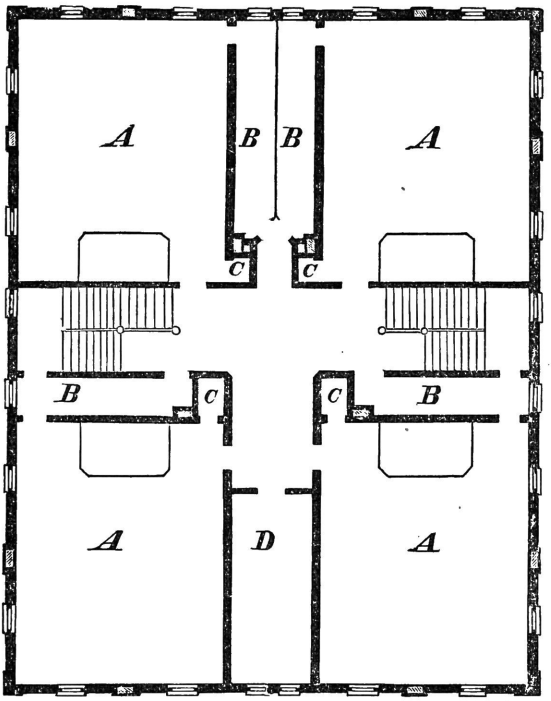


Fig. 179.—Basement Plan of a Central or High School, adapted to Fig 178.

attached; spacious corridors, with entrances on each side of the house for pupils, and a principal entrance in front. The side doors do not open directly into the corridors, but into vestibules, from which other doors open to the corridors and also to the stairways leading to the basement. The second and third floors only differ from the first in having windows in place of the outside doors and vestibules of the first floor; and the second floor has a reception or principal's retiring room, cut off from that part of the corridor towards the front of the house. By an examination of the plans it will be seen that the pupils, in passing to and from the school-rooms, will generally have to pass through the wardrobes, B, B, B, B.

The rooms are designed to be ventilated through the ventilating shafts or buttresses in the exterior walls (*Fig.* 179). The exterior is in a plain Italian style of architecture, and is devoid of anything like ornamentation, save in its bold projecting buttresses, which form the ventilating and chimney shafts before mentioned. The deeply recessed doorway in front, with buttresses on each side, and mansard roof—the sloping sides of which are covered with slate, and pierced with dormer windows—gives it altogether a pleasing effect. Externally, the finish of the basement to the principal floor should be stone. Above this the building may be of red or white brick, neatly pointed, with stone (or white or red brick) dressings to doors, windows, buttresses, etc. The building is designed to be warmed by a boiler placed in a room, H (*Fig.* 179), at the rear of the building, and covered with a lean-to roof rising no higher than the basement. The boiler house, H, is very properly placed in the rear of the building. (See note on page 156.)



REFERENCES.

AAAA. Class rooms.

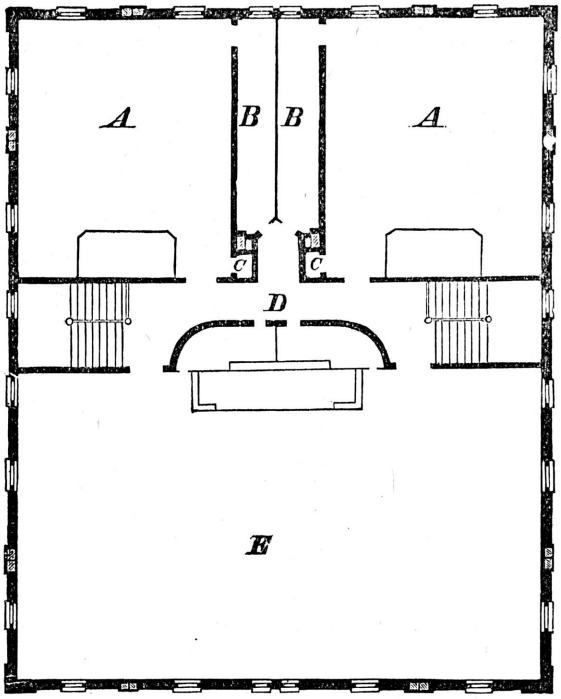
BBBB. Passages and wardrobes.

CCCC. Teachers' closet.

D. Teachers' room.

Fig. 180.—Plan of Ground Floor, adapted to Fig. 178.

Fig, 180 is the ground plan adapted to Design No. 55. The arrangement on this ground floor is very convenient. Each room, as will be seen, is entirely separated from the others by the passages and wardrobes, B, B, and by the teachers' room, D, and thus the noises are reduced to a minimum. There are also two stairways, which facilitate easy egress from the building. This is a matter which should always receive special attention on the part of the trustees and architects, so as to prevent the sad and painful consequences of a sudden fright or panic amongst the pupils. The remarks and illustrations on this subject, which will be found on page 120, will furnish some useful hints on this subject, to which the attention of trustees is solicited. There is a closet, C, connected with each class room, but they are quite too small, while there is no separate room for the teachers' on the floor. This is a serious defect, which can and should be remedied.



REFERENCES.

AA. Class rooms.

BB. Separate passages.

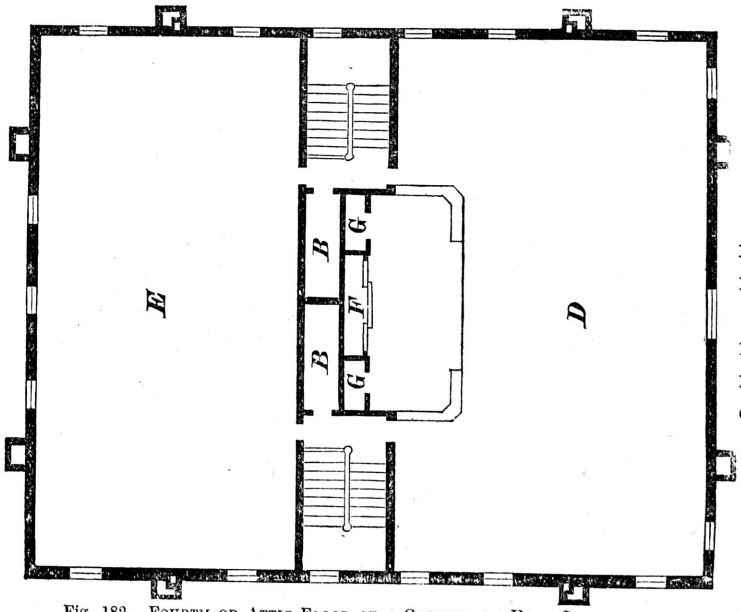
CC. Closets.

D. Lobby.

E. Assembly hall.

Fig. 181.—Plan of Second Floor of Design No. 55, Fig. 178.

The same plan of arrangement is followed in *Fig.* 181 as in *Fig.* 180, except that two of the class rooms are made into one large assembly hall. There is a large coved recess behind the teacher's platform.



REFERENCES.

BB. Closets.

D. Drawing or large assembly room.

E. Gymnasium.

F. Press.

GG. Closets.

Fig. 182.—Fourth or Attic Floor of a Central or High School, adapted to Fig. 178.

The foregoing plans (*Figs.* 181 and 182) furnish ample room in the building for the purposes of the school. The whole of the pupils may be assembled in the large room, E, *Fig.* 181, while rooms D and E, *Fig.* 182, will be found useful as a gymnasium for small children in wet weather, and as a room for drawing classes.

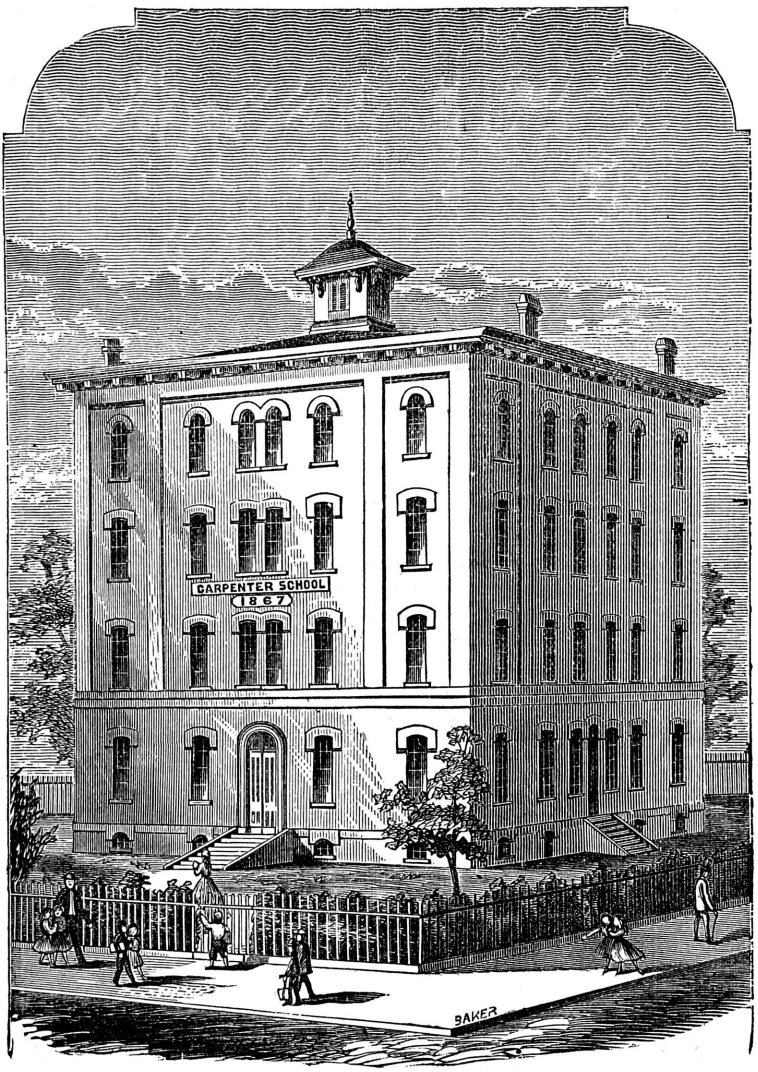


Fig. 183.—Design No. 56.—For a Central or High School in a City or Town.

Design No. 56 is that of the "Carpenter School," erected in Chicago in 1867. It is plain and compact. *Figs.* 179, 180, 181 and 182 are adapted to Design No. 56, which, for a school of that size and form, is an inexpensive style. The great objection to it, and to all other three or four-storey school buildings of a square form, is, the great danger to the lives of the children in case of panic or fire in the school. Besides, in the ordinary daily routine of the school, the noise necessarily caused by several hundreds of children is very great indeed, and leads inevitably, unless very great care is taken, to confusion and inconvenience. On these subjects see the remarks made on pages 120, 144 and 163.

The following engraving also represents a four-storey school building, but owing to its form and interior is much less objectionable than the preceding one.

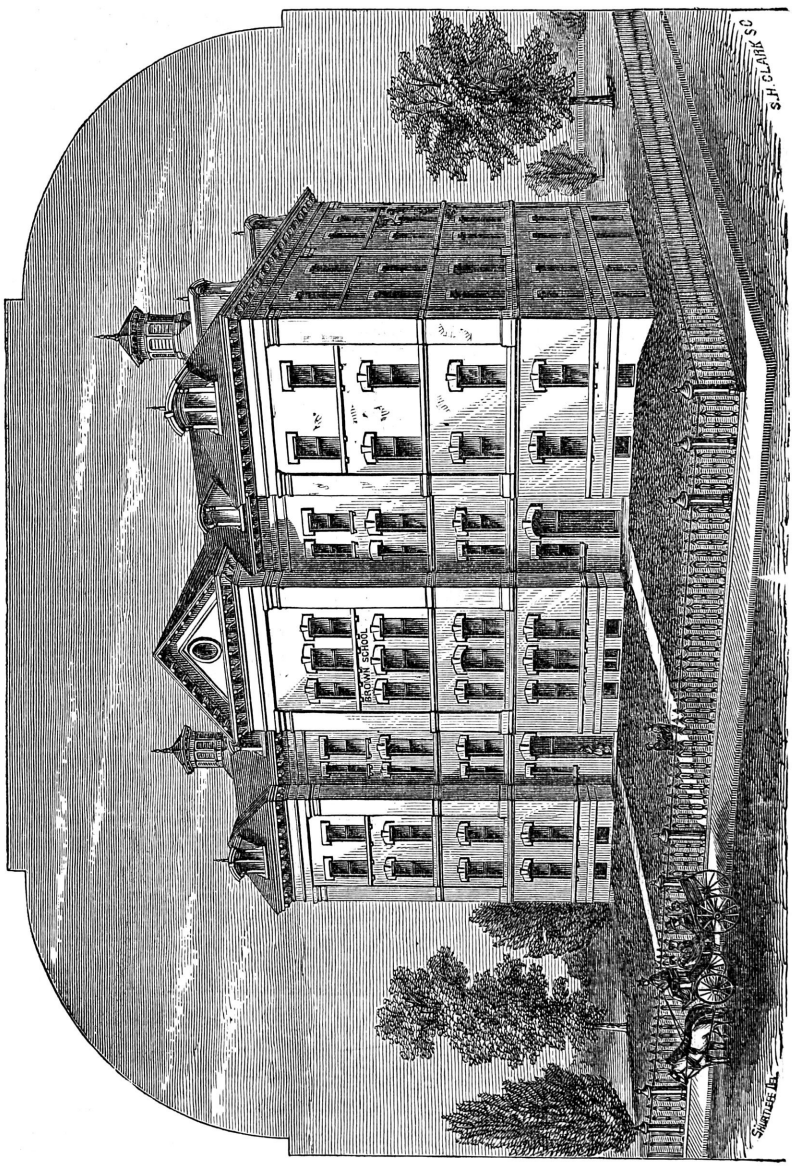
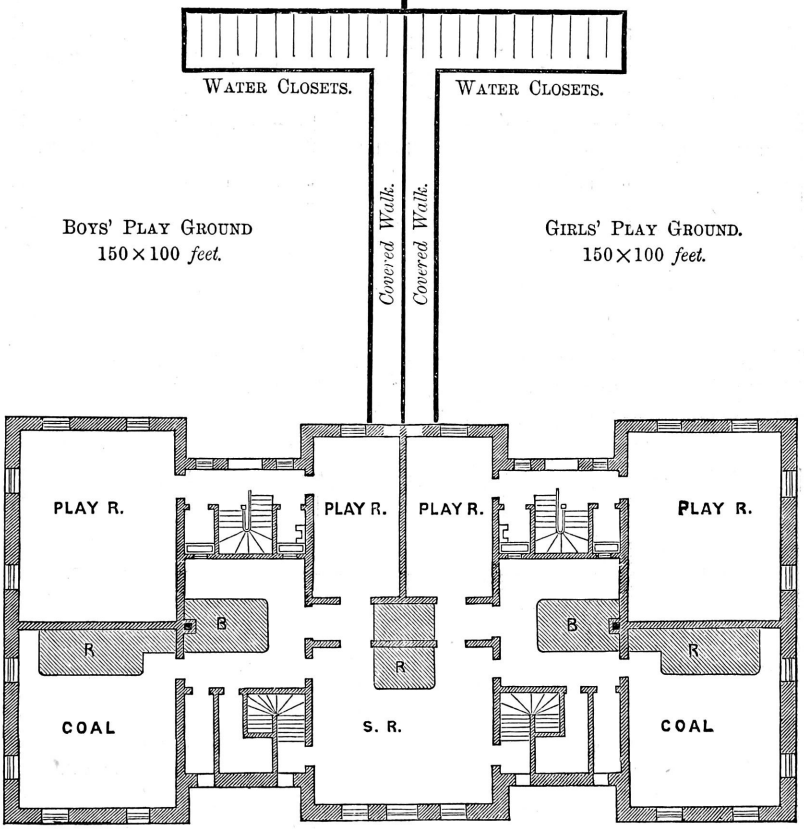


Fig. 184.—Design No. 57—For a High School or Collegiate Institute, adapted to Figs. 185, 186 and 187.

This Design (No. 57), is that of the "Brown School," of Hartford, Conn. It is a large, neat, plain building, and has a pleasing appearance. The objection to it is the same as that urged against the preceding Design—that is, its great height of four-storeys. Only in case of great necessity should a school building exceed two storeys, and then the suggestions on page 120 should be carefully followed by the trustees and those having to do with its erection.



PLAN NO. 1.—BASEMENT.

R.—RADIATORS. B.—BOILERS. S. R.—STORE-ROOM.

FRONT YARD.—200×75 *feet.*

Fig. 185.—BLOCK PLAN OF BUILDING AND GROUNDS OF FIG. 184.

This block plan (*Fig.* 185) is very compact and complete. The only objection is the proximity of the water closets. Those for boys and girls should be entirely separated, as already pointed out on page 27 (which see).

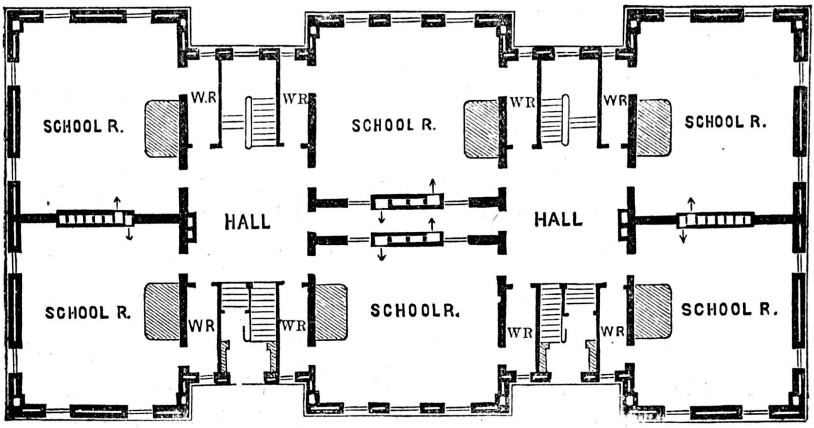


Fig. 186.—Plan of First, Second and Third Floors of Design No. 57.

WR WR WR WR. Wardrobes.

This plan (*Fig.* 186) is also very complete and compact. It provides for six class rooms on each of the first, second and third floors. These school-rooms are separated from each other by halls or passages.

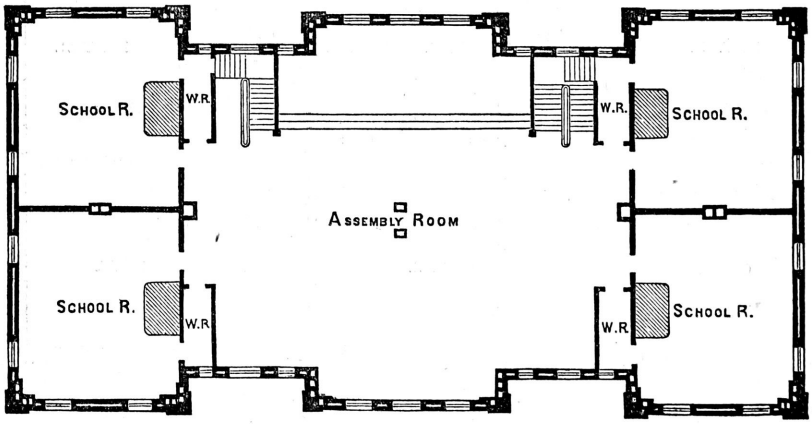


Fig. 187.—Plan of Fourth Storey of Design No. 57.

This plan (*Fig.* 187) differs from the others in having its large, central assembly room, with a fine, wide platform for the speakers, in place of the two centre school-rooms.

It will be noticed in *Fig.* 186 that each school-room has its own separate wardrobe. One great advantage to be pointed out and commended in this *Fig.* is, that there are four staircases provided, so as to render egress from each floor as easy and convenient as possible. This provision very greatly lessens the evil of many-storied school-houses, and should always receive attention from trustees when they find themselves compelled to erect more than a one-storey school-house.

The next engraving (*Fig.* 188) is that of the Bowditch School, Boston, Massachusetts, and is one of the old, substantial style of school-houses in that city.

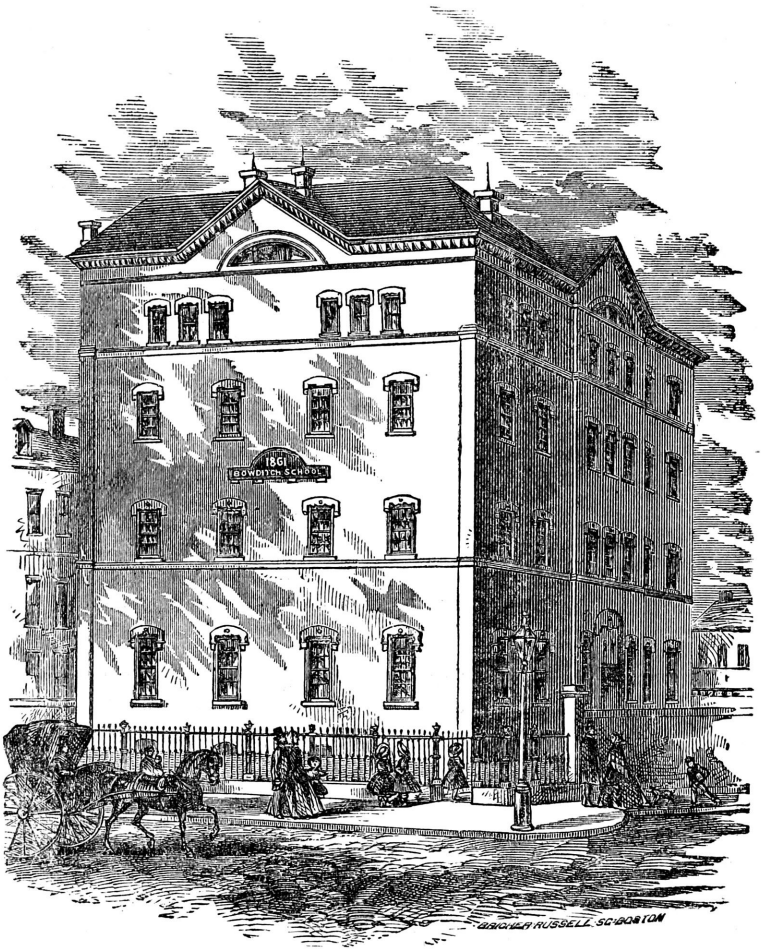


Fig. 188.—Design No. 58.—For a City Public or High School.

Fig. 188 represents a very plain but inexpensive style of school-house for a city or town. Economy and compactness have been consulted in its arrangements. These are good; but the present tendency on the part of trustees and others is to erect school buildings of a more ornate style of architecture, and for this we commend them. It is a great mistake to make a school-house look like a jail a poor house. It should be neat and elegant in its exterior, and convenient and complete in its interior arrangements. It is a misfortune, too, for children that they should, in cities and towns, where abundance of fresh air is required, be confined to the small area for play-ground with which (owing to the cost of land) trustees are often compelled to be content. Added to this, the heated, vitiated air, which, in such lofty school-houses as those of three and four storeys, is sure to be accumulated, is very unfavourable to health, and the life of a child attending them is not to be envied. It is to be hoped that where three and four-storey school-houses have to be erected, these evils will be removed or mitigated as far as

possible, and that trustees and other persons having to do with the erection of these lofty school-houses, will carefully consider the remarks on the subject of heating and ventilating school-houses, which will be found on pages 41-59.

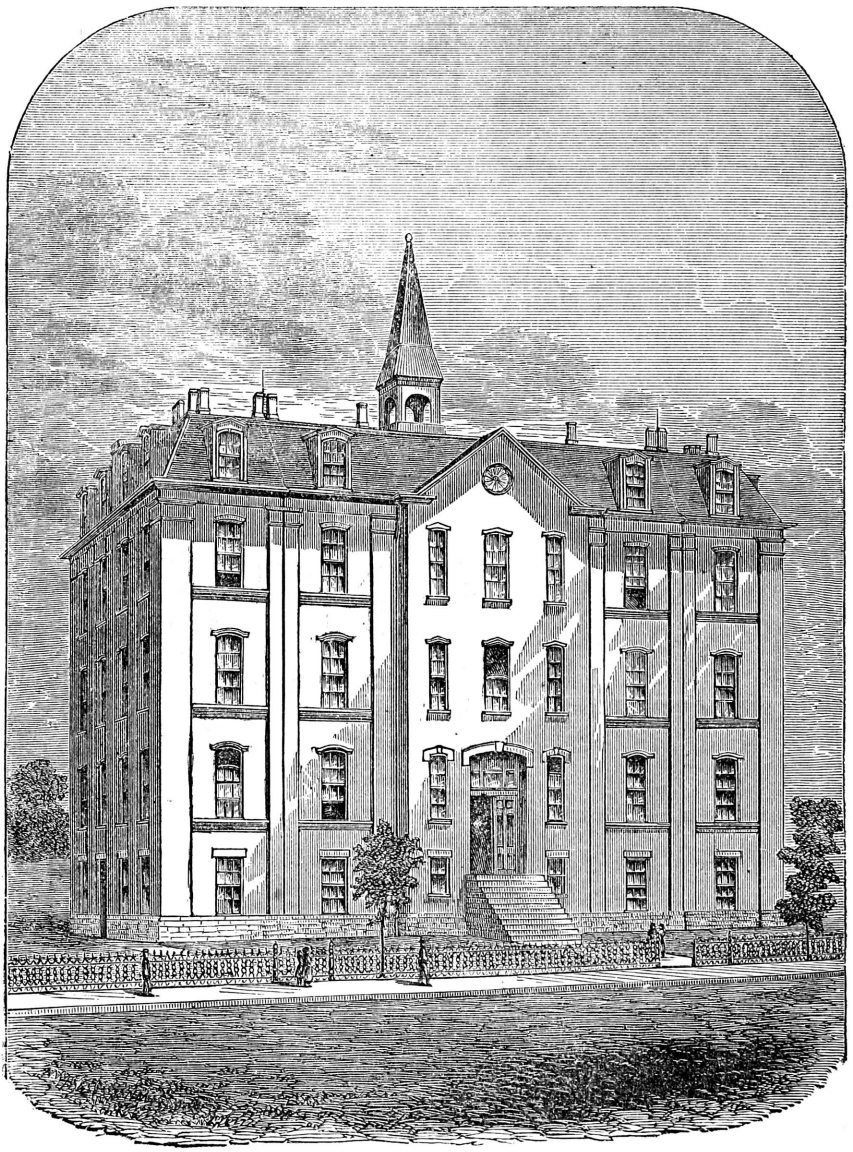


Fig. 189.—Design No. 59.—For a Public or High School House, adapted to Figs. 190 and 191.

Like the preceding Design, this building (*Fig.* 189) represents a very plain and compact school-house of four storeys high. We insert it for variety, although we cannot commend it for adoption. The meagreness of the cupola or belfry gives a mean appearance to the building. It is quite out of proportion to the size of the edifice. The interior arrangements are, however, very good, but not equal to those shown in *Figs.* 186 and 187.

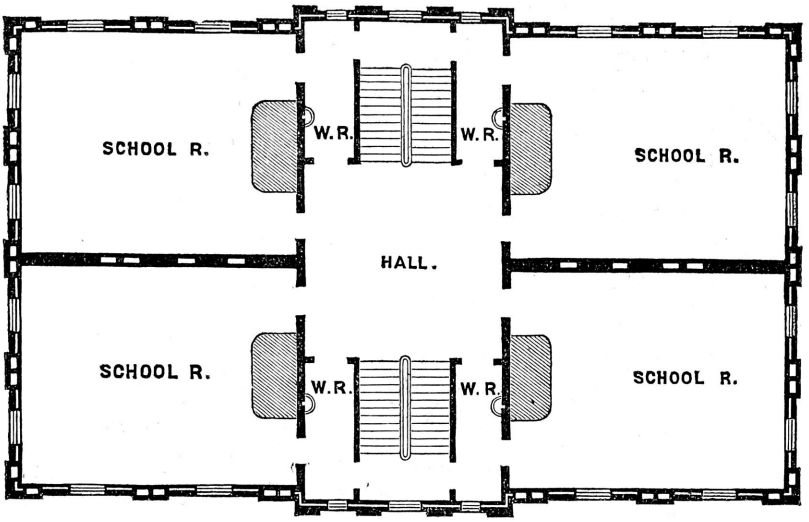


Fig. 190.—Plan of Second and Third Floors, adapted to Fig. 189.

Fig. 190 represents the second and third floors of Design No. 59. It has the advantage of a double stairway, which greatly facilitates egress from the school.

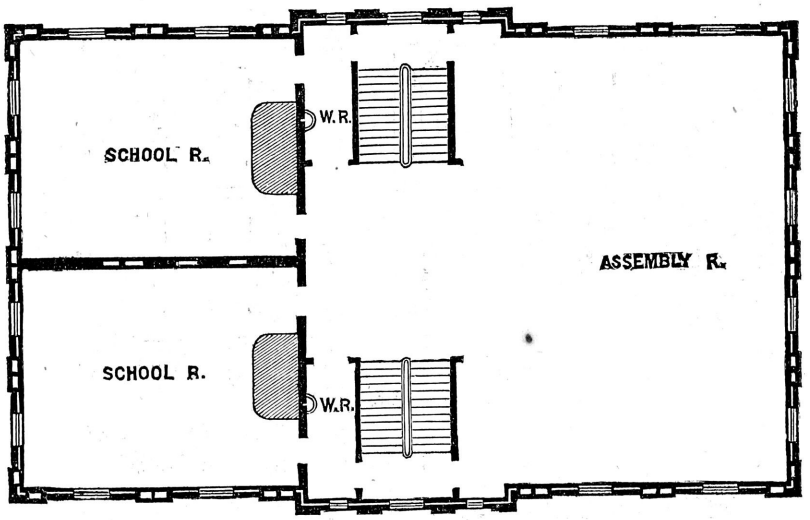


Fig. 191.—Plan of the Upper Storey, or Attic, adapted to Fig. 189.

The fourth floor has two school-rooms of the same size of those below. Each room is provided with a separate clothes room, with water, and everything for the comfort and convenience of the school. *Fig.* 191 is a plan of the attic floor.

Fig. 192 represents a structure two storeys high, exclusive of basement and attic. The walls of the superstructure are designed to be of red brick, faced externally with white brick. The trimmings of the doors and windows, and also the angle quoins, may be of Nova Scotia or Ohio freestone, or coloured brick. The basement should be of granite or ordinary stone. The walls may be finished with a handsome cornice, composed partly of stone and partly of wood and bricks,

with zinc or copper gutters. Above the main cornice is a high mansard roof, which is surmounted by an ornamental ventilating turret, about thirty feet high. Projecting from the middle of each of the two longer sides is a wing, and in front

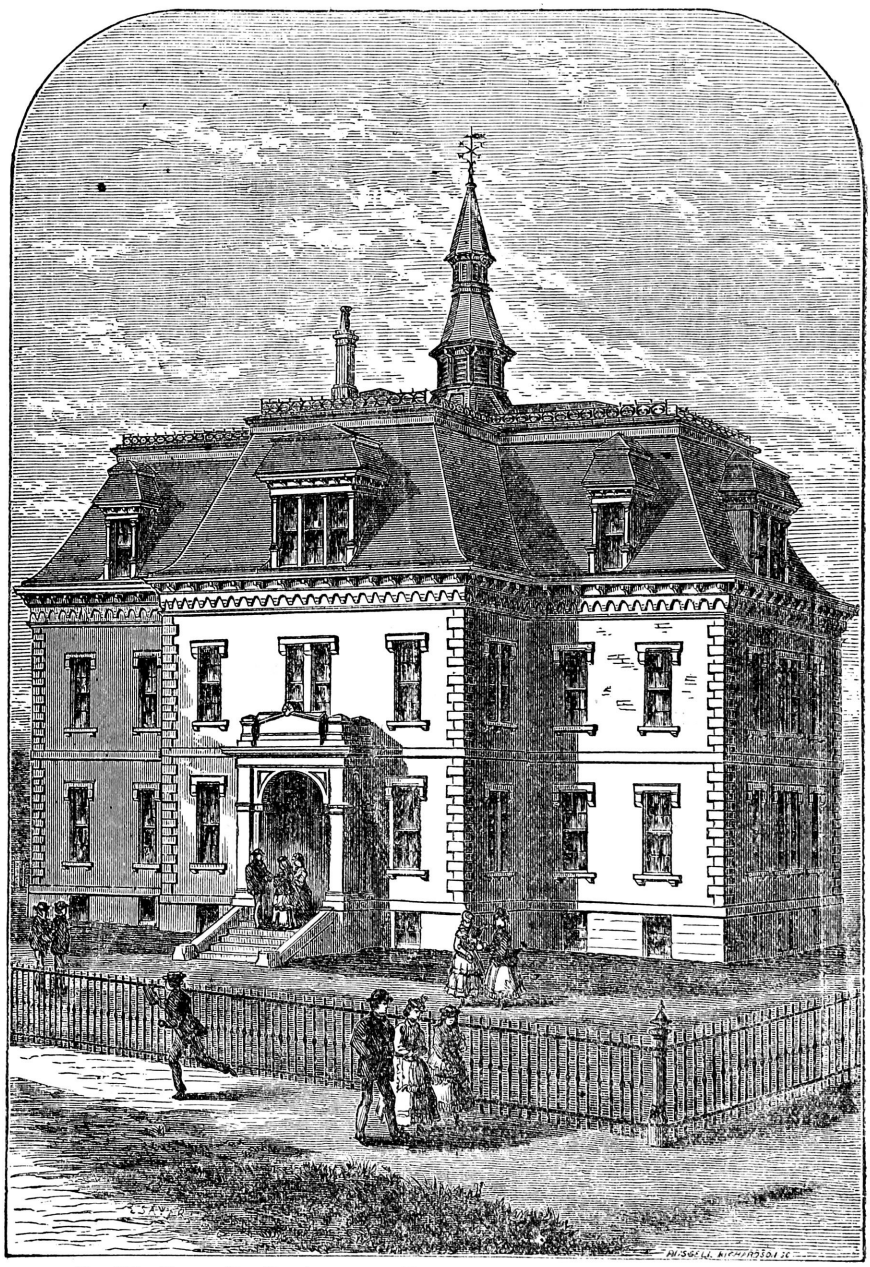


Fig. 192.—Design No. 60.—Adapted to Figs. 193, 194, 195 and 196. (See Design No. 62.)

of each wing is a brick and stone porch, or vestibule, through which the boys and girls enter. The wings are occupied by the staircases and cloak rooms,

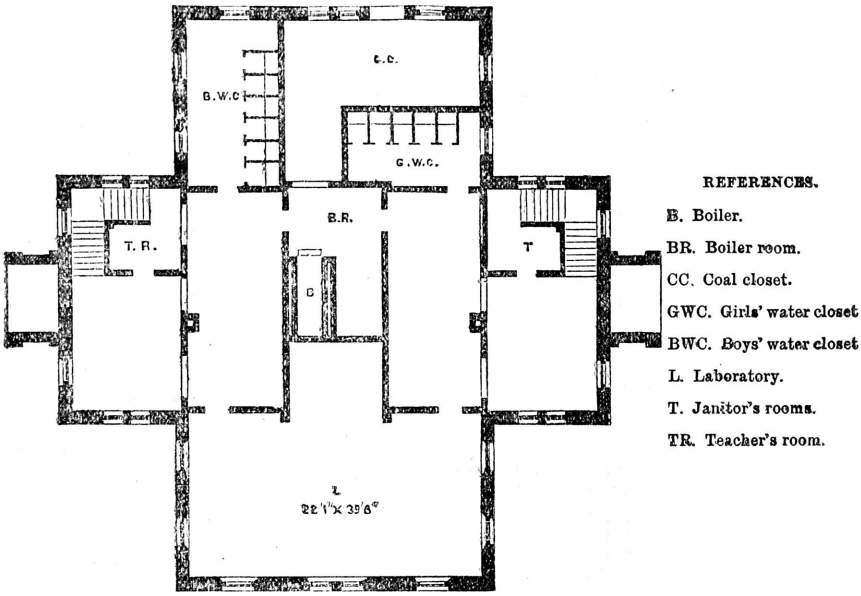


Fig. 193.—Plan of Basement, adapted to Fig. 192.

In the basement (*Fig.* 193) is a chemical lecture room and laboratory, a room for the steam-heating apparatus, coal room, dry earth closets for boys and girls, etc.

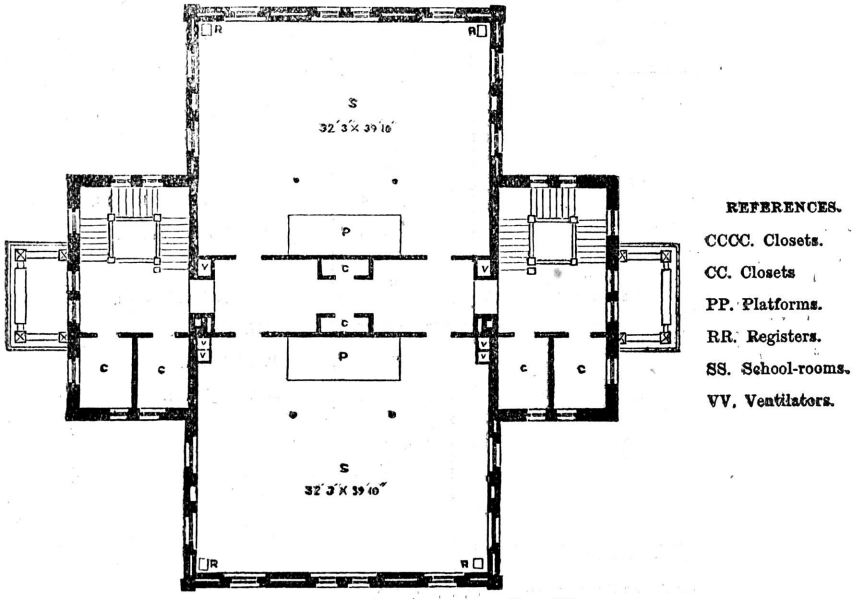


Fig. 194.—Plan of Ground Floor, adapted to Fig. 192.

In this ground floor (*Fig.* 194) provision is made for two class rooms, S, S (separated from each other by a hall or passage), with teachers' platforms, P, P, and closets, C, C, opposite the stairways, etc. The boys' and girls' entrances are at either side of the building, as well as the separate staircases to the upper floors.

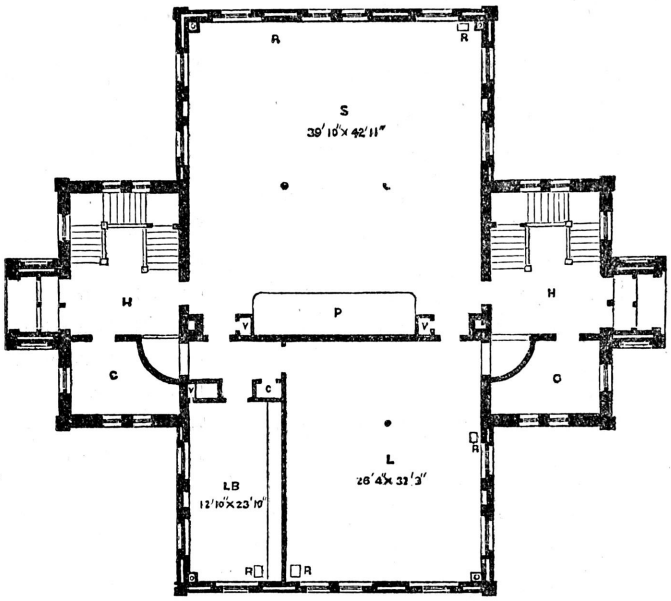


Fig. 195.—Plan of First Floor or Second Storey, adapted to Fig. 192.

On the first floor (*Fig.* 195) is a large class room, S, a lecture room, L, and library, L B, with lobbies, H, H, closets, C, C, registers, R, R, etc.

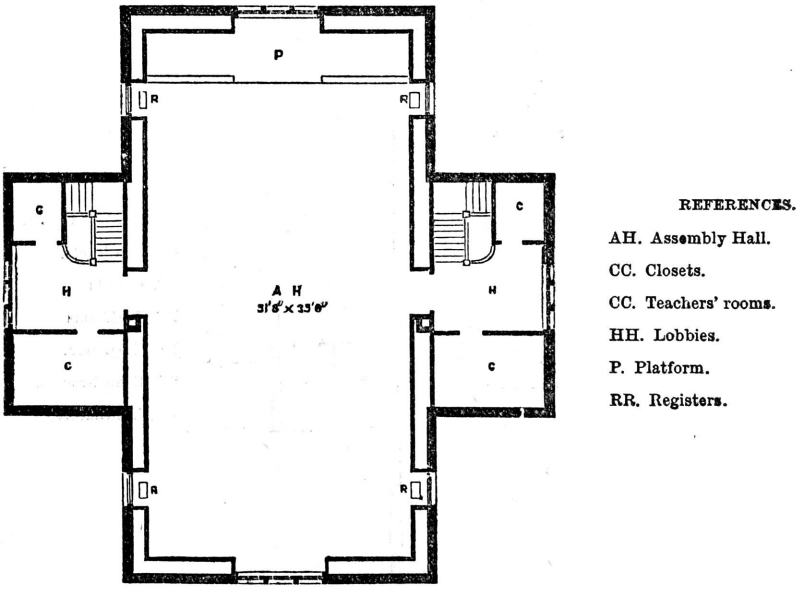


Fig. 196.—Plan of Attic Storey, adapted to Fig. 192.

The entire area of the attic storey of the main building is devoted to an assembly hall, A H, for the scholars, or for other purposes. There is a wide platform at the end for speakers, etc. The teachers' rooms, C, C, are opposite the stairways, and small closets, C, C, are at either side of them.

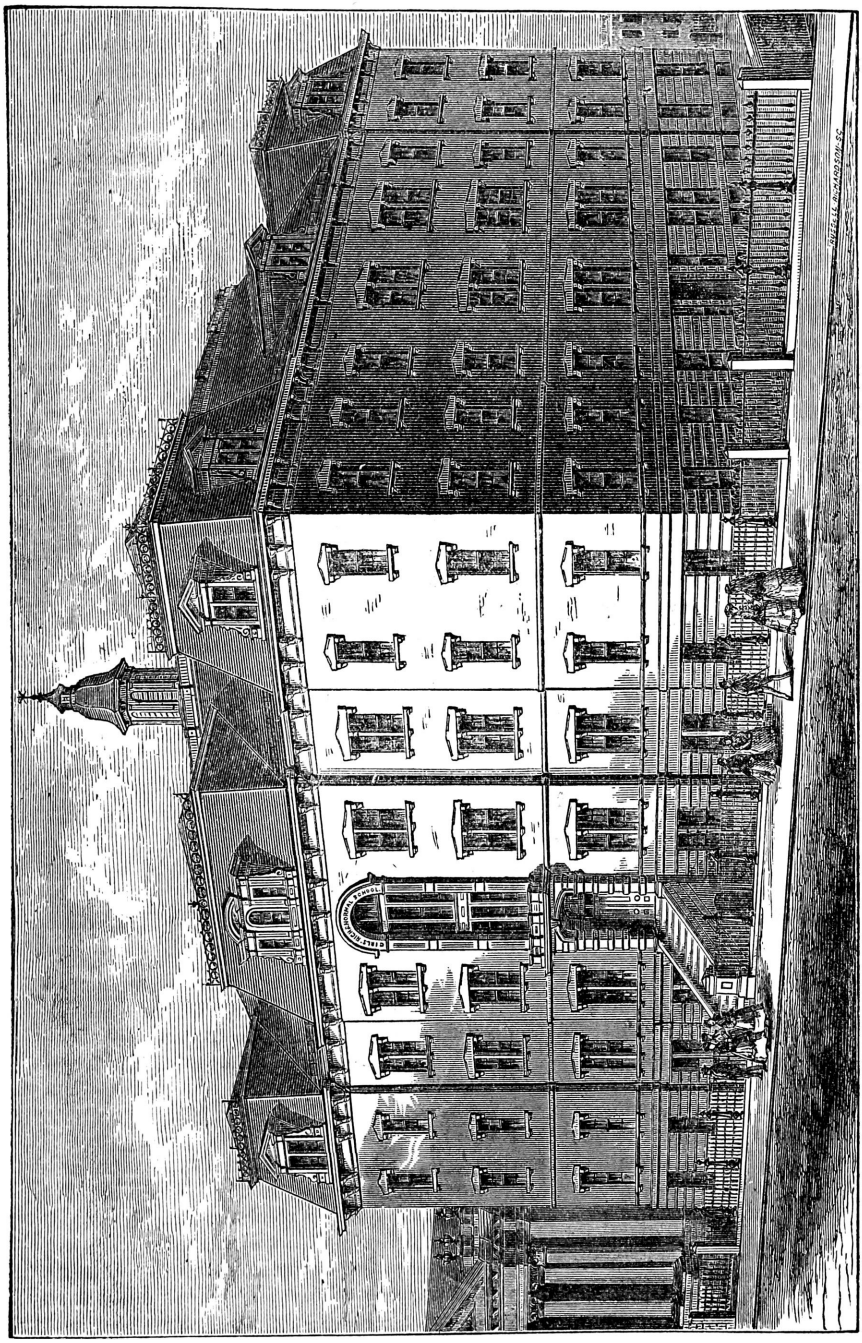


Fig. 197.—Design No. 61.—Perspective of a Central or High School or Collegiate Institute. (See Figs. 198, 199 and 200.

Design No. 61 represents the girls' high and normal school, erected in Boston, Mass. It is also adapted to a central or high school, or collegiate institute of the largest class. The building is plain and compact. The outlines of the building are broken at the corners by projections, and also on each side. There are

two entrances above the basement—one in the centre of each street front, and approached by flights of stone steps fourteen feet broad, which lead up to a vestibule. There are four finished storeys, including the basement, which should be at least twelve feet high; the first and second storeys are each fourteen feet high; the large hall in the third storey is eighteen feet six inches high.

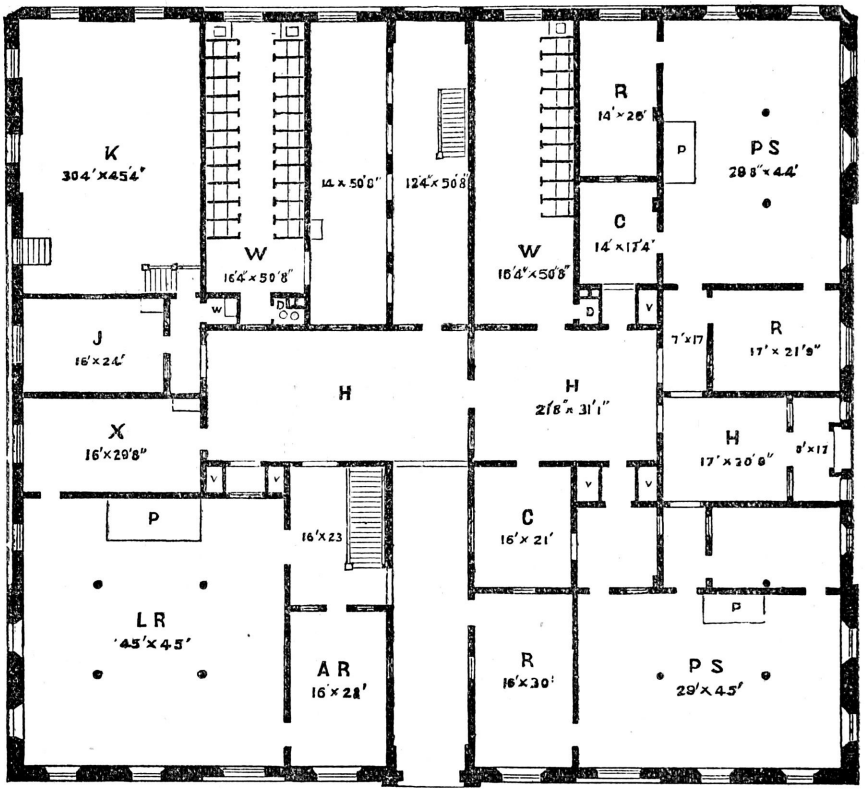


Fig. 198.—Plan of Basement of Design No. 61.

This basement plan is adapted to the purposes of a primary school, and should be almost entirely above the street level, as shown in *Fig.* 197. In the westerly corner of the basement storey is the chemical lecture room, L, R; around three sides of this room are tables placed about five feet away from the walls, and fitted up with all of the requisite apparatus and appliances, at which and with which pupils may perform experiments. On the fourth side of the room is the lecturer' platform and table; in the middle of the room are seats for the class. On th northerly side of and adjoining the lecture room is a laboratory, X. On th easterly side of the lecture room is a cabinet for minerals, A, R. Adjoining th inner end of the cabinet is a passage and staircase leading to the story above. In the northerly corner is the boiler room, K, which supplies the steam for heating the building. The room for coals occupies the space between the outside of the building and the line of the street, of the width of the boiler room, and out to the curbstone under the sidewalk. At the southerly end of the boiler room is a room for the janitors, J. On the easterly side of the boiler room are the water-closets, constructed on the dry earth principle, and occupying a space between the side of the boiler room and side of corridor. The remainder of the space in the north-westerly half of the building is occupied by the central hall, and a staircase at the end of the corridor.

There are, as may be seen in the plan of the ground floor (*Fig.* 199), two staircases, one in the front and the other in the rear. The gallery and school-rooms are in the angles of the building—the parts between are occupied with hall, H, masters' rooms, M, R, R, R, library and store rooms, F, T, and closets, C, C, C, etc. In the middle of the building is a central hall, H, crossing the corridor at right angles; at each end of the hall are two rooms, R, R, R, N, which, with the hall, occupy the entire length of the building. It will be observed that the hall and corridor divide the building into four equal sections or quarters, which are subdivided as follows:—At the left of the front entrance is a reception room, F; beyond the reception room is a passage leading from the corridor to the master's

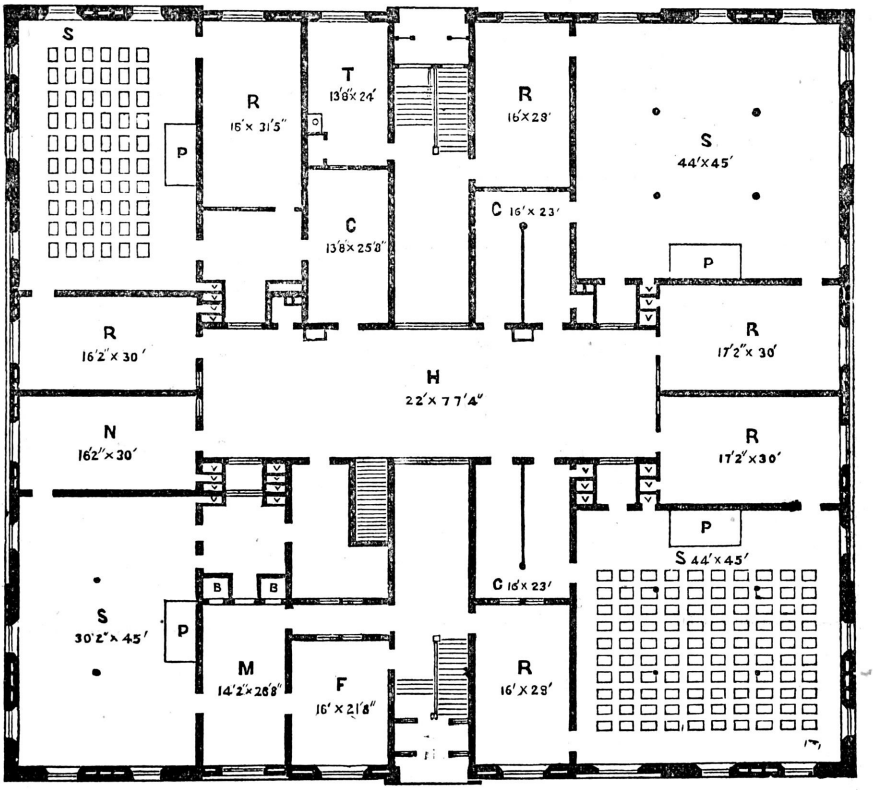


Fig. 199.—Plan of Ground Floor, adapted to Fig. 197.

room, M, which can be furnished, and the walls lined with bookcases. This room is connected with the reception room, F, and with a room, S, for the advanced class, occupying one corner of the building. The inner portion of this quarter of the building is occupied by a passage leading from the hall to the advanced class room, S, and master's room; a staircase leading down to the basement storey, a cloak room for the advanced class, master's closets, B, B, and the ventiducts, V, V, V, V, for this quarter of the building. At the end of the central hall, and occupying the middle portion of a side, are two rooms, one of which, R, is designed for a library; the other, N, is a recitation room. In the corner is a class room, S; at the south-easterly side of the class room is a recitation room, R, between the inner end of which and the central hall is a large, brick foul-air shaft and chimney, and a passage leading to the class room, recitation room, and cloak room in this

quarter of the building. At the right of the rear entrance is a dressing room, T, for female teachers, at the inner end of which, and occupying the remainder of the space in this quarter, is a cloak room, C. At the left of the same entrance is a recitation room, R; in the corner of the building is a class room, S, adjoining which, on the side, and at the end of the central hall, is another recitation room, R, connected with S. The remainder of this quarter is occupied by a cloak room, C, divided in two, and occupying the space between the side of the central hall and inner end of recitation room at the left of entrance, and a space lying between the class room, S, and hall, and the recitation rooms, R, R, at the end of the hall. The ends of this space are occupied by the ventiducts, V, V, V, for this quarter of the building; through the middle is a passage leading from the hall to the class room. The southerly quarter of this floor has the same amount of accommodation, and is arranged precisely like the easterly quarter last described; and further, the same arrangement is carried through the three storeys above the basement, in the south-easterly half of the building and the westerly quarter of the second storey; that is to say, a class room, two recitation rooms, and a cloak room, as above described. The northerly quarter of the first floor or second storey plan contains a class room, S, with two recitation rooms, a cloak room, teachers' dressing room, etc., as in the northerly quarter of the first storey.

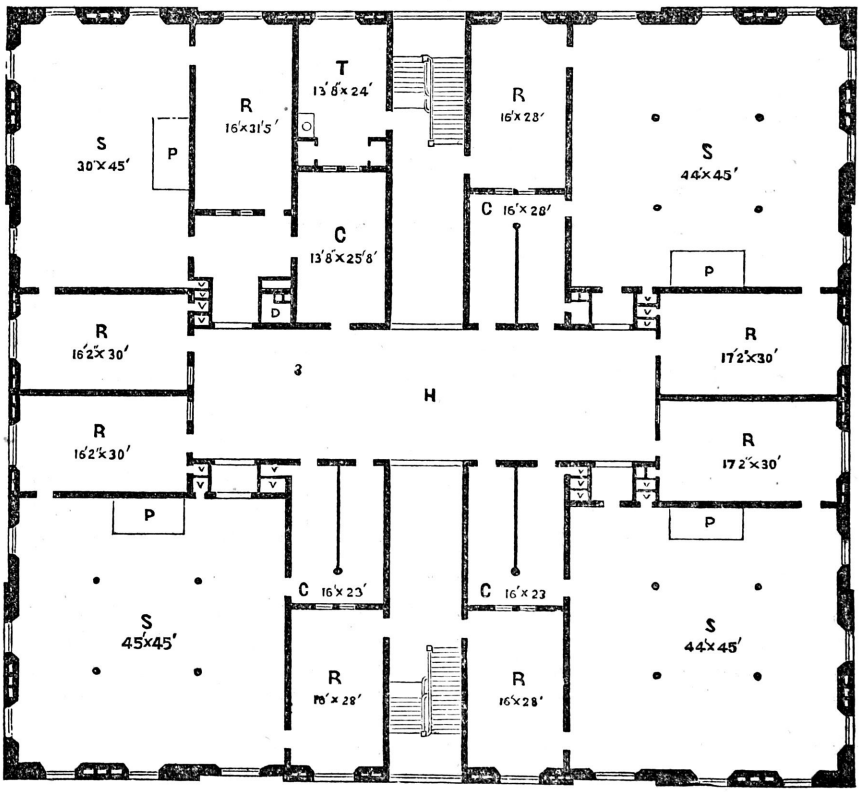


Fig. 200.—Plan of the First Floor or Second Storey, adapted to Fig. 197.

Fig. 200 represents the plan of the first floor, and is almost identical in arrangement with that of the ground floor. The school-room at the left angle is, however, larger, and two wardrobes take the place of the stairway to the basement.

The arrangement of these wardrobes is very convenient. The pupils pass into them through one door and out of them by another, leaving their coat or cloak, bonnet or hat, as the case may be, on the peg in passing. There need therefore be no crowding or confusion on the part of pupils.

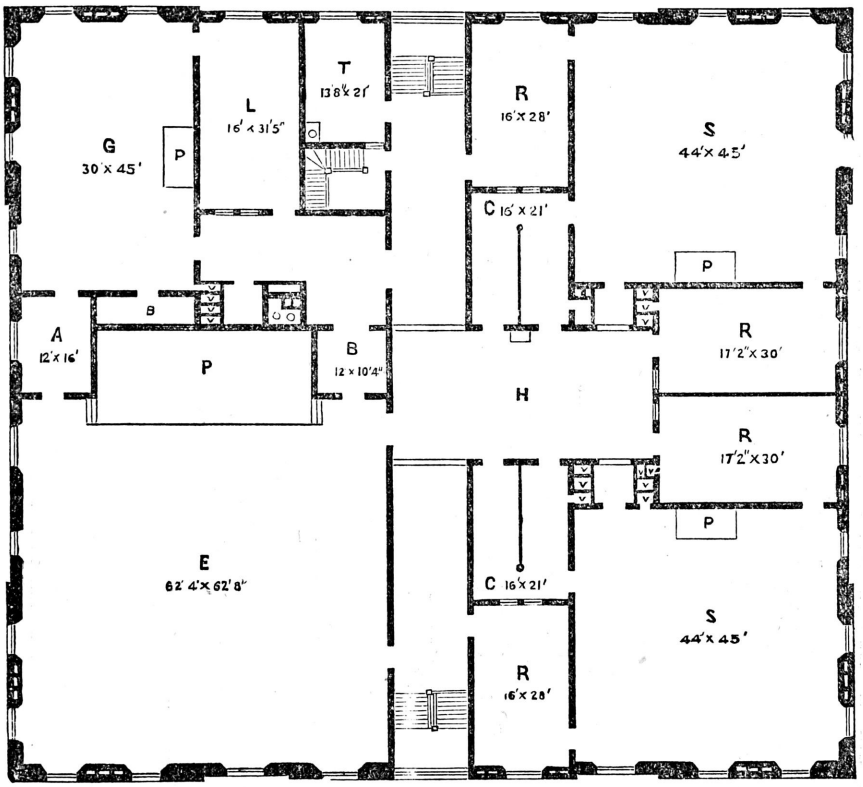


Fig. 201.—Plan of the Second Floor or Third Storey, adapted to Fig. 197.

Fig. 201 is similar to *Fig.* 200, except that there is a large assembly room, E, instead of a small room, S, as in *Fig.* 200. There is a large platform, P, for the speakers, with conveniently sized rooms, A and B, at either side, for teachers or other purposes. The central hall, H, is shorter than in *Fig.* 200, and there is a stairway near T leading up to the attic storey. The arrangement is otherwise about the same as in the other storeys, and is very convenient for the double purpose to which the original building was applied. The great objection to it and to other large, lofty buildings, is, that the means of egress are too limited. (See note on page 189.) Instead of two stairways in the building there should be at least four, so that the pupils could make their exit readily in case of alarm or panic. We have before called attention to this serious defect on page 120. The basement of all of these school-houses should be finished at least ten feet high; the first and second storeys fourteen feet high; and the assembly hall sixteen feet high. The walls of the basement ought to be twenty-four inches thick; those of the first floor eighteen or twenty inches; and those of the second and third floors fourteen and sixteen inches. The great advantage of such substantial walls is, that they ensure the stability of the building, while they contribute to the warmth of the school in winter, and its coolness in summer.

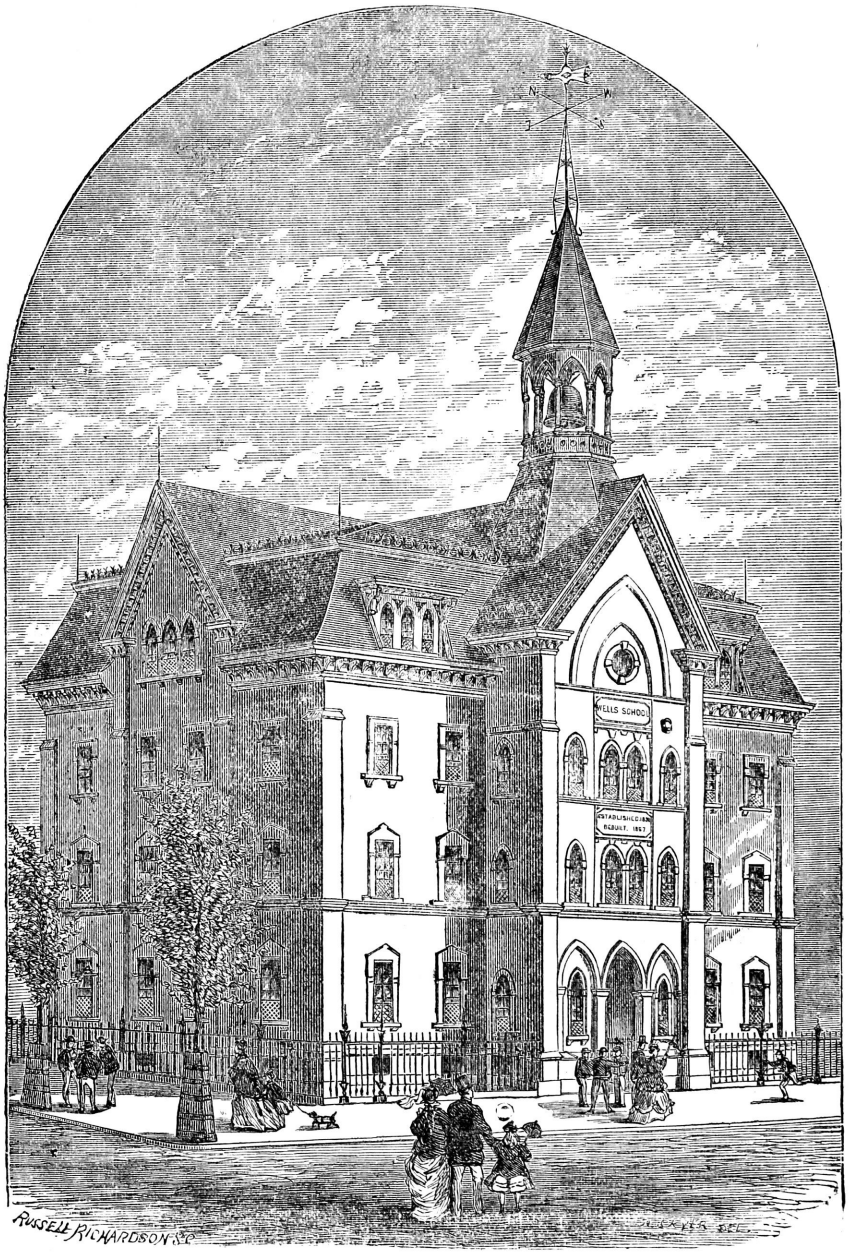


Fig. 202.—Design No. 62.—For High School, adapted, with modifications, to Figs. 204 and 205.

Fig. 202 is a very handsome design for a high school or collegiate institute in a city. The proportions are harmonious, and the appearance of the building is neat and elegant. The engraving represents the "Wells' School," erected in 1867. Including the attic, or mansard roof, the building is four storeys in height. It is a handsome and yet substantial structure. The finish of the mansard roof and cornice is very neat and plain, and yet quite in harmony with the tasteful style of the building.

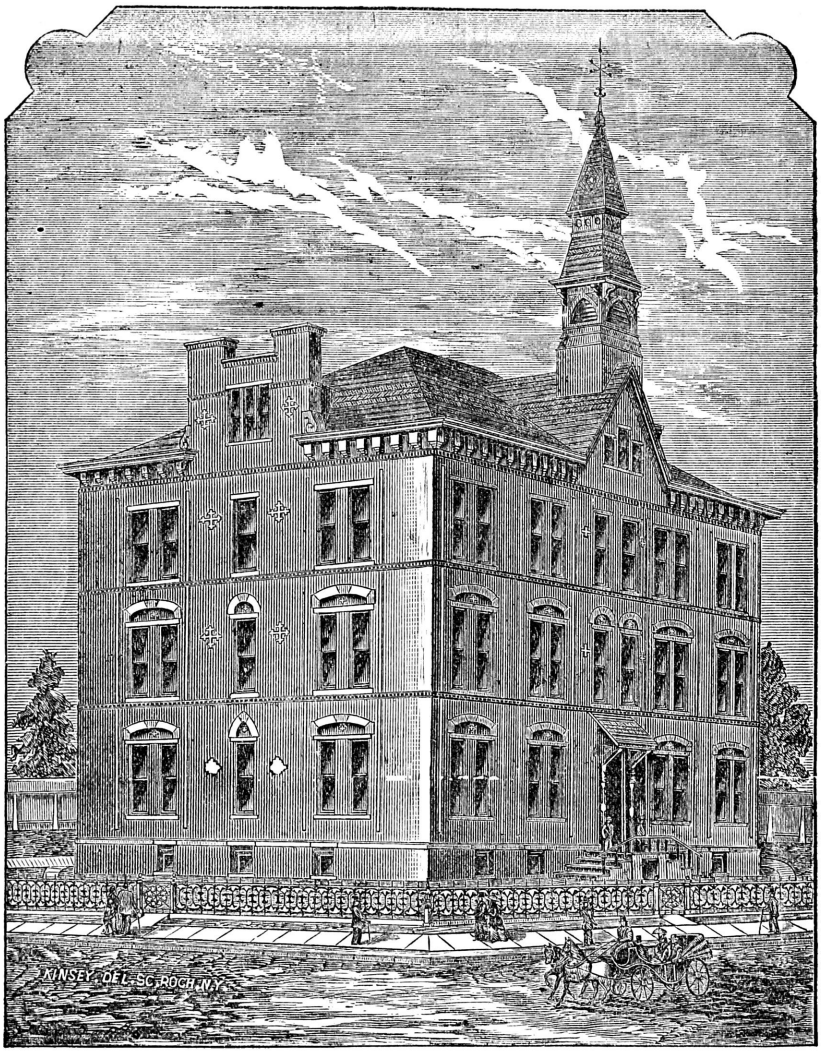


Fig. 203.—Design No. 63.—Central or High School, adapted to Figs. 204 and 205.

The engraving (*Fig.* 203) represents the Genesee school building, erected in Rochester, N. Y. It is a plain and compact school-house, and may be adapted to a central or high school, for a city or town. It has two entrances, a front and rear one. The style is inexpensive, and much less ornate (too much so) than that of the preceding Design, No. 62. The bell tower, or cupola, seems rather awkwardly placed on a front gable of the building, and gives the whole structure an inelegant appearance.

Fig. 204 is the plan of the ground and first floors, adapted to Designs Nos. 62 and 63. It has a front and rear entrance, and four convenient class rooms.

Note.—The walls of all such buildings should be double, bound together by iron ties, the exterior wall of faced brick, and the whole 20 inches thick, with a four-inch air space between, for the purpose of intercepting moisture, and promoting a uniform temperature through the building. The mansard roof should be covered with uniform slating; the upper roof being tinned, and surrounded by an ornamental cast iron snow-guard.

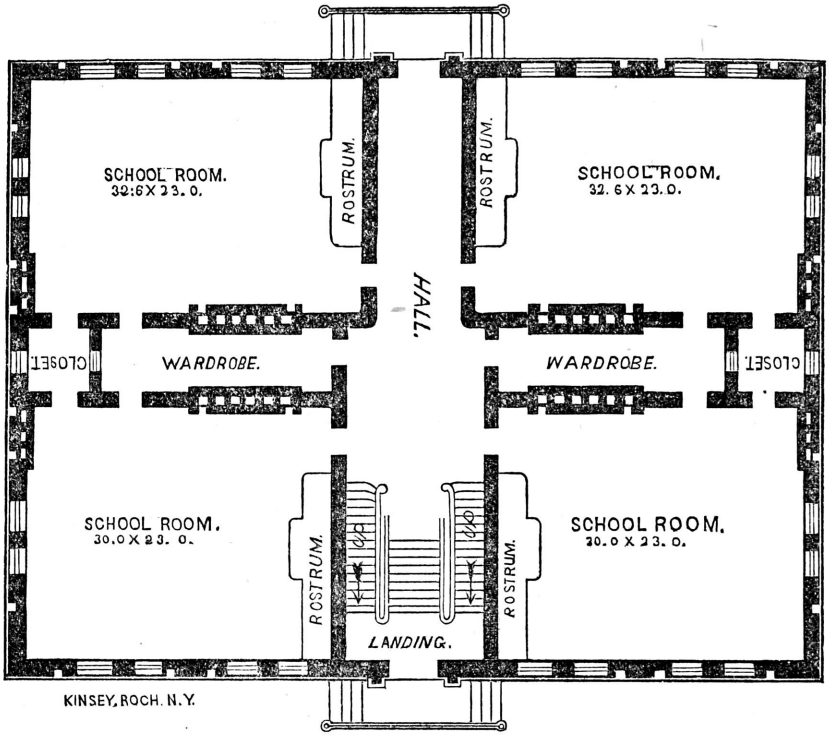


Fig. 204.—Plan of Ground and First Floors, adapted to Figs. 202 and 203.

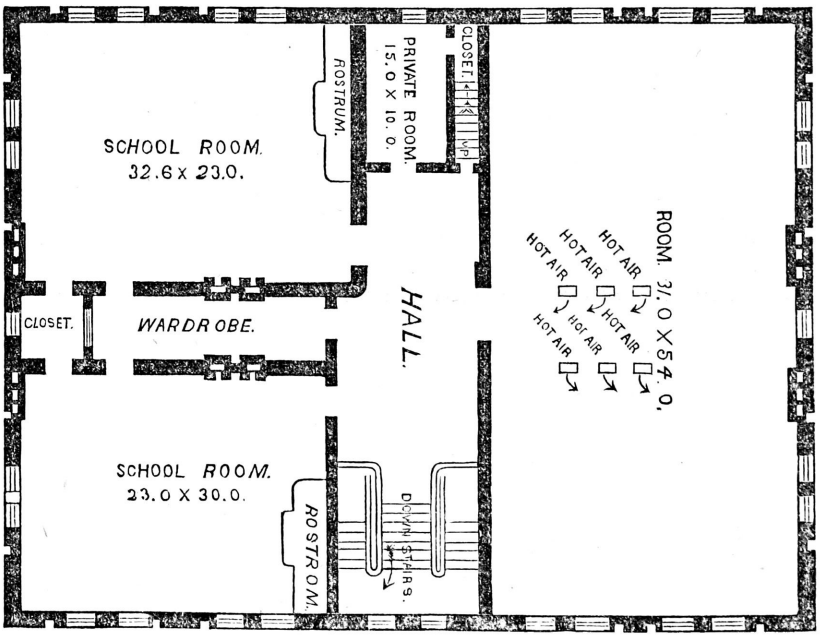


Fig. 205.—Plan of Second Floor, adapted to Figs. 202 and 203.

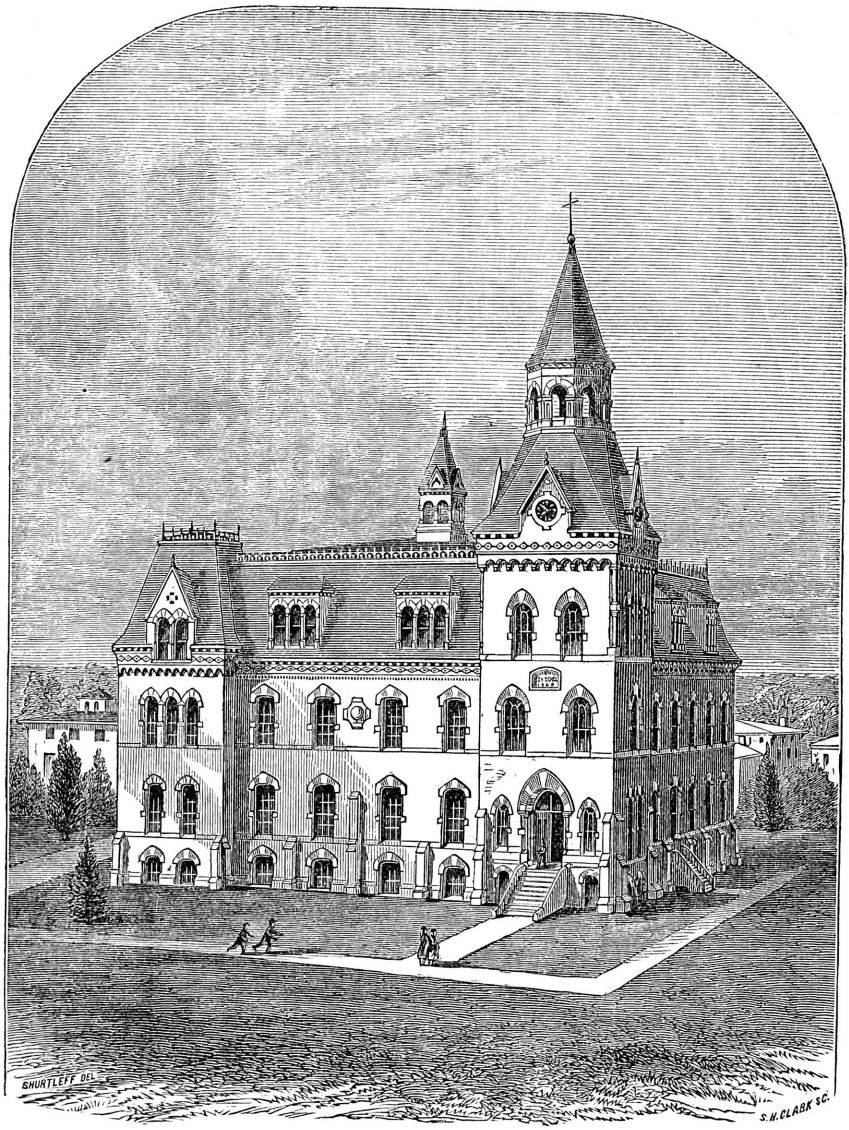


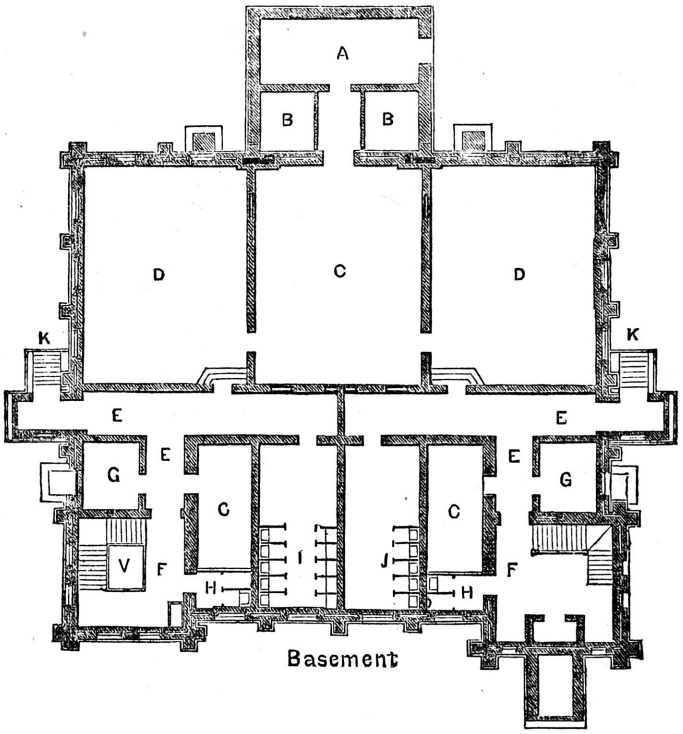
Fig. 206.—Design No. 64.—For a High School or Collegiate Institute, adapted to Figs. 207, etc.

Fig. 206 represents one of the most tasteful and elegant structures for schools in this book. It is of a mixed style of architecture, the Norman style, however, predominating. It consists of two storeys, with a raised basement, and surmounted with a mansard roof, making practically four storeys. The foundation is of freestone, carried up to the middle of the basement windows, and overlaid by a water-table of Ohio sandstone. The window-sills and belt-courses are also of the Ohio sandstone; the window-caps on the front and on the main towers are arched with blocks of the same, alternating with the Portland stone; the others are ornamented brick caps, with an Ohio key-stone. The building was originally erected as the high school of Hartford, Conn. The interior arrangements differ materially from those of preceding plans, and, as will be seen, are very convenient.

The only objection is, that the stairways are placed too far away from the rear of the building. These defects are remedied in *Figs.* 212, 213 and 214, page 188.

In the north-east corner of the building is an observatory tower of suitable height. The observatory itself is an octagonal room about 12 feet in diameter, with windows upon all sides, having an unobstructed prospect in all directions. Below this is the clock-room, containing a clock with four dials. Another tower, on the south-east corner, is occupied by the ventilating shaft, around which the boys' staircase ascends.

The main entrance is on the eastern front, ornamented with brown stone columns, having foliated capitals and bases of Ohio stone, and is approached by a flight of stone steps with a heavy balustrade. The entrance-doors for the girls are on the north side, one leading into the first storey, the other directly beneath into the basement. Similar entrances for the boys are on the south side of the building. The three vestibules are deeply recessed.



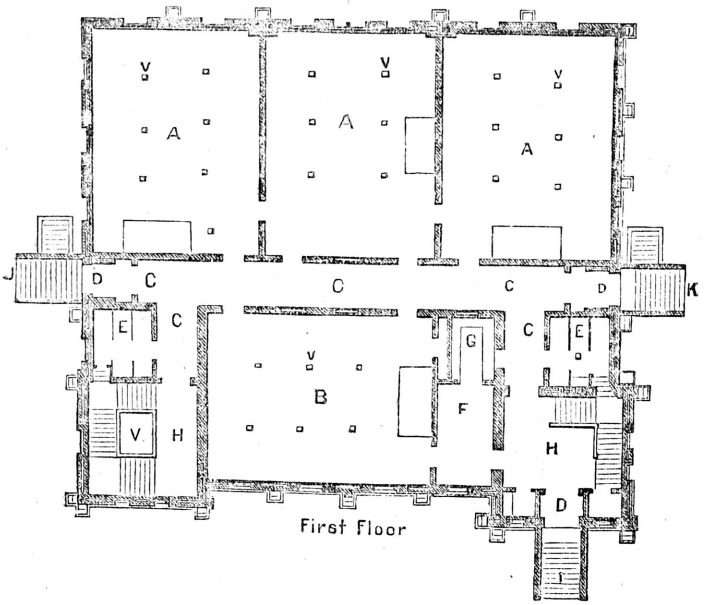
A, Coal Rooms. B, B, Boilers. C, C, Store Rooms. D, D, Gymnasia. E, E, Passage Ways. F, F, Staircase Passages. G, G, Janitor's Rooms. H, H, Teachers' Closets. I, Boys' Closet. J, Girls' Closet. K, K, Entrances to Basement. V, Ventilating Shaft.

Fig. 207.—Plan of Basement, adapted to Fig. 206.

In the basement is a gymnasium for the boys, 30 by 40 feet, and 12 feet high, well supplied with apparatus; also a separate play-room of the same size for the girls in wet weather. On this floor, also, are janitors' rooms, rooms for coal and ashes, and for storage. The entire floor is paved with brick, and cemented.

In the first storey are four rooms, designed for 56 pupils each. One of these is the principal's room, in which are bell-pulls connecting with gongs in the four storeys, and speaking-tubes communicating with different parts of the building. Contiguous to the principal's room, and between it and the front entrance, is the library and reception room. On each side of the entrance are wardrobe rooms for the teachers, supplied with basins and other conveniences. The wardrobe

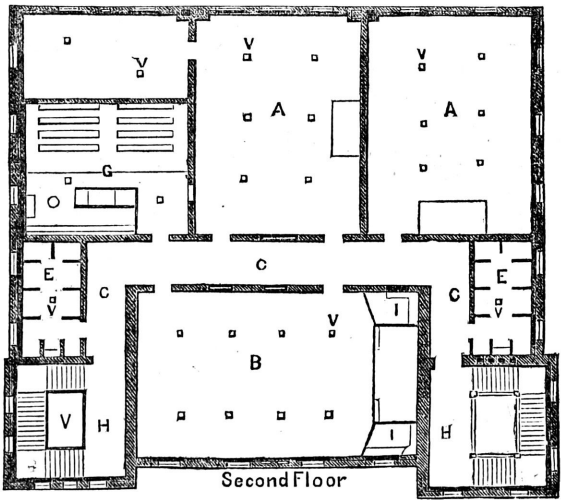
rooms for the pupils on this floor are four in number, two for each sex, the middle ones being entered from a landing on the staircase. In these rooms the available



A, A, A, Fourth Class Rooms. B, Senior Class Room. C, C, Corridors. D, D, Vestibules. E, E, Wardrobe Rooms. F, Reception Room. G, Library. H, H, Staircase Halls. I, Main Entrance. J, Boys' Entrance. K, Girls' Entrance. V, Ventilating Shaft. *v*, *v*, Ventilating Register.

Fig. 208.—Plan of the First Floor, adapted to Fig. 206.

space for hanging garments, etc., is multiplied by transverse partitions, extending $5\frac{1}{2}$ feet inward from the wall, upon which, as well as upon the wall, are stout

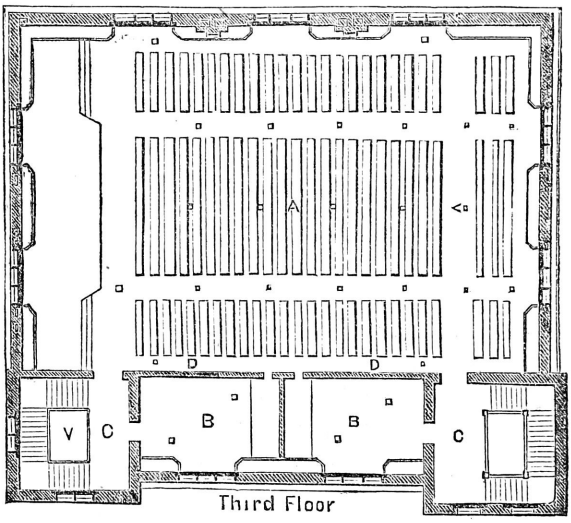


A, A, Third Class Rooms. B, Junior Class Room. C, C, Corridors. E, F Wardrobe Rooms. G, Laboratory. H, H, Staircase Halls. I, I, Philosophical Apparatus. V, Ventilating Shaft. *v*, *v*, Ventilating Registers.

Fig. 209.—Plan of Second Floor, adapted to Fig. 206.

iron hooks for clothing, all numbered. These rooms are likewise furnished with iron sinks, having self-closing faucets, fixed wooden stools, and other conveniences.

On the second floor are two recitation rooms, for 56 pupils each, and one somewhat larger, to accommodate 75 pupils, in which are two cases of philosophical instruments, enclosed with glass frames to the ceiling, so as to be nearly dust-tight. On this floor, also, is the laboratory, well furnished with chemical apparatus, and provided with sliding window-shutters, so arranged by means of an adjustable panel that light can be entirely excluded, or admitted only through apertures from one-half inch to three inches in width, as may be desired in optical experiments. To enable a class to see experiments more readily, the operating table and pneumatic trough are placed on the level of the floor, from which seats, enough to seat 60 pupils, rise in four tiers upon platforms 8 inches high. In the rear of the laboratory, but not connecting with it, is a large recitation room. For the pupils in the second storey two wardrobe rooms are provided, and of full height, furnished in all respects like those below.



A, Large Hall. B, B, Recitation Rooms. C, C, Staircase Halls. D, D, Cabinets. V, Ventilating Shaft. *v*, Ventilating Registers.

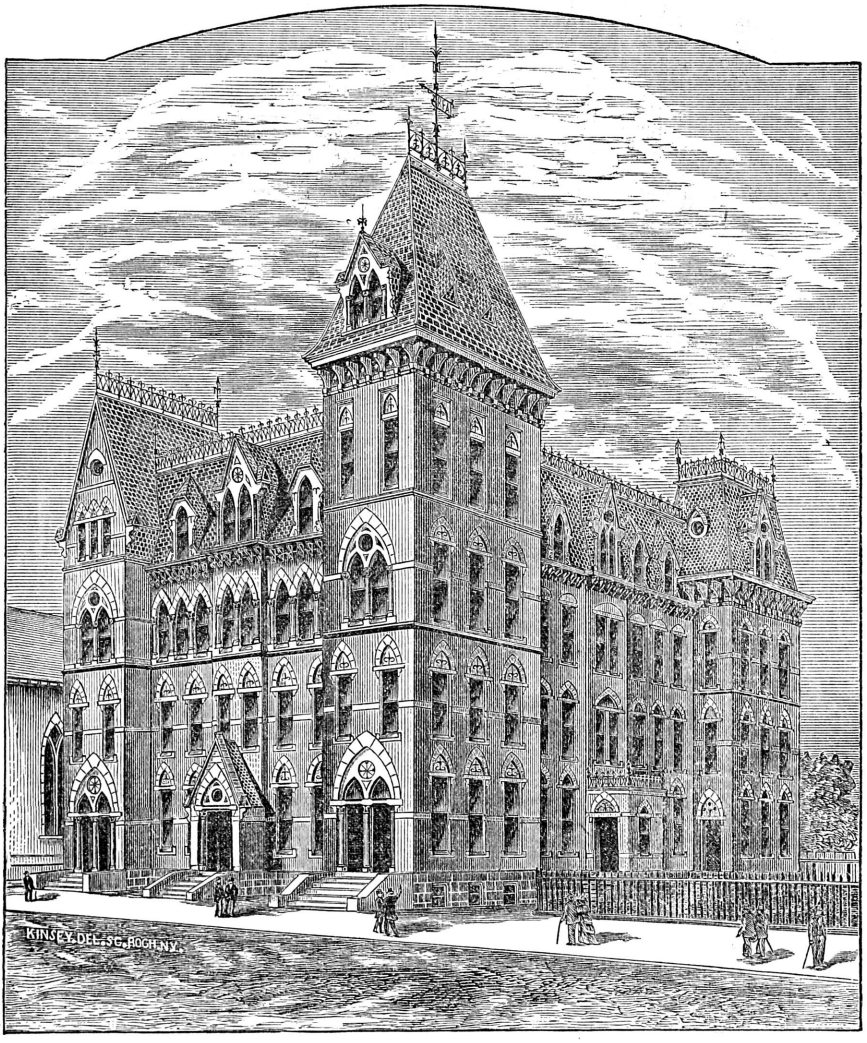
Fig. 210.—Plan of Third Floor, adapted to Fig. 206.

The third storey, which is in the mansard roof, is occupied chiefly by the hall or chapel, a large room 22 feet in height, used every morning for devotional exercises, and many times a week for other purposes. It is capable of seating 800 to 1,000 persons, and will therefore be useful on public occasions. The roof is supported by six trusses, and a large ventilator opens directly to the external air, to be used whenever other means of ventilation are not sufficient. In this room are cabinets of minerals and shells, and connecting with it, as well as with the stairways, are two recitation rooms.

Note.—All the partitions, from the basement to the third storey, should be of solid brick, and if the two stairways and the various corridors are enclosed within brick walls, the building may be regarded as quite secure against possible danger to the pupils or a crowded assembly in case of fire. The floors can also be made partly fire-proof by a thick layer of laths and deafening mortar. The interior of each room should be fitted with inside blinds and moulded back linings, and the walls prepared with slated black-boards. The entire inside finish of the building for doors, windows, wall-linings, etc., might be of soft brown ash. The wood might be gummed to fill the grain, and then oiled. The stairways should be of easy ascent, well lighted, and strongly built, as suggested in the note on page 120. The inside recitation rooms should have windows opening into the corridors, by which a more free circulation of air can be secured when necessary, the lower sashes only having ground glass.

In the south tower of the building is a ventilating shaft, 8 feet square, reaching from basement to roof, open to the sky, and kept warm by a small furnace, the

smoke-pipe of which passes centrally through the entire length of the shaft. To insure perfect security against fire, the shaft is lined with corrugated iron. Leading into this main shaft are large ventiducts, one for each storey, constructed of smoothly-planed boards; and every room in the building is connected with one of these ventiducts by several ventilating flues, opening downward through registers in the floor. Under each school-room there are six or more of such flues, and under the large hall twenty-four. Upon placing a smoking match, or



(Fig. 211.—Design No. 65.—For a First-class High School or Collegiate Institute. (See Figs. 212-214.)

anything of the kind, near one of these registers, it is found that the air is constantly and rapidly passing out through them. Still further to promote ventilation, by allowing the air to escape from near the top of the room, as well as through the floor, swivel blinds are placed over all the doors, through which the air passes freely into the corridors, and up the stairways into the assembly room, where there are large ventilators in the ceiling, which can be opened or closed at pleasure, and which lead directly to one large ejector placed at the highest point of the roof. We cannot too highly commend these ventilating arrangements.

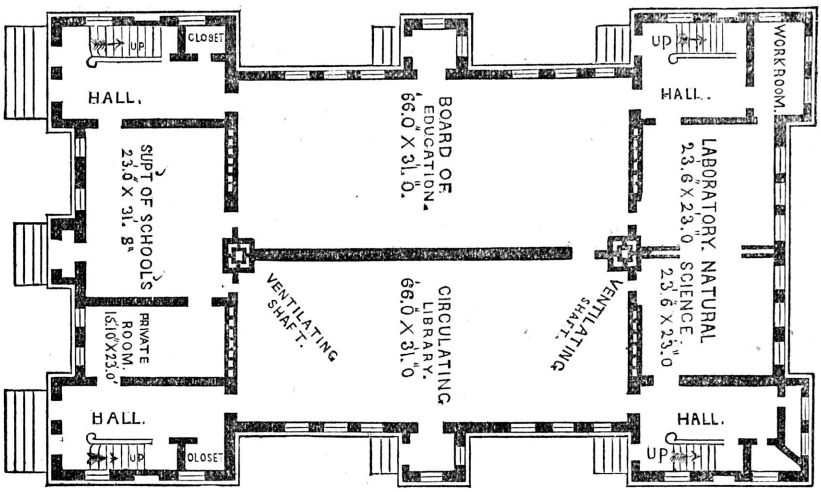


Fig. 212.—Plan of the Ground Floor of Fig. 211.

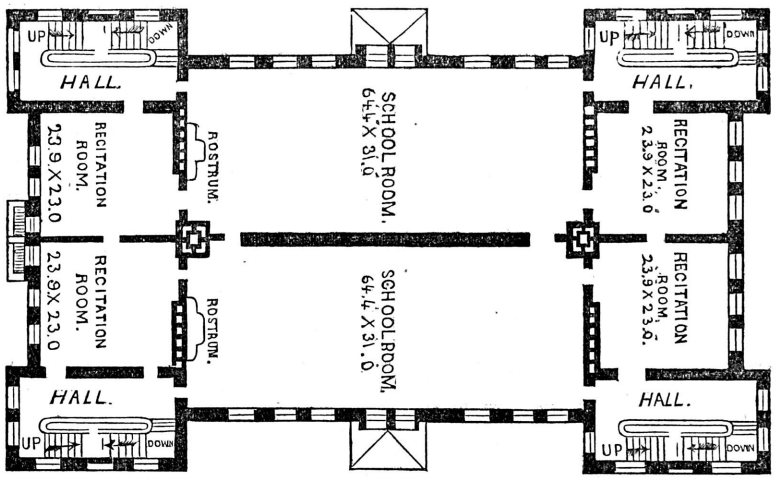


Fig. 213.—Plan of the First Floor or Second Storey of Fig. 211.

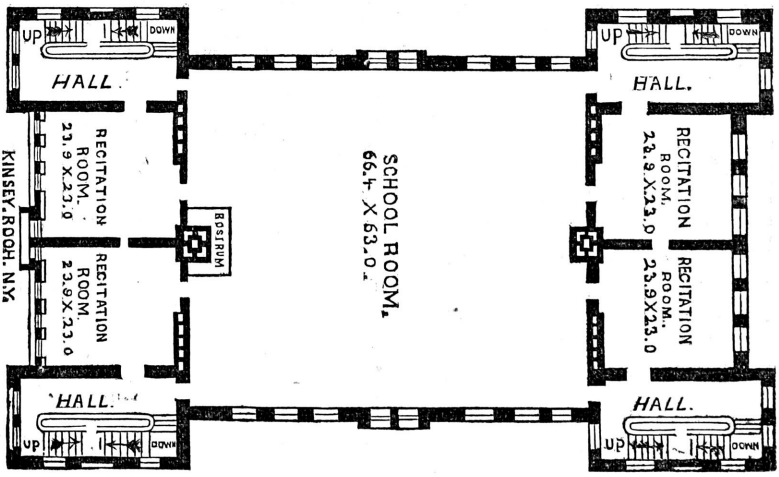


Fig. 214.—Plan of the Second Floor or Third Storey of Fig. 211.

Fig. 211 represents a very handsome building, designed for a first-class high school or collegiate institute. The engraving is that of the "Free Academy," in Rochester, N. Y.

Fig. 212 is a plan of the ground floor adapted to *Fig.* 211. There are *seven* entrances to the building—a wise precaution in so large a structure.

Fig. 213 is a plan of the first floor or second storey, adapted to Design No. 65.

Fig. 214 is the plan of the third storey or second floor, adapted to Design No. 65.

NOTE.—As already intimated, we are not at all in favour of a three or four-storey school-house. The difficulty and delay of getting up and down, apart from the fatigue of doing so, would be fatally increased in the event of a sudden panic in the case of fire or other calamity. Besides, the incessant noise overhead, and in going up and down the necessarily numerous stairs, is in itself a strong objection to a three-storey school-house. In this country, where land is abundant, a three-storey school-house is most undesirable, especially as the additional cost required in order to secure proper ventilation more than makes up for the so-called economy of such an erection. The accumulation in one building, where there are so many young and delicate lungs, of quantities of vitiated air, is greatly to be deprecated; and this of itself should be considered a sufficient objection. even apart from any improved modes of ventilation which might be adopted. There are many days in the year, both in the extreme sultriness of summer and the cold and fogginess of spring, autumn, and winter, when even the best system of ventilation will be found unequal to the task of removing impure and providing fresh air; and this difficulty is always greatly increased when large numbers are gathered together in one building on such days. (See remarks on these important subjects on pages 30-59.)

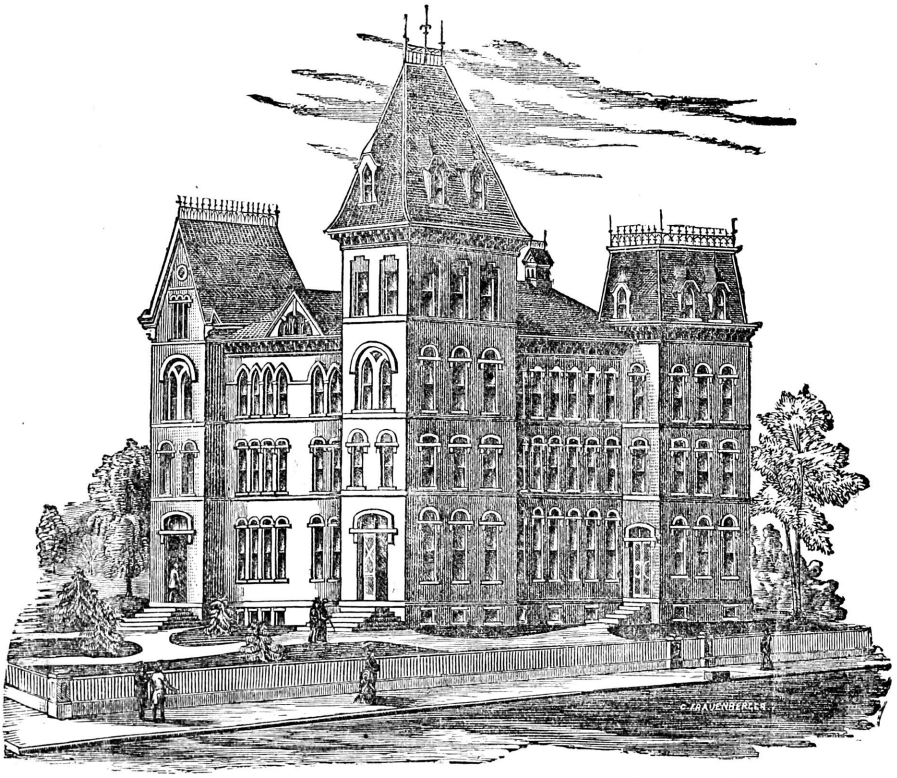


Fig. 215.—DESIGN NO. 66.—FOR A FIRST CLASS HIGH SCHOOL, OR COLLEGIATE INSTITUTE.

This Design, No. 66, is that of a first-class high school or collegiate institute. The original is that of the high school at Batavia, N.Y. The style is French in its origin, but is not strictly carried out. The following plans were prepared for a Boston school, but will answer, with modifications, to Design No. 66,

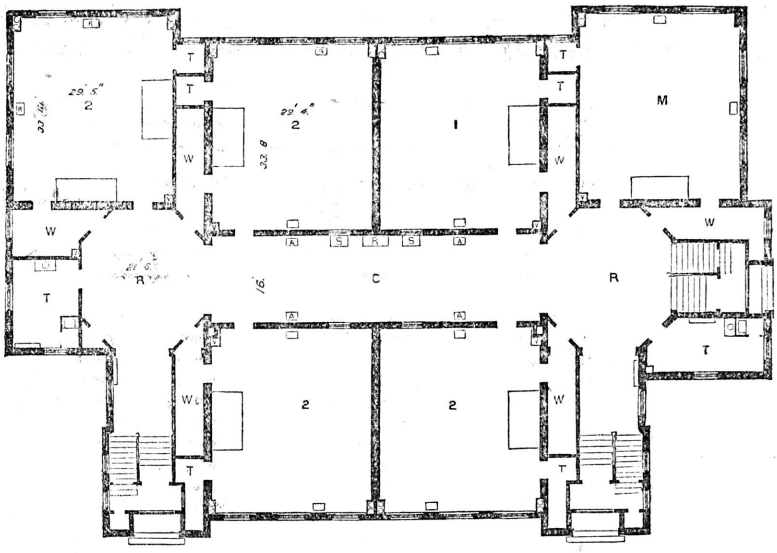


Fig. 216.—Ground Plan adapted to Design No. 66.

C. Corridor.
M12. School Rooms.
R. Circular Halls.
T. Teachers' Rooms.
TTTT. Teachers Closets.
WWWW. Wardrobes.

This plan is very compact. It is admirably adapted to the purpose for which it is designed. These interior plans were originally prepared for the "Rice Grammar School," in Boston, Mass. They can be adapted to *Fig.* 215.

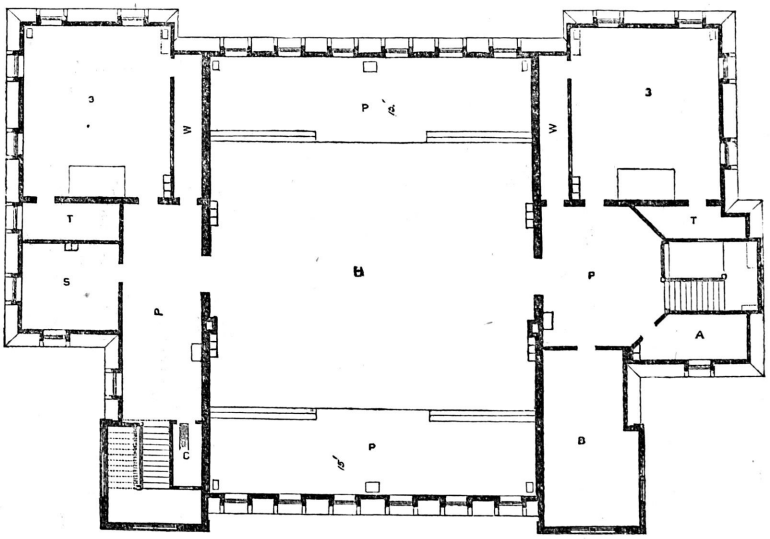


Fig. 217.—Plan of Third or Attic Storey adapted to Design No. 66.

A. Teachers' Room.
B. Library.
C. Closet.
H. General Hall.
33. Class Rooms.
P. Landing.
PP. Platform.
Q. Lobby.
S. Teachers' Rooms.
T. Closet.
WW. Passage.

Plan, *Fig.* 217, contains one large assembly room, with large platform at either end. There are also two class rooms, with library, teachers' rooms, etc.

The next three Designs which we insert are unique in their character, but we cannot commend them. They are inelegant and expensive, and their style of architecture is somewhat of a hybrid gothic and Italian mixed.

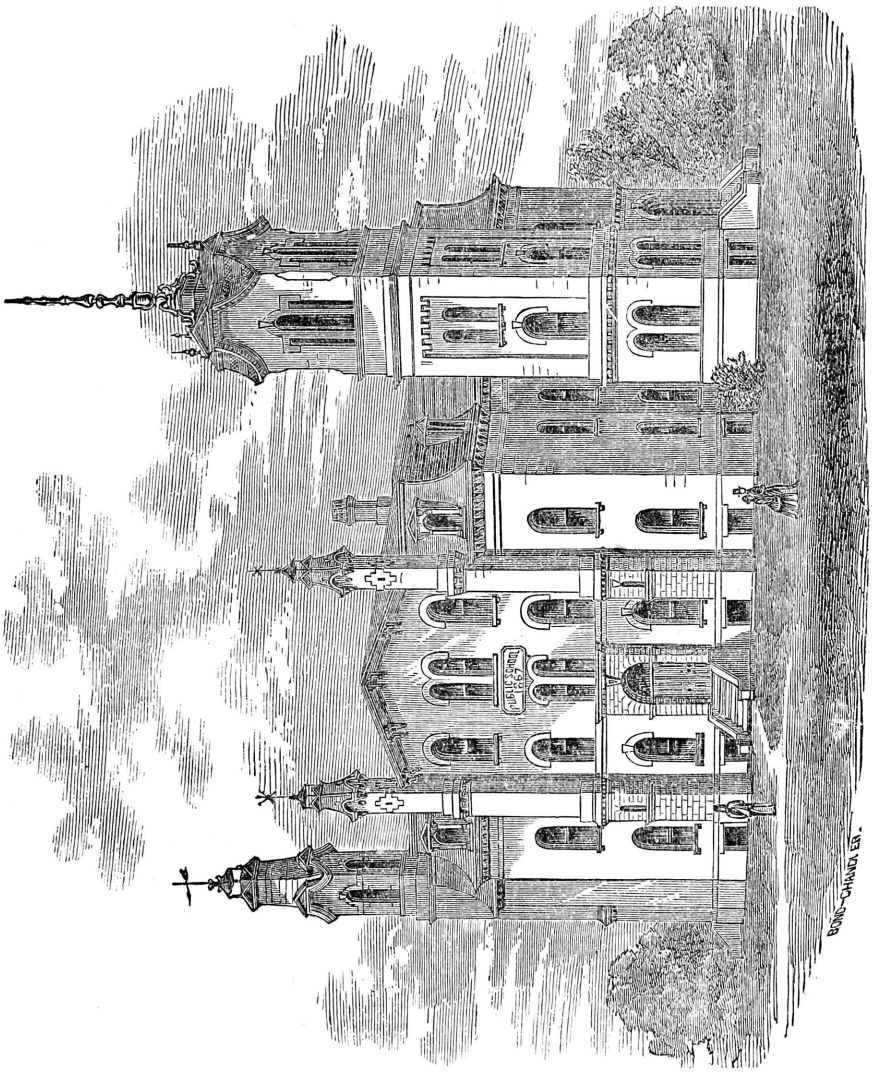


Fig. 218.—Design No. 67.—Adapted for a Public or High School. (See Figs. 216 and 217.)

Design No. 67 is that of a high school in Marshall, Michigan. The architecture is somewhat Italian in its style, but, as we have observed, not very graceful in its general outline. It is worthy of remark, that in erecting a school-house one of an inferior and faulty style of ardhitecture is just as expensive, if not more so, than one of a neat and elegant design, and harmonious in outline. The cause of the erection of so many ill-shaped and tasteless school-houses is the reluctance of trustees to take the trouble to consult a good work on the subject of school architecture, or a professional architect. The consequence is unfortunate in many cases, both for the masters and pupils, and ultimately for the finances of the

school section or division. The common defects in school-houses which are planned by amateur school architects, are frequently—(1) Want of sufficient school-room space; (2) either none, or defective ventilation; (3) absence of a room for the teacher; (4) closets for maps and apparatus; (5) separate entrances for boys and girls; and (6), what is more important and essential, separate offices for the sexes.

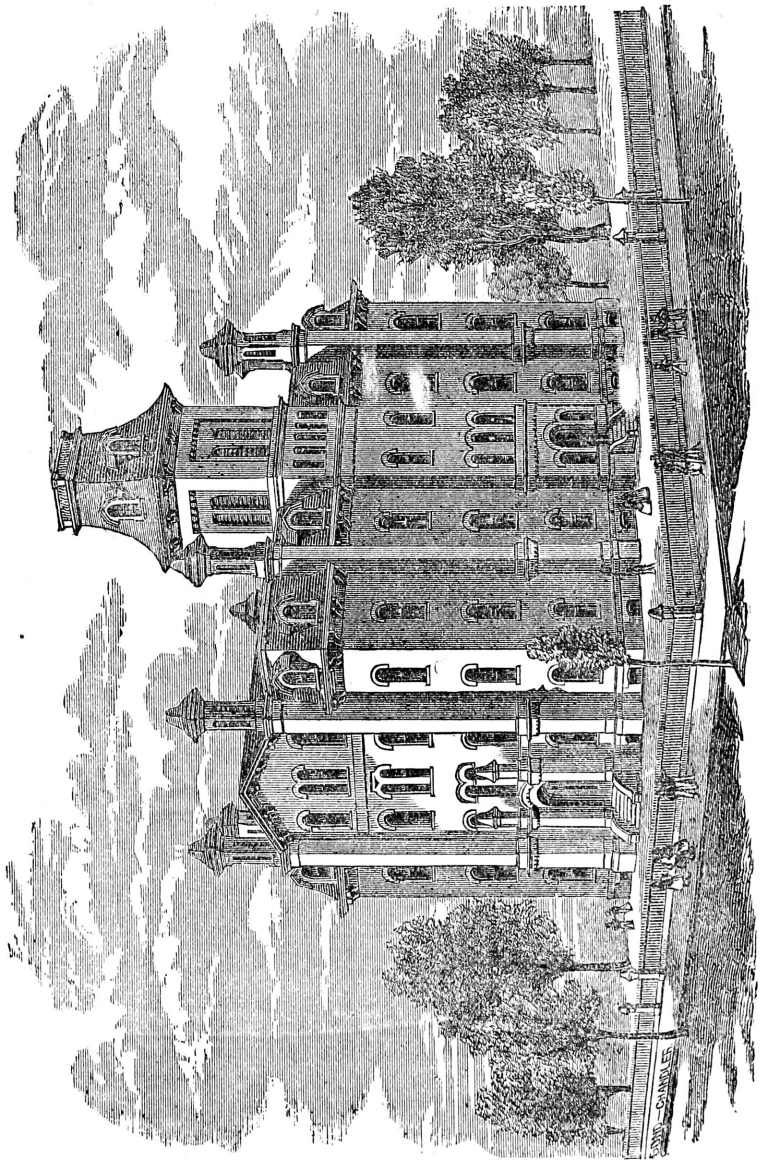


Fig. 219.—Design No. 68.—Adapted to a Central or High School. (See Figs. 216 and 217.)

Design No. 68 represents a high school building erected in Aurora, Illinois Like the preceding design, it is also partly Italian in its style, but lacks gracefulness of outline. The defects can, however, be easily remedied by a good architect, as they are chiefly in the turrets of the ventilating shafts, and cupola.

The following Design is more artistic in its style than is No. 68, but it is nevertheless marked by similar defects to those already pointed out.

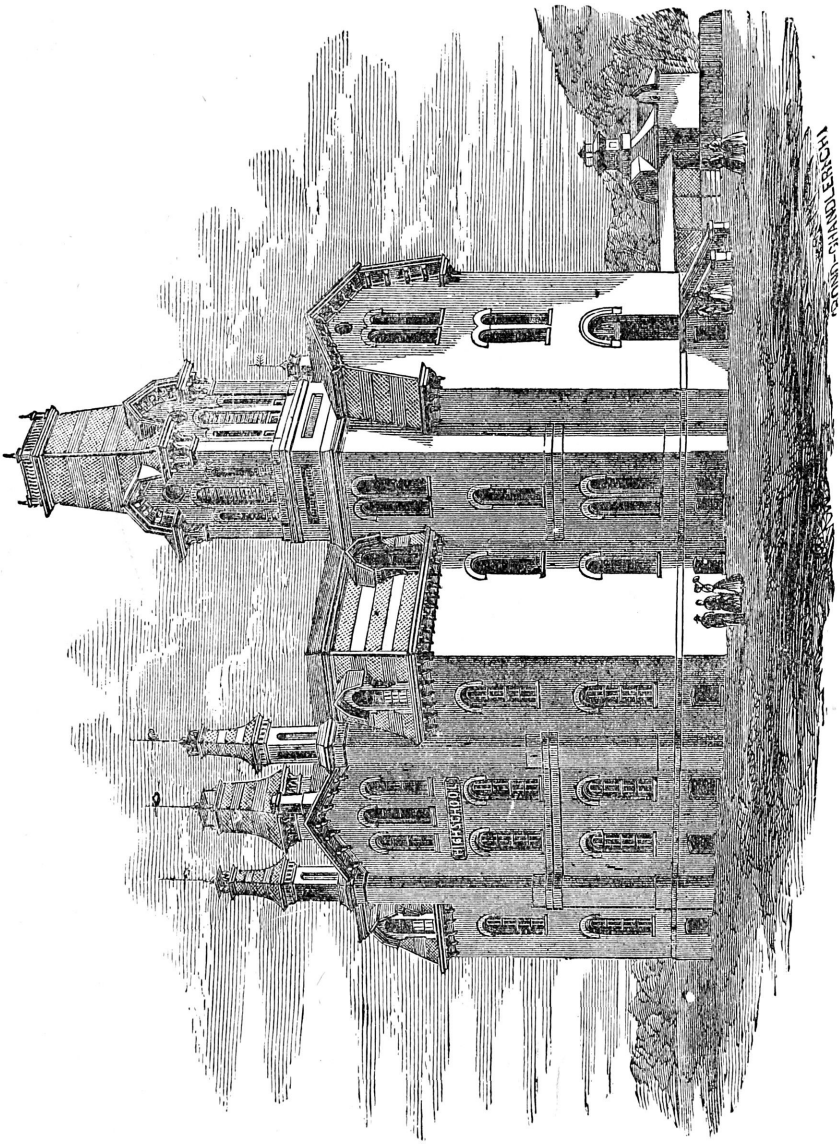


Fig. 220.—Design No. 69.—Adapted for a Central or High School. (See Figs. 165 and 167.)

Design No. 69 represents a high school building erected at Winona, in Minnesota. Like the two preceding engravings, it lacks elegance in style, but this can be easily remedied by a skilful hand. The chief defects are in the turrets and cupola, and front gable, which are not in harmony with the rest of the building. For a three storey school-house, there are also insufficient means of egress. The entrance door is quite too small for so large a building.

The following Design and accompanying plans are adapted to graded schools, which can best be practically carried out in school buildings virtually distinct, but yet conveniently connected together. We give two examples—one American and one English.

Fig. 221 is an engraving of a school building erected in Hartford, Connecticut. The elevation is neat, plain, and handsome, and very suitable for a central or

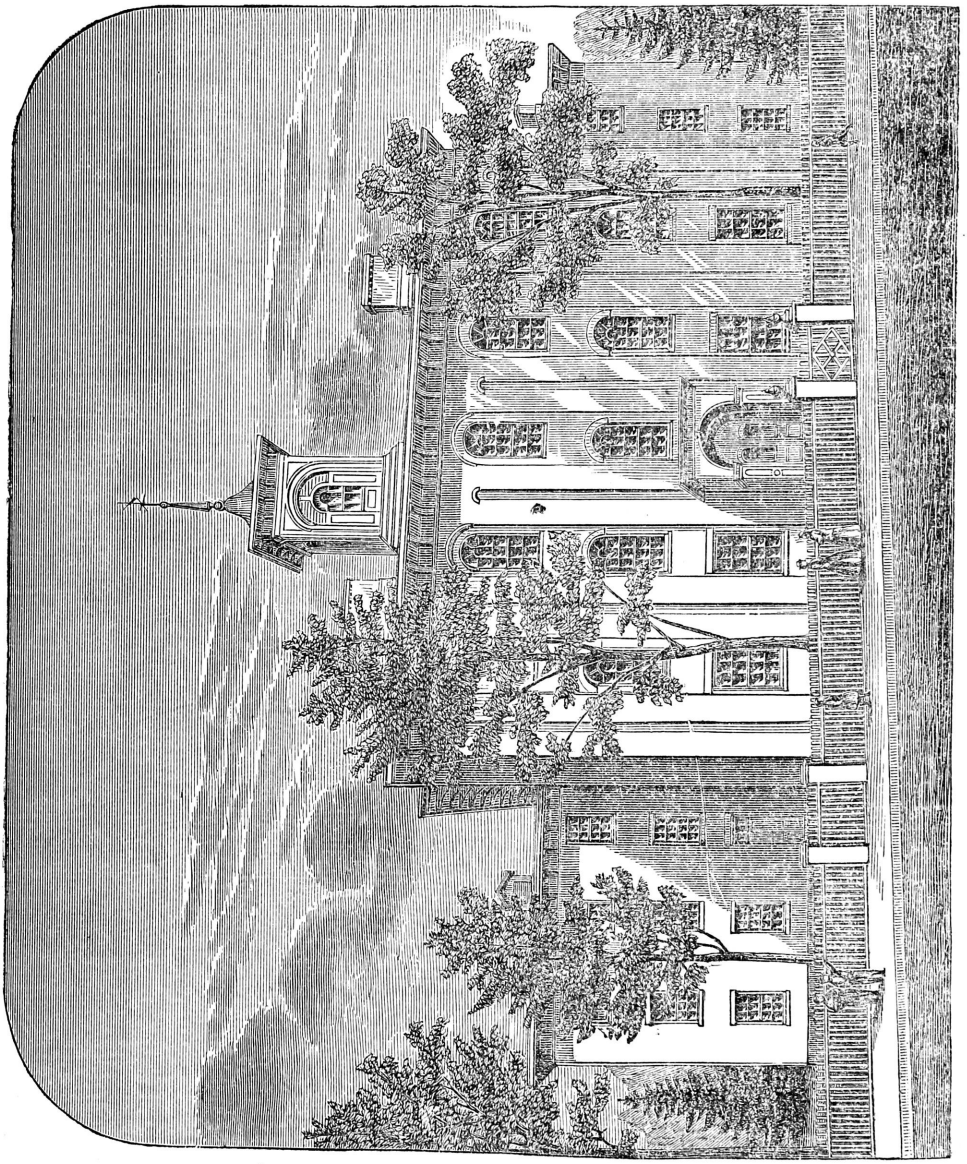


Fig. 221.—Design No. 70.—Plan of Public or High School, adapted to Figs. 222 and 223.

superior high school. The interior arrangement is very convenient. It combines the advantage of a triple building, each one having a direct communication with the other.

Fig. 222 is adapted to Design No. 70, and shows a very convenient arrangement of detached school-rooms.

In *Fig.* 223 the same arrangement of the detached school-rooms is followed. It possesses all the advantages of a triple building.

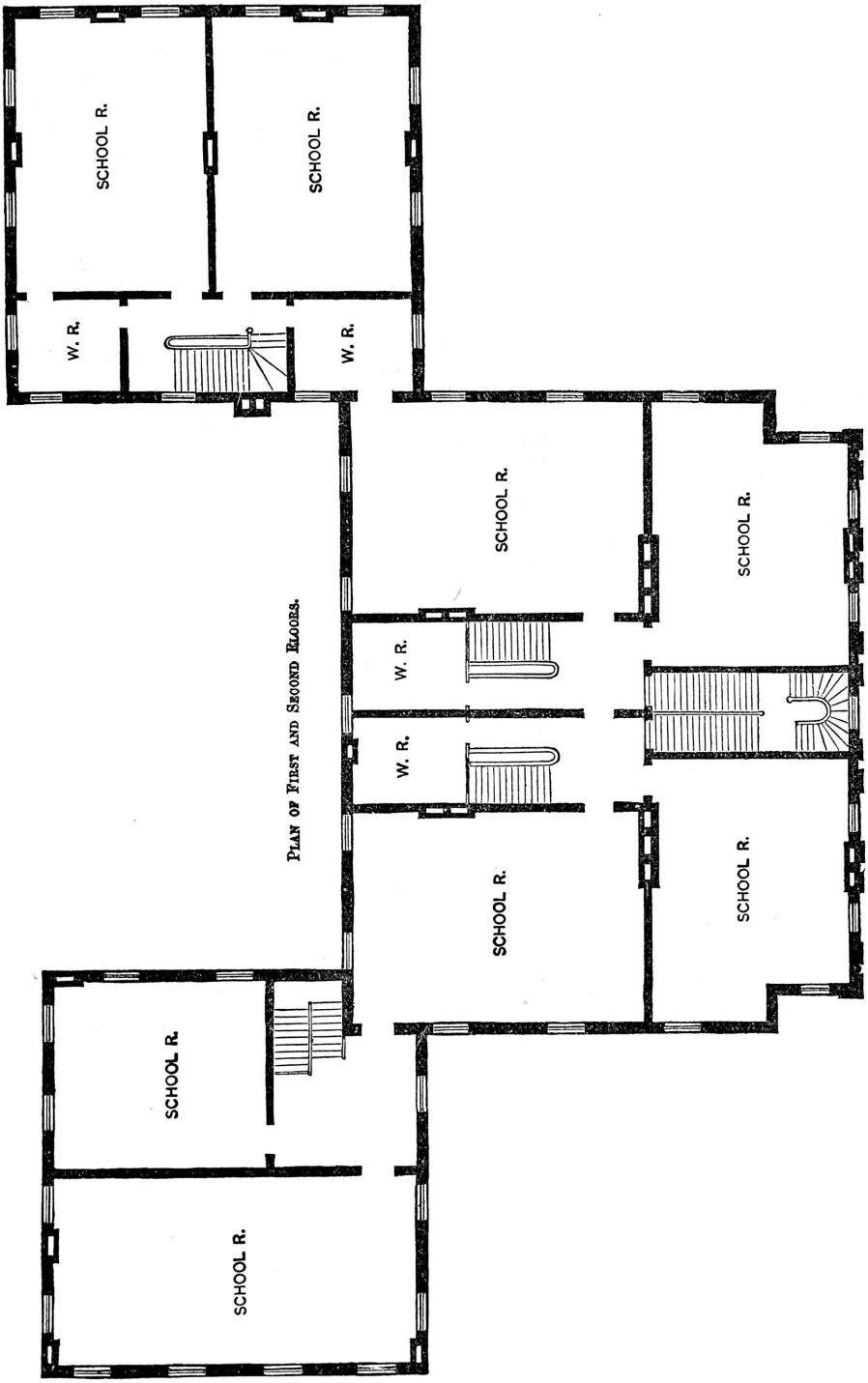


Fig. 222.—Plan of First and Second Floors, adapted to Fig. 221.

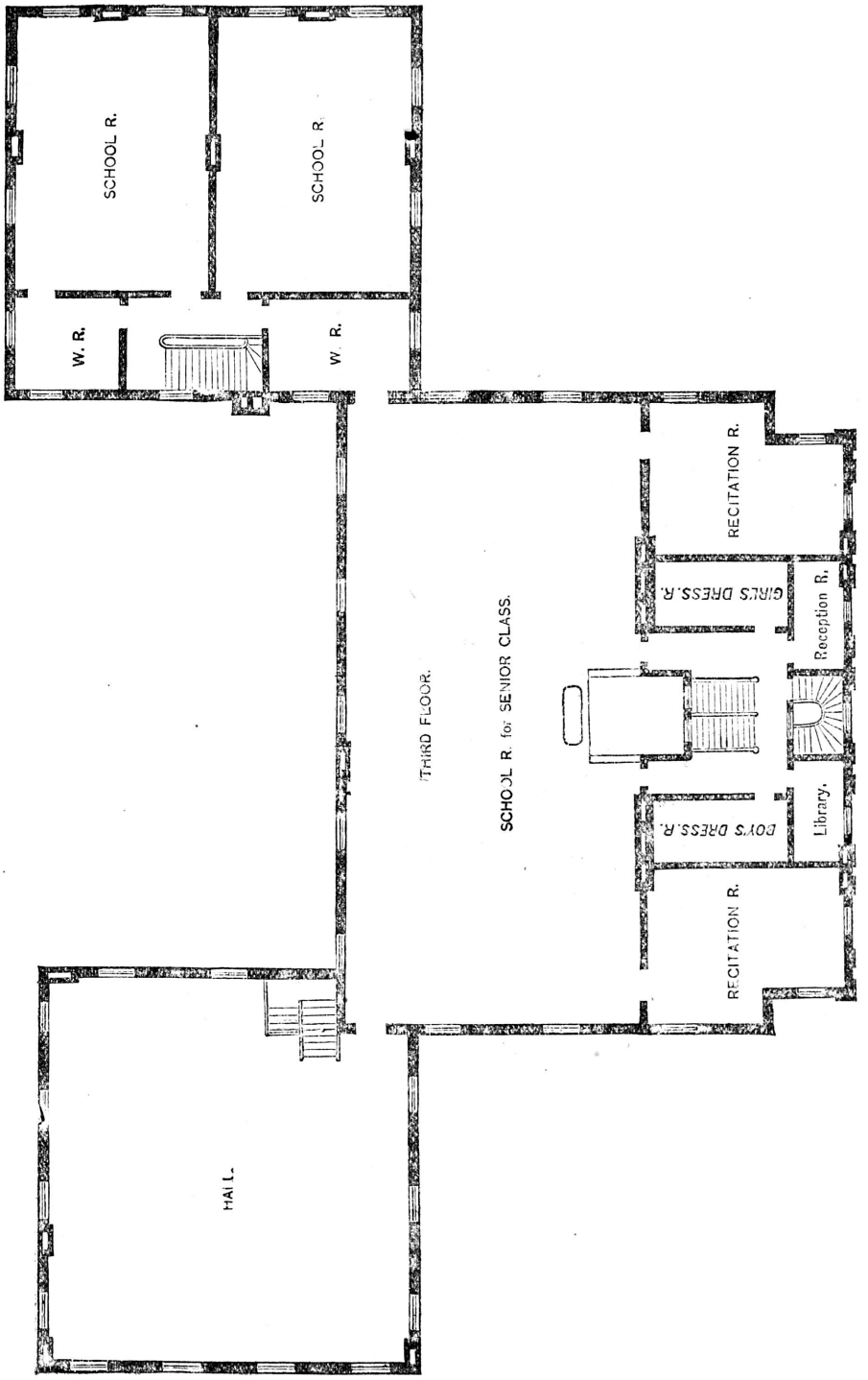


Fig. 223.—Plan of the Third Floor, adapted to Fig 221.

2.—Arrangements of a Graded School considered.

The foregoing plans (*Figs.* 222 and 223) suggest an arrangement of rooms for a graded school. It is so far successful as to provide for grouping what may be regarded as separate and distinct schools (connected together by passages and doors), but virtually under the same roof. This will be found of great practical convenience, which can be turned to good account if the schools are carefully graded. The question of graded schools is somewhat mixed up with that of seating. Formerly, the only kind of desks and seats used was the long desk and backless seat for all kinds of pupils. This was succeeded by the long desk, with the improvement of a backed seat; but yet used for all kinds of pupils. At length, as a great improvement, the dual system of seating was adopted in many good schools. This dual system is, however, gradually being displaced by the system of single desks and seats—especially for the senior pupils. In England, where the long bench and desk system prevailed for such a length of time,

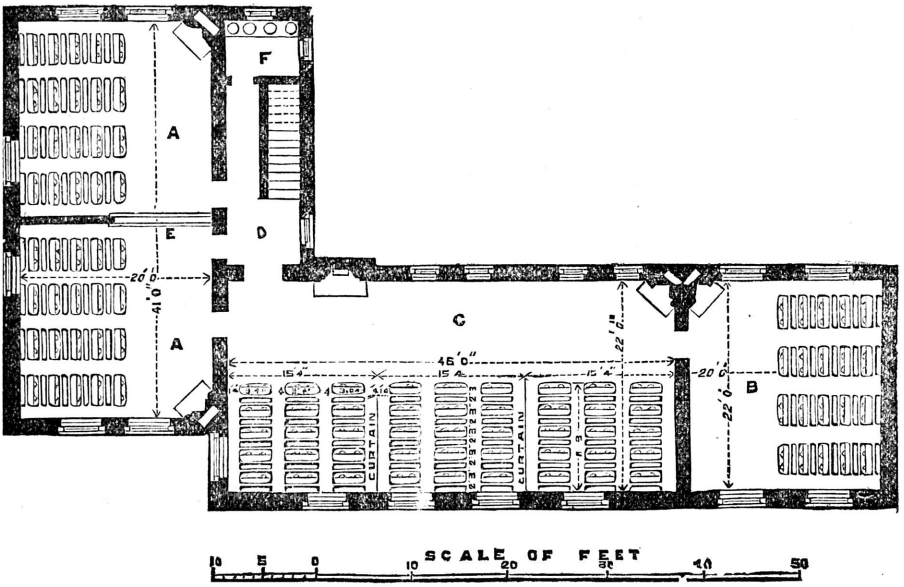


Fig. 224.—English Plan for a Graded School of 210 Pupils.

AA. Double class room.
B. Single class room.
C. Large school-room.
D. Landing.
E. Sliding partition.
F. Lavatory.

the dual system has been adopted in many of the best schools, especially under the new local school boards. *Fig.* 224 is a plan suggested by Mr. Robson, in his "English School Architecture," for a graded school of 210 pupils, seated on the dual system. A, A, is a double class room, separated by the sliding partition E. The large school-room, C, is designed for three classes, divided by the curtain, as indicated in the engraving. The room B may be either used as a class or gallery room. All of these class rooms are under the same roof, yet in effect in separate buildings. The arrangement of the teachers' desks differs materially from those shown in preceding plans. In the rooms A, A, B, and one end of C, it is placed at an angle of the room. The advantage claimed for this arrangement is, that the teacher can see every pupil from a diagonal standpoint, and observe him at work, without being directly seen by the pupil in return.

CHAPTER XVII.

INTERIOR OF THE SCHOOL-HOUSE.

1.—The Size and Character of a School-House Interior.

In regard to the *size* of the interior of a school-house, the *master's platform* and the *entry*, or porch, we have already made several suggestions on page 61. In regard to the selection of school furniture, no specific directions can be given which will meet all cases. Most houses and schools will require certain modifications to suit local or peculiar circumstances. There are, however, certain general principles, both of construction and arrangement, governing this subject, which should never be violated. These will be indicated in their proper place, leaving details to the circumstances of each case. The accommodations for a school-house, embraced under the head of furniture, may be divided into four classes:—(1.) Those relating to the entry and clothes rooms. (2.) Those connected with the purposes of the principal school-room. (3.) Those of the class room. (4.) Those of the gallery.

NOTE.—On the subjects of this chapter see the remarks and suggestions on page 61.

2.—Entry and Clothes Room Furniture.

(1.) *The Scraper.*—The space immediately in front of every school-house should be paved with brick or stone, covered with plank, or the surface, by some other appropriate means, rendered smooth and so hard as to resist the action of the rain and frost. On this space the steps or platform leading to the door will be placed, and either will be incomplete without a strong, convenient shoe-scraper at each side. Two will be required, for the reason that the pupils enter the school, morning and afternoon, about the same time, and if there be only one scraper, it will either cause delay or compel some to enter the building with soiled shoes. Cleanliness and neatness are amongst the cardinal virtues of the school-room; and every means of inculcating and promoting them should receive the earliest and most constant attention.

(2.) *The Mat.*—After the rougher and heavier portion of the mud has been scraped from the feet, a good rubbing on a coarse mat will not only remove the balance, but aid in drying the shoes, so that there will be less danger from wet and damp feet than would be experienced without this precaution. In addition to this, there will thus be less of that annoying dust in the school-room, which, when present in large quantities, is constantly kept afloat in the air, to the great discomfort of the inmates, and to the injury of clothes, books, and lungs. These rough mats should be placed just inside the main entrance door. The use of the scraper and mat should in all cases be insisted on, and every pupil entering with soiled feet should be sent back and made to clean them.

NOTE.—A pair of mats, or two pair in a large school, to be used alternately—one to be dried and beaten free of dust while the other is in use—may be made of corn-husks or straw. If the teacher manage properly, mats, quite sufficient for the purpose, will be readily made or provided by the larger pupils in turn, if they can be had in no other way. If the female pupils were to prepare a rag mat, to be laid inside of or near the door leading from the entry or vestibule into the school-room, for a second wiping of the feet, the precautions against dust in the room would be complete.

(3.) *The Lavatory.*—Children often soil their hands in play, and some even come to school with unwashed hands and faces and uncombed hair. Such should never be permitted to enter the school-room till all the requirements of outward decency are complied with. In the country it will generally be too far to send them home again for that purpose; and therefore preparation for it should be found in the school. Hence, a wash-stand in a large building, or a regular lavatory in one of

the highest class, becomes proper. Mr. Robson, in his "School Architecture," says: "The washing rooms for children should not be so placed as to involve possible cold or wet feet in reaching them, as when a yard or playground has to be crossed. Neither is it a good plan to utilize one or both sides of a porch or entrance passage with lavatory fittings; for wherever the washing process is carried on there is sure to be more or less of sloppiness or untidiness, which is best placed apart and away from the eye in a separate, though small apartment, convenient of access from the school-room. The common method of placing the basins across one end of the cap and cloak room (*Fig.* 225) should not be adopted where the general plan admits, without extravagance, of a better arrangement, for the caps and cloaks are thereby liable to become splashed and wetted. The wood cut (*Fig.* 226) shows a kind of lavatory which has proved best under all circumstances. Instead of being made to tip up on a pivot, the basin is fixed, but the removal of a couple of screws is sufficient

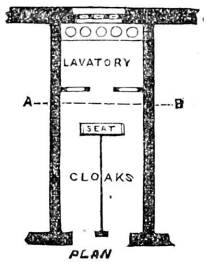
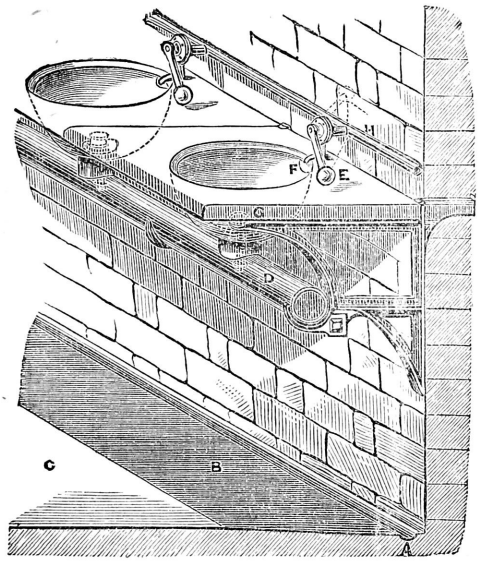


Fig. 225.—Lavatory and Cloak Room Combined.



REFERENCES.

A. Gutter in floor, under lavatory.

B. Portion of floor sloped.

C. Level floor.

D. Iron drain.

E. Tap, with lever and ball of lead or iron.

F. Overflow in enamelled iron basin.

G. Slate slab.

H. Supply pipe.

Fig. 226.—Sketch showing Mechanism of Lavatory.

to release it for the removal of any stoppage. The plug cannot be removed and lost, as when attached to a chain. For letting out the water, it is lifted half an inch and turned half round. The water cannot be left running, for the removal of the child's finger lets drop the leaden (or iron) weight, and turns off the tap. An overflow should always be provided from the basin, so that in case of accident the room be not flooded. In the floor, and immediately under the line of basins, there should be a gutter to carry away the water always splashed on to the floor."

(4.) *Pails.*—Every school should have two pails—one for drinking water, with cup near it, and one for washing and scrubbing purposes.

(5.) *Broom and Brushes.*—No school, however small or plain, should be without a broom for sweeping the floor at least twice a week, and if daily, the better. Large buildings should also have a hair sweeping or floor brush, and a cobweb brush or ceiling duster with a long handle. To this list should also be added a scrubbing brush for the floor, and a whitewash brush for the walls; and the more they are all used the better for the health and habits of the pupils.

(6.)—*Umbrella Stand.*—In wet weather the entry, or the corners of the school-room, are often flooded with the drippings of umbrellas. An umbrella stand should therefore be placed in one corner of the entry, to receive the umbrellas of the whole school, and prevent this annoyance. A simple one might be constructed of a water-tight trough one foot wide and one foot deep, and two, three or four feet long, according to circumstances, painted inside and out, with four legs a foot high, and a guard or slat around it about one foot above the top edge for the umbrellas to lean against. This would be a neat article of school furniture, cost but little, and contain a large number of umbrellas. There should also be a hole in the bottom of it, with a cork, to run off the collected water into a bucket.

(7.) *Fire-irons.*—If the school is heated by means of a wood stove, a pair of tongs and a fire shovel, with an ash-bucket or pan, will be indispensable. If coal is used, a pair of tongs will also be necessary, with a small shovel and a poker, a coal scuttle and a sieve for the cinders. In both cases an axe and a saw to cut the wood or the kindling, will also be needed.

(8.) *Clothes Hooks.*—In all school-houses there should be enough clothes hooks put up to allow of one for each pupil, which should be numbered, and each pupil should be required to use his or her own.

(9.) *Dinner Closet.*—In the country many pupils, living at a distance, necessarily bring their dinners with them, and require a safe and fit place for it during the forenoon. A closet, with a lock and key, should be placed in the entry or clothes room for this purpose. When this is done the closet should be locked by one of the pupils appointed for that purpose, after all are in. Thus the baskets will be properly and safely kept, and the untidy practice of having them standing under the desks or along the walls in the school-room, avoided. This will also prevent those liberties being taken with the dinner baskets by mischievous pupils while passing in and out during school hours, which often create disturbance, when the baskets are left in the clothes rooms without being locked up.

NOTE.—Several of the articles just named are indispensable, and will not be refused by any board of trustees. Others may be. In that case it will be in the power of the teacher, by showing a disposition to keep the school-house in good order and condition, and by a respectful representation of the utility and necessity of additional articles, to induce a reasonable board to obtain them. If not, he has the pupils to appeal to. By proper explanation of the uses and value of the desired conveniences, and of the habits dependent on them, he will rarely fail in creating such a feeling in the school as will supply all that is requisite, till the trustees shall discover their own duty in the matter.

3.—Mode of Using these Articles.

Most of these school articles, such as scrapers, mats, basins, buckets, fire-irons, clothes hooks and dinner closets, are in daily use, and only require a little constant attention on the part of the teacher to render them greatly conducive to the neatness and tidiness of the school, and of the formation of right habits on the part of the pupils. But others, such as brooms, sweeping brushes, scrubbing and cobweb brushes, and above all, whitewash brushes, only come into use occasionally, and will require an effort on the part of the teacher to develop their full use and value. But this effort, if properly made, will be its own reward.

NOTE.—Although the official regulations require the trustees to make provision for keeping the school-house clean, as directed by the teacher; yet if the larger pupils be requested voluntarily to meet the teacher in the school-house during a Saturday forenoon once a month, or even every six weeks, for a general sweeping, scrubbing, and, if necessary, whitewashing, the effect on the school—both personal and material—will be found most salutary, and the object will be accomplished. Children like to feel themselves of use to those whom they respect; and, if properly governed, they delight in improving their own things. The teacher is their best friend, and the school is their own. Their nature will incline them, if it be properly guided, to oblige the one and beautify the other. In addition to this thorough cleansing, there should be a general arrangement of the books, apparatus, furniture, etc., of the school-room every Friday afternoon, before dismissal for the week.

4.—School Seats and Desks for every Pupil.

Desks and seats constitute the main portion of the furniture of the room, and upon their form, construction, and arrangement, will depend much of the comfort of the pupils and the order of the school. It is now admitted as settled principles applicable to all schools:—(1.) That every pupil, whether old or young, should have a desk as well as a seat. (2.) That both should be made as comfortable and as well adapted to their object as possible. (3.) That the seats and desks should be so arranged as to permit each pupil to pass to and fro from his own, without disturbing any other in so doing. To these may be added:—(4.) That the more neatly and substantially the seats and desks are made at first, the longer they will last, and the greater will be the saving to the school section in the end.

NOTE.—See remarks and suggestions on this subject on page 63.

5.—Desks and Seats are required for the Younger Children.

The desk is as necessary for young as for older pupils, for several reasons. Children should not be long confined to one attitude—frequent changes of position being a want of their nature. After sitting upright in their seats for some time, they soon lean on the back of the chair or bench; but this posture before long also becomes tiresome, and they will be observed to lean sideways upon each other. At this time it is that restlessness and disorder begin to manifest themselves amongst the younger pupils, and at this time the forward support afforded by the desk, both for the person and the book, would form a relief to the scholars, and tend to the quiet of the school. Moreover, it is now admitted by all good teachers that the slate and pencil should be put into the hands of every pupil the very first day of his entrance into school; and this renders a desk indispensable, if for no other reason.

NOTE.—To render the seat and desk comfortable and convenient, both should bear a proper proportion, in height and form, to the size of the pupil; so that when seated his feet should rest firmly on the floor, and his arms should have easy action on the desk, without either raising them above the proper level for free use, or compelling him to stoop so as improperly to bend the body and contract the chest. The seat should in all cases have a comfortable back, and be slightly higher before than behind, so as to give a firm position to the person upon it. The desk, being designed to retain the books or slate without the necessity of holding them upon it with the hand to prevent them from sliding off, should be very slightly inclined from front to rear, with a level space at the extreme rear for pencils, pens, etc.

6.—Each Pupil should have easy access to his Seat.

It needs no argument to show that every pupil should have free access to his own seat. This is generally admitted with regard to the older scholars; but it is equally if not more requisite in the case of the younger, who are more uneasy, and require to leave their places more frequently. This object can only be effected by the use of single, or at most double, desks—that is, desks at which no more than two pupils sit. The former would be the more desirable in all cases; but as they occupy more floor space, when arranged with a passage at each end, the double desk is now in use in nearly all, except the highest grade of schools.

7.—Kind of Seats and Desks for Primary Pupils.

Various kinds of desks and seats are now in use for this class of pupils, all seeking to unite comfort with neatness and durability. The combined seat and desk represented by *Fig.* 228 are among the very cheapest in use. The legs or staunchions are of cast iron, and the remainder of wood. The seat of each pair of pupils is connected with the desk of the pair behind them, and so on; but the whole being firmly secured to the floor will not be liable to shake, so as to cause disturbance in the school, or to either of the pupils in the front or rear.

Each pupil should be provided with a seat and desk properly adapted to him or her, as to height and distance, the front of the desk constituting the back or support of the seat, as shown in *Fig.* 228. *Fig.* 227 represents a section of the simplest kind of desk and seat, giving the usual slope of one inch in the foot to the seat. The desk should slope about $2\frac{1}{2}$ inches in 16 inches. The seats should vary in height from $9\frac{1}{2}$ to 17 inches, for children of different sizes and ages—the youngest occupying the seats nearest the platform, and the elder those at the rear.

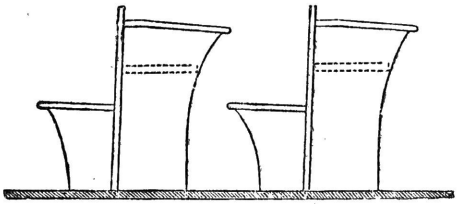


Fig. 227.—Section of Seat and Desk.

Note.—The seat should be so made that the feet of every child, when properly seated, can rest on the floor, and the upper and lower part of the leg form a right angle at the knee; and the back of the seat, whether separated from or forming part of the adjoining desk behind, should recline to correspond with the natural curves of the spine and the shoulders. The seat should be made as far as possible like a convenient chair.

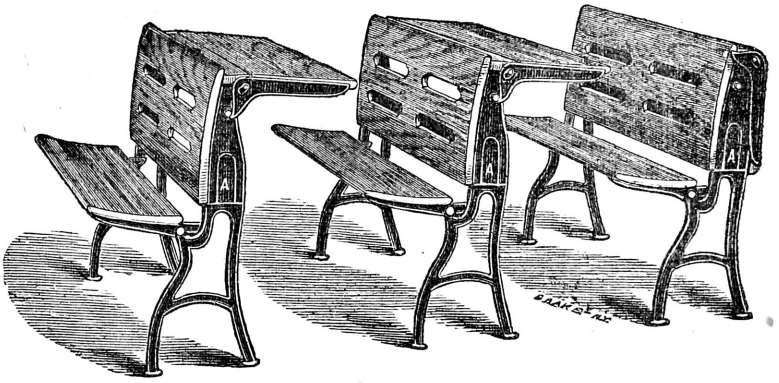


Fig. 228.—Double Folding Desk and Seat.

Fig. 228 represents a double folding desk and seat. The great advantage of their use is, that the desk can be let down and the seat folded up so as to allow the floor to be easily and thoroughly cleaned. There is another advantage in the use of these desks. They provide, at A, A, A, a place or box extending the entirel ength of the desks, for the pupils' books, slates, etc.

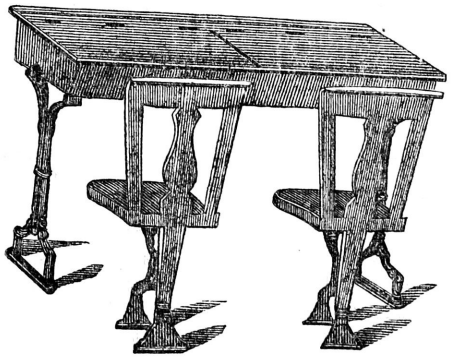


Fig. 229.—Double School Seat and Desk.

Fig. 229 shows a seat and desk differing much in form from the preceding, yet it is the same in principle as the last, except that the desk has an enclosed box, covered with a hinged lid, for each pupil. This arrangement is not preferred, as the raising of the lid interposes a screen between the teacher and pupil, behind which, and in the box itself, acts may be performed which would not be openly attempted; while the opening and shutting of the lids cannot but create noise in the school. The desk with a stationary lid, a shelf beneath, and a slit in the back for a slate (as in *Figs.* 230 and 231), seems to meet the views of the greater number of teachers.

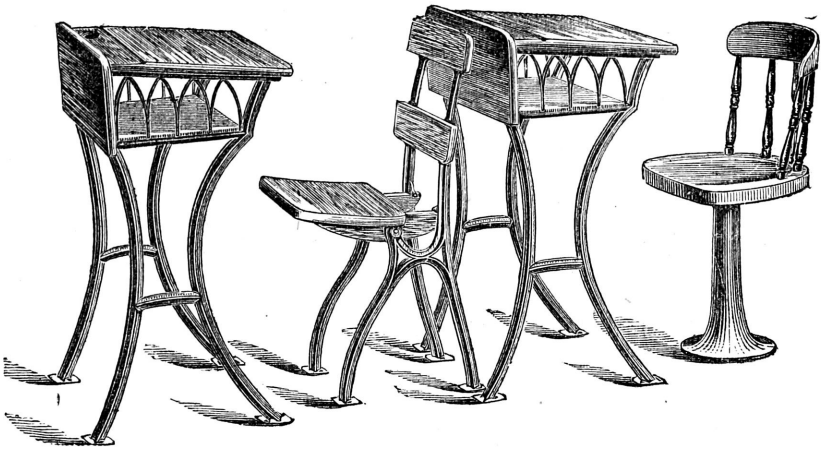


Fig. 230.—Single School Desk and Seat.

Fig. 230 represents a style of single desk and seat of neat and light appearance. The back of the seat is curved so as to fit the back of the pupil. The peculiar construction of the support to the desk gives it additional strength and solidity on the floor. The sides are open to the inspection of the teacher.

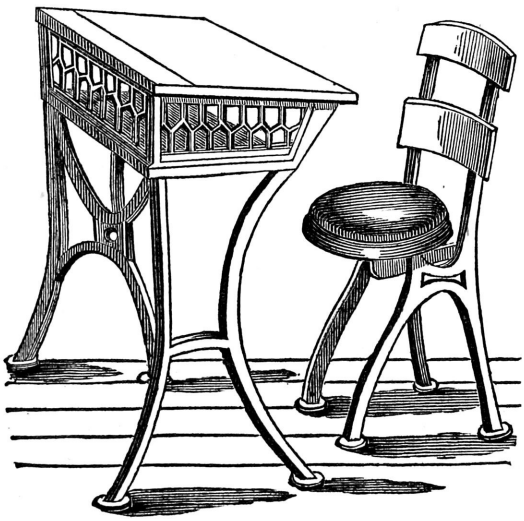


Fig. 231.—Potter's Patent Desk, with Folding Seat.

Fig. 231 represents an excellent school desk, with folding desk, now used in the Normal School, at Ottawa, and the Model Schools, at Toronto, besides in numbers of the best schools in the province. It is manufactured by Mr. Charles Potter, 9 King street east, Toronto. (See advertisement.) Mr. Potter states that "the seats and backs of the improved folding chairs are constructed on correct physiological principles, being curved to fit the natural shape of the human body, thus compelling, when seated, a more strict adherence to the erect posture; and, by allowing the chest of the pupil full expansion, promotes better health and physical development than could be produced by the old style of chair, which causes the pupil to be in a stooping position most of the time. The folding chairs enable the pupils to take their seats and leave them without the usual disturbance. They are turned down on India-rubber cushions, which act as grateful springs to their occupants. They also afford a better chance for cleanliness, as there are no angles for the lodgment of dust, and a free passage is obtained, when the seat is lifted up, for the sweeping and the washing of the school-room floor. The folding seat is of particular advantage for young ladies' schools, as there is no danger of their clothes being torn when moving to and fro."

Single desks are generally to be preferred to double ones. The whole expense for room and desks is about twenty per cent. more; but full particulars as to cost and construction of these patent desks with folding seat, can be obtained from Mr. Potter, No. 9, King Street East, Toronto.

8.—Relative Sizes of School Seats and Desks.

The desks and seats for larger or smaller pupils should be of different dimensions. We think it desirable for two juniors to sit together; and each desk for two may be $3\frac{1}{2}$ or 4 feet long. The younger pupils being placed nearest the master's desk, the front ranges of desks may be 13 inches wide, the next 14, the next 15, and the most remote 16 inches, with the height respectively of 24, 25, 26 and 27 inches. The seats should vary in like manner—those of the smallest class should be 10, the second $10\frac{1}{2}$, the third 11, the fourth or largest class $11\frac{1}{2}$ or 12 inches wide; and being in height 13, 14, 15 and 16 inches respectively. All the edges and corners should be carefully rounded.

The desk for a single pupil should be at least two feet long ($2\frac{1}{2}$ is better) by 18 inches wide, with a shelf beneath (as may be seen in *Fig.* 231) for books, and a narrow, deep opening between the back of the seat in front of the desk itself to receive a slate, as at *b*, in *Fig.* 232. The upper surface of the desk, except three inches of the part nearest the seat in front, should slope one inch in a foot, and the edge should be in the same perpendicular line with the front of the seat. The three inches of the level portion of the surface of the desk should have a groove running along the line of the slope (see *a*, in *Fig.* 232), to prevent pencils and pens from rolling off, and an opening at *c*, *Fig.* 232, to receive an inkstand, which should be covered with a metallic lid. The end pieces or supporters of the desk should be so made as to interfere as little as possible with sweeping.

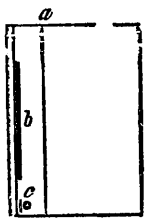


Fig. 232.—Top of Desk.

The following Table is said to show pretty accurately the proportion which should exist between the heights of seats and desks for the various sizes of pupils; the corresponding width and length of the desks; and the proper distances between desks of the same size in the same row, so as to admit the chair between them.

Height of seat.	Height of front of desk.	Width of desk.	Length of desk per pupil.	Chair space between desks.
10 inches.	21 inches.	12 inches.	17 inches.	20 inches.
12 "	23 "	13 "	19 "	22 "
14 "	15 "	14 "	21 "	24 "
16 "	27 "	15 "	21 "	26 "

9.—Arrangement of School Seats and Desks.

We have already suggested (page 41) that, in arranging the furniture of a school-room, the pupils should be faced towards a wall containing no windows, or if any, that they should have close blinds or curtains; and that if possible this should be the north wall. It is also believed that the teacher's platform and desk should be across the end, and not the side, of the room, thus throwing the whole of the pupils more in front of him.

In all schools, but especially in those of mixed studies and ages, there should be seats and desks of different heights to suit the respective sizes of the pupils. In such cases the smaller seats for the younger pupils should be placed in front—that is, nearest the teacher's desk—in order to have them more under his eye and control.

Seats and desks should never be allowed to touch the wall. If the size of the room will not allow a full passage next the wall, the desk should be kept at least six inches from it, both to allow the pupil near it the free use of his arm, and to keep him from contact with the damp, cold wall.

Note.—A great mistake has been made in some school-houses by seating them in such a way as to have all the pupils in the room face the windows. Such an arrangement cannot be otherwise than injurious to the eyes of the pupils, as the strong light is constantly shining into them. Pupils should always be seated with their backs or sides to the windows. There should be no windows in front of them. (See page 41.) When practicable, the house should be so placed that pupils as they sit may face the north. In rooms to be used in summer as well as winter, it would be better that there should be no windows on the south. In all cases there should be outside or inside blinds. Outside blinds are to be preferred to keep

the room cool. Inside blinds can be more easily managed so as to modify the light in the school. The gable end of the school-house should also be toward the south, since by this arrangement the roofs would be much less heated in summer.

10.—Class Space for Seats and Desks.

In a school-house without recitation rooms, or with but one teacher, a sufficient space in front of the platform, for classes during recitation, will be indispensable. It should be as large as possible, after making full allowance for the necessary passages. The full breadth of the room should be allowed for this purpose, if practicable; if not, space for painted or brass semi-circles at the side rows of seats on the floor should be allowed.

11.—Diagonal Arrangement of Single Desks and Seats.

By a diagonal of single desks and seats in a school-room, as many scholars can be seated at single as at double desks, and they will only occupy the same floor room. There is also a gain over single desks as arranged in the common way in schools, by seating forty-eight scholars, with these desks, in the same space as thirty-six are commonly seated. The desks and chairs are arranged diagonally on the floor, so that no one scholar can see the face of another without one of the two being at right or left half face. When the school is called to attention, all can rise at once, and step into files in the aisles, without coming in contact with one another. (See the "Desk drill," and illustrations, section 13, page 206.) Scholars arranged diagonally are more directly under view of the teacher, and can therefore, as a general rule, be kept in better order.

12.—How to Make Desks and Comfortable Seats.

The problem of an easy seat and desk for a school-room is a very important one, which, like many other problems, has not yet received its *only* good solution. I send you the following as the result of my own labour and study. I have tried it by years of actual use, and know the plan and proportions to be good.

Make the seat from half an inch to an inch lower than one-fourth of the person's whole height. Make the back from one to two inches higher than one-fourth of the person's height. Make the desk (level) one-sixth of the person's height above the front edge of the seat (reasons for this may be seen by referring to the Oxford Drawing Book). Thus, for a person about six feet high, the seat should be seventeen inches, the desk twenty-nine inches from the floor, and the back nineteen inches from the seat. For one three-and-a-half feet, there heights would be ten, seventeen, and twelve inches.

In a room for pupils of all sizes, the seats may vary from ten to sixteen or seventeen inches high; the desks from seventeen to twenty-eight or twenty-nine. In a primary department, seats may vary from ten to thirteen inches, and desks from seventeen to twenty-one. In an intermediate department, seats from twelve to fifteen inches, and desks twenty to twenty-four. In a higher department, seats fourteen to seventeen inches, desks twenty-three or twenty-four to twenty-eight or twenty-nine. In all cases seats should be graded with care, and pupils seated according to their sizes—the tallest in the back of the room.

NOTE.—For "relative sizes of school desks and desks," see section 8, page 204.

Incline the seat from the front downward one inch in one foot. Incline the back one inch in six, except the back of the seat next to the wall, which should be about twenty-five inches wide, and slant one in five.

The seat for the largest size should be full twelve inches wide, and the top (or lid) of the desk eighteen or nineteen. The ends of all boards should project an inch over the standard, for firmness in nailing. Nail-heads should not be *set*, so as to require putty for children to pick out.

Every projecting corner of the seat, back, and desk, should be rounded to a quarter circle of a radius of three or four inches; every outer edge of the same

to a semicircle. Desks for two should be from three-and-a-half feet to three feet nine inches in length for larger pupils; while three feet is long enough for a primary department. To vary the size, after making enough for one row across the room, cut off from the top and bottom of the standard each quarter of an inch; from the width of the lid and back each quarter of an inch; and from the width of the seat one-eighth of an inch. The seat should never be less than ten inches wide. These variations may be two or three times as great in a promiscuous school.

The standard may be, at each side, an inch or more narrower than the top and seat to be nailed upon it.

The shelf should be rabbeted (I think that is the term) into the standard; and the latter be nailed to the floor. Both are stronger and neater than cleats.

The whole, made of *well-seasoned* whitewood (which is less liable to split than pine), stained, or nicely grained and varnished, give a room a very neat appearance, are comfortable, and not so likely to be cut to pieces as those not well finished.—*Illinois Teacher.*

NOTE.—Says Dr. J. C. V. Smith, "There is a radical defect in the seats of our school-rooms. Malformation of the bones, narrow chests, coughs ending in consumption, and death in middle life, besides a multitude of minor ills, have their origin in the school-room. To the badly-constructed seats and writing desks are we to look, in some measure, for the cause of so many distortions of the bones, spinal diseases, and chronic affections, now so prevalent throughout the country." Another physician, Dr. Woodward, says, "High and narrow seats are not only extremely uncomfortable for the young scholar, tending constantly to make him restless and noisy, disturbing his temper, and preventing his attention to his books, but they have a direct tendency to produce deformity of his limbs. Seats without backs have an equally unfavourable influence upon the spinal column. If no rest is afforded to the backs of the children while seated, they almost necessarily assume a bent and crooked position. Such a position, often assumed and long continued, tends to that deformity which has become extremely common among children of modern times, and leads to diseases of the spine in innumerable instances, especially with delicate female children."

13.—Seat Drill in Schools.



Fig. 233.—"RETURN."



Fig. 234.—"UP SLATES.

With a view to enable teachers to introduce a system of seat and desk drill for schools, we have selected the accompanying illustrations on the subject from "Robson's School Architecture." The advantage of employing this drill is, that pupils soon learn to move with celerity and precision, besides being more amenable to control. Obedience to the "word of command" is invaluable in maintaining order and discipline in the school; and a wise teacher will avail himself of every means at his command to promote these chief of all school virtues.

The following "code of drill" has been drawn by Mr. Robson:—"At the word "Return" (*Fig.* 233, "Return"), the hands should be raised to grasp the slate.

Fig. 234, "Slates."—At the word "slates," the slate should be smartly lifted and placed in the groove in front of the desk, without noise. The hands should then be lowered.

NOTE.—If books have been used, as in the case of an arithmetic lesson, the additional command may follow:—(1) "Return" (2) "Books." At the word "books," the books should be placed on the shelf under the desk, and the hands brought back to their original position.

Fig. 235, "Lift" (or "Raise").—At the word "lift" (or "raise"), the edge of the flap should be grasped by both hands.



Fig. 235.—"LIFT" (OR "RAISE.")



Fig. 236.—"DESKS."

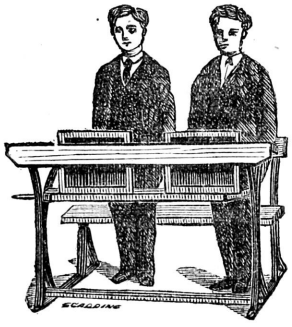


Fig. 237.—"STAND."

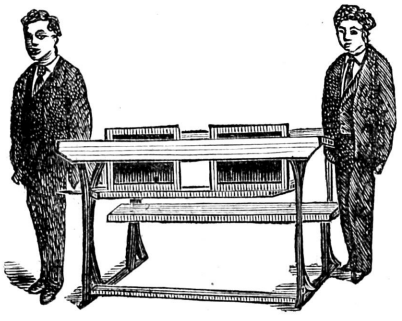


Fig. 238.—"OUT."

Fig. 236, "Desks."—At the word "desks," the flap should be raised quickly, but without noise, and the hands dropped.

Fig. 237, "Stand."—At the word "stand," the pupils should rise smartly, with arms straight by their side.

Fig. 238, "Out."—At the word "out," the pupil at the *right* end of the desk takes one step to the *right*, and a short step to the *front*. At the same moment the scholar at the *left* end of the desk takes a step to the *left*, and a short pace to the *rear*.

NOTE.—This last movement, "out," leaves the pupils in Indian file down their respective passages. The word of command may then be given, "*quick*" "*march*"—the word "quick" being simply used as a caution before moving. At the word "march," all the files move off with the *left* foot, taking care that regular paces be maintained. When the last scholar in each file has reached the front of the desks, the word "halt," or "right turn," may be given. In returning to their places, the scholars should be marched in file, halted and fronted, and then afterwards seated at the given words :—

"Sit."—At the word "sit," the pupil *opposite the right end of the desk* takes a short step to the *rear* and another to the *left*; at the same moment the pupil *opposite the left end of the desk* takes a short pace to the *front* and another to the *right* (*Fig.* 238).

"Down."—At the word "down," each pupil takes his place promptly (*Fig.* 237).

"Lower" (or "Close").—At the word "lower," the top edge of the flap should be grasped with both hands (*Fig.* 236).

"Desks."—At the word "desks," the flaps should be quietly let down (*Fig.* 235).

"Take out."—At the word "out," the hands should be raised to the slates or books as required (*Fig.* 234).

"Slates" (or "books").—At the word "slates" (or "books"), the slates (or books) should be lifted from the groove (or other place, if books) and laid gently on the desks—the pupils "dressing by the right" (*i.e.* boy to the right), and taking time from the teacher, who signals with his hands.

NOTE.—For advantages of a diagonal arrangement of desks and seats, and this drill, see section 11 of this chapter.

14.-Additional Exercises for Relief Changes, or Seat Drill, in Schools.

The teachers of the lower grades of our schools need frequently to introduce exercises which will afford physical relief to their pupils, promote their health, and make discipline more easy. We copy two sets of such exercises from the Connecticut *Common School Journal*. In all such drills, precision, promptness and life are dispensable.

SET No. 1.

1. Sit erect.
2. Fold arms.
3. Extend right hand.
4. Extend left hand.
5. Extend both hands, in front.
6. Clap three times.
7. Place right hand on hand.
8. Place left hand on head.
9. Raise both hands perpendicularly.
10. Clap twice.
11. All rise—without noise.
12. All face the north.
13. All face the east.
14. All face the south.
15. All face the west.
16. All sit—quietly.
17. All take slates (or books)—without noise.

SET No. 2.

1. Hands clasped and resting on edge of desk.
2. Sitting erect, arms folded.
3. Arms folded behind.
4. Ends of fingers resting on shoulders.
5. Fingers meet on top of the head.
6. Palms of the hands meet above the head, with one clap.
7. Arms folded on the desk, head resting on them.
8. Arms akimbo, hands on the hips, fingers towards each other.
9. Right hand extending, left hand on the hip.
10. Reverse the preceding.
11. Both hands extended horizontally.
12. From the 11th position, hands brought up perpendicularly, fingers shaking.
13. Soft part of the ends of the fingers tapping on the desk, imitating the sound of rain.
14. Hands twirling one over the other, then brought suddenly to the desk with a noise.
15. Right hand extended, left hand on breast.
16. Reverse the preceding.
17. Both hands crossed on breast.
18. Arms extended forcibly and carried back.
19. All rise.
20. All sit.
21. Assume a devotional posture—hands on the face, and head bending upon the desk.
22. Study lessons.

15.—Desks for Drawing, and Drawing or Examination Table.

In giving lessons in drawing in elementary schools, the ordinary desk will be found sufficient; but in the advanced classes, a properly-constructed drawing

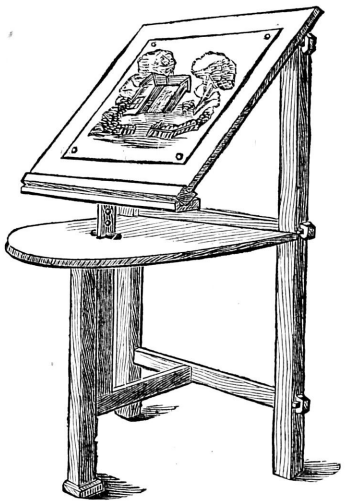


Fig. 239.—VICTORIA DRAWING EASEL.

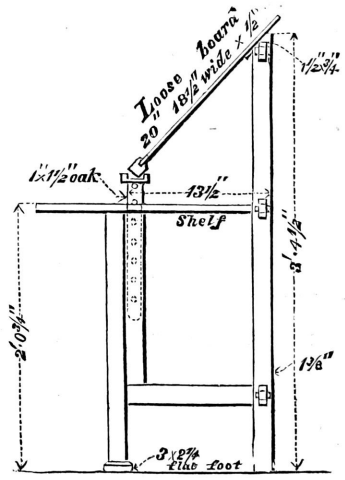


Fig. 240.—SECTION OF DRAWING EASEL.

desk or easel will be found to be indispensable. *Fig.* 239 is an illustration of a neatly contrived and convenient drawing easel, in the higher class for the study of art at the Victoria School for Girls, in Berlin, Prussia. *Fig.* 241 is a plan of the "shelf" or "table" of the easel; and *Fig.* 240 is a detached section of the easel itself, showing the sizes of its various parts, and the details of its con-

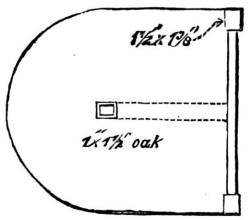


Fig. 241.—Plan of "Shelf" of Drawing Easel.

struction. The easel board may be raised or lowered, to suit the height of the pupil, by means of a peg being placed in the hole of the supporting standard. The shelf will be found convenient as a place on which to place crayons, chalk, ruler, etc.

Note.—The materials used in drawing classes will be illustrated and described in a future chapter.

Fig. 242 may be used for a double purpose, viz., as a drawing or examination table. It was constructed at the suggestion of President White, of Cornell University, Ithaca, N. Y. It contains no drawer for the concealment of books or papers, and folds flat, so as to be easily put away when not required.

Note.—The table may also be used with good effect for giving lessons on objects, as they can be placed upon it, and may be easily seen.

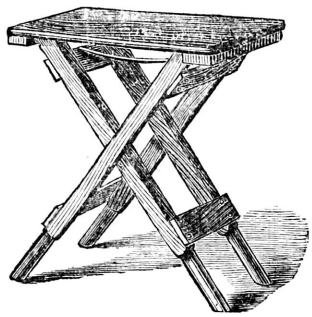


Fig. 242.—Drawing, Object Lesson (or Examination) Table.

16.—Teacher's Platform, Desk, Seat, and Reading Stand.

(1.) *Platform.*—In all contracts for the erection of school-houses, the platform should be included, and it should be ample and substantial. The north end of the main room has frequently been pointed out as the most desirable situation; but this will depend on the position of the house and of the windows. The platform should extend across the whole end or side of the room where it is placed, if not curtailed by doors; and it should be one full step higher than the floor, but probably two steps will be found equally useful for ordinary purposes, and more so in times of exhibition, etc. Across each end of, and upon the platform, will be an appropriate place for two standing closets—one for apparatus and the other for a library, if no room be specially provided for those purposes. This part of the wall, as it does not face the school, will not be so desirable for a blackboard as the cross wall, and can more readily be dispensed with for closets than any other. No platform should be narrower than four feet, but five would be better, and six ample for all purposes.

(2.) *Teacher's Desk.*—Many forms of teachers' desks are in use. Any of them will do if it have the following qualities:—(1.) A large, level, table-like surface on the top, not less than two and a half feet wide by five feet long, with a ledge not higher than three or four inches at each end of the back, and a movable inclined surface for writing on, if desired. If the ledge is higher, it will interfere with the teacher's view of a class in front of him, and may impede the pupils' view of articles or experiments when exhibited on the desk; and the inclined writing surface should be movable, to leave the whole desk-top free for similar occasions. (2.) It should have no deep box or well, covered with a lid, but drawers underneath or at the side, and shelves with doors, or both, always accessible without disturbing the articles necessarily placed on the top.

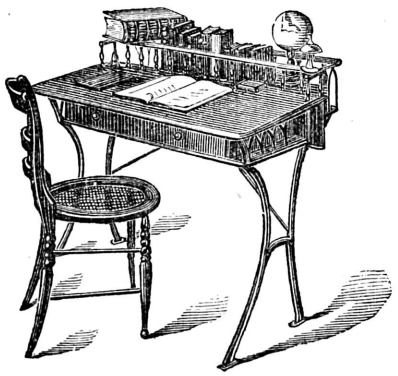


Fig. 243.—Teacher's Desk and Chair.

(3.) *Teacher's Chair.*—The platform should have at least one large, comfortable, and sedate looking chair; not that the chair, or the desk, or any other part of the school-room furniture or apparatus, will supply any defect in the teacher; but every proper means should be adopted to add to the respectability of his position and the dignity of his office. The platform should also have a half dozen other chairs for visitors, and particularly for the board of trustees, who, when they visit the school, should always, during at least a portion of their stay, appear on the platform, and be seen and known in their official character. Children are naturally inclined to be much influenced by the presence of those in authority; and it is a great error in any system for the education of the people, whose laws and the agents of whose laws depend wholly on voluntary obedience, to weaken—or rather not to strengthen—this right feeling. This salutary habit of respect for the law and its officers will not only be strengthened by the official reception and presence of school trustees, but the teacher will find his heart cheered and his hands strengthened by their frequency. When it is known that this is a matter of periodical recurrence, it will be expected and prepared for; and when the rules of the school are understood to emanate from other authority, and their results to be reported to another tribunal, parents will have an additional motive for conformity, and pupils one more strong stimulant to progress.

Fig. 243 represents a very good style of teacher's desk and chair. The rack on the desk is arranged to hold a small globe, dictionary, and various books of reference. There are two drawers underneath for private papers, stationery, blank reports, etc. The teacher's chair, for convenience, is movable.

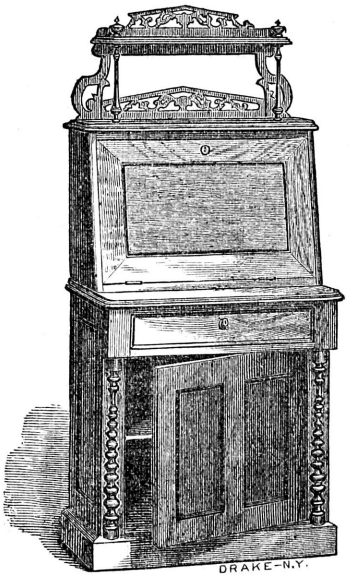


Fig. 244.—Teacher's Desk and Press.

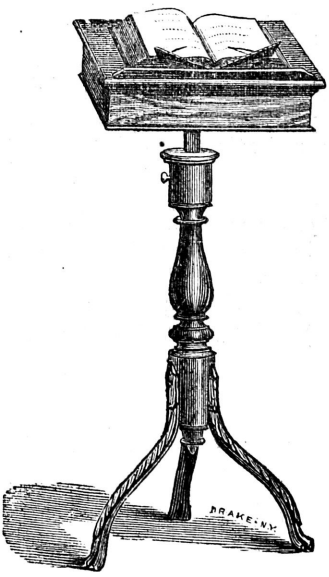


Fig. 245.—Teacher's Book Easel.

Fig. 244 represents a teacher's very handsome desk and press, with drawer, pigeon-holes, etc. It has also two shelves for books at the top, the back of which is ornamented with fretwork. The upper part or door, covering the pigeon-holes, can be let down, forming a desk for writing on. When done with, the teacher's papers may be put in the pigeon-holes and the door closed up and locked.

Fig. 245 shows a convenient reading stand or easel for the teacher. It can be used at the opening religious exercises of the school, or when the teacher wishes

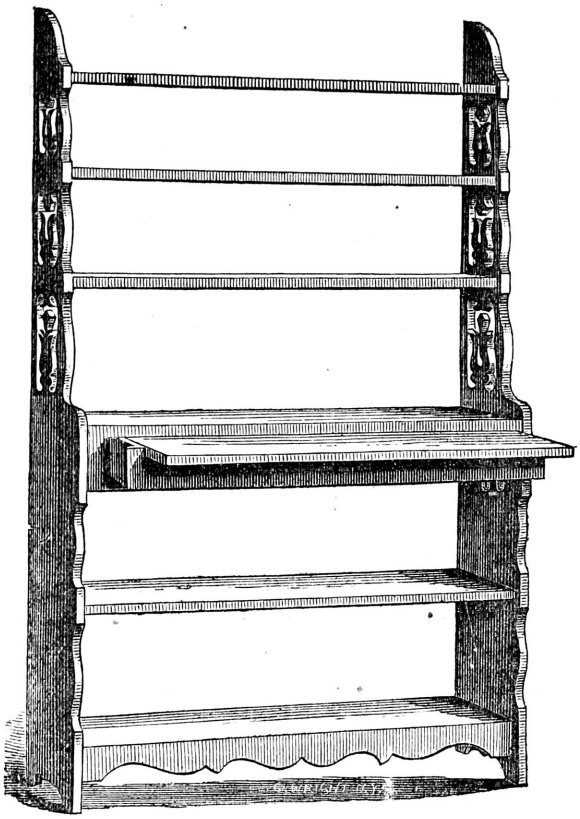


Fig. 246.—Portable Book Rack and Writing Table.

to stand at a recitation. The upper portion, or desk, is movable in the socket, and can be raised or lowered at the pleasure of the user. A pin at the left of the upper part of the stand keeps the desk in its place when raised or lowered. Movable fingers, or pins, are used to keep open the book or manuscript while reading. The feet of the stand should be made of iron and screwed on the central pillar. The desk itself may form a box or well, covered with the top, in which to keep the bible used at the morning or evening religious exercises, or other books used on the stand from time to time.

17.—School Library Shelves and Presses.

Fig. 246 represents the Gardner Portable Book Shelves and Writing Table (Schermerhorn, New York). It has, as will be seen, a sliding writing shelf or table, with drawer attached. These shelves can be so constructed as to be taken apart and put together again readily. They are suitable for teachers' rooms, or for the school library.

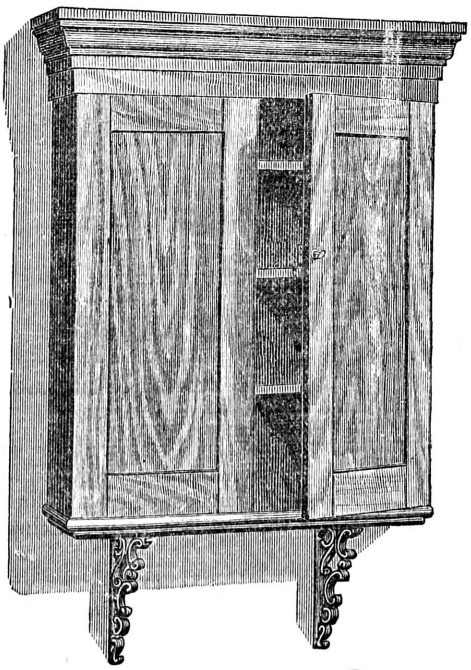
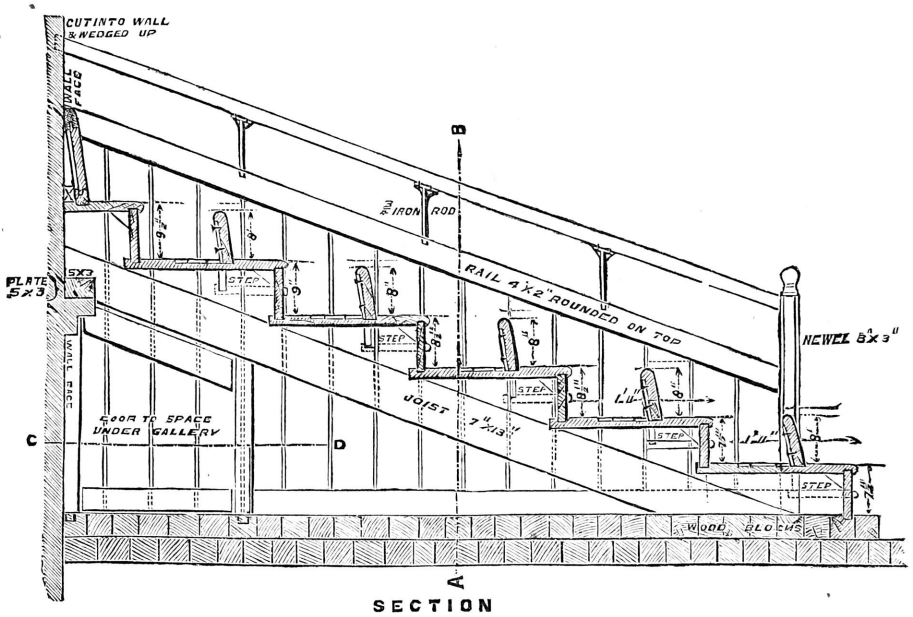


Fig. 247.—Library Book Case, or Press.

Fig. 247 represents a library case, or press, for a teacher's room or small library. It can be set up on two iron brackets fastened into the wall. It should also be screwed to the wall from the inside, near the top, so as to keep it firm in its place. It will thus be found a convenient piece of furniture, besides being neat and ornamental in a room. It may be made of walnut, cherry, butternut, or other hard wood. If pine be the wood chosen, it should be smoothly planed, so as to bring out the grain and knots well, and then be stained to imitate walnut.

18.—Gallery Room, for Object Teaching.

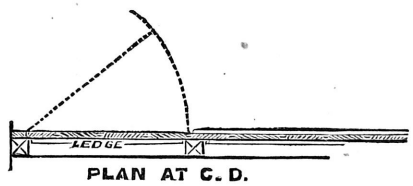
One of the most important adjuncts to a school is the gallery room for object teaching. We therefore insert three illustrations on the subject. The first and second give the details of the construction of a gallery, and the third gives a practical illustration of the mode of teaching in the gallery itself.



SECTION

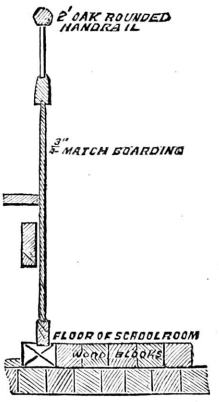
Of a Gallery (Fig. 248), showing Details of Construction.

From *Fig.* 248 any intelligent carpenter can easily understand the details of the construction of the gallery, and can readily give an estimate of the cost. *Fig.* 250 gives a section of the gallery from A to B, and *Fig.* 249, from C to D. The section of the gallery shows six rows of seats, graduated from $7\frac{1}{2}$ to $9\frac{1}{2}$ inches in height, according to the sizes of the pupils. The seat (allowing 14 or 15 inches for each child) should be fitted with a low back 8 inches in height. The steps up, or gangways, should



PLAN AT C. D.

Fig. 249.



SECTION ON LINE A.B.

Fig. 250.

be 18 inches wide, placed at each end of the gallery; and the steps should be so arranged as to be out of the way, and not too high for the little legs intended to use them. The width from back to back should be 23 inches, so as to afford room for freely passing in and out. Next to the wall, at the rear, matched skirting boards should line the wall.

Note.—Galleries should, if possible, be always lighted from the right side of the pupils or from the top, but never from the back or front of the pupils, if it can be avoided.

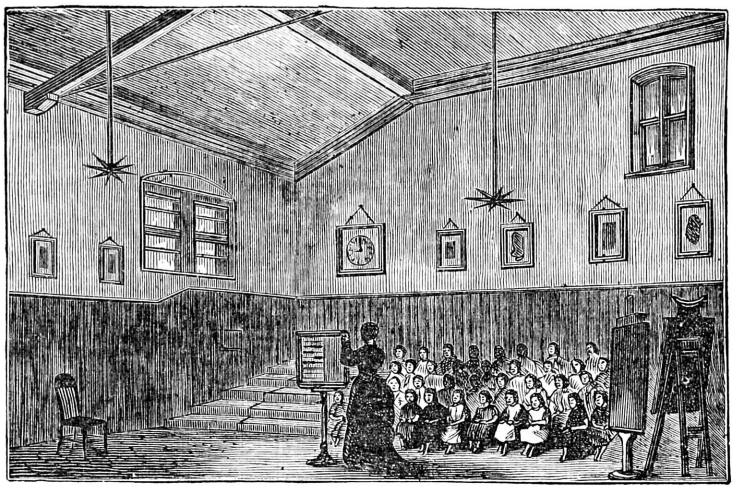
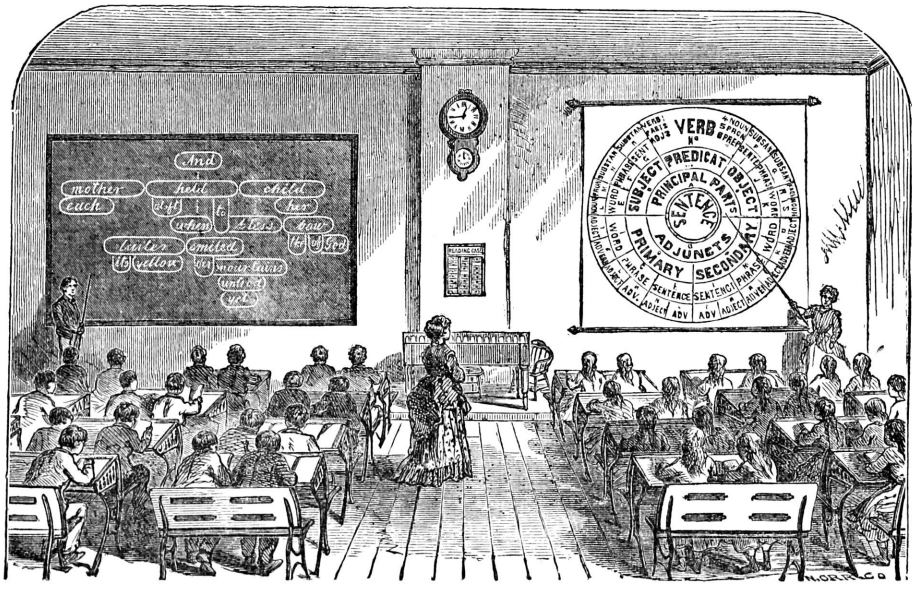


Fig. 251.—Illustrating a Gallery Lesson in Arithmetic.

Fig. 251 affords an illustration of the gradual rise of seats in a gallery room. The pupils are gathered in front of the teacher, and can readily see any object in the teacher's hand. She also can fix her eyes on any pupil, and detect any inattention on his or her part. In the illustration given, the teacher is using a numeral frame for teaching the simple principles of arithmetic. The blackboard easels, which are at her right hand, can next be used with effect for practical illustrations of the lesson in hand, or for the purposes of teaching the elements of drawing, or any other subject which admits of illustration.



Fig, 252.—Illustrating Object Teaching in a School-Room.

Fig. 252 gives an illustration of how far and in what way object teaching can be used in an ordinary school-room. On one side is a chart, with a teacher

illustrating the lesson on English grammar; on the left-hand side is a blackboard exercise on the same subject, with a boy explaining it to his fellow-pupils.

19.—Illustrations of Object Lesson Teaching.*

Each exercise in object lessons should be conducted with a view to forming habits of attention and careful observation through the use of the senses.

Form.—In Nature's school, children first learn to know things as wholes; they learn to know their parts afterward. The teacher who would be successful must follow Nature's plan of instruction. Present, therefore, common objects as wholes, and lead the pupils to notice resemblances in shape, first; afterward direct their attention to prominent differences.

A Box of Forms and Solids, containing forms and fifteen solids, has been prepared for the special purpose of *object teaching*. This is the most important aid in illustrating the various forms and solids.

Select the form to be taught from the box of forms, and lead the pupils to observe it, and then tell them its name; next require them to mention other objects having the same shape. Proceed in this manner with each form and solid, and continue these exercises until the pupils can recognize and name each.

Colour.—The pupils should be led to distinguish resemblances and differences in colour, from "coloured cubes," or cards, and to group together objects of like colours. They should also learn the names of the six principal colours.

Objects.—The lessons on *common objects* should be simple and conversational, treating only of their most obvious parts and uses. Such common objects as a bell, chair, slate, pencil, hat, cup, knife, etc., are appropriate for this purpose. The pupils should be led to notice and point out the principal parts, and encouraged to tell what they see and what they know of each object shown them. (See *Fig.* 267.)

Human Body.—The lessons on the human body should lead the pupils to notice and name the parts, as head, neck, trunk, arms, hands, legs, feet; also, parts of the head, as crown, face, forehead, cheeks, chin, mouth, nose, eyes, ears, etc.

Drawing on Slates, etc.—The exercises of *drawing* and *printing on slates* should be introduced in such a manner as to give an interesting variety to the class-work; also, so as to aid in the discipline of the class, by giving the children something *to do* that will interest them after they have become tired with their other lessons. The children might be allowed to use slates for drawing, as a reward for good order and attention. Short daily exercises may be made very useful. (See *Fig.* 267.)

Length of Exercises.—The exercises of this grade should not be continued upon the same subject longer than fifteen minutes at one time, without materially changing the manner of the exercise.

Discipline.—Young children cannot attend to the same thing for a long time without change in the form of attention. Their natural activity demands frequent changes in the position of the body; also constant but varied employment. If the teacher does not furnish the needed employment and changes of position by variety in her methods of instruction, the children will seek to gratify their need by play. Therefore children *should never be compelled to sit without employment either for the mind, the hands, or the body.*

Children should be led to do right by encouragement rather than be driven by fear. Judicious praise is more efficient than scolding. Teach them to be cleanly, mannerly, truthful, and obedient. Let good examples of these traits be commended frequently.—*American Educational Monthly.*

* Further papers on this subject will be given in the "Hand Book of Teaching," edited by Dr. Hodgins.

20.—The Black-board and its necessity in a School.

(1.) *Extent of Surface.*—By all competent teachers, the black-board is known to be the most useful, and, next to seats and desks, the most indispensable article of school furniture. With a sufficiency of black-board, the well-qualified, experienced teacher can do almost anything in the way of instruction; without it, he feels himself at a loss in every branch. As to the quantity requisite, it may be said that it can readily be too little, but cannot well be too great. The whole wall behind the teacher's seat, and all the spaces between the windows and doors on the other walls, if covered with good black surface, extending five feet upwards, from a point two feet above the floor or platform, would not be too much; but a black-board of the height specified, and extending the whole length of the platform, is indispensable. This position faces the whole school, and is, therefore, the most suitable for the instruction of the whole at once; while it is as proper as any other for the use of individual pupils.

(2.) *Kinds of Black-board.*—A number of expedients have been tried to supersede the painted and varnished board, first and still used for this purpose. The objections to the wooden surface are, that it is liable to warp and crack, is costly, and requires to be painted very frequently. Several of the black surfaces now in use will be described; the wooden board requiring no other directions than that it should be composed of the widest, soundest, and clearest boards that can be procured, perfectly seasoned, exactly jointed, and well glued together. They should be strongly framed or "iron tongued," to prevent warping, and should be firmly fastened to the wall, so as to prevent, as much as possible, the noise made by the chalk in writing upon it. *Fig.* 253 represents a collection of portable wooden black-boards, of various sizes, including one ruled for music.

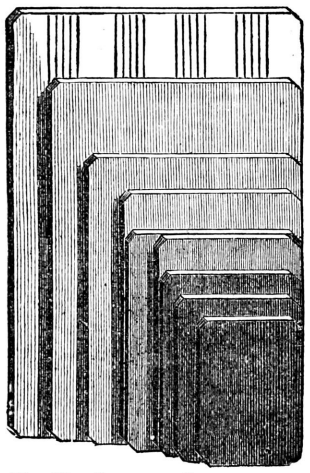


Fig. 253.—PORTABLE BLACK-BOARDS.

(3.) *Paper Surface.*—Let the surface be cleared of all roughness or inequality, with sand paper. Take common wall paper, let it be pasted smoothly and firmly on the required spaces, and covered according to the following recipe:—Lamp-black and flour of emery, mixed with spirit varnish. No more lamp-black and flour of emery should be used than are sufficient to give the required black and abrading surface; and the varnish should contain only sufficient gum to hold the ingredients together, and confine the composition to the wall. The thinner the mixture the better. The lamp-black should first be ground with a small quantity of alcohol, to free it from lumps. The composition should be applied to the smooth surface with a common painter's brush. Let it become thoroughly dry and hard before it is used. This kind of surface, if properly made and used, will last for several years. Another paper surface may be speedily and cheaply prepared, by pasting strong wall paper smoothly on the wall, then sizing it to prevent the paint from sinking into the paper, and afterwards giving it a couple of coats of black oil-paint, with a small mixture of emery to give it a grit, or hold on the crayon, and enough varnish to cause it to dry rapidly.

(4.) *Composition Black-board.*—For twenty square yards of wall, take three pecks of mason's putty (white finish), three pecks of clean fine sand, three pecks of ground plaster, and three pounds of lamp-black, mixed with three gallons of alcohol. Lay the mixture evenly and smoothly on the surface to be covered. The alcohol and the lamp-black must be well mixed together, before they are mixed with the other ingredients.

NOTE.—A superior article of liquid slating for black-boards, with directions for using, may be obtained at the People's Depository, Toronto.

(5.)—*Another Recipe.*—To 100 lbs. of common mortar, add 25 lbs. of calcined plaster; to this add twelve papers, of the largest size, of lamp-black. This is to be put on as a skim coat, one-sixth of an inch thick on rough plastering, after it has been thoroughly raked and prepared. This should be covered with a coat of paint, made in the following manner:—To one quart of spirits, add one gill of boiled oil; to this add one of the largest papers of lamp-black, after it has been thoroughly mixed with spirits. To this add one pound of the finest flour of emery. This paint may be also put on boards or canvas. This should be con-

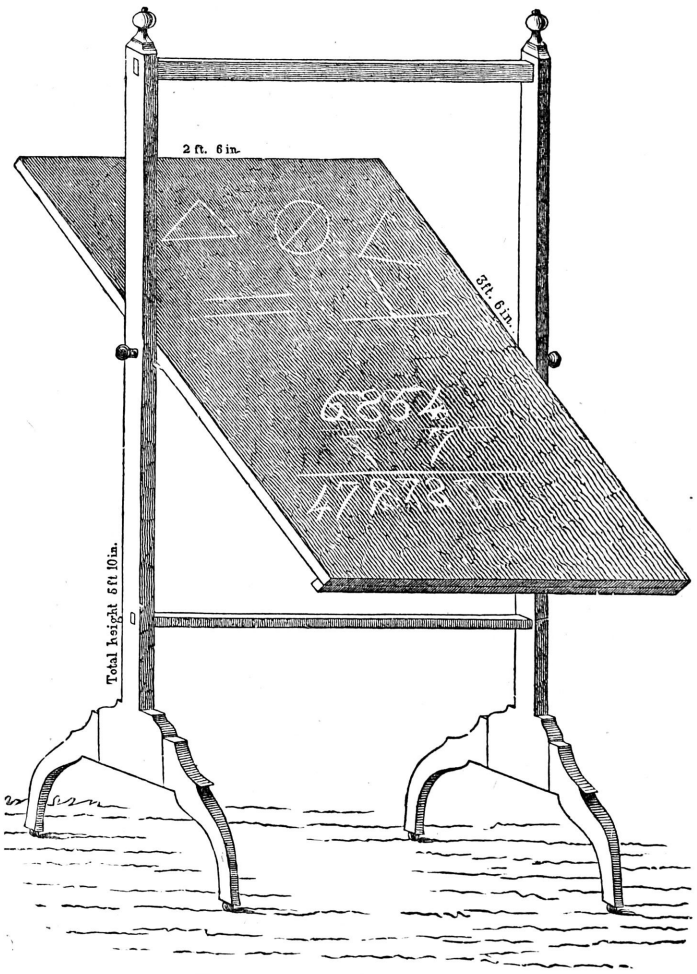


Fig 254.—A MOVABLE BLACK-BOARD.

stantly stirred when used, to prevent the emery from settling. If too much oil, or if any varnish be used, the board will become more or less glazed, and unfit for use. Some prefer to have the board behind the teacher green or bronze, which is more grateful to the eye. This can be done by using chrome green instead of lamp-black. None but the very finest flour of emery should be used. Some prefer pulverized pumice-stone to emery.

NOTE.—All stationary black-boards should have a neat frame or moulding at the top and each end, and a ledge or narrow trough at the bottom, to hold the chalk or crayons and the wipers, and to catch the dust from above. This should be so made as to prevent the crayons from rolling off and breaking on the floor.

(6.) *Canvas substitute.*—A prepared canvas substitute for a black-board, which may be procured at the People's Depository, Toronto, of the following sizes, is painted black, with wooden frames:—No. 1, size 24 inches by 36 inches; No. 2, 30 inches by 36 inches; No. 3, 30 inches by 42 inches.

(7.) *Movable Black-boards.*—These have the advantage of presenting both sides for use. One kind is set in a frame, and turns on pivots, as shown in *Fig.* 254. Another and a cheaper kind rests on a stand, something like a painter's easel. It is supported by pins, which can be raised or lowered at pleasure—both sides being also prepared for use.

21.—Necessity for the Slate and Black-board in a School-Room.

The slate and black-board are both indispensable instruments in primary teaching. Drawing has too long been regarded as an accomplishment to be acquired only by the few. It should be deemed a necessity, and the elements at least be acquired by the many. I have long been of the opinion that the elements of linear and mechanical drawing should be included in the common school course, and that the former, at least, should be commenced in the primary department. Beginning with the straight line, let the class be taught to draw it; first as a horizontal, next as a perpendicular, then at all the intermediate angles. Let them afterwards try to divide the line by the eye, without measurement, into two, three, or more, equal parts, till they can do it promptly and well. Then take up the curves, the circle, and the simple geometrical figures, etc. Great progress can be made in these elements, by very young children, and, besides the immense advantage to them in life, they will take great interest in the exercise. The letters of the alphabet furnish an admirable series of exercises in drawing. Nearly all the primary movements, as straight lines, perpendicular, horizontal, oblique, curves, etc., are involved in their formation. Especially is this true of the capitals. Some of the best teachers of the art employ them as copies, even for more advanced pupils. For primary scholars, it is an excellent training for the eye and hand, and, while imparting knowledge and skill in the elements of drawing, it *incidentally* fixes the name and shape of each letter indelibly in the memory; for, when a child has learned to draw a letter correctly, and to associate with it its appropriate name, he will not forget it. Thus, while the eye and hand are being trained to skill—while the first principles of a noble and useful art are being thoroughly learned—while the mind is pleasantly excited and interested, instead of being wearied and stupified, the alphabet itself is completely mastered; incidentally, almost unconsciously. The names of the letters are not only more permanently learned in this way than by the old routine repetition process, but in less than half the time. This is not theory, but fact. It has been demonstrated by a thousand trials. That such an amount of precious time is annually wasted in the effort to print the mere names of the twenty-six characters of our language upon the memory of the child, by the endless iteration of a–b–c, would be ludicrous, if it were not so sad. Not only one, but several school terms are often squandered, before the stupendous result is achieved! And when at last the victory is won, how poor and barren it is—the child can call the names of twenty-six crooked, dry, unmeaning things! that is all. No mental power has been developed; no new faculty has been awakened; no pleasure has mingled in the weary task; the mind is deadened, almost stultified; the child is disgusted with his book and tired of school, but he *knows his letters*, and great is the rejoicing of friends! There is, thank God, "a more excellent way." It is difficult to over-estimate the good effects of a judicious use of the slate and black-board in

primary schools. No school-room for small children is equipped without them—no one is fit to be a primary teacher who is unable or unwilling to use them.—*N. Bateman.*

22.—Music written on the Black-board.

Lessons in music written on the black-board the moment they are wanted are always more interesting to pupils than such as are contained in a book. The teacher should accustom himself to write with ease and rapidity, and should depend more upon the black-board lessons than upon any others. The board should have the lines of the staff painted upon it, so as to save the time of the teacher. The staff, without clefs, should also be so cut into the slates of the pupils that it may always be ready for use when they are called upon to write what is sung, as well as to sing what is written. The time which is occupied in writing a lesson is not lost in a well regulated school, for the pupils will watch the movements of the teacher with interest, and will examine each note and character as it is written. It may also at times be desirable for the teacher to have his pupils name the tones as he writes them. No written lessons can possibly do away with the necessity for the black-board. If all the teachers in the world should set themselves to writing lessons, and all the printers in the world should be employed to print them, and all the shops should be full of the books containing them, and all the pupils in the world should have all the money in the world with which to purchase all the books of printed lessons in the world, and every pupil should be furnished with a copy of every book that was ever printed, still the necessity for the black-board would remain. It might indeed be superseded in part by a sufficiency of printed lessons, so far as practical vocal exercises are concerned; but yet for these it can never be given up by a good teacher; but even if it were given up for these, it would still be needed constantly for the illustration of such subjects as will be constantly coming up in teaching. The idea of giving up the black-board is preposterous, and any one who entertains the thought of doing without one, proves conclusively that he cannot possibly be a good practical teacher. Perhaps our language on this point may appear to be strong, but surely there is no subject on which we feel a greater degree of certainty than this. That the black-board is an indispensable requisite in every well furnished school-room, whatever be the subject taught, is the concurrent testimony of all good teachers in all parts of the world, in all departments of school teaching. It is needed, too, from the beginning to the end of a course; it is not to be used for a few of the first lessons, and then to be given up; its use is never to be wholly discontinued.—*T. F. Seward.*

23.—Chalk and Crayons—their Composition and Use—Black-board Brushes.

(1.) *Chalk and Crayons.*—Chalk is the substance most generally used for writing with on the black-board; but it is so often gritty and liable to scratch the board, that prepared crayons, when obtainable, are much better. The following recipe is said to produce excellent articles, at a small cost; and if one person were to make them for a whole district, the cost and the labour would both be further reduced. Crayons thus made will not cut or scratch the board, but they are easily broken, and require more care than chalk.

(2.) *To make Crayons.*—Take five pounds Paris white and one pound of wheat flour, wet with water, knead it well; make it so stiff that it will not stick to the table, but not so stiff as to crumble and fall to pieces when it is rolled under the hand. To roll out the crayons to the proper size, two boards are needed—one to roll them on, the other to roll them with. The first should be a smooth pine board, three feet long and nine inches wide. The other also should be pine, a foot long and nine inches wide, having nailed on the under side, near each end, a slip of wood one-third of an inch thick, in order to raise it so much above the

under board as that the crayon, when brought to its proper size, may lie between the boards without being flattened. The mass is rolled into a ball, and slices are cut from one side of it about one-third of an inch thick; these slices are again cut into strips about four inches long and one-third of an inch wide, and rolled separately between these boards until smooth and round. Near at hand should be another board, three feet long and four inches wide, across which each crayon, as it is made, should be laid, so that the ends may project on each side. The crayons should be laid in close contact and straight. When the board is filled the ends should be trimmed off, so as to make the crayons as long as the width of the board. It is then laid in the sun, if in hot weather, or if in winter, near a stove or fire-place, where the crayons may dry gradually, which will require twelve hours. When thoroughly dry they are fit for use. Crayons can also be procured at the People's Depository, Toronto.

(3.) *Black-board Brush or Wiper.*—To save time and promote cleanliness, every pupil should, when at the board, be provided with a wiper, to clean the board and prevent, as much as possible, the dust from flying through the room. A common sized sheep's pelt would afford a sufficient number of the kind represented in the cut for an ordinary school. The skin should be cut in pieces eight inches long and five wide, and be carefully tacked, woolly side out, on a block a little smaller in size. If the block is two or two and a half inches thick, it can be trimmed up so as to form a handle out of the same piece. These wipers will last a long time, and if properly made will not cut or scratch the boards or wall.

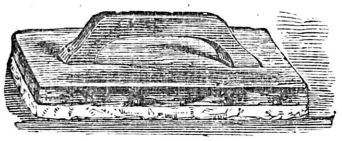


Fig. 255.—Brush or Wiper.

The conical brush or wiper is a very superior article, and is sufficiently explained by the engraving. A wiper of some kind should be provided, and its use insisted on in every school. The reprehensible practice of using the edge of the hand, or the cuff of the coat for this purpose, should never be tolerated in any school in which order and neatness are observed.

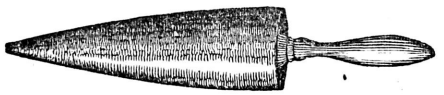


Fig. 256.—Conical Brush or Wiper.

24.—School-House Furnishings.—Clock, Time Table, Bell, Registers, Thermometer.

(1.) *The Clock.*—The habit of correct observation cannot be cultivated in a better way than by a constant reference to time. In school this is particularly the case. Every day has its appointed duties, and every day its special exercise. To secure punctuality, regularity, harmony, and good order, a clock, which may now be obtained for a small sum, should be placed in some conspicuous position in the school-room. (See *Fig.* 252.) A time table or programme of the daily and hourly class duties should also be neatly written, or printed in large letters, and hung up in an accessible place.

"The bell strikes one. We take no note of time.
But from its loss."

"Time is dealt out by particles;
To give it then a tongue is wise in man."

(2.) *The Bell.*—A little hand-bell should accompany the clock, as a conservator of order, and will, if judiciously managed, save the teacher many an effort of the lungs. For opening the school, in changing classes, and at dismission, it is a sovereign remedy for noise and confusion. Sometimes a single clip of the clapper, accompanied by a glance of the teacher's eye, will speak a language "louder than words." For ordinary purposes, a simple twenty-five cent bell will be amply sufficient, and much preferable to the spring-bell, which is sometimes used.

(3.) *The Programme and Time Table.*—As the official regulations require the time table to be hung up in every school, blank forms of them can be obtained for a trifle at the People's Depository; also, a copy of the prescribed programme. The utility of the time table is acknowledged by every good teacher.

(4.) *The School Registers.*—The school law requires two registers to be used in every school, viz: an entrance register and a daily register. The former for recording the entry, progress, and departure of the pupils of the school—the other in which to keep a record of the attendance of the scholars. These registers are to be kept by the teacher, and carefully preserved for future reference. To carry out the law, a register should be obtained by the trustees, from the Depository, ruled according to the prescribed form. They should require it to be kept neatly and accurately by the teacher, and presented regularly for inspection. A book of record of this kind, kept as contemplated, would exert a beneficial influence upon all connected with the school. To the trustees it would afford, at a glance, the comparative merits of one pupil with another, and of the present with the school of the past. To the parent it would exhibit the attendance of the child, and its character. The pupil, knowing the permanence of the record, would strive to appear to the best advantage upon its pages. And lastly, the teacher could refer to it as one evidence of his neatness, regularity, and faithfulness. The inspector, at his visits, should carefully examine the register.

(5.) *The Thermometer.*—To ascertain the degree of temperature in the school-room (always a consideration of importance), there should be at least one thermometer. By means of the ventilators the teacher may regulate the temperature, and prevent those extremes of heat and cold so injurious to health and prejudicial to comfort. The temperature should, if possible, range between sixty and seventy degrees. (Good school thermometers, in boxwood cases, can be obtained at the People's Depository, Toronto. See also remarks on page 49.)

25.—How to get a Clock for the School.

Every teacher would like to have a clock, but the question is, how to get it. I will tell you how I have managed, in a number of instances, to purchase a clock for my school. I have addressed my pupils on this wise: "Scholars, we have now got a programme—would it not be pleasant for you to know just when to come to your classes to recite, without being called? Now, if we had a clock, you could all do this, and could see that each class gets its full time. Besides, you could tell just when the school would open and close, when the recess should come, etc. How many of you would like to have a clock? All hands are up. Then let us manage to buy one. We can get one for from two to four dollars. A three-dollar one would answer our purpose well. Now here are thirty of us. I propose that we form ourselves into a joint stock company. Let us put a share at *ten cents.* It will require thirty shares to be taken, to buy the clock. Mary, you may act as secretary; get your paper; put me down *five* shares—here is the half dollar. Now if there should be any pupil not able to take a share, I will give him one of mine. I only want one share, the others are for gratuitous distribution. Now, John, what will you do, and Henry, and Susan, and Anne, how much will each of you give? If you are not prepared to pay now, bring your dimes or sixpences to-morrow morning. Perhaps some of you would like to speak to your parents first—that is right; it would be well for you to consult them. But Jacob, Mary, and George say they have each a dime of their own. They will bring it to-morrow. That is well, but they should speak to their parents about it. Children should always consult their parents. Remember, to-morrow morning is the time to finish up this clock matter; ask your parents to let you have the money they were going to spend for candy for you; tell them that you would prefer a *clock* to candy. Do the best you can, and we shall have a clock, sure. To-morrow evening I shall expect to go and get one, and next

day morning we shall have it up. *How nice it will be!*" Need I say that in pursuing this course I have never failed, in a single instance, to secure a clock? So with a black-board or any other article of school furniture.—*Iowa Instructor.*

26.—Various School Appliances—Honour Roll, Book Carrier, Inkstand, and Pencil Rack.

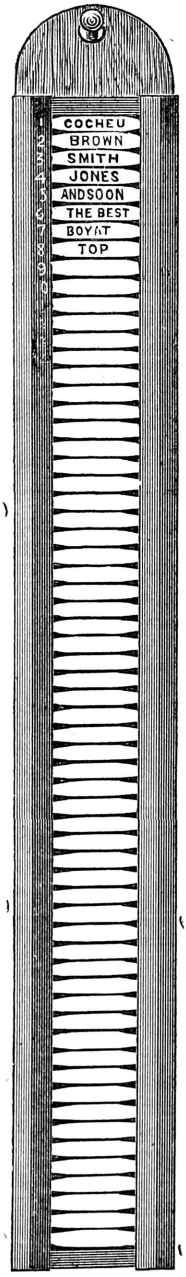


Fig. 257.—Honour Roll.

The use of the honour roll, or record, somewhat like that shown in *Fig.* 257, will be found to have a most salutary influence in a school. The intention is to have the names of the best pupils in the school written on card slips, and at the end of each month or quarter to place them in the "honour roll," or record, in the order of merit—the name of the best boy in the school would of course head the list. The rank of the pupils can be determined either by the use of the admirable system of "merit cards," issued by the Education Department, Toronto, or by any private system of marking adopted by the teacher. A highly artistic style of "honour roll" has been issued by the People's Depository, Toronto, at 75 cents. The "roll" can be used to indicate either the scholarship alone of the pupil, or his deportment, or both, as may be decided by the teacher. It should be displayed in some conspicuous place, so that all the pupils, as well as parents and visitors, could readily examine it. Its use in a well-conducted school cannot but be conducive to the order and discipline of the school, and the conduct and diligence of the pupil.

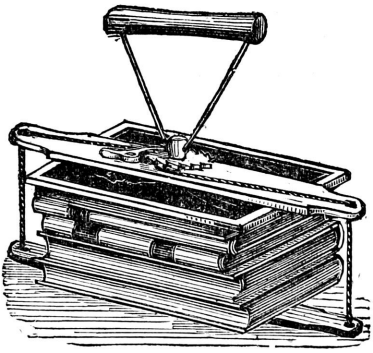


Fig. 258.—Book Carrier—No. 1.

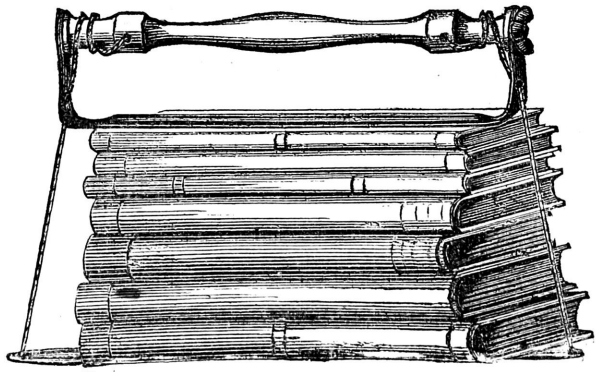


Fig. 259. Book Carrier—No. 2.

Figs. 258 and 259 represent two kinds of school book carriers for boys or girls. The ordinary strap will keep books well together, but it rather injures the binding; while these book carriers preserve it, as well as keep the books flat.

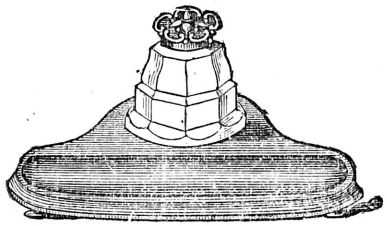


Fig. 260.—Teacher's Inkstand.

Fig. 260 is only inserted as a sample of one of the many styles of teachers' inkstands in use. It has a pen tray on the stand attached to the ink bottle. The ink bottles for pupils' desks are also very numerous. They are supplied from the People's Depository, at various prices.

Fig. 261 represents a pencil rack. It can be made of tin, about three, four, or five inches high, and the holes large enough to receive a pencil. At the close of the school one of the pupils can be designated, in rotation, to gather up the lead and slate pencils and place them in the rack, so that they can be readily got

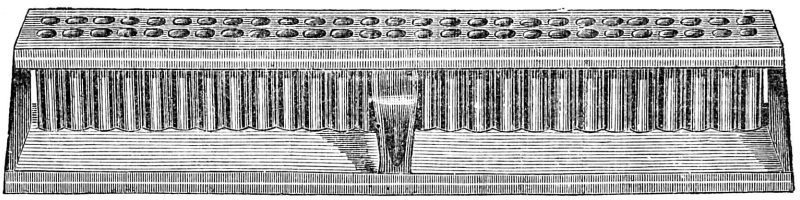


Fig. 261.—Pencil Rack.

next morning when the school opens. This practice will be found to be productive of good results, and tend to promote order, regularity, and economy of time —and of pencils. Besides, each pupil can readily get his own pencil, and no time need be lost in looking for one.

27.—Slate, Tablet and Object Lessons, Drawing, Black-board, etc.

(1.) *Apparatus for the Little Ones.*—It would be an easier task to select and use the apparatus of a college, than to make choice of those things suitable for the "little ones" of the school.

> "The earth was made so various, that the mind
> Of desultory man, studious of change,
> And pleased with novelty, might be indulged."

The school-house should also be "made so various." If children be well taught in school, efforts must be made to satisfy their desire after novelty and variety. They must be interested; and to interest them, they must have constant employment.

(2.) *The Slate.*—Every child old enough to attend school should be furnished with a small, neat, well-bound slate. All children love to draw figures and make marks with the chalk or pencil. If the propensity which affords them so much amusement be properly directed, it will save them many a weary hour at school. If parents were confined six hours a day, with but little intermission, listening to their teacher of sacred things, in the church; or if the father were obliged to sit for several days constantly as a juror—a slate and pencil, or a picture, would afford great relief. Letters, words, and figures may be written, and pictures may be copied during the time which, without these amusements and employments,

would be spent in idleness, restlessness, or mischief. Several kinds of slates are now in use. The lighter, stronger, and more beautiful the article, the more it

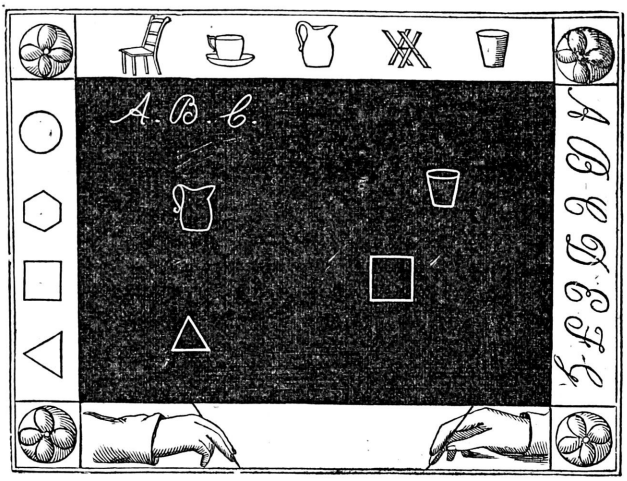


Fig. 262.—SLATE WITH PICTURES.

will be prized and used. A very useful drawing slate, with pictures on the outside frame (*Fig.* 262), may be obtained at the People's Depository, Toronto.

(3.) *Tablet Lessons and Drawings.*—To the great comfort of teachers and saving of primers, the pages of the first reading-book in use have been printed in sheets, so as to be stretched on pasteboard. A class may recite from these with pleasure and profit. When not in use, the children may copy the words and letters on their slates. Cards, called "chalk drawings," to be used by children as copies at the black-board, are very useful and beautiful. They represent the object—a horse or a flower, as the case may be—on a black ground with white lines, so that they appear as if drawn with chalk on the black-board. (See *Fig.* 262.) The primary and secondary colours should be painted on cards, to teach children to distinguish colours, and to cultivate their taste for the beautiful. Reading and natural history object lessons may be obtained in great variety at the People's Depository, Toronto.

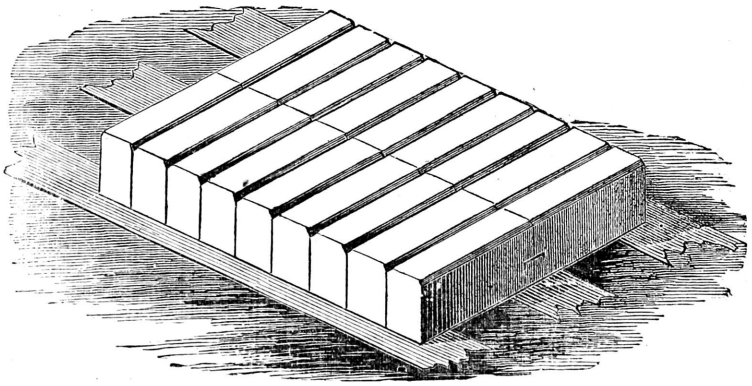


Fig. 263.—BUILDING BLOCKS.

(4.) *Building Blocks.*—For the purpose of illustrating the principles of gravitation, about one hundred blocks, each one inch thick, one inch wide, and two

inches long, should be provided. Many practical arithmetical difficulties might be explained by reference to a construction by the blocks; but the chief excellence of such a set would consist in the amusement and employment it would afford the "little ones." While the teacher was busy teaching a class, they would be no less busy in quietly building those little houses.

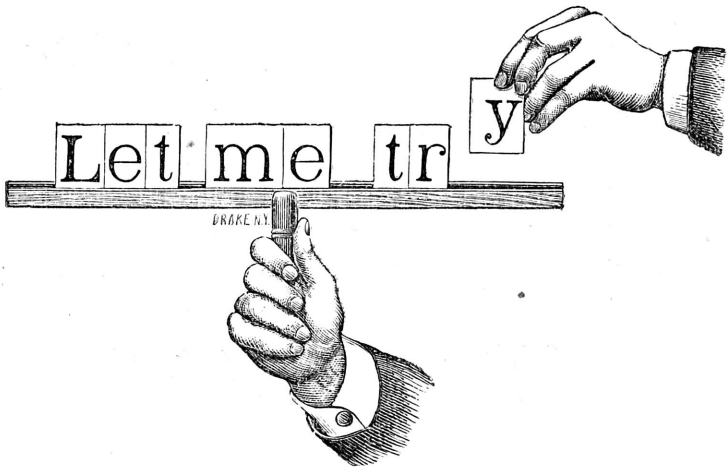


Fig. 264.—Alphabet Hand Frame.

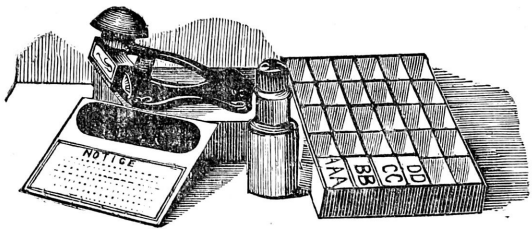


Fig. 265.—Alphabet Box.

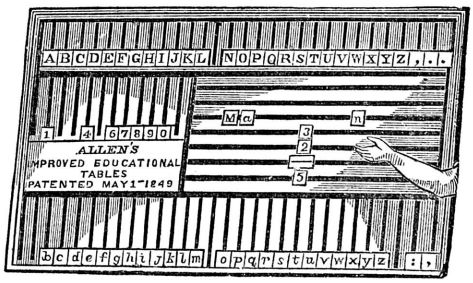


Fig. 266.—Alphabet Frame.

(5.) *Alphabet Blocks.*—The most agreeable way for a child to learn the alphabet is by means of alphabet blocks, or separate letters printed on cards. Children first learn the name of the letters, and then how to combine them into words, as illustrated in the hand frame (*Fig.* 264), or the alphabet frame (*Fig.* 266). For convenience, the letters may be kept in a box with 26 pigeon holes, as in *Fig.* 265, or inserted in a movable shape in a frame, as in *Fig.* 266.

(6.) *Object Lessons* may be taught in two ways, viz., by pictures of animals, scenes, and phenomena, and by cabinet objects. (See *Fig.* 267, and *Figs.* 251 and 252.) Indeed to complete the list of those things deemed indispensable for the use of the teacher and the benefit of the "little ones," there should be provided a strong box, to contain a cabinet, or *omnium gatherum*, selected from everywhere—picked up in every place. Common-place things should there have a place. Whole volumes might be written on the simple texts there contained, which could be gathered in

an hour; for, as Shakespeare says, there are "sermons in stones, and good in everything." For

"Truths,
That 'tis our shame and mis'ry not to learn,
Shine by the side of every path we tread
With such a lustre, he that runs may read."

This box should contain silk, muslin, flannel, linen, oil-cloth, felt, drugget, brick, pottery, china, glass, iron, steel, copper, lead, tin, brass, pewter, a type, a ring, a needle, a pin, a button, steel pen, paper, parchment, leather, morocco, kid, buckskin, cocoon, hair, wool, hemp, flax, wax, gum, bean, pea, clove, coffee, cinnamon, wheat, oats, barley, buckwheat, sponge, shells, etc. Such a box would contain a mine of truth to be had for the taking. Cabinets of this kind, at a cheap rate, can be obtained at the People's Depository, Toronto.

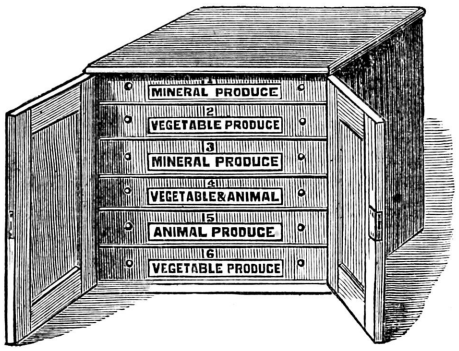


Fig. 267.—Object Lesson Cabinet.

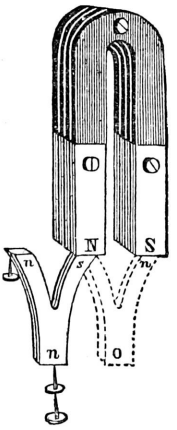


Fig. 269.—A Magnet.

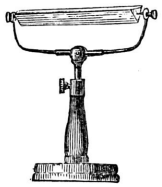


Fig. 268.—A Prism

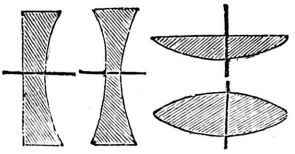


Fig. 270.—Lenses.

Much philosophy can be gathered from boys' toys. A top, a kite, a bat and ball, a marble, a bow and arrow — all illustrate some principle or principles of mechanical law. An ingenious, thinking teacher will, if many of these things are not provided to his hand by those who ought to furnish them, make them himself rather than be without them. And besides these, any teacher can afford a syphon, a magnet, a prism, a lens, etc. (See *Figs.* 268 269 and 270, and illustrations in the next chapter.)

28.—Practical Teachings of the Eye.

It is the wise observation of a French writer, who has given utterance to very much that had better never have been written or spoken, that "few men know how to take a walk;" by which I suppose him to mean, that few of those who go forth amidst all the glories of nature, profit as they might from the scenes presented to them. I quite agree with him; and could wish to make a few observations connected with the subject.

In the first place then, as it seems to me, every *wise* man will, more or less, be an earnest observer of nature. How deep a student was David in that school! To him nature seems to have been a great depository, out of which he was every hour drawing materials for his own happiness and improvement. The storm and the sunshine; the moon walking in brightness; the sun rejoicing as a giant to run his race, and sinking to rest in the golden west; the cattle on a thousand

hills; the labourer going forth to his work, and returning to the repose of the evening; the rain descending on the new-mown grass; the fruitful field, the golden harvest, the snow on the mountain-top, and the deep fountains of the valleys beneath—are all subjects on which he loves to expatiate, and he evidently walks among them as the delighted spectator of a theatre of wonders. Almost as much may be said of him whom I may call his more philosophical and practical son. What a watcher had Solomon been of the ant in her many-chambered mansions; and of all the world of plants, from the cedar of Lebanon to the hyssop on the wall! And so the Creator, when the world first proceeded from His glorious hand, is described as looking upon it with evident delight, and pronouncing it to be "very good." What poetry is there in the expression, "Let there be light, and there was light!"

How full of imagery drawn from nature is also the language which God is pleased constantly to put into the mouths of His prophets. And thus, also, in the New Testament, the sparrow falling to the ground, the lillies of the valley, the fields white with the harvest, are objects of His notice, and are called in as images to illustrate and adorn His lessons. I need go no further. He who would follow in the footsteps of the holiest of men, and of their glorious Creator Himself, will be a careful spectator of nature. He will be far from hurrying through its scenes without feelings of admiration and delight. In fact, what an injury do they inflict on themselves who shut their eyes on the beautiful volume which the Lord of heaven and earth has thus thrown open to them. Other beautiful objects, the works of man, the treasures of human wisdom and art, are locked up in the museums of the rich and great. But Nature is the universal treasure-house, to which the peasant has as free access as the king. How delightful for the man shut up during the hours of daily toil in the hot and crowded city, or in some low and smoky cottage, to be at liberty to escape for a moment to the green meadow or the shining river, to watch the last ray of the sun, to see the stars kindling in the heavens, till, at last, night spreads out the "brave overhanging canopy," spangled with ten thousand stars.—*Conn. C. S. Journal.*

CHAPTER XVIII.

SCHOOL APPARATUS, WITH DIRECTIONS FOR ITS SELECTION, USE, AND PRESERVATION *

1.—Necessity of Apparatus and Libraries in the Public Schools.

The following is an extract from the report of the committee on apparatus and district school libraries, to the Iowa State Teachers' Association:—

"Your committee, to which was referred the subject of apparatus and district school libraries, reports as follows:—Both subjects have been carefully considered, and the conclusion arrived at is, that it is high time that the people awake to their own interest on these subjects. * * * * * There can be no doubt but that conducting schools without any kind of school apparatus, is an expenditure of time and money that the people are unable to afford, And it is the opinion of your committee, that if no other means can be devised to procure necessary apparatus for our public schools, that it would be an *advantage* to the children, and to all concerned, to suspend them for six months, or even a year,

* This chapter, with some modification, is taken from Mr. Gow's paper, published in the Pennsylvania School Architecture. Most of the articles mentioned may be obtained at the People's Depository, Toronto. See descriptive catalogue sent to trustees and inspectors.

and to use the money required to support them for purchasing suitable school apparatus. Every school should have the necessary maps (up to the times), globes, mathematical blocks, a numeral frame, charts of different kinds, and at least a small philosophical and chemical apparatus; thus furnishing teachers the means of illustrating intelligently to their pupils the various branches taught. Until such apparatus is supplied, very many things must pass unexplained, and the youth pass through our common schools, and probably through life, with only a smattering knowledge of many of the subjects they should best understand. * * * * Your committee concludes by adding, that, in its opinion, it is the duty of every *true teacher and friend of education* to use all honourable means to induce school officers, and especially the people at the regular school meetings, to avail themselves of the benefit of the provisions made in the school law for the purchase of apparatus and school libraries.

2.—The Utility and Importance of School Apparatus.

The utility and importance of the use of apparatus in the school-room have not, until lately, been generally appreciated, as there are even yet some school sections in which nothing of the kind can be found.

It is now conceded by every one, that we can best understand those things which we can see and handle, as well as talk about. It is the habit of mankind to be better satisfied with a knowledge of those things the eye has witnessed, than with the knowledge of the same things of which they have only heard. "We have seen, and therefore we know," is the general sentiment. It is true that much of our knowledge of material things, of facts and of principles, is not the result of our own observation or experiment; much that we know is received and appropriated upon the faith we have in others, in connection with our own knowledge of facts and principles; but he is not well educated who relies implicitly upon the statements of others, without some corroboration of his own judgment and experience, Scholars should think well and reason correctly—should form conclusions from established facts; and to do this, as much of their education as possible should be demonstrated or illustrated by practical appeals to their reason, through the media of the eye and the touch, as well as the sense of hearing. Nor are the senses always able to convey the truth to the mind, although generally so reliable. We may deceive ourselves by relying too much on the appearances things may assume. Optical illusions or deceptions are not unfrequent, and hence the necessity of understanding things not only as they appear, but as they are.

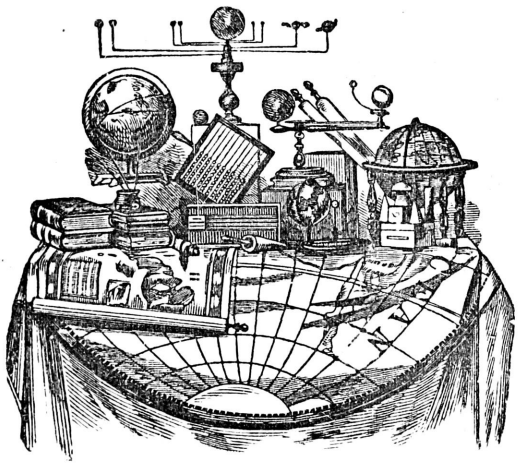


Fig. 271.—Collection of School Apparatus.

3.—Necessity for Practical Illustrations in Teaching.

The most enlightened and gifted teacher will frequently find that words are not sufficient to give a clear and distinct idea of subjects which are material and

objects of sense. He must bring his subject, not abstractly, but really and practically, to the mind of the pupil, in order that it may be fully understood; and if he be not prepared to make his illustrations or experiments from the best sources and models, his ingenuity should be excited to present the best his means and opportunities will allow. The more that all the senses can be employed, the

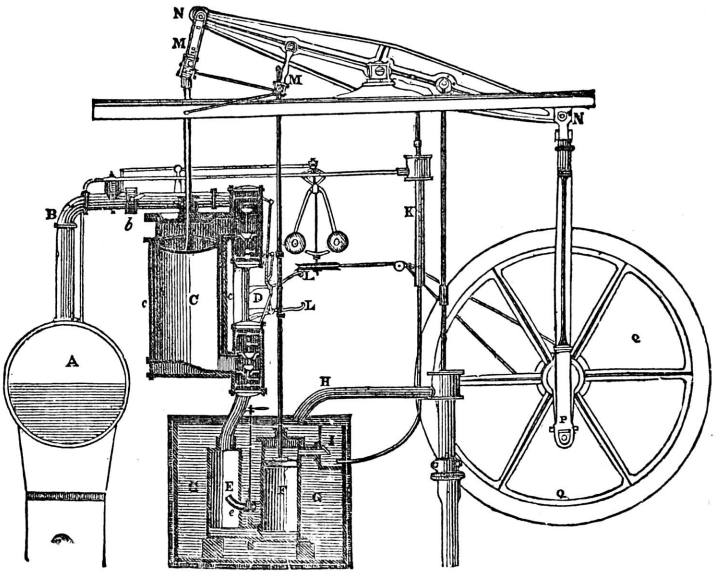


Fig. 272.—Illustration of a Steam Engine.

more information can be gained of any subject. The wisest philosopher, endeavouring to explain the construction and operation of a steam engine, to one not well versed in mechanical science, would fail to convey any correct idea of the machine, unless assisted by diagrams, pictures, and models. Language alone would not be sufficient to present to the mind a clear conception of the complicated structure. Its various parts so nicely adjusted and well adapted to each other—its tremendous power and extreme velocity—could never be understood or appreciated unless it was thus seen and studied.

It is thus a question of great moment, how far material objects can be brought to assist in the improvement of the schools? Or, in other words, what tools can be put into the teacher's hands to enable him to do the most and best service, in the least time, and with the most economical expenditure of funds?

4.—What kinds of Apparatus are necessary in a School.

School apparatus may be enumerated under two classes. The first embraces those things which should be considered indispensable, and which no school should be without; the second contains such articles as may be considered exceedingly useful, though not absolutely essential, and also such as are most highly finished and expensive.

As the public school law requires that certain branches of elementary science shall form part of the curriculum of every school in the province, we would distinguish that apparatus as belonging to the first class, which is necessary to demonstrate, illustrate, or teach the elementary branches of geography, grammar, arithmetic, reading, writing, and spelling. The large majority of the schools would require a complete set of apparatus adapted to this end; and some might.

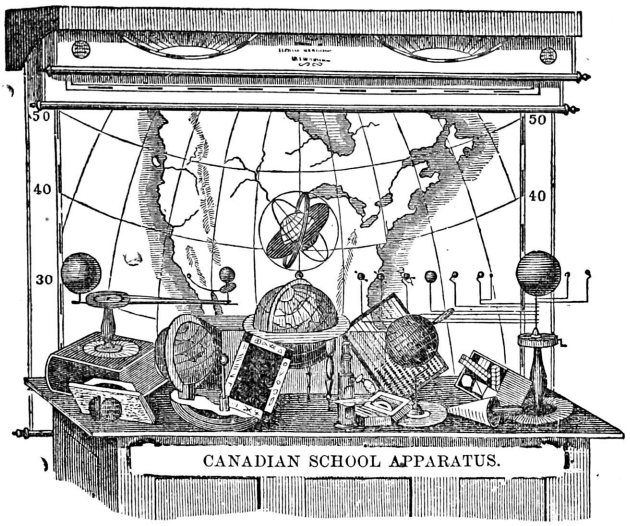


Fig. 273.—Illustration of School Maps and Apparatus.

even go further, and secure some of the instruments adapted to schools of the highest grade.

5.—Maps, Diagrams, Pointers, Globes, Tellurian, Orrery, etc.

(1.) *Maps.*—A map is a picture of a part, or of the whole, of the earth's surface. From a study of such pictures the mind is enabled, by the principle of association, to transfer and secure a mental copy or impression from the canvas or plate.

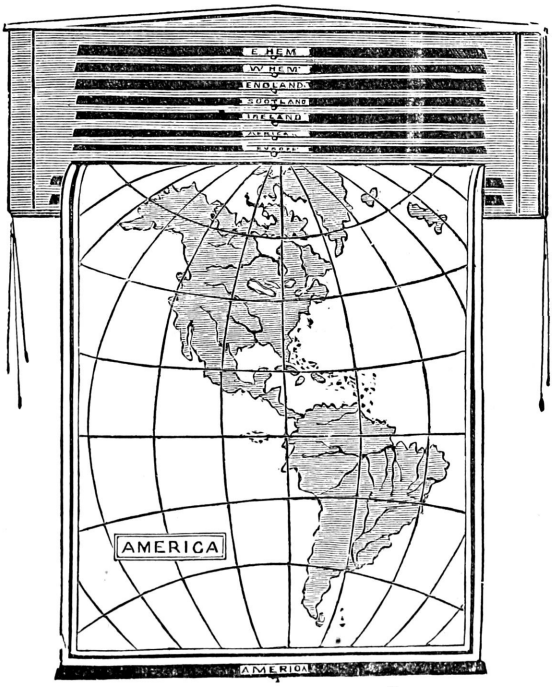


Fig. 274.—Specimen of a Map Case.

Amongst the best maps for the school-room are those which show clearly and distinctly the physical and political divisions of the various countries. Outline maps, or such as have no names on them, but merely an outline of the general characteristics of the country represented, are also very good.

Among the maps used in a school there should, if possible, be a map of the county and township containing the school. These maps should also be well coloured, and hung as objects of beauty and taste around the room. They can be procured singly or in cases and movable stands, of very ingenious construction, as may be seen at the People's Depository, Toronto. Whenever they are used in recitation, the

case or stand should be removed to the north side of the house, so that the points of the compass on the map may correspond with their true position on the earth. Maps mounted also in frames, on endless rollers (as in *Fig.* 275), can be obtained at the Depository.

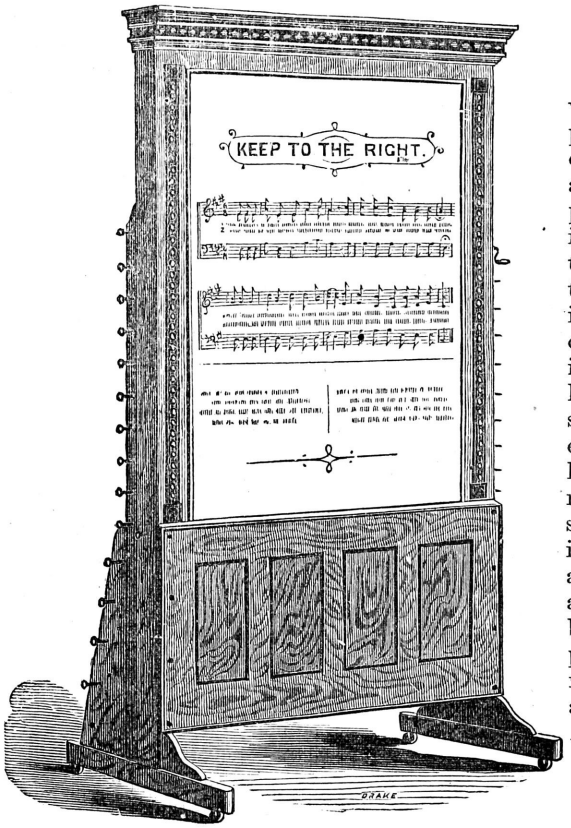


Fig. 275.—Music Sheets on Endless Rollers.

(2.) *Diagrams* of every variety, relating to natural philosophy, the physical sciences, vocal music, etc., may also be obtained at the Depository, Toronto. These illustrations give great interest to the subject to which they refer. *Fig.* 275 is an illustration of an admirable contrivance for displaying, in a convenient form, an endless variety of school songs, set to music, on sheets printed on a large scale. Hullah's illustrations of vocal music, printed on large sheets, can also be displayed in the same way. The great advantage of the plan is, that a succession of music can be brought into view with promptitude and convenience, by turning the handle at the right-hand side of *Fig.* 275.

(3.) *Pointers or Wands.*—Several pointers should be furnished for use in the demonstration of problems on the board, and for pointing out places on the outline maps. They should be four or five feet long, neatly tapering to a point, and light. Pointers can be obtained at the Depository, Toronto.

(4.) *Cardinal Points.*—To familiarize scholars with the principal points of the compass, North, South, East, and West should be neatly painted or printed, and put up either on the corresponding walls of the school-house, or on the ceiling, where the four points of the compass might be painted in distinct colours, with letters designating the several points.

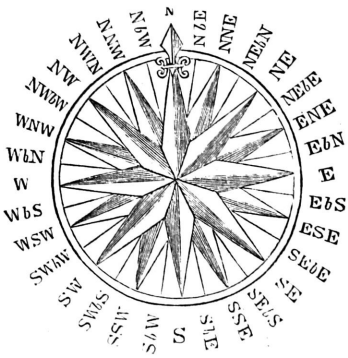


Fig. 276.—The Compass.

(5.) *Globes.*—It is a difficult thing for a scholar to appreciate the fact that the earth on which we live is round or globular, and that though it has a motion



Fig. 277.—Bronze Frame Globe.

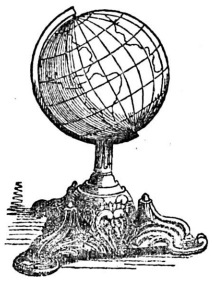


Fig. 278.—Bronze Frame Globe.

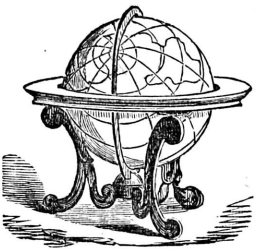


Fig. 279.—Semi-Frame Globe.

which tends to throw us from its surface, yet we cannot fall from it. Few children can understand that a ship can be lost to sight on the ocean. Maps may,



Fig. 280.—Globe, with High Stand and Compass.

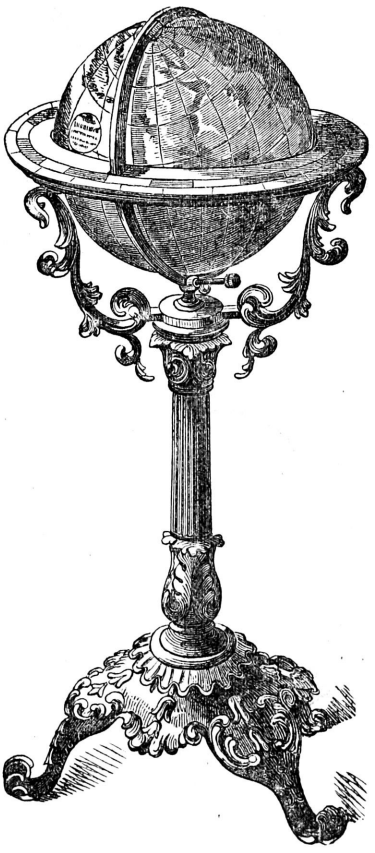


Fig. 281.—Bronze Frame, High Stand.

to some extent, be used for this purpose; but to convey the complete idea, a model is indispensable. That model is the terrestrial globe. Not unfrequently,

the pupil, attempting to learn geography without this aid, has, and will always continue to have, a confused idea of equator, meridians, parallels, and poles; of latitudes, longitudes, axis, and zones. The whole is to him without system, and with little sense. On the contrary, these terms are easily taught, if suitable subjects for illustration be provided.

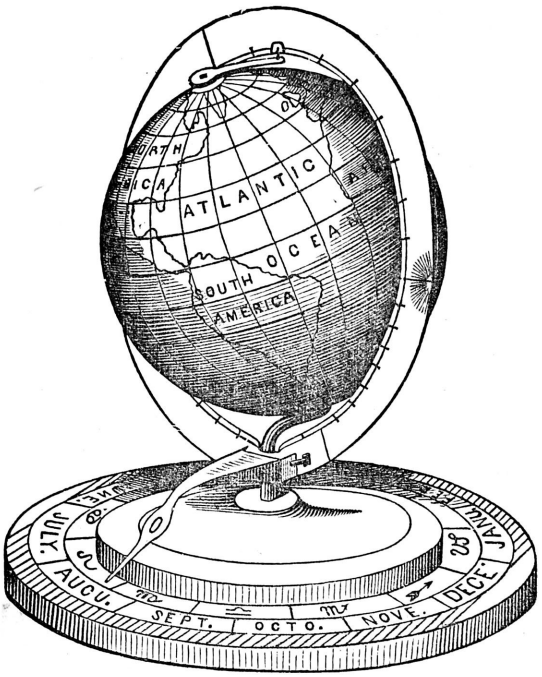


Fig. 282.—Cornell's Terrestrial Globe.



Fig. 283.—Magnetic Globe, with Figures.

The neapalic globe (*Fig.* 283) is designed to illustrate gravitation. It is metallic, and by the use of magnetized objects, representing men of different races, animals of different climes, light-houses, steamers, ships, the actual living, moving world, with much of its most interesting and instructive phenomena, is presented in miniature to the mind of the pupil.

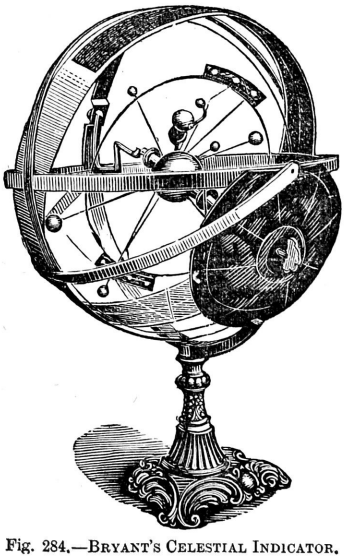


Fig. 284.—Bryant's Celestial Indicator.

(6.) *Planetarium and Celestial Indicator.*—The Indicator (*Fig.* 284) is intended to illustrate clearly to children and to adults the various phenomena of the heavenly bodies—the motion of the earth around the sun, and the changes of the seasons; the earth's axial motion; the precession of the equinoxes; nutation; tides; eclipses, both solar and lunar; the change of the pole star; changes in the declination and right ascension of stars; the difference between the siderial and tropical years; the retrogradation of the signs of the zodiac; the revolution of the moon's nodes, etc., etc.

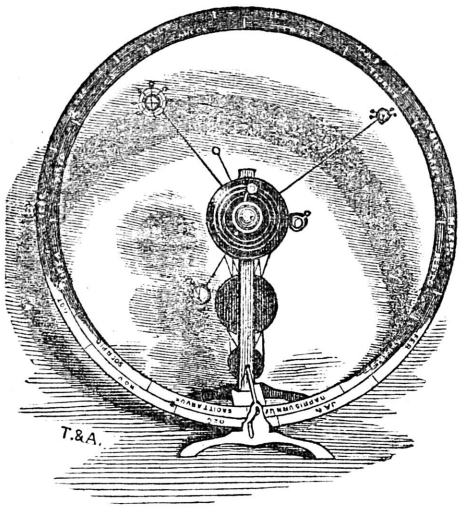


Fig. 285.—A Planetarium.

The celestial globe, or planetarium, will also much facilitate the conveyance of information as to the position and the motion of the heavenly bodies, and will also enable the teacher to impart some knowledge of astronomy. Globes are generally constructed in pairs, and though the terrestrial is more useful, and better calculated to impress the true idea of the thing represented, than the celestial, yet both will be found highly advantageous. But in addition to a celestial globe, a planetarium (*Fig.* 285), or a celestial indicator (as it is called, *Fig.* 284), will be found highly useful and convenient in explaining the movements and relation to each other of the heavenly bodies.

The hemisphere globe (*Fig.* 286) supplies a want long felt, viz., an illustration, which any child can understand, of the reason of the curved lines on a map, and shows how the flat surface is a proper representation of a globe. Two hemispheres may be constructed separately (as in *Fig.* 286), or be united by a hinge, and, when closed, a neat little globe will be presented; when opened, two maps are seen, showing the continents as if through transparent hemispheres.

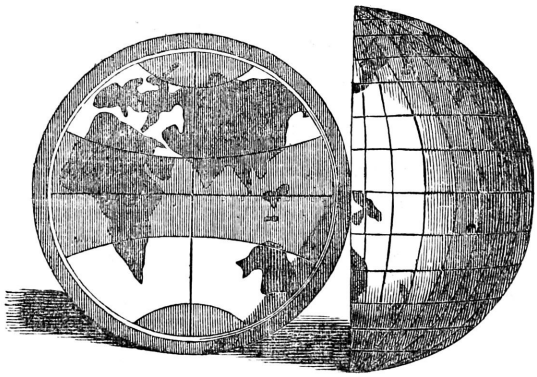


Fig. 286.—Hemisphere Globe.

(7.) *The Tellurian, or Season Machine.*—As a useful accompaniment to the globe and maps, in the study of geography, we notice the tellurian, or season machine. Among the most difficult phenomena presented to the minds of children, are the changes of the seasons—the revolutions of the moon around the earth, and the earth around the sun—and the subject of tides. These, and several others, may be illustrated and explained by the aid of this machine. The science of geography, in its common acceptation, includes, with "a description of the surface of the earth," some account of its physical phenomena—of its people, manners, customs, religion, and laws; and of its relation to the other

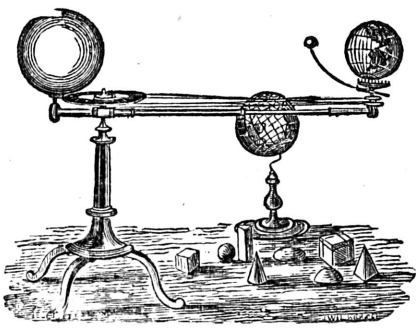
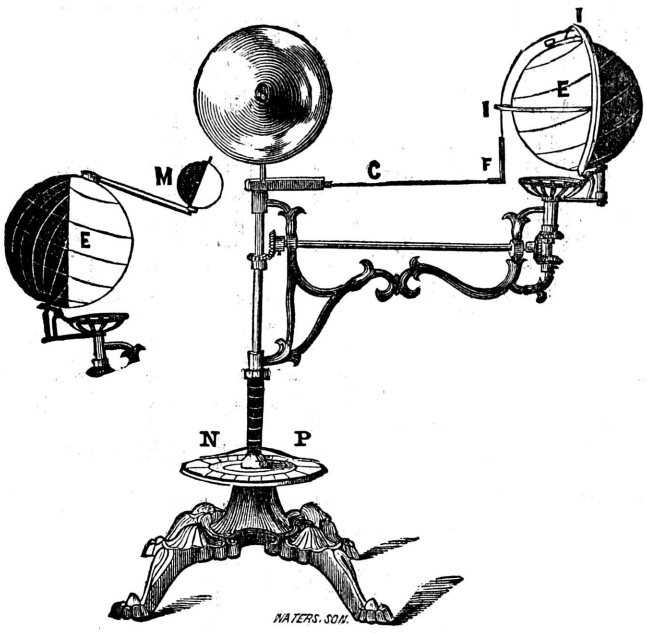


Fig. 287.—The Tellurian.

parts of the solar system. In this view, the study of the earth's motions and changes, although belonging to the science of astronomy, might properly be classed among those subjects to be taught in the school. (See *Figs.* 287 and 288.)



REFERENCES:

S. The sun.

E. The earth.

M. The moon.

H. The indicator, supported on the pivot arm.

C. Its connecting rod.

F. Its joint, which may be unscrewed.

P. The earth's pointer.

N. The sun's pointer.

Fig. 288.—LONG'S TELLURIAN.

(8.) *Astronomy.*—The apparatus to which we refer, for the study of the science of astronomy, consists of the orrery, or model of the planets, revolving in their

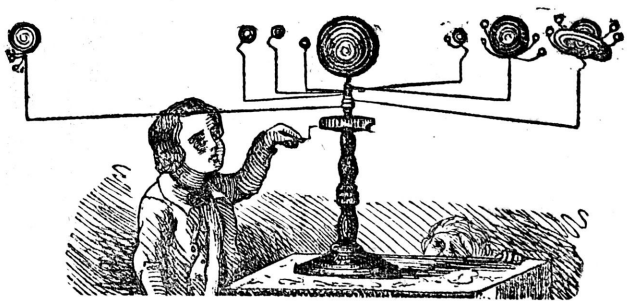


Fig. 289.—BOY TURNING CRANK OF ORRERY.

various orbits and surrounded by their satellites, and put in motion by a crank or spring; the telescope, without which we cannot see very far into this science; the tellurian, as above; and the celestial globe. (See *Fig.* 289.)

6.—Arithmetical Tables, Numeral Frames, Forms and Solids.

(1.) *Multiplication Table.*—In order to acquire facility in using numbers, the multiplication table must be committed to memory. To facilitate the memorizing of abstract numbers, musical association may be used. Cards, large enough to be seen across the school-room, should be hung around it. They will serve as ornaments to the room, and answer the double purpose of assisting the memory

and training the vocal organs. It is an immense labour to learn these tables. If any one doubts this, let the attempt be made to commit to memory the numbers from twelve times twelve to twenty-four times twenty-four, and the doubt will be dispelled. Everything should be done to assist children, and make pleasing such hard labour, in which the thinking powers take little part.

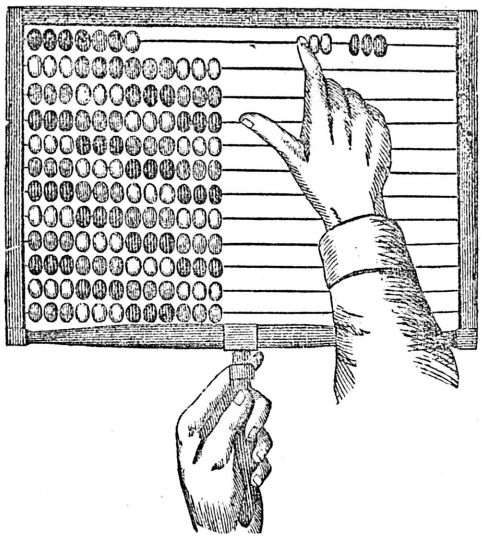


Fig. 290.—Abacus, or Numeral Frame.

(2.) *The Abacus, or Numeral Frame.—Fig.* 290 shows a frame supporting twelve rows of little wooden balls, strung on wires, along which they move readily. The simple rules of arithmetic are difficult to acquire abstractly. Children count by means of their fingers until they acquire proficiency. This instrument is better, as the teacher can instruct a whole class or school at the same time. Addition, Subtraction, as well as Involution and Evolution may be illustrated by means of the instrument, to those further advanced in mathematical study.

(3.) *Geometrical Solids.*—A portion of practical arithmetic, in most or all the text-books now in use, is devoted to the mensuration of solids. Such solids should always be put into the hands of the pupil. Cubes, cones, prisms, pyramids, spheres, hemispheres, spheroids, cylinders, and sections of each, should comprise a portion, at least, of the set. If measures of length, as the foot, divided into inches and nails—yard and rod; and measures of capacity, as pint, quart, gallon, and half bushel, were added, the assortment would be more useful and complete. Solids, representing timber and boards of different measurements, should also be secured. Every school should be supplied with sets of these most useful and necessary adjuncts to the teaching of mathematical science. They simplify to the eye abstract truth which, without these appliances, would be most difficult to make plain to the capacity of children.

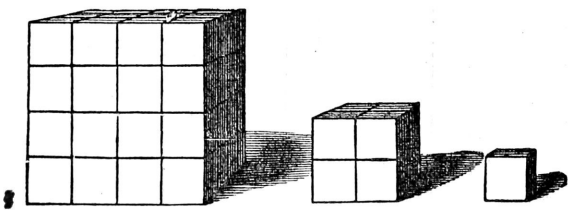


Fig. 291.—Set of Cubes.

From this set of cubes (*Fig.* 291) the pupil can easily see that the one square figure, increased four-fold on every side, makes the number of separate cubes amount to eight; and this figure, when increased four-fold on every side, amounts to sixty-four separate cubes—or a multiple of eight in each case. These cubes and other geometrical solids, can be obtained at the People's Depository, Toronto.

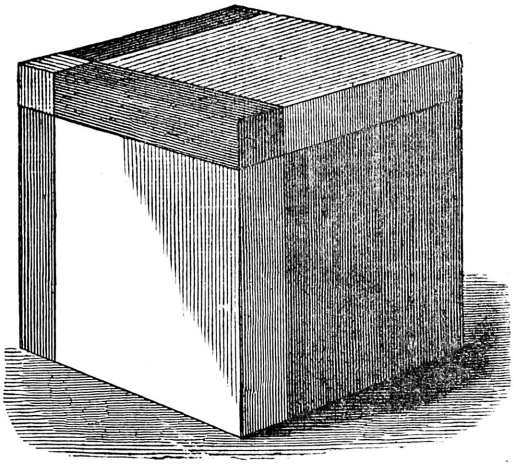
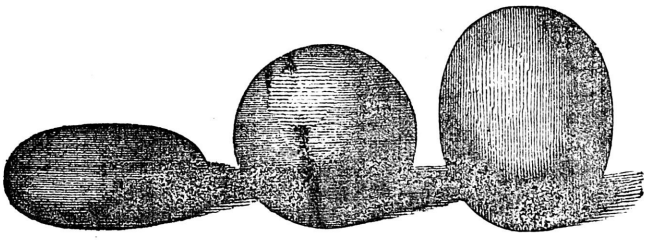


FIG. 292.—CUBE ROOT BLOCK.

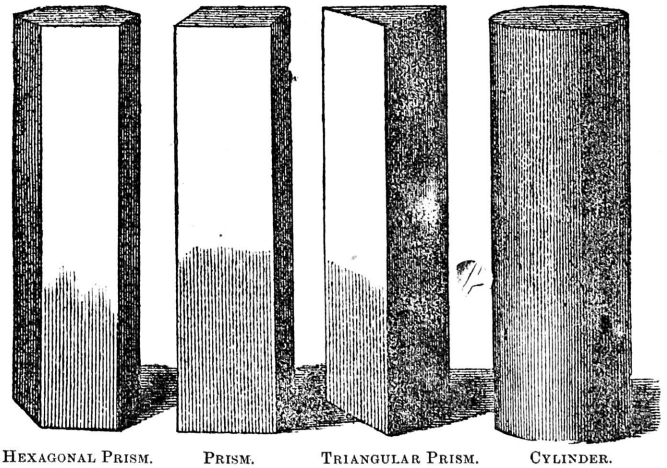
(4.) *Cube Root Block.*—To make apparent the reason of the rules for the extraction of cube and square roots, the sectional cube block should be used. This block, or rather number of blocks united, forms a cube. The parts may be separated from each other, being held together by wire pins. In connection with the abacus before mentioned, the whole subject may be rendered perfectly plain by its use. The cost of the above articles depends upon their size and the finish put on them. They can be obtained at the People's Depository, Toronto. (*Fig.* 292.)



OBLATE SPHEROID. SPHERE. PROLATE SPHEROID.

Fig. 293.

Fig. 293 represents forms of the sphere and spheroid, which may be multiplied and varied indefinitely. The oblate and prolate spheroid is shown in *Fig.* 293.

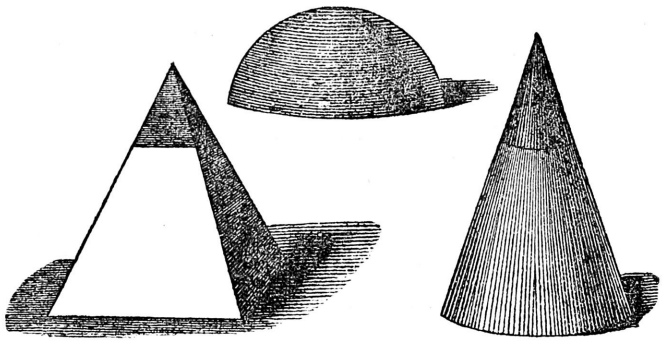


HEXAGONAL PRISM. PRISM. TRIANGULAR PRISM. CYLINDER.

Fig. 294.

Fig. 294 illustrates the various forms of the prism, as well as the cylinder.

Fig. 295 represents the pyramid and frustum, as well as the cone and frustum. In both cases the frustum can be separated from the pyramid and cone.



PYRAMID AND FRUSTUM. CONE AND FRUSTUM

Fig. 295.

7.—Mathematical Instruments.

In connection with the study of mathematics, the use of mathematical instruments is indispensable. We have therefore inserted specimen illustrations of cases of these necessary and most useful instruments, which can be procured from the People's Depository, Toronto.

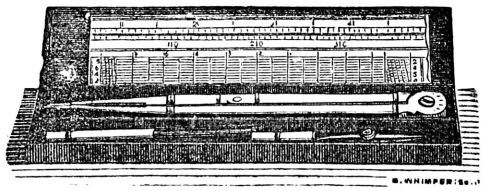


Fig. 296.—CASE OF MATHEMATICAL INSTRUMENTS, No. 1.

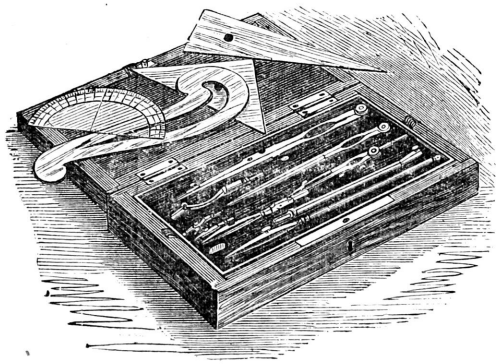


Fig. 297.—CASE OF MATHEMATICAL INSTRUMENTS, No. 2.

Fig. 296 (No. 1) represents an elementary set, and an inexpensive one; *Fig.* 297 (No. 2) is a better set, with the necessary squares and figures, in a good case; but *Fig.* 298 (No. 3), in a superior case, is better still.

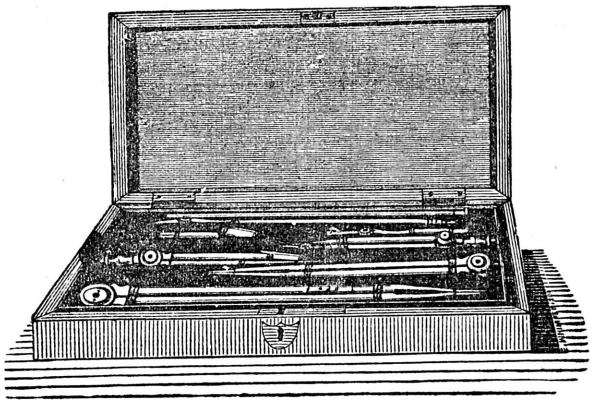


Fig. 298.—Case of Mathematical Instruments, No. 3.

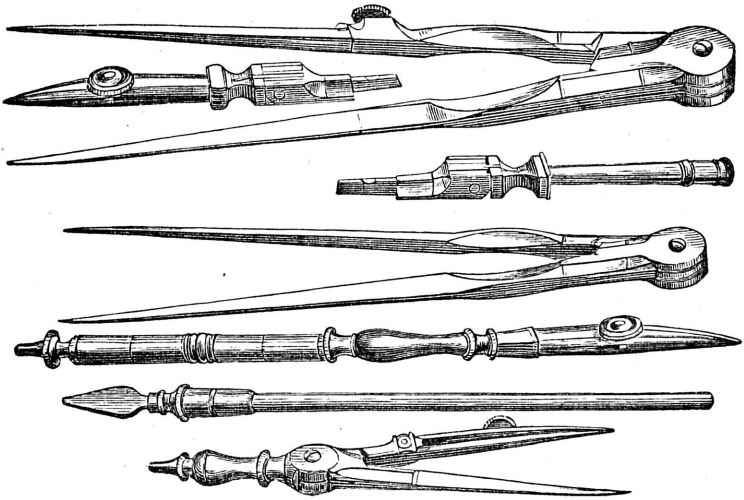


Fig. 299.—Various Kinds of Mathematical Instruments.

Fig. 299 represents a number of mathematical instruments commonly used in drawing mathematical figures. They consist of a compass or dividers, with various pens, etc.

8.—Mechanical Powers, Electrical Apparatus.

(1.) *Mechanical Powers.*—The principles of natural philosophy, in their practical application, should be seen and understood in school. Many arithmetical

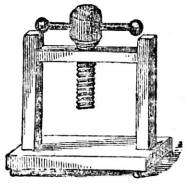


Fig. 300.—Screw.

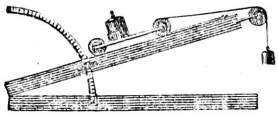


Fig. 301.—Inclined Plane.

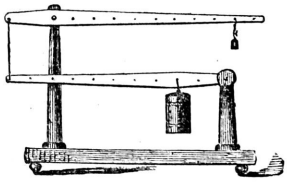


Fig. 302.—Levers.

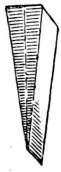


Fig. 303.—Wedge.

operations are based upon them. An apparatus, such as is seen in the cuts, would give a better practical knowledge, in a few weeks, of the principles of

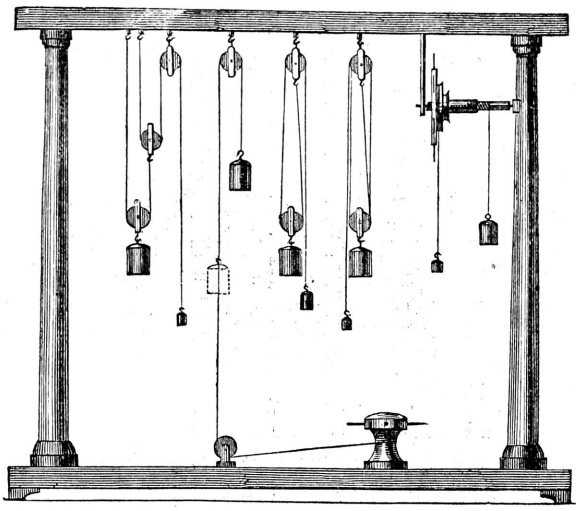


Fig. 304.—Set of Mechanical Powers.

mechanics, than would be learned by experience in years. Such knowledge is invaluable to its possessors, as every day some principle is used in practice. The

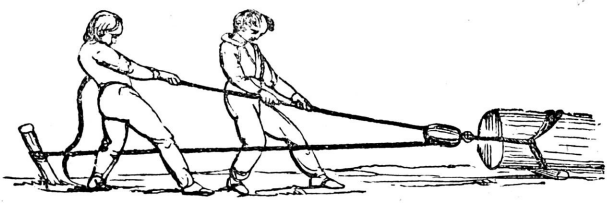


Fig. 305.—Application of the Pulley.

set should embrace the lever, simple and compound; the wheel and axle, erect and inverted; the pulley, fixed and movable; the inclined plane, the wedge, and



Fig. 306.—Illustration of Inclined Plane.



Fig. 307.—Application of the Wedge.

the screw. Homely illustrations, as in *Figs.* 305, 306 and 307, can be given. To these might be added a set of illustrations of the centre of gravity, both amusing and instructive.

(2.) *Electricity.*—The science of electricity affords perhaps as great and as interesting a variety of experiments as any other. The principles of the science

may be presented in so many applications as to keep the student in constant wonder and delight. By aid of apparatus the operator seems invested with magical or supernatural power. He calls this invisible agent into active life,



Fig. 308.—Gold Leaf Electrometer.

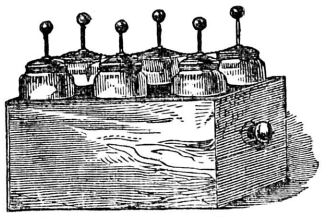


Fig. 309.—Electrical Battery.

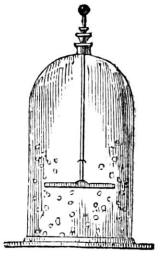


Fig. 310.—Electrical Pith Balls.

directs its energy, and controls its force. Now, it appears darting and flaming, sparkling and crackling like the lightning's flash; and now subdued and tame, it rings a chime of bells. Now, the birds fall before the mimic gun, charged, like

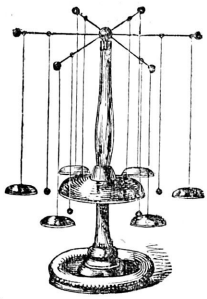


Fig. 311.—Electrical Bells.

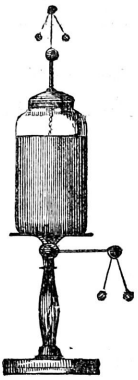


Fig. 312.—Insulating Stand.

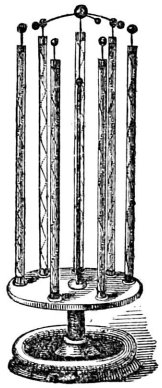


Fig. 313.—Electrical Spiral Tube.

an engine of death, to destroy; and again, it causes light-footed figures to dance a merry reel. We fear its force, we wonder at its greatness, and we laugh at the curious freaks it plays. The shattered model of the miniature house, the

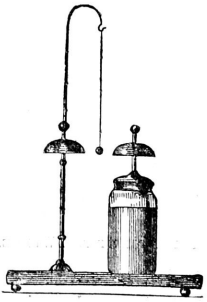


Fig. 314.—Electrical Bells and Jars.

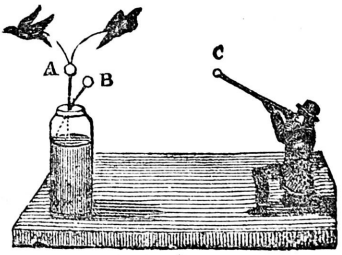


Fig. 315.—Electrical Sportsman and Birds.

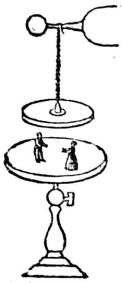


Fig. 316.—Dancing Figures.

head of hair in wild disorder, the miser's plate, the magic picture, are all full of interest and instruction. There are various kinds of electric machines. Instead of the plate, many machines are furnished with a glass cylinder, as a generator.

The plate machines are deemed the best. Machines of the most modern con-

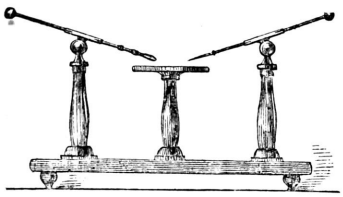


Fig. 317.—Universal Discharger.



Fig. 318.—Jointed Discharger.

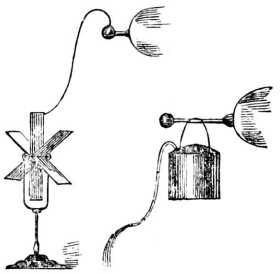


Fig. 319.—Bucket and Fly-wheel.



Fig. 320.—Leyden Jar.

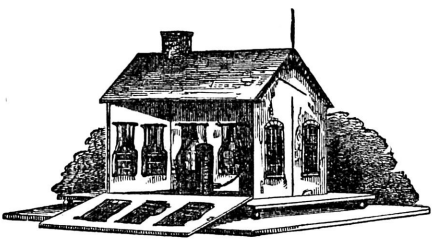


Fig. 321.—Thunder House.



Fig. 322.—Luminous Leyden Jar.

struction may be purchased at the Depository, at from thirty to one hundred and fifty dollars, exclusive of jars, discharging rod, chains, etc.

9.—Illustrations of Electro-Magnetism.

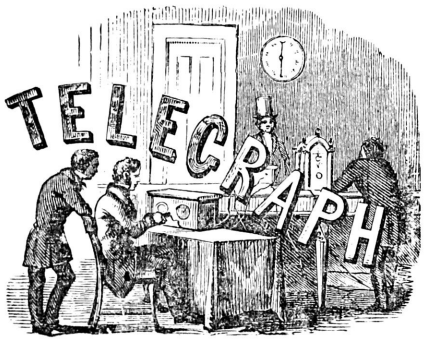


Fig. 323.—English Electric Telegraph.

Closely connected with the preceding is the subject of electro-magnetism. We therefore insert a few illustrations on the subject, from which selections can be made for the schools.

Fig. 333 represents Morse's American telegraph, as first invented. The instruments now in use, though somewhat identical in principle, are of very superior construction.

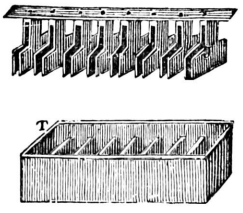


Fig. 324.—Cruickshank's Battery.

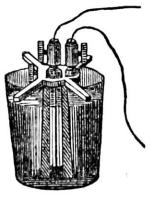


Fig. 325.—Smee's Battery.

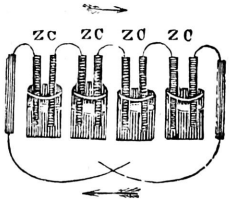


Fig. 326.—Voltaic Couple.

Figs. 324, 325 and 326 represent various kinds of batteries, and a voltaic couple.

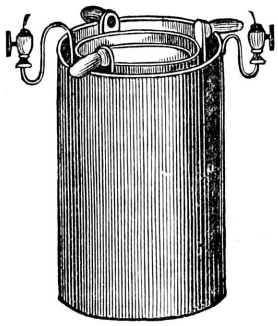


Fig. 327.—Sulphate of Copper Battery.

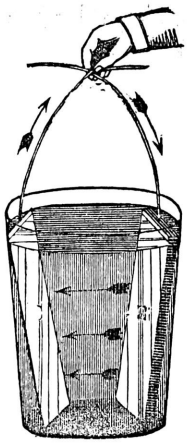


Fig. 328.—Simple Battery.

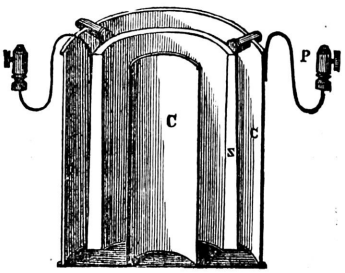


Fig. 329.—Section of Sulphate of Copper Battery.

Fig. 327 represents a sulphate of copper battery. It is charged with a solution of sulphate of copper (blue vitriol), by which the power of the battery is sustained. *Fig.* 328 is a simple battery. *Fig.* 329 is

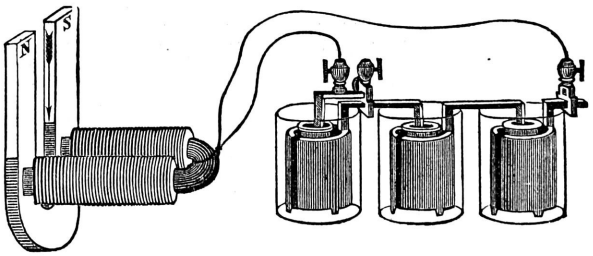


Fig. 330.—Three-cell Battery.

Fig. 330 represents a Grove's battery of three cells in the operation of magnetising.

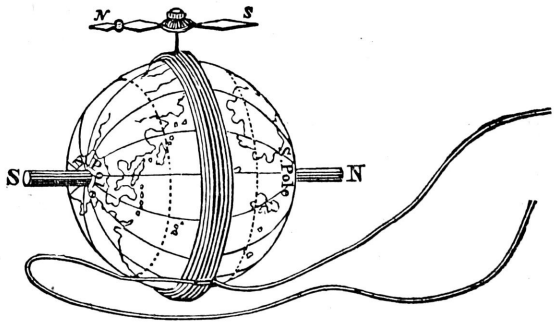


Fig. 331 —Globe and Coil, with Dipping Needle.



Fig. 332.—Dipping Needle.

Fig. 331 is a globe and coil, with magnets (north and south pole) and dipping needle. *Fig.* 332 is a dipping needle of another construction.

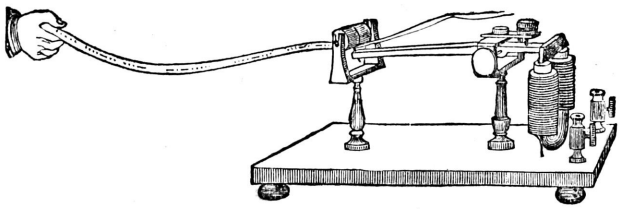


Fig. 333.—Model of American Telegraph, with Spool and Paper.

Fig. 333.—This is the receiving instrument, the message being marked on the slips of paper, as shown.

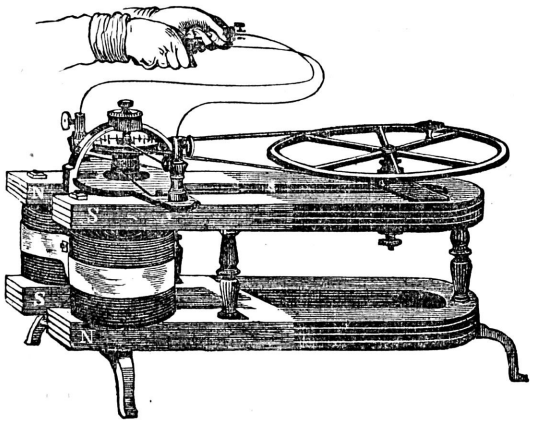


Fig. 334.—Hand Magneto-Electric Machine.

Fig. 334 illustrates a magneto-electric machine. This machine having two sets of magnets, is very powerful. It is used chiefly for nervous and other diseases.

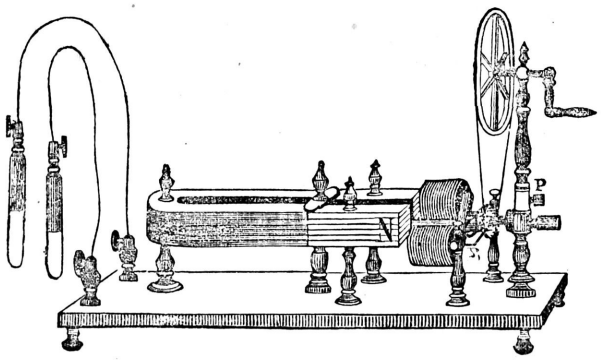


Fig. 335.—Electro-Magnetic Machine.

This represents another modification of the same machine. On account of the increased rapidity with which the helix can be made to revolve, by means of the large wheel, a greater quantity of magnetism may be obtained.

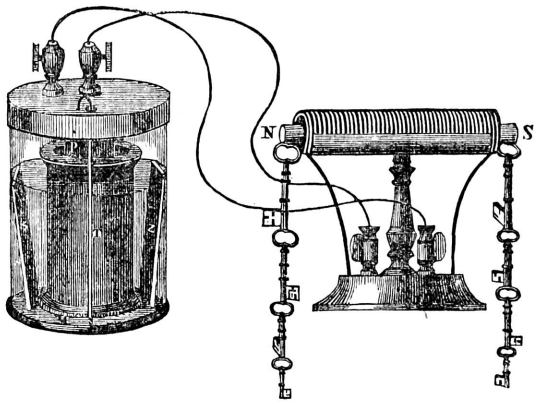


Fig. 336.—Smee's Battery and Helix and Bar.

This represents a single cell of Smee's battery in the operation of magnetising a bar of iron. The effect is seen by the bar supporting a number of keys, while the battery is in operation.

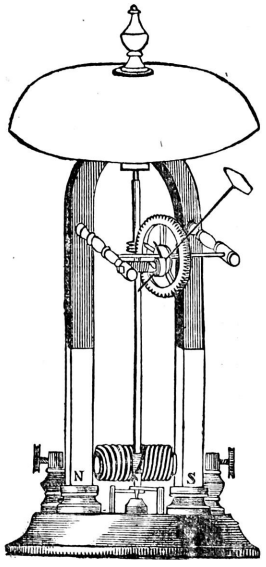


Fig. 337.—Horizontal Revolving Armature Bell Engine.

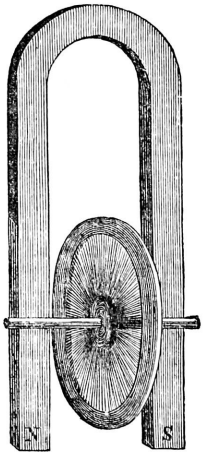


Fig. 338.—Wheel Armature.

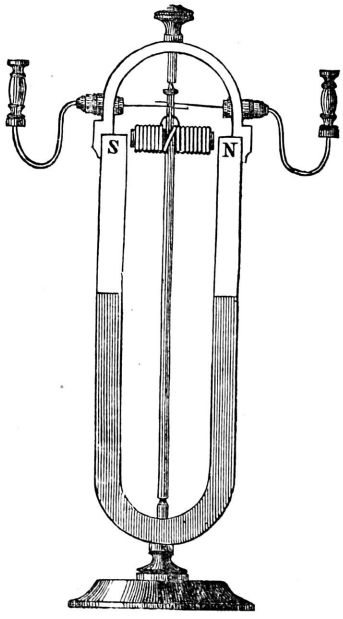


Fig. 339.—Revolving Helix.

Fig. 337.—When the engine is connected with a battery the current is established, and keeps the bell striking regularly.

Fig. 338.—This represents a horse-shoe magnet powerful enough to sustain a wheel, as shown.

Fig. 339.—When this helix is connected with a battery the current is established, and keeps the helix revolving.

Fig. 340 is an instrument for showing, by experiment, the deflection of a magnetic needle.

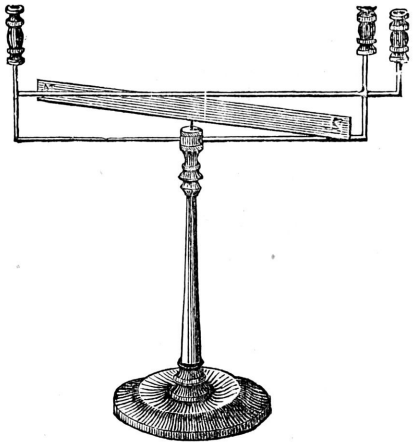


Fig. 340.—Oersted's Electrometer.

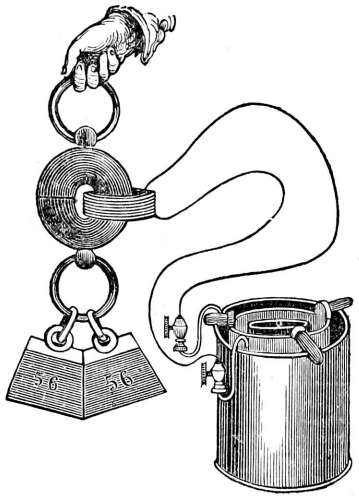


Fig. 341.—Electro-Magnet and Keeper.

Fig. 341.—This represents a battery, electro-magnet, and keeper, in operation. Large weights may be supported without parting the magnet.

8.—How to make Scientific Illustrations in School interesting.

The unparalleled progress which the arts are now making, and the intimate dependence of these on experimental science, have given to this latter an importance well known to every intelligent mind. Never before in the history of man has every branch of agricultural, mechanical, and commercial industry received such impulses from this source. Through all the wide range of the arts we can scarcely point to a single department which has not, within a short period, received important aid from experimental researches in science. Such being the fact, it becomes a matter of importance, that every lad who enjoys the blessings of even a common school education, should receive at least some general instruction in reference to those laws by which the changes in matter are governed.

But how shall these instructions be best given? Can books or oral instruction alone convey to the mind of the scholar a clear understanding of the facts in Nature? No doubt some minds, possessed in a remarkakable degree of the power of applying principles, would find the hints given by such sufficient for directing their observations of natural phenomena; but with the majority it requires at least a miniature application in order to so elucidate and fix the principle as to make it of any practical utility. A boy, for instance, may study and commit the whole theory of the action of the barometer, the siphon, or the fire-engine, without a tithe of that comprehension of the cause of their operation which a few well-explained and successfully-performed experiments with the air-pump would afford. So of the theories of electric induction, the electric telegraph, the refraction of light, etc.—all are far more readily and satisfactorily comprehended by a few appropriate and well-performed illustrations with an ordinary philosophical apparatus. I say *well-performed*, for a bungling, imperfect mechanical illustration of scientific principles is oftentimes worse than no illustration at all. And on this point allow me to dwell for a moment. While all intelligent teachers admit the advantages of experimental illustrations of science, few, comparatively, regard the *successful* performance of such as an art requiring attention, ingenuity, and a certain degree of mechanical skill. To suppose that every teacher who has

studied in a general way the principles of philosophy, astronomy, or chemistry, can go at once before his classes and illustrate with an apparatus these principles, is as absurd as to expect a successful performance upon a church organ from a mere reader of Mozart's compositions. Apt illustrations with instruments require experience and a due degree of attention. The demonstrator of science who views illustrations with philosophical machines, as he does the production of music from a crank organ, will find himself sadly disappointed in the trial. In illustrating the properties of liquids or gases, for instance, no machines will give satisfactory results in the hands of an indifferent, inexperienced manipulator. In each there is a score of nice contingencies to be regarded, which only careful observation and experience can remedy.

To operate a nice air-pump as if it were a common water pump, or an electric machine as we would a grindstone—to disregard the extreme tenuity of gases, or the subtle nature of such an agent as electricity, is to insure disappointment and failure. To be sure, some of the coarser and less intricate illustrations may be produced by almost any one, but the nicer and more attractive experiments require experience and skill.

Not understanding *how to allow for results* is often a cause of failure. In the use of the mechanical powers, for instance, the theory as taught in works of natural philosophy, does not regard friction or inequalities in the density of the parts of the levers; accordingly, upon the application of weights to the arms, there is found to be a discrepancy between the theory and the actual result, requiring a little exercise of skill to obviate.

One experimenter will perform an entire course of pneumatic experiments without the slightest accident to the apparatus or failure in the illustrations. Another, with the same instruments, finds that the receivers do not fit to the pump plate—that the stopcocks leak—that the glass of the water hammer is too thin—that mercury and acids have found their way into the air-pump, where they ought not to; and so each instrument seems imperfect, and each illustration proves a failure. In chemistry, too, the sad results of a want of skill are still more obvious.

Confidence, says Lord Bacon, lies at the two extremes of knowledge. This is especially the case with illustrators of science.

No teacher is qualified to use even the most simple philosophical apparatus before his classes without some previous preparation; and no successful teacher of natural science will fail to exercise his ingenuity and avail himself of the means within his reach, for rendering attractive and impressive the facts he would teach.—*Massachusetts Teacher.*

9.—Apparatus for Pneumatics, Physiology, Optics, etc.

(2.) *Pneumatics.*—Many beautiful and interesting experiments may be performed with the air-pump. The elasticity, expansiveness, and compressibility of air, may be illustrated by this machine. Four of our cuts represent experiments which are made by the air-pump. These experiments demonstrate, clearly and practically, some facts which to the uneducated would seem paradoxical. Thus, to prove that air is the means by which sound is transmitted, it is only necessary to place a bell under the glass receiver of the machine, and to exhaust the air, or, in other words, to pump it out, and then by a contrivance, as seen in *Fig.* 344, to ring the bell, and no sound will be heard. If the air is returned to the receiver, and the bell struck, its presence is discovered by the

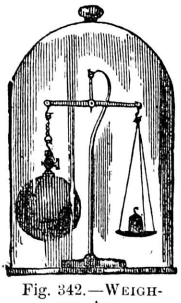


Fig. 342.—Weighing Air.

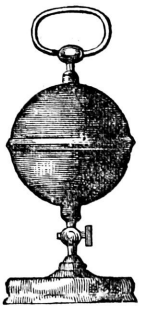


Fig. 343.—Hemisphere Cups.

ringing. Again, to ascertain the weight of air, if a hollow sphere of copper, and air tight, is placed, as seen in *Fig.* 342, at one end of a delicate balance, under the exhausted receiver, after being weighed in air, the difference of the weight

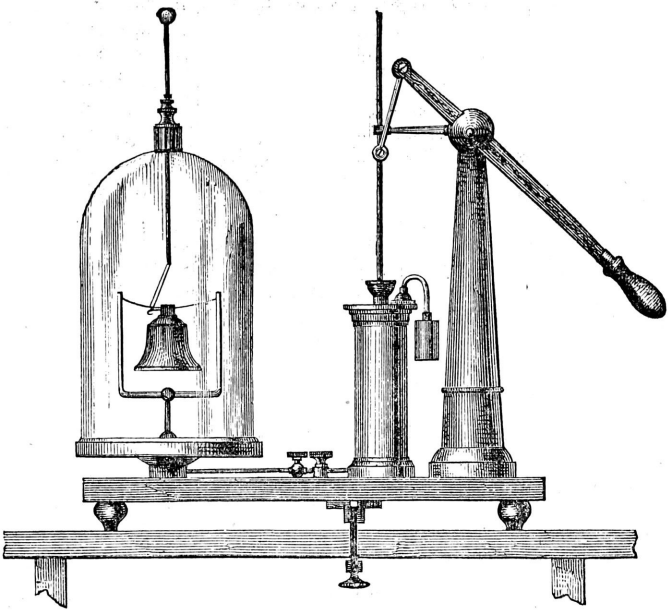


Fig. 344.—Ordinary Air-pump.

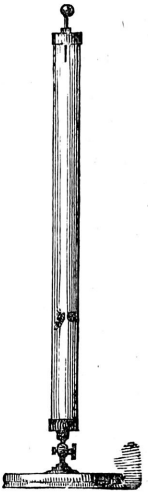


Fig. 345.—Guinea and Feather Apparatus.

will indicate the weight of the air. *Fig.* 345 shows that the air offers resistance to falling bodies, and that if the long glass tube have the air removed from within it, on being inverted suddenly, the piece of coin and the feather which it contains will fall to the other end at the same instant. *Fig.* 346 exhibits a glass receiver.

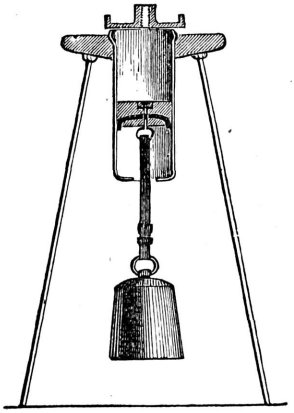


Fig. 346.—Weight-Lifter.

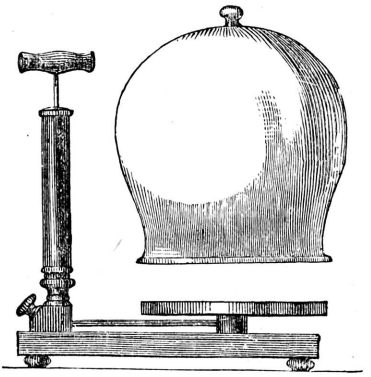


Fig. 347.—Simple Air-pump.

The air exerts a pressure of fifteen pounds to the square inch in all directions—up as well as down; so that when the air is exhausted from the glass, it presses upward externally to fill the vacuum, and carries with it the suspended weight. These and a great variety of others may be subjects of illustration in this interesting department. Apparatus illustrating the principle of pneumatics is exceed-

ingly useful, as it teaches that which has a constant application to the business of every-day life.

(3.) *Hydrostatics and Hydraulics.*—This department of science may be illustrated by many interesting and instructive experiments. The water level (*Fig.* 348) exhibits a variety of vessels of different forms and capacities, united at the bottom by an aperture common to all. If water or any other liquid be poured into the funnel-shaped vessel at the end, it will run into each of the others and rise as high in them as in the one into which it was poured, thus demonstrating that a liquid will rise to a common level, without regard to size or shape of the united vessels which contain it.

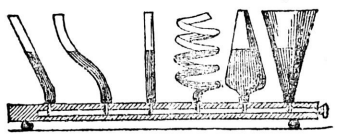


Fig. 348.—Equilibrium Tubes, or Water Level.

(4.) *Physiology.*—In the sciences of anatomy and physiology which are taught in all good schools at the present time, anatomical charts and models illustrating

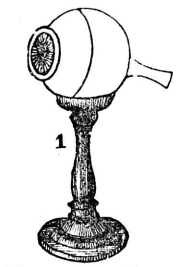


Fig. 349.—The Eyeball.

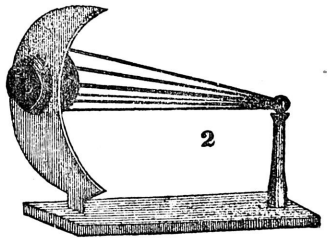


Fig. 350.—Muscles of Eye.

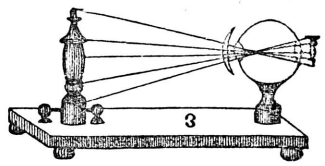


Fig. 351.—Cause of Long and Short Sight.

the functions of the several parts of the body, or their philosophy in the system, are found necessary. *Figs.* 349, 350 and 351 exhibit something of the anatomical structure of the eye, together with the illustration of optical philosophy, as seen in that organ. *Fig.* 352 represents the "spectacle instrument." The object of this instrument is to show the reason why the concave glass is suitable for one eye, under certain conditions, and the convex glass, in different circumstances, is better suited to the necessities of another; or in other words, to show why the boy cannot see with his grandfather's "specs." Every school in which these studies are pursued, should be provided with such facilities.

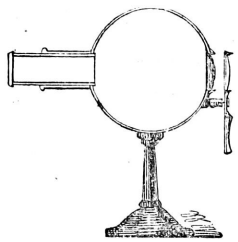


Fig. 352.—Spectacle Instrument.

(5.) *A Manikin,* or model of the human figure, with the muscles and other parts removable at pleasure, and of the form and colour of life, will be found of great use and value in this study. A set of physiological plates, at least, should be in every good school.

(6.) *The Microscope* is a most valuable instrument in the higher schools. It creates a taste for the collection and examination of the minuter objects of Nature, which so wonderfully display the great Creator's power. *Fig.* 353 represents the effect produced by the lenses of a double microscope. The rays which diverge from the object A, B, are collected by the lens L, M, and form an inverted image on the retina of the eye at C, D, and so on.

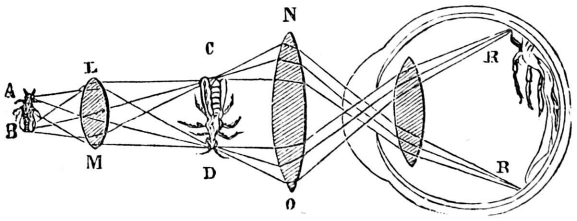


Fig. 353.—Section of Double-Lens Microscope.

10.—The Value of the Microscope in Education.

The microscope is a most valuable aid in this early training in natural science. "But few of us," you say at once, "can afford to buy a microscope;" and you think, of course, of an outlay of thirty or forty dollars as the least that will give you even a tolerable instrument. But what if we tell you that you can get a really good one for a few dollars. Objects properly mounted for the instruments can be obtained at small cost—a dozen for a dollar and a half. It is well to have a dozen or more of these, especially such as you could not readily prepare yourself. They are always ready for use when you cannot conveniently find anything else to show the children; and the little people never weary of seeing them even for the hundredth time. A young friend of ours, scarcely four years old, rarely comes into the library without teasing to "look through the microscope." If we are "too busy," he pleads for "just one" sight—the butterfly's tongue, or wing dust, the fly's foot, the bit of wasp's wing, or the saw-fly's saws. He enjoys it so intensely that we are often tempted to prolong the "show," even if we have to work a little faster or later to

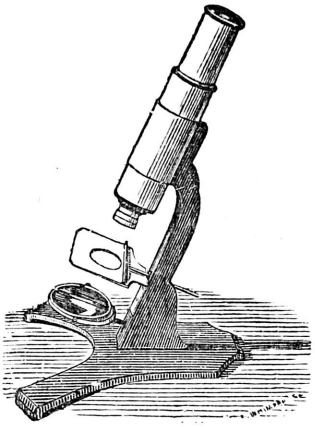


Fig. 354.—Simple Microscope.

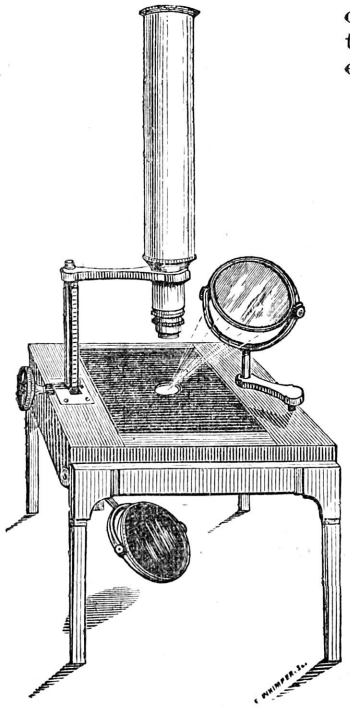


Fig. 355.—Compound Microscope, with Stand.

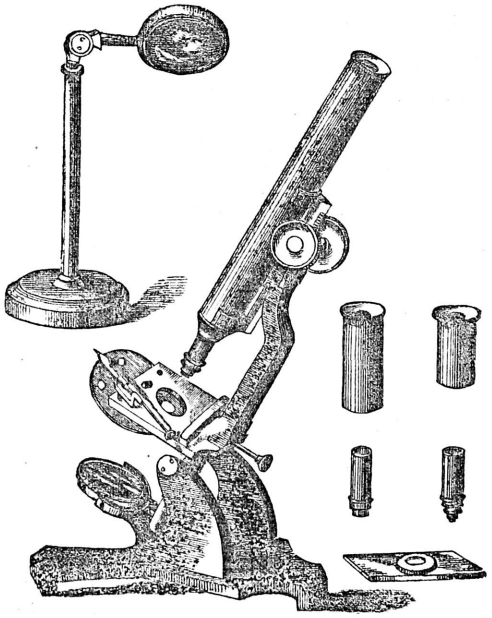


Fig. 356.—Compound School Microscope.

make up for it; and so we go on, dissecting flies and gnats with cambric needles, and exhibiting their feet, and jaws, and eyes, and *antennæ;* or, with vengeful satisfaction, catch a mosquito and deprive him (or her, since it is the females that torment us) of the long, keen lances which have been plunged into our flesh so

ruthlessly; or we may take pieces of wood, drops of water, "motes in the sunbeam," or any little object, and subject them to inspection.

One word, by the way, about a class of mounted objects, of which you should have at least one or two specimens. We mean microscopic photographs. These are interesting, not only as testing the power of the instrument, but as showing how infinitesimally small and yet how marvellously perfect is the picture painted by the pencil of light. In the centre of a bit of glass you can just discern, with the naked eye, a spot such as you may make by lightly touching the point of a lead pencil to paper. Put it under the lens, and you read the Lord's prayer, (or God save the queen) the letters very small—though magnified ten thousand times superficially—but clear and distinct; or the Greek slave stands before you, as faultlessly beautiful as in marble of Crawford; or the tiny speck expands into Canova's graces, lovingly entwined in a lovely group.—*M. S. E., in Massachusetts Teacher.*

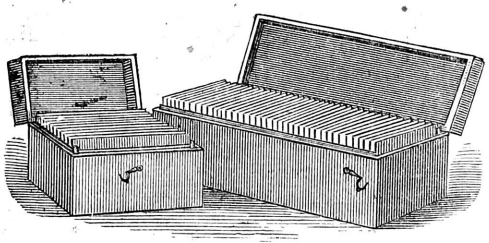


Fig. 357.—Box of Microscopic Objects.

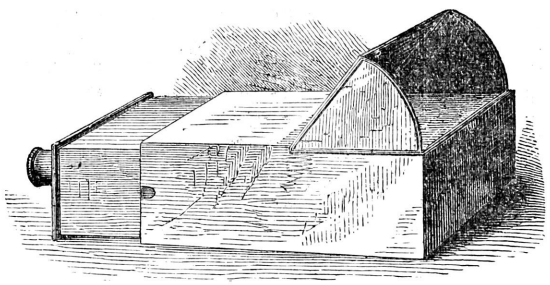


Fig. 358.—Camera Obscura.

11.—The Magic Lantern—Its Uses and Construction.

There is no kind of amusement for the long winter evenings more instructive than the magic lantern, with its appliances. It was formerly used only for exhibiting the grotesque and ridiculous, in a so-called magical manner—hence its name—but is now considered of sufficient educational importance to be used in our colleges and schools to illustrate the various branches of knowledge. The magic lantern is remarkable for the simplicity of its construction; and a short description of it will be given explanatory of the manner in which a few magnifying lenses can be so applied as to become an object of interest and instruction. It is a *refracting* optical instrument, and consists of a dark lantern with a funnel or chimney on the top, the funnel being bent for the purpose of intercepting the light in letting out the smoke. It contains a lamp (see engraving, *Fig.* 355), the light from which is reflected upon a convex lens. This further concentrates the light upon the slides onwhich the picture is painted. This picture is inserted in an inverted position in the opening; the rays from the

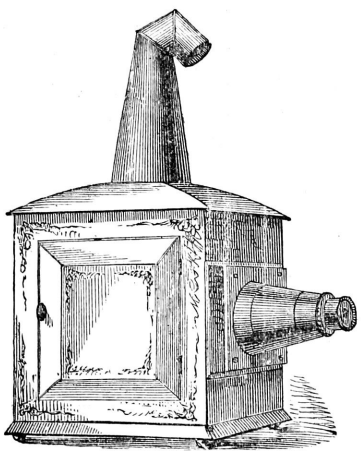


Fig. 359.—Single Magic Lantern.

illuminated object then enter a sliding tube and reproduce the picture on an enlarged scale on the screen. The sliding tube can be adjusted to the proper focus, and by this means the picture can be produced, on the screen, of any desired magnitude. To enlarge the picture, it is only necessary to bring the lens closer to the slides and remove the screen to a greater distance; this will, however, diminish its brightness, as the greater the surface over which the light is diffused, the more faint, in proportion, will the picture be.

The slides are usually painted with highly transparent varnish on glass; but by the aid of photography, photographic views of the most beautiful description have been prepared for the lantern; some of which can now be procured, with all the necessary apparatus, from the People's Depository in connection with the Education Department.

There are two ways of exhibiting the magic lantern. In the first the lantern is placed in front of the screen. In this case the picture is seen by aid of the light which is reflected from the screen, after having been projected upon it by the lantern. Care must be taken that no light penetrates through the screen, since such light would be lost, and the picture made proportionally more faint. The best sort of screen, in exhibitions of this sort, is one of white paper pasted on canvas and stretched on a frame, or what is still preferable, a white wall may be used with better effect. When the magic lantern is used more for amusement than instruction, a semi-transparent screen is the best, the lantern being placed on one side of it and the spectators on the other. In this case it should be made of white muslin or calico suspended from a beam or frame, at a convenient distance from the wall, its transparency being increased by wetting it well with water; or, a transparent screen may be prepared by spreading white wax, dissolved with spirits of wine, or oil of turpentine, over the muslin. This has the advantage of being always ready for use, and can be rolled up without injury.

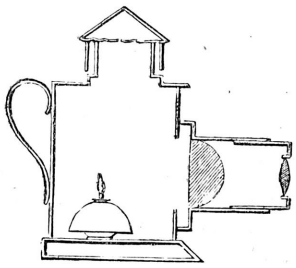


Fig. 360.—Section of Lantern and Lens.

To prepare the lantern for exhibition, the lamp must be furnished with a cotton wick (which should never be used twice), and trimmed in the usual manner. In order to supply the lamp with oil, the reservoir must be removed from the cistern, and a small quantity of oil poured into the latter, so as to cover the hole at the bottom and well saturate the cotton wick. The reservoir should then be filled with the *best sperm oil*, and replaced in the cistern. If two ounces of powdered camphor be put into a pint of oil, it will add greatly to the brilliancy of the light obtained.

Before using the lantern the lenses should be taken out and wiped, so as to remove any dust or moisture that might be on them. The lamp glass must be also cleansed previous to placing it on the lamp, and the reflector brightly but very carefully polished.

The lamp having been lighted and a clear light obtained free from smoke, the lantern may be placed at a distance of from eight to ten feet from the screen, according to the size of the lenses. Should it not throw a clear and well-defined disc of light on the screen, move the lamp a little backward or forward until this is satisfactorily effected. A slide may then be put into the groove and focussed, by moving in or out the brass tube until the picture is perfectly clear and distinct.

In addition to the slides above referred to, another very beautiful kind of illustration, suitable for the magic lantern, is the chromatrope. The varieties of

this kind of slide are endless, showing every combination of waived and curved coloured lines.

The term "phantasmagoria" applies rather to the way in which the instrument is used, than to any difference in its construction. When intending to produce the phantasmagoria effect, the exhibitor is placed behind the transparent scene, and either holds the lantern under his arm, or has it fastened by a strap around his waist. By approaching the screen closely, and quickly adjusting the focus, the spectators will see a very small image, which will appear to them as representing something at a distance; by gradually withdrawing from the screen, and at the same time adjusting the focus according to the distance, the figures will appear to increase in size and advance towards the spectators; on again approaching the screen they will seem to recede. The greatest difficulty is in regulating the focus with sufficient rapidity. To obviate this, the best lanterns have a rackwork and pinion attached to the tube, by gently turning which the focus is obtained with great nicety by a little practice.

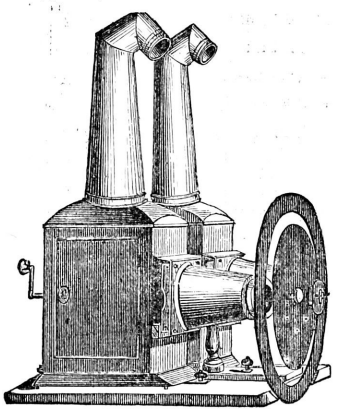


Fig. 361.—PHANTASMAGORIA LANTERN, WITH DISSOLVING APPARATUS.

Dissolving views are exhibited by means of two lanterns. (See *Fig.* 356.) A sliding cover is placed in front of the nozzle of each of the lanterns, and these are moved simultaneously in such a manner, that when the nozzle of one lantern is completely opened, that of the other is completely closed; so that, accordingly as the former is gradually closed, the latter is gradually opened. It is necessary to make the discs from both lanterns perfectly coincide on the screen. Should the edge of one disc show beyond the edge of the other, move the lanterns sideways—it being necessary to place one of them at an angle which will vary according to the distance from the screen.

To illustrate the optical effects produced by two lanterns in this way, let us suppose one picture represents a church and bridal party in summer, and another picture of the same size with the church and a funeral in winter. If the cover of the nozzle of the lantern containing the summer scene be gradually closed and the other gradually opened, the effect will be that the summer picture will gradually assume the appearance of approaching winter—this change going on until the picture on the screen represents a winter scene, and the procession will undergo a similar change. Many beautiful effects may be shown in this manner, such as buildings illuminated, ships in storm and calm, water mills, falling snow, lightning, rainbows, and other atmospheric phenomena.

The oxycalcium light is often employed with these lanterns, and is a great improvement on the oil lamp. It is produced by a jet of oxygen passing through the flame of a spirit lamp, and impinging upon a cylinder of lime; it is of intense brilliancy, scarcely inferior to the oxy-hydrogen light, at one-half the expense, and may be used without the slightest danger.

CHAPTER XIX.

EXTERIOR OF THE SCHOOL-HOUSE—GYMNASTICS AND CALISTHENICS.

1.—The Rev. Dr. Ryerson on Physical Education.

In his official report on a system of public elementary instruction for Upper Canada, published in 1846 by the Rev. Dr. Ryerson Chief Superintendent of Education, are the following admirable remarks on physical training in our schools:—

"On the development of the *physical* powers, I need say but a few words. A system of instruction making no provision for those exercises which contribute to health and vigour of body, and to agreeableness of manners, must necessarily be imperfect. The active pursuits of most of those pupils who attend the public schools, require the exercise necessary to bodily health; but the gymnastics regularly taught as a recreation, and with a view to the future pursuits of the pupil, and to which so much importance is attached in the best British schools, and in the schools of Germany and France, are advantageous in various respects—promote not only physical health and vigour, but social cheerfulness; active, easy, and graceful movements. They strengthen and give the pupil a perfect command over all the members of his body. Like the art of writing, they proceed from the simplest movement to the most complex and difficult exercises, imparting a bodily activity and skill scarcely credible to those who have not witnessed them.

"To the culture and command of all the faculties of the mind, a corresponding exercise and control of all the members of the body is next in importance. It was young men thus trained that composed the vanguard of Blucher's army; and much of the activity, enthusiasm, and energy which distinguished them, was attributed to their gymnastic training at school. A training which gives superiority in one department of active life, must be beneficial in another. It is well known, as has been observed by physiologists, that 'the muscles of any part of the body, when worked by exercise, draw additional nourishment from the blood, and are, by the repetition of the stimulus or exercise, increased in size, strength, and freedom of action. The regular action of the muscles promotes and preserves the uniform circulation of the blood, which is the prime condition of health. The strength of a body or of a limb depends upon the strength of the muscular system, or of the muscles of the limb; and as the constitutional muscular endowment of most people is tolerably good, the diversities of muscular power observable amongst men is chiefly attributable to exercise.' The youth of Canada are designed for active, and most of them for laborious, occupations. Exercises which strengthen not one class of muscles, or the muscles of certain members only, but which develop the whole physical system, cannot fail to be beneficial."

2.—Physical Education among the Greeks and Romans.

To physical education, great importance has been attached by the best educators in all ages and countries. Plato gave as many as a thousand precepts respecting it. It formed a prominent feature in the best parts of the education of the Greeks and Romans. It has been largely insisted upon by the most distinguished educational writers in Europe, from Charon and Montaigne, down to numerous living authors in France and Germany, England and America. It

occupies a conspicuous place in the codes of School Regulations in France and Switzerland, and in many places in Germany. The celebrated Pestalozzi and De Fellenberg incorporated it as an *essential* part of their systems of instruction, and even as necessary to their success; and experienced American writers and physiologists attribute the want of physical development and strength, and even health, in a disproportionally large number of educated Americans, to the absence of proper provisions and encouragements in respect to appropriate physical exercises in the schools, academies, and colleges of the United States.

3.—Sketch of the Athletic Games of the Ancients.

Among the Greeks, periodical games were of high antiquity, and exerted an important influence upon their national character. Such games were early celebrated, especially in honour of the dead; and Homer, the father of Grecian poetry, describes, in his account of the funeral of Patroclus, the chariot races, foot races, boxing, wrestling, throwing the quoit, etc. These games were at length connected with the *religious* festivals of the Greeks, were deemed *sacred*, and regarded as part of their religion. In his epistle to the Grecian Christians, at Corinth, St. Paul refers to these games in illustration of Christian conflict, duty, and hope. He says he "runs not as uncertainly;" he "fights, not as one that beateth the air;" he has in view, "not a corruptible, but an incorruptible crown." He also "keeps his body under, and brings it into subjection"—referring to the severe course of physical regimen and exercise required of Grecian competitors, preparatory to their public appearance.

There were four public solemn games in Greece—the Olympic, Pythian, Nemean, and Isthmian. The *Isthmian* games were celebrated near the Isthmus of Corinth, whence they derived their name. They were observed every third, and afterwards every fifth year, and held so sacred that a public calamity could not prevent their celebration. The victors were crowned with a garland of *pine leaves*. The *form* of these crowns was similar to the civic and triumphal crowns given in the annexed engravings; but in other respects they differed.



Fig. 362.—Triumphal Crown.



Fig. 363.—Civic Crown.

The *Nemean* games were celebrated in the town of Nemea, in Argolis, every third year. The victors were crowned with *parsley*.

The *Pythian* games were celebrated every fifth year, in the second year of every Olympiad, near Delphi. The victors were crowned with *laurels*.

The *Olympic* games were celebrated the first month of every fifth year, at Olympia, a town situated on the river Alpheus, in the territory of Elis, on the western coast of the Pelopponesus. These were the most famous games of the Greeks. They lasted five days, and drew together an immense concourse from all parts of Greece, and even from foreign countries. No one was permitted to contend in them unless he had prepared himself, by continual exercises, for ten months, in the public gymnasium at Elis. The competitors were obliged to take an oath that they would use no unlawful means to obtain the victory. The prize

bestowed on the victor was a crown of *olive;* yet this honour was considered equal to the *victory of a general* among the Greeks, and to a *triumph* among the Romans. Thucydides informs us that during the celebration of these games, a sacred truce was observed between all the States of Greece; all hostile operations were suspended, and, for the time, they regarded each other as fellow-citizens and brethren.

The only authentic chronology of the Greeks is connected with these games. The space (four years) that intervened between one of their celebrations and another, was called an *Olympiad.* The era of the first Olympiad is 776 years before the Christian era. The Olympiads may be reduced to the common era, by multiplying the Olympiad, immediately preceding the one in question, by 4, and adding the number of years to the given Olympiad, and, if B.C., subtracting the amount from 777; if A.D., subtract 776 from the amount.

The exercises practised at these games were, first, foot races alone; but they afterwards consisted also of throwing the quoit, boxing, wrestling, horse, and chariot races. At that period, when gunpowder was unknown, and war had not become a science, and each battle was only a multitude of single combats, such exercises of bodily strength and activity were much cultivated by most ancient nations; but the Greeks were the first to reduce them to a system, and to invest them with the importance of a national institution.

These games were not wholly confined to gymnastic and athletic exercises. Contests were, also, at later periods, admitted between poets, orators, musicians, historians, philosophers, and artists of different descriptions. It was there that portions of the history of Herodotus were first recited or read; and it was by thus listening to the fascinating tales of the Father of profane history, that Thucydides first caught the inspiration which prompted him to write a history as philosophical as it is brilliant, and as charming as it is profound. It was at these games, also, that Lysias recited his harangue on the fall of the tyrant Dionysius. Intellectual enjoyments thus became blended with social amusements and athletic contests; and assemblages which first produced martial skill and prowess, were, in after ages, productive of social and intellectual refinement.

4.—Illustrations of the Ancient Greek and Roman Games.

The following illustrations will give some idea of the principal athletic exercises which were practised at the Grecian games, and which cannot fail to impress us with the much greater elevation of modern taste, and manners, and institutions, and especially of religion and morals, notwithstanding the boasted refinement and grandeur of Grecian taste and character.

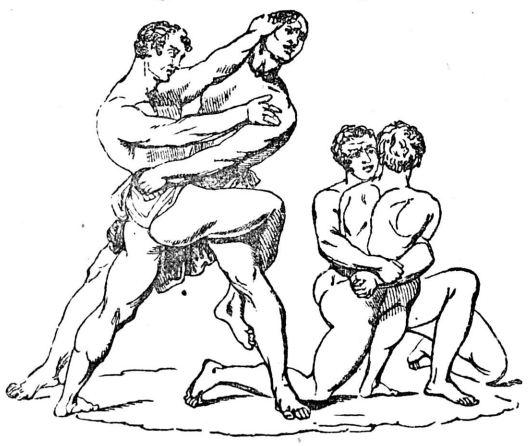


Fig. 364.—WRESTLING.

In wrestling, the competitors were nearly or quite naked, and they seem to have displayed great skill and agility. Excited by the presence of a vast assembly, they put forth amazing efforts, and though bruised and maimed in the struggle, they gave no evidence of suffering.

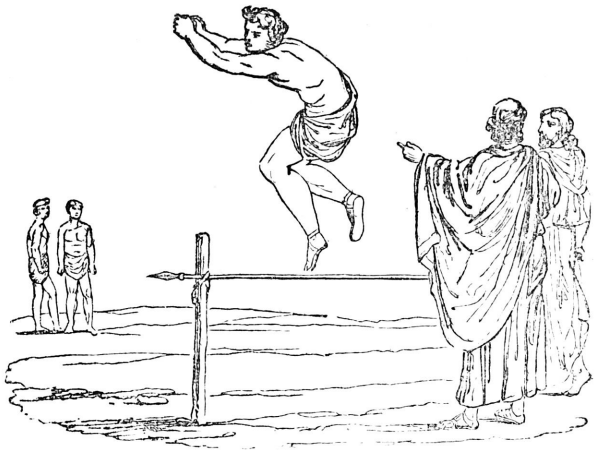


Fig. 365.—Leaping.

Leaping was performed by springing over a bar. No one was permitted to enter into this sport, at the Olympian games, who had not practised ten months.



Fig. 366.—Boxing.

Boxing was a favourite sport, and appears to have been practised much as it is now in England. No unfair advantage was allowed in this or any other contest. The least trick was severely punished.



Fig. 367.—The Discus.

Throwing the *discus* or *quoit*—a round piece of stone, iron, or brass—called forth the energies of the most powerful men; and the feats performed, in hurling large weights, were astonishing.



Fig. 368.—Running.

Running was practised, and if we may believe the accounts which are given by Greek writers, the racers must have surpassed the fleetest of modern pedestrians.



Fig. 369.—Chariot Racing.

Horse racing and chariot racing were conspicuous among the sports. The latter was particularly imposing, and persons of the first rank engaged in it. Such was the applause bestowed, that it was fancied that Alexander, the son of Philip, and afterwards the celebrated conqueror, might desire to engage in the contest; but when it was proposed, the haughty youth declined, unless kings could be his rivals.

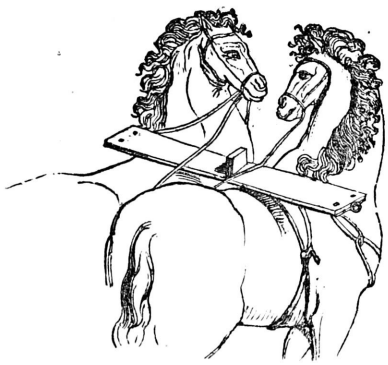


Fig. 370.—Mode of Yoking the Horses.

The mode of attaching the horses to the chariot, by means of a plain, straight curricle-bar, is shown in the annexed figure. It was extremely simple, and left the horses quite free in their movements. The war chariot differed but slightly from the racing chariot, as will be seen by the following illustration.



Fig. 371.—War Chariot.

We also give illustrations of the military knights on horseback, a war galley, the foot soldier, the military leader, and, to complete the series of illustrations of ancient social life, the figure of an emperor, patrician, plebeian, and slave.



Fig. 372.—Military Leader.



Fig. 373.—Military Knight.

The military knight was one of a body appointed originally, as is supposed, by Romulus. The knight was selected from the patrician families, and mounted at the public expense, to serve as a body-guard to the king.

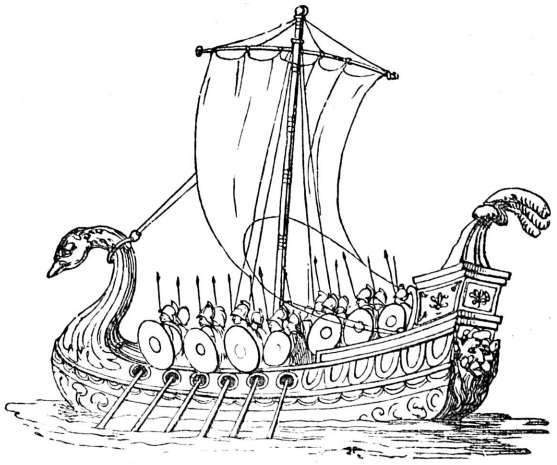


Fig. 374.—A War Galley.



Fig 375.—Roman Soldier on March.

War galleys were frequently employed, some simply as transports; while on the decks of others, towers were erected from which missiles might be discharged.



Fig. 376.—EMPEROR.



Fig. 377.—PATRICIAN.



Fig. 378.—PLEBEIAN.

The emperor, patrician, and plebeian of ancient Rome, are represented by the modern English ranks of king, lords, and commons. The slaves and gladiators were the lowest grades.



Fig. 379.—SLAVE.



Fig. 380.—GLADIATORS AWAITING THE SIGNAL.

The gladiators fought with swords, and were exhibited at funerals and public festivals, for the amusement of the Roman people. They were at first taken from captives in war, or malefactors; afterwards from slaves trained to the profession.

The first poets and musicians were assembled from all quarters, and an immense crowd of rich and poor, high and low, gathered to witness those displays, which were not only interesting from the excitement they produced, but from the sanction that the popular religion bestowed upon the occasion. It would appear that, at the present day, there is no public festivity in any country which engages so deeply the passions of mankind, as the games of ancient Greece and Rome.

5.—Open and Covered Gymnasiums for Schools.

In connection with the remarks in chapter xii, on the laying out of school grounds and premises, as well as providing for a playground and gymnasium, we insert the engravings, *Figs.* 381, 382 and 383, illustrating this subject. *Fig.* 381 exhibits the block plan of a school site, with a double school-house on it, and provision on the grounds for a girls' playground on one side, and a boys' gymnasium on the other, each of which is intended to be nicely shaded with trees. The illustration is that of the parish school in Pankstrass, at Berlin, Prussia, taken from Robson's "School Architecture." The school-house divides the girls' and boys' playgrounds, and the latter is supplied with complete apparatus for out-door gymnastics.

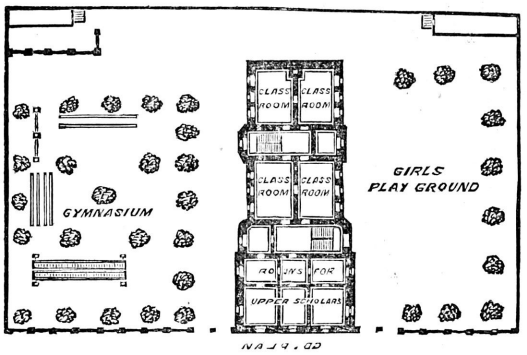


Fig. 381.—Block Plan of Double School-House, with Gymnasium.

Fig. 382 is also taken from Robson's "School Architecture," and is copied from a German work of the same kind. It represents the block plan of a school

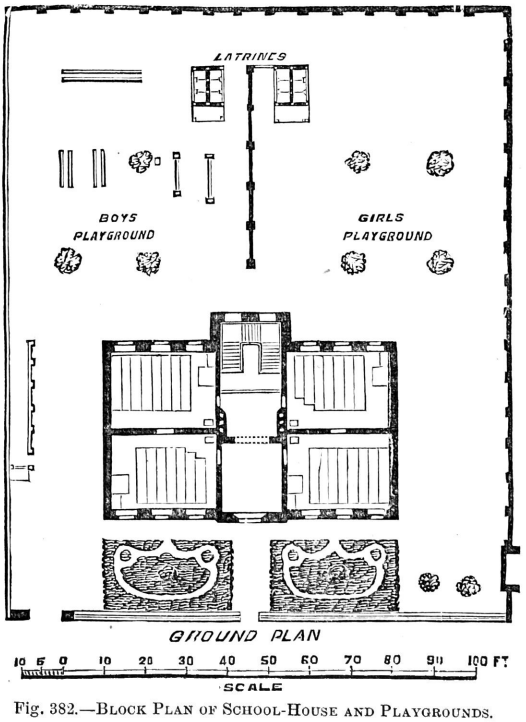


Fig. 382.—Block Plan of School-House and Playgrounds.

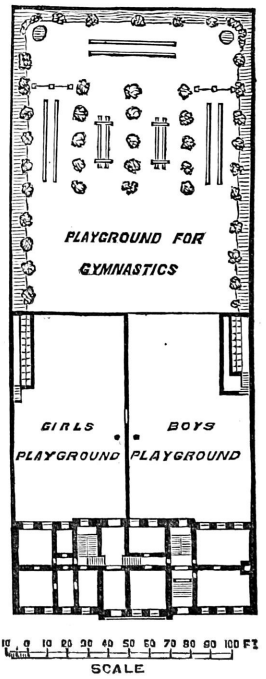


Fig. 383.—Block Plan of School Site and Playgrounds.

site, showing a double school-house, with separated playgrounds for boys and girls, and a playground with suitable apparatus for gymnastics, in the rear. The

apparatus, it will be seen, is completely shaded (as the ground should be) with trees. (See page 81 of this book.)

Fig. 383, from the same work, shows the block plan of the municipal school in the Frankfarter-strass, Berlin, Prussia, and is a simpler kind of arrangement for gymnastics, though with a larger area for its practice. This illustration will also be found on page 81 of this book.

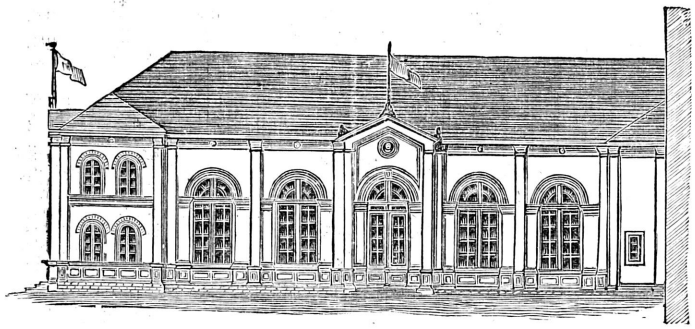


Fig. 384.—Design for Covered Gymnasium.

Fig. 384 furnishes a design for a covered gymnasium, or German *turnhalle*. The illustration shows the *turnhalle* attached to the *Gewerbeschule*, or Trade School, at Hof. It is plain and simple in its construction. A building of this kind should be attached to every large high or public school, or collegiate insti-

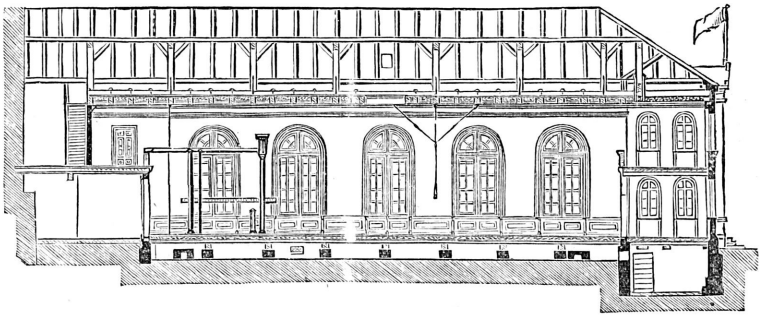


Fig. 385.—Section of Covered Gymnasium.

tute, as gymnastics under a competent instructor would always form an agreeable change in the amusements of school boys. An instructor is necessary, from the fact that boys, left to themselves in their gymnastic exercises, would be apt either to play practical jokes on each other, or indulge in exercises quite too violent in their character for safety or health.

6.—Simple Gymnastic Apparatus for Young Children.

Fig. 386 is a plan which may be adapted to a covered gymnasium, or to an "uncovered school-room," as an out-door gymnasium for young children is sometimes called. The one shown in *Fig.* 386 is the plan of a playground for children, recommended by the English "Home and Colonial School Society," whose long labours (Mr. Robson remarks, in his "School Architecture") in the field of infant education entitle their opinion to weight. There are four kinds of apparatus shown in the plan (*Fig.* 386), but we give a fifth also. These comprise—

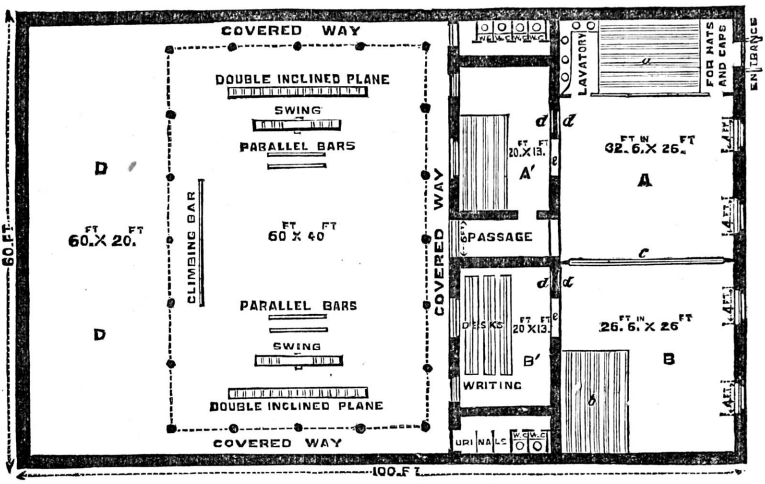


Fig. 386.—Ground Plan of Covered Gymnasium.

(1.) A double inclined plane for the use, as will be seen in *Fig.* 387, of the youngest children. In its construction, each length of plank should be about 12 feet long, and be raised 2 feet 6 inches from the ground. On the upper sides of the planks should be nailed cross pieces (see cut), at intervals of 8 or 9 inches, to prevent slipping.

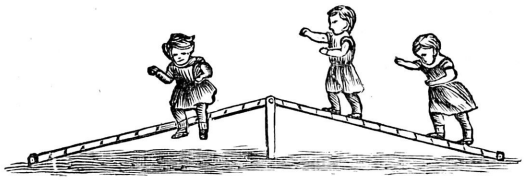


Fig. 387.—The Double Inclined Plane.

(2.) *Fig.* 388 exhibits a wooden swing, or "see-saw," for the use of young children. It consists of a plank $2\frac{1}{2}$ inches thick and 12 feet long, fitted with three handles (in three divisions) at each end, to be grasped by the children. The long plank should be made to move on a fixed pivot of thicker plank, standing about 18 inches out of the ground. Between the handles the plank should be rounded off, so as to make an easy seat for the young children.

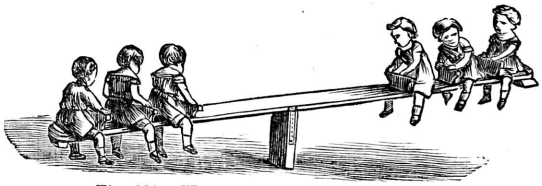


Fig. 388.—Wooden Swing, or "See-Saw."

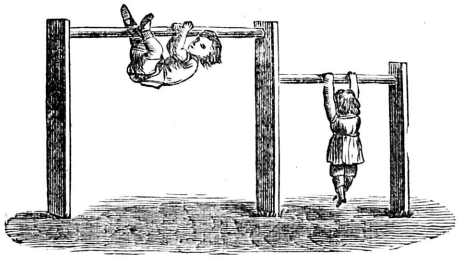


Fig. 389.—Single Bars.



Fig. 390.—Parallel Bars.

(3.) *Fig.* 389, single bars, which should be 3 inches in diameter, and 6 and 8 feet long, made of round, smooth hard wood. There should be two of these single bars (as shown in *Fig.* 389)—one 5 feet high and the other 4 feet.

(4.) *Fig.* 390.—*Parallel Bars.*—These bars should be from 6 to 8 feet long, with rounded corners, or ends, projecting about 4 inches beyond the tops of the supporting posts. These posts should be 18 inches apart.

(5.) *Fig.* 391.—*The Climbing Ropes.*—This consists of a simple frame, supporting three ropes for climbing —all hanging loosely— the two outer ones being attached to the posts, so as not to allow them to swing about too freely.

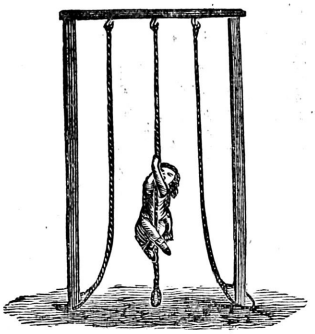


Fig. 391.—CLIMBING ROPES.

Fig. 392 is a safe and neat swing seat.

These six articles may be used by young children quite safely, and with much advantage to their health and physical development.

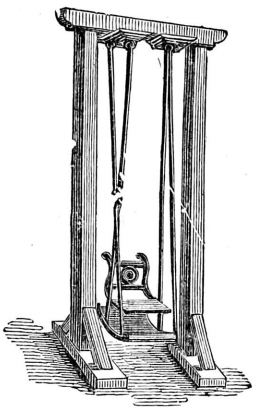


Fig. 392.—SWING SEAT.

7.—Advantages of Training and Developing the Physical System.

Dr. S. S. Putnam, an American physician, thus refers to the advantages of physical training in schools:— * * * Gymnastic training cannot fail to be of use in regard to training children who were not naturally strong, and therefore not inclined to take part in outdoor sports, which are, of course, beneficial to the healthy and vigorous among our children. The benefits resulting from systematic gymnastic training are, too, decidedly different from those accruing from ordinary outdoor sports. The former scientifically trains special groups of muscles, and confers special benefits upon the bodily system. Skilled instructors are, of course, required, and Dr. Putnam maintains that the result of such training was to promote general health, and to bestow special accomplishments.

It is not necessary that very great muscular power should be developed, as that is not necessarily conducive to good health, nor does it always accompany it. One way in which school children may be greatly benefited is by helping them to perfect the process of respiration. This was demonstrated by the work done by Prof. Monroe with the children of the Boston schools. Good breathing is by no means common, and the singing teacher has always much to accomplish in this respect. Instruction in this regard may not only give vastly increased power to healthy persons, but it may save many who are affected by lung disorders from early deaths.

Proper physical instruction in our schools should also relate to the sitting of the scholars, to proper methods of study or of mental application, to proper means of ventilation, etc. It is a notorious fact that many cases of injury to the spinal column arise from improper postures while sitting. (See page 206.) Among 731 pupils at Neufchatel, 62 cases of this sort were observed among 350 boys, and 156 cases among 381 girls. The curvature of the spine occasioned was mostly to the right, caused, no doubt, largely by writing at unsuitable desks. The excess among girls is due, no doubt, very much to the fact that they take less active exercise, and are much less robust, as a rule. Herr Raag, of Berlin, says that he has found gymnastics very useful in preventing these spinal curvatures. With practical benefits resulting from these exercises, the lectures of hygiene, etc., will have much greater force than otherwise.

For proper school gymnastics it is only requisite that there should be space enough about the desks to enable the pupil to advance one step and to swing the

arms freely. A large hall, with a few desirable pieces of apparatus, is all that is needed for further gymnastic exercise, which is to give to the scholars special accomplishments in this matter. In Europe, gymnastic apparatus are now considered absolutely necessary for the uses of scholars in the public schools.

8.—Inexpensive Gymnastic Apparatus for Schools.

In constructing gymnastic apparatus for schools, the following will be found to be both simple and inexpensive. *Fig.* 393 represents a swing treee. This may be from 16 to 20 feet long, supported by legs, as shown at GG. It should consist of as clear a piece of pine timber as possible, dressed and cleaned off, and then sawn down the middle. Two swing trees may thus be made out of one piece of timber. The diameter of the tree, when dressed, should be from six to eight inches.

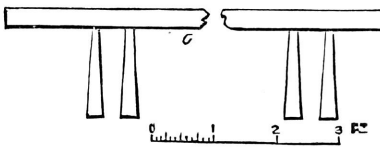


Fig. 393.—A Swing Tree.

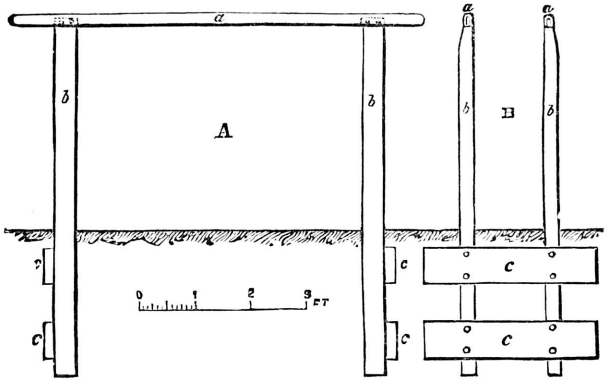


Fig. 394.—Fixed Parallel Bars.

Fig. 394 represents the simplest and most ordinary kind of fixed parallel bars. A is the side elevation, and B the end view or section. The two bars, *a*, *a*, are each supported by two posts, *b*, *b*, fixed in the ground, and connected underground by two planks, *c*, *c*.

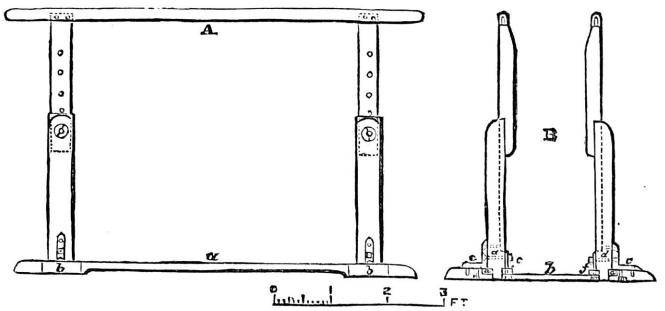


Fig. 395.—Adjustable and Movable Parallel Bars.

Fig. 395, represents a movable and adjustable pair of parallel bars. The advantage of them is, that in wet and cold weather they can be moved and used

under cover. A is the side elevation, and B a section of it. The posts are tenoned into a framed footing, *b*, *b*, and fixed by angle irons, *c*, *c*. The bolts, *d*, *d*, are screwed to the bolts, *f*, *f*, which reach through the framed pieces, *a* and *b*.

9.—Simple Gymnastics for Boys.

(1.) *Means of Exercise.*—In the country school sections, where the playground is extensive, and suitable for the use of bats, balls, hoops, stilts, jumping sticks, etc.—which the pupils will themselves furnish in abundance—it will render any special provision in this respect less necessary. But in case the grounds are small, and in towns where greater variety of means is required, additional arrangements should be made for such physical exercise as may secure proper muscular development.

Amongst boys, running and leaping are favourite pastimes, and both are conducive to health. For running, no other preparation of the ground is needed than that there shall be space enough, and that the surface be sufficiently level to be safe.

Some kinds of leap require preparation. The long leap, along the surface of the ground, only needs a level space for the run, and ground not too hard for the leap itself. The high leap may be made a useful and safe exercise by means of a proper leaping cord or bar, so constructed as to be elevated in proportion to the increase of the youth's activity by practice, yet so arranged as to prevent the injury by striking the feet against the cord or bar.

The pole leap brings the muscles of the hands and arms into play as well as those of the lower limbs; and if it be cautiously practised and gradually increased, will give a degree of confidence and activity to the performer, which may be valuable to him in the dangerous and trying positions of after life.



Fig. 397.—POLE LEAP.

Vaulting is another kind of exercise which strengthens the muscles of both upper and lower limbs. The power to swing oneself over a fence too high for a

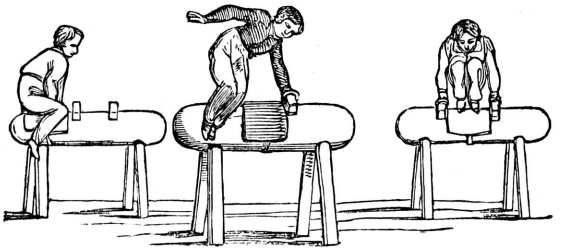


Fig. 398.—VAULTING.

leap, in times of danger or great haste, is desirable. Rapid and graceful mounting on horseback may also be thus taught. The necessary fixtures cost little, and add to the variety of the playground.

The parallel bars are admirable contrivances to exercise and strengthen the arms, and open and expand the chest. If of different heights and sizes, they may be used by pupils of all ages. They possess the advantage of being perfectly free from the possibility of accident to the smallest boy who uses them; and should therefore be among the first means for exercise introduced upon the playground.



Fig. 399.—Parallel Bars, No. 1.

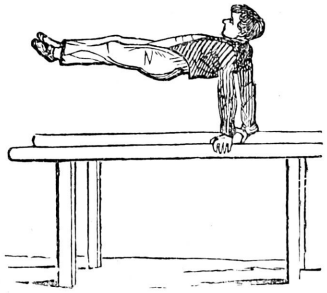


Fig. 400.—Parallel Bars, No. 2.

The horizontal bar is for lads of more advanced age, and its use, besides strengthening the hands and arms, affords the opportunity of placing the body and limbs in a great variety of positions, and of thus strengthening many muscles not ordinarily called into action.

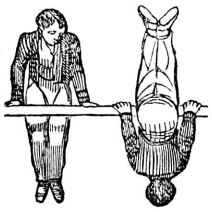


Fig. 401.—Horizontal Bar

The balancing bar is so constructed as to admit of elevation from the ground in proportion to the pupil's confidence in himself and skill in using it. It is admirably fitted to give strength to the lower limbs, steadiness to the brain, and self-possession to the mind. The constant practice of balancing the person with exact reference to the centre of gravity, must also have a beneficial and graceful effect on the figure and general deportment.

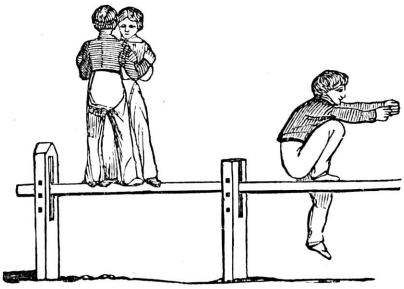


Fig. 402.—Balancing Bar.



Fig. 403.—Inclined Board.

Climbing the ladder, the rope, and the inclined board, are all calculated to add

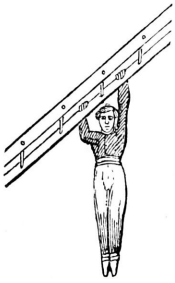


Fig. 404.—The Ladder.



Fig. 405.—The Rope.

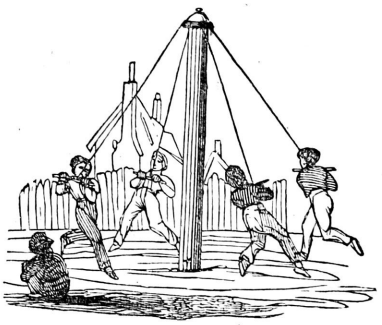


Fig. 406.—Rotary or Flying Swing.

strength to the limbs, activity and health to the body, and variety to the exercises of the playground. They can be provided for at slight expense, and be found, in

common with other similar arrangements, to increase love for school, by rendering it attractive. No gymnastic apparatus combines greater variety of healthful and pleasant exercise than the rotary or flying swing. It combines running, leaping, and climbing, with the addition of engaging several in the same exercise at the same time. It also has the advantage, which few of the exercises which have been enumerated possess, of being equally adapted to boys and girls.

10.—Calisthenics for Girls.

In suggesting these or similar arrangements and apparatus for the amusement and physical training of the youth of both sexes, of course it is not designed to assert that all, or even any of them, are indispensable to every school. It is admitted that children, in good health, will have exercise of some kind, and, if not restrained, will generally manage to secure a sufficiency to promote growth and vigour of body; but it is also known that, if left to themselves, they will generally neglect the studies proper for their intellectual culture. Hence the latter, with that of their moral nature, becomes the object of primary importance and obligation. But then, it is also believed that the means of physical exercise may also be vastly improved in nature and result, and at the same time be made a strong attracting influence in favour of the school and of learning. In this view of it, physical training rises in importance to a point only secondary to that of the culture of the heart and the intellect; and it may, therefore, not be overlooked without detriment to the best interests of the child and of society.

Though girls neither require the same robust exercise nor rough sports, to develope their frames and fit them for the duties of life, as boys, yet the system of education which omits or slightly provides for their physical training, is most radically defective. In addition to such of the apparatus already enumerated, and others proper for both sexes, those more peculiarly adapted to their wants should be provided. In this point of view, light dumb-



Fig. 407.—DUMB-BELL.

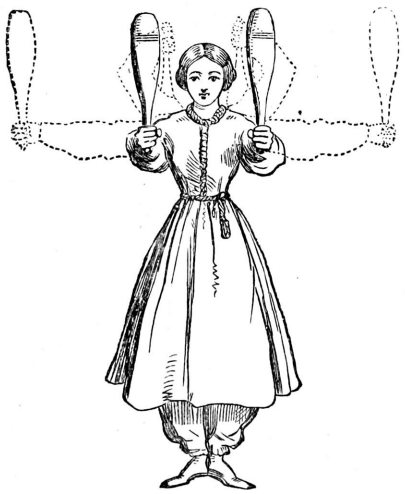


Fig. 408.—INDIAN CLUB EXERCISE.

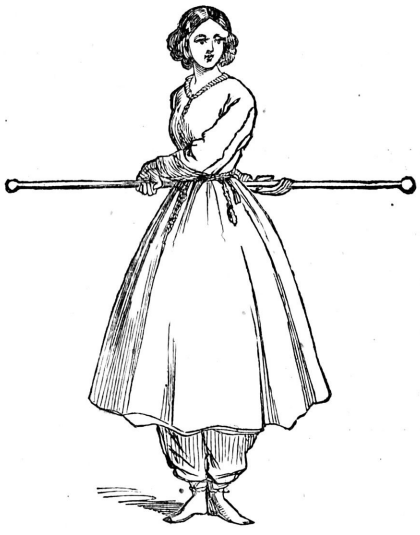


Fig. 409.—BALANCING BAR EXERCISE.

bells or Indian clubs are best calculated, if properly used, to strengthen the arms and expand the chest. Both may be found of great service. *Fig.* 408 indicates

the different motions of the Indian club exercise. The balancing bar can also be employed with great effect, and as an easy and graceful exercise.

The long back-board is also well calculated to expand the chest and give litheness and grace to all the movements of the arms and bust. The variety of attitude into which its use can be made to throw the person, cannot but be beneficial. The triangle is a short bar of wood, attached by a light rope at each end to one



Fig. 410.—Triangle Exercise.



Fig. 411.—Back-board Exercise.

secured at some point of considerable height. This is so arranged, by means of a pulley, as to be adaptable to the size of the person using it, and is a simple contrivance which may be used in a shed or room, in bad weather, and made to answer most of the uses of the rotary swing.

If it do not suit the convenience or the means of the section, to expend money to provide for the physical training of its youth, by means of proper gymnastic arrangements, much may be effected by the teacher and the pupils. Timber is cheap, and there will be found in every school of the ordinary size, several scholars of sufficient age, mechanical turn, and, if properly influenced, of willingness to labour for the common good. A Saturday or two devoted to this purpose will readily produce one or more of the simpler kind of gymnastic apparatus, and the agreeable and beneficial effects of these will soon introduce others. In this way a full set may in time be obtained.

As to where the exercises shall take place in rainy weather, has been a question. Some have proposed to fit up and use the basement for the purpose; some have thought that the school-house should be constructed with two stories, the upper one of which might be used for play; and others have proposed separate covered buildings or sheds. Should such a use be made of the second storey of the school building, the walls of the first storey must be made thick and firmly bound together. They need not extend, however, higher than the first story, as the second should be open, but surrounded by a balustrade and pillars to support the roof. The floor ought to be laid with thick plank, and deafened. More costly arrangements might be described, but these have both simplicity and cheapness to recommend them.



Fig. 412.—Various Gymnastic and Calisthenic Exercises.

Should the price of ground in particular localities render it advisable to occupy a room in the school building, for gymnastic or calisthenic exercises, or to erect

a building purposely (in which case alone such expedients should be resorted to as the sole means of exercise), the utmost care must be taken to ensure a full supply of pure air. No consideration ought to be permitted to interfere with this indispensable requisite.

11.—Gymnastics in Switzerland.

From the English *Journal of Education* we make the following extract on the subject of gymnastics in Switzerland :—

"In Switzerland, almost all the schools, both primary and secondary, are provided with a *manège*, or gymnasium, having all the machinery necessary to a complete course of gymnastic exercises — a ladder, climbing-ropes and poles, a cross-pole, parallel bars, leaping-poles, a vaulting-horse, and a large balancing-pole. The apparatus is sometimes erected in the open air—sometimes under a covered roof; and many of the schools have both a covered and an uncovered gymnasium. The covered gymnasiums have no floors, but a ground of loose sand, which can be raked up to render it soft. The uncovered gymnasiums are always placed in a field, or grass plot, for the same reason.

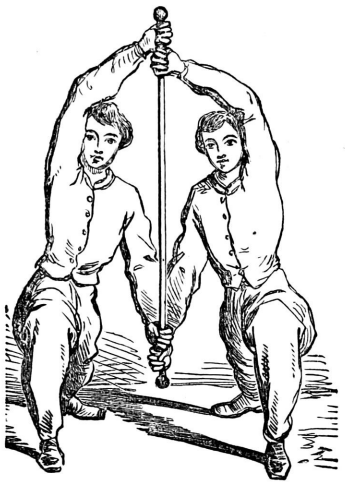


Fig. 413.—Balancing Pole Exercise, No. 1.

"Such is the interest which the Swiss students take in gymnastics, that they form themselves into *Turnvereins*, or gymnastic associations, and each association sends about some of its members from school to school, in its own district, to organize the gymnasiums, and give the benefit of their instruction and example to the scholars. Each of these associations holds annually a *Turnfest*, or gymnastic festival, at which all the members attend; and a great

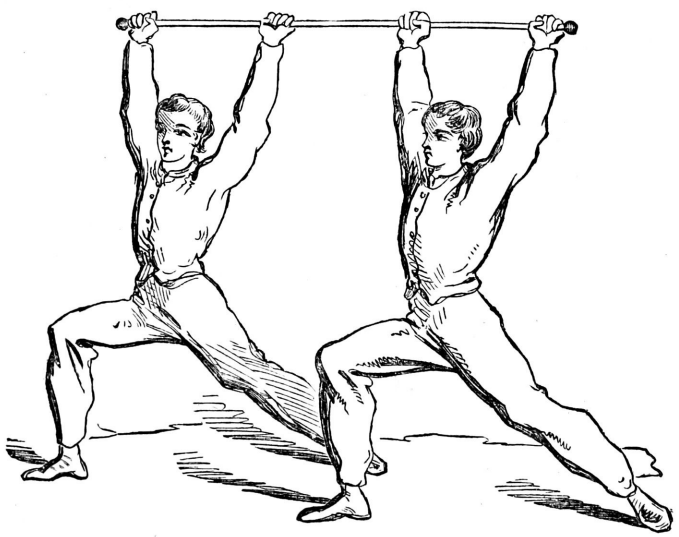


Fig. 414.—Balancing Pole Exercise, No. 2.

number of exercises are gone through upon every part of the apparatus in the *manège*, which they hold for the purpose. This, however, is only preparatory to

a great triennial festival, which is held at the principal Swiss towns in succession, as the government used to be. At this festival all the associations meet, and the members compete with one another for wreaths, prizes, and other distinctions, just as in the old Grecian games, before they had been perverted from their original purpose, and degraded into mere exhibitions of particular feats. People assemble from all parts of the country to witness the performances; the fine national songs of Switzerland and Germany, sung in chorus by the friendly antagonists, excite and sustain the general enthusiasm. The standards of the associations, and the gay clothes of the spectators, give a radiant aspect to the scene: everything contributes to the joyousness and merriment of the occasion. At the close of the festival, which generally lasts three days, the wreaths are placed on the brows of the victors, in the presence of the assembled spectators, and the prizes distributed by the hands of fair ladies, who thus grace with their presence the ceremony of the award, and impart a higher value to the marks of distinction.

"All this is very well, it will be said, and feasible enough, in a country where the education of every member of the community is carefully provided for at the public expense, and where, so far from being a national debt, the governments of the several Cantons have generally a considerable surplus revenue at their disposal for public works. But we reply, that the expense of fitting up even a complete gymnastic ground need not be anything very considerable if once the site is obtained; and that the playground of an elementary school may be furnished with the common apparatus at a cost almost insignificant. The most expensive piece of apparatus, after all, is the circular swing, which has already been erected in the playgrounds of so many schools. It is certainly right to provide first for this most exhilarating of gymnastic exercises. If the schoolmaster were competent to give a course of gymnascic exercises, he would have no difficulty, we imagine, in inducing the managers to supply the necessary apparatus.

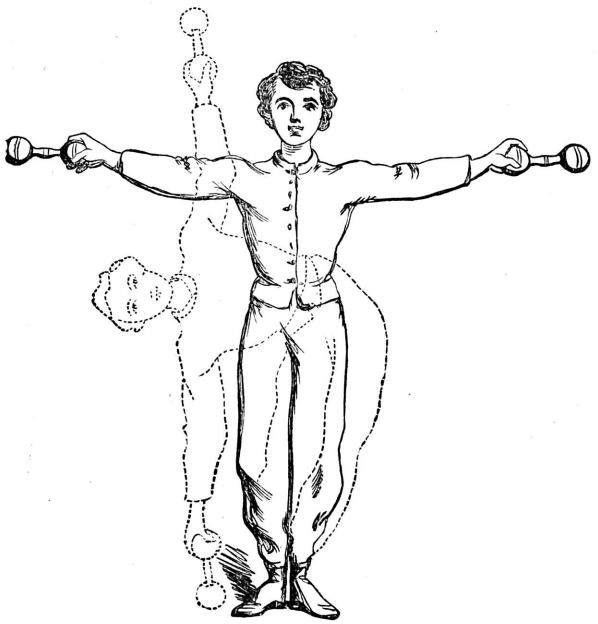


Fig. 415.—Hand Dumb Bell Exercise.

"But, as our readers are aware, there is a large class of gymnastic exercises which do not require any apparatus at all; and these are, in fact, more essential than the others, to which they are preliminary and introductory. They are such, namely, as are designed to develope the activity of the limbs rather than to call forth the physical strength. These should not be neglected in any school for children. They are very carefully taught in many of our boarding schools; and we cannot see that they are less useful to the children of the poor than to those of the middle classes. This is one of the few particulars in which the middle schools are not behind the best elementary schools, and it is owing to the fact

that the former are able to pay for the services of a drill-sergeant, and the latter are not. But there is no reason whatever why every school-master should not be his own drill-sergeant; in fact, were it possible to procure the services of a drill-sergeant in an elementary school, it would be still preferable that the master should superintend this and every other part of the discipline himself—for he should be all in all to his own school.

"It is hardly necessary to remind our readers of the more common and obvious advantages which result from gymnastic exercises.

"The principal, of course, is the beneficial influence which they exert upon the health. This is a sufficient reason to induce everybody to attach great importance to them; but it is a consideration which derives still greater weight in relation to the school and school-master. The regular practice of these exercises will do much towards enabling both to discharge their duties with success; and, in those schools where anything like high pressure is put on, will act as a most useful safety-valve. Besides, light hearts are the natural concomitants of good health; and certainly nowhere are they more desirable than in an elementary school, where there are already annoyances enough, in all likelihood, without those which result from the jarring of bad tempers. How much more pleasantly, both to teacher and taught, does the work of the school proceed where these are absent, and a cheerful tone prevails.

"We would beg leave, however, in a special manner, to call attention to one advantage which is not so generally understood. It is thus referred to by M. de Fellenberg:—

"'The *gymnastic exercises*, in all their forms, are a powerful aid to the practice of design, in cultivating the taste for the beauty of *form or motion*. Their effect in this respect is very obvious; and the occasional festivals which are accompanied by gymnastic games, present examples of a high degree of cultivation in this respect. It is a spectacle which charms the eye, and exhibits the intimate connection of easy and graceful motion with the improvement of physical force, and the capacity to escape from danger or surmount obstacles.'

"It has accordingly been remarked, that one reason for the pre-eminence of the ancients in sculpture, was the patronage bestowed upon the public gymnasiums, in which the artist could form his models from every variety of development of which the human form is susceptible. However this may be, there can be no doubt whatever that gymnastics do contribute materially to the *æsthetic* training of the mind."

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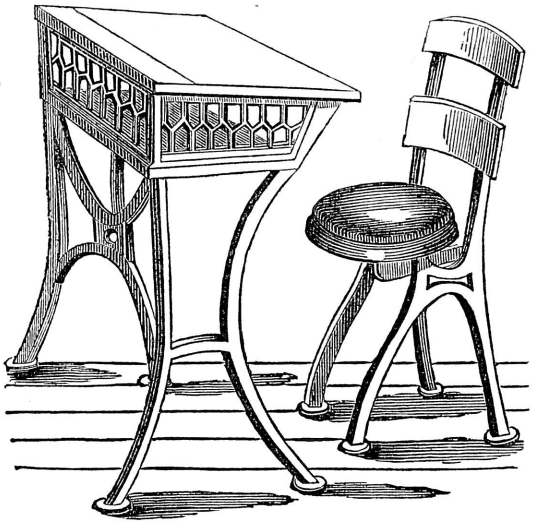

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