FIRST ANNUAL REPORT

OF THE

STATE BOARD OF HEALTH

OF THE

STATE OF NEW HAMPSHIRE,

FOR THE

FISCAL YEAR ENDING APRIL 30, 1882,

WITH THE

REGISTRATION REPORT, 1881,

RELATING TO BIRTHS, MARRIAGES, AND DEATHS.

CONCORD:
PARSONS B. COGSWELL, STATE PRINTER.
1882.

illustrations which the paper contains are the results of actual experiment, and are in no part theoretical. For the plates we are indebted to the courtesy of the Connecticut State Board of Health.

The evils of non-ventilation are apparent to every physician in every community, but the public mind scarcely recognizes the serious results that come from such a source. If the effete products of respiration and skin elimination, dead and decomposing particles of the body, which are breathed over and over in unventilated rooms, absorbed by the system, poisoning the blood, impairing the vital force, ruining the constitution, and sapping all the physical and intellectual powers, could for a single moment be seen with the eye, the dullest senses of the most obtuse mind would be severely shocked; but the suggestion alone ought to be sufficiently comprehensive for any ordinary mind. These points are strongly and vigorously brought out in the paper above referred to, and certainly merit attention.

The physical disasters which come from inattention to ventilation, while embracing all classes of buildings, public and private, undoubtedly cause the most serious results through dwelling-houses and school-rooms. Especially is the school-room too often a pen for the cultivation of disease. These facts are well brought out in Dr. Conn's paper.

Particular attention is called to those plates which illustrate the various methods of receiving and discharging the air from a room heated by a furnace or steam by indirect radiation.

SCHOOL BUILDINGS.

The paper which is contributed by Mr. Warren R. Briggs, architect, is a very valuable one for several reasons, which will be obvious upon a careful perusal of the same in connection with the plates. We have been to considerable expense in illustrating the paper, but feel that it presents sufficient merit to warrant the outlay. The health and intellect of so many children, frequently impaired and sometimes ruined, is too grave a question to pass over in silence.

The chief faults to be overcome in the construction of school buildings seem to have been well and seriously studied in the plans that are presented. The author could not have been unacquainted with the faulty, disease-producing school-rooms that are to be found in almost every town in New England; and the methods presented in his plans and paper, some of which are entirely new, will certainly commend themselves upon examination.

The system of heating and ventilating described is the result of experiment, and not of theory;—hence its perfect practicability and utility cannot be doubted. The removal of foul and vitiated air through avenues placed at or near the floor, though contrary to most methods in use, has been demonstrated to be correct in principle and most efficient in practice, and is now in successful operation in public buildings and some private residences. Perhaps the most radical change in indirect heating and ventilation is in admitting the warm air at a point quite high up in the wall. A study of the paper on ventilation by Dr. Conn, and its accompanying plates, will give a plain and concise idea of this method, and should be carefully read prior to studying the paper under consideration.

The arrangement of the school-room itself, though deviating from the "good ways of our fathers," possesses merits which are original and attractive.

The admission of a good amount of light from behind the scholars is a step towards the prevention of myopia, opthalmia, and other defects of the eye, which have become so common in our schools.

The entire plans presented by Mr. Briggs are applicable in the building of any village school-house in the state. While the drawings represent quite an expensive building, the whole principle may be embodied in a comparatively cheap wooden building, should limited funds demand the construction of a less costly structure. We would respectfully urge any district, town, or denomination proposing to build new school buildings, to carefully consider at least the fundamental principles which are brought out in this paper.

To ignore the best and most approved methods and systems of school hygiene in this era of intelligence, when it has been demonstrated time and again that the evils of such neglect have brought disaster, and even death, to many bright and promising children, is a crime which no human law seems adequate to punish.

ADULTERATION OF FOOD.

On this subject Edwin J. Bartlett, M. D., has favored us with a valuable paper showing the character and extent of the adulteration of many ordinary articles of food. While the statistics given are very meagre so far as relates to the subject in our own state, for the reason that no especial attention has been given to the question, it is reasonable to presume that our state finds a market for as many spurious and adulterated articles of food as any other; indeed, it is possible that, owing to the neglect of the state to investigate the matter in the past, New Hampshire may be a favored market for unscrupulous manufacturers, producers, and salesmen to dispose of their fraudulent goods.

The attention which the subject has recently received in other states, mostly through the labors of their respective Boards of Health, has well demonstrated the wholesale practice of commercial adulteration, and that the evil can be largely prevented. We have a vigorous though defective law, with ample penalties, but it, like too many other laws of our state, remains a dead letter. An evil which requires expert knowledge and scientific labor to determine can never be done away with without some compensating provision is made to search it out;—hence the principal reason that the law has been inoperative.

The effect of proper legislation is well illustrated in the paper mentioned, by statistics taken from the Canadian reports, which show a decrease of such adulteration in six years from 51.63 to 24.99 per cent. Such work must, from its character, require accurate and sometimes systematic analytical examinations to determine, and men competent to perform the same are generally engaged in more lucrative labor than usually comes from philanthropy alone.

It is one of the purposes of this Board to investigate the qualities of the various articles and forms of food offered for sale in New Hampshire, the results of which will be presented in a future report.

SUBURBAN SCHOOL-HOUSES.

BY WARREN R. BRIGGS, ARCHITECT, BRIDGEPORT, CONN.

Under the stimulating influences of what is known as Sanitary Reform, the outgrowth mainly of the systematic organization of state and local boards of health, there is in some localities a laudable desire among the school and building committees to improve the general condition of existing school-houses, and in those about to be erected to embody, in a greater or less degree, the lessons taught by sanitary science and practical experience.

While the spirit of this movement is to be highly commended, it is to be deplored that however conscientiously the advocates of better structures for school purposes may labor, they almost invariably fall far short of the desired results. This is directly attributable to several causes.

First, the stereotyped school-house is always before them, and is usually taken as a model for the new building. Committees and teachers are alike slow to depart from the established custom, fearing, if unsuccessful in their efforts to improve, the severe censure they are sure to receive from the community. Many valuable suggestions are not adopted from this cause, it being considered better to leave well enough alone, no matter how bad "well enough" may be.

Second, local prejudice against hygienic reform. The ancient inhabitant classes it with all other modern crazes and new-fangled notions. "In my school days," he argues, "we had no such nonsense, and children were healthy and hearty enough, I am sure. Why should they not be so to-day, with better buildings, and all the so-called 'modern improvements'?" It is true that we have "modern improvements" of all kinds, not only in our buildings, but in our studies as well. The time has been, when a few months' schooling each year in the rudimentary branches was considered an almost unwarranted luxury. The greater portion of the lives of the youth of both sexes was spent in manual labor, thereby strengthening them physically, without taxing the mental powers. They lived, as a rule, in a country thinly populated, and had at all times an abundance of fresh air and exercise. Malarial and contagious diseases were comparatively unknown. Modern civilization and improvements had not contaminated either the soil or the air, as is the case in our day. I venture to say, that, if we could take the healthy, robust children of fifty years ago, and crowd them into our modern badly ventilated, poorly heated, and imperfectly lighted school-rooms, confining them in the unwholesome atmosphere five or six hours daily, subject them to our forcing system of education, and continue this strain for the greater portion of each year without the least thought of their physical culture, the healthy child of "ye olden time" would quickly be reduced to as unhealthy and puny a stripling as the majority of our modern school children.

The very salvation of the child in those days was the small amount of mental labor, and the vast amount of physical exercise required of him. The state of the community at that time required that it should be so, while in our day it is exactly the reverse. It is as absurd to compare the school system and buildings of those days with what is now required as it would be to put the ancient stage line in competition with the railroad.

Third, penurious and short-sighted economy in the appropriation of small sums for the construction of buildings.

The average parents will cheerfully provide their children with suitable, and often expensive, clothing; will indulge them with costly toys; obtain for them special teachers in music, drawing, etc.,—all without a murmur. But should there be a special tax levied to help pay for a new school building, or should he be asked individually to contribute a certain sum for that purpose, you will usually find him as stingy and close-fisted as a miser.

I put it to any thinking man or woman,—which would be most beneficial to our children, money spent in useless toys that please for the moment only, or the same sums invested in the construction of healthful school-rooms in which they may pursue their studies?

In nine cases out of ten, where first-class professional talent has been secured by a committee to adorn and assist in the planning and construction of new buildings, this talent is so hampered by the meagreness of the means at hand that it is impossible to improve much upon what has already been done. Should a request for an additional appropriation be taken before a public meeting, there will be a tremendous outburst of popular indignation, and the useless waste of public funds will be harped upon on all sides. The committee themselves will be looked upon as vultures trying to prey upon the people's treasury, instead of men of common-sense, who have the welfare of the rising generation in their minds. Until this niggardly policy is abolished, and public sentiment brought into harmony with the spirit of reform, we may expect little or no improvement in our buildings.

The fourth obstacle in the way of thorough sanitary reform in school buildings is the difficulty of obtaining satisfactory data. The average layman has very little idea of the requirements of a thoroughly good school building, and I am sorry to say that a majority of my profession are equally as ignorant. They have yet to learn—many of them—that something more than a showy exterior and rooms large enough to contain a certain number of pupils is required. In many cases some local architect of little experience, or master-builder, is employed, having little or no insight into hygienic or sanitary science; and, with an over-confidence in his own ability, he usually opposes the calling in of an expert, on the ground that such a step would involve an uncalled-for expense, and result in no practical good.

For the enlightenment of unprofessional men generally, and more particularly those who are directly interested in schools or school buildings, I have written this article, my aim being to call attention to existing evils, and to show in a practical way how they may be remedied. I submit for your inspection plans that are based upon correct principles. Objections will probably be raised to them on the score of cost. In answer to this, I would say, that nothing has been introduced that is not essential to sound, healthful construction and practical convenience. The details are simple, and within the range of ability of the ordinary village craftsman, it being my firm belief that any New England town has home talent enough to construct, under proper guidance, buildings that will embody all that the most exacting exponent of school hygiene may require.

SITE.

The selection of a proper site is of the greatest importance. A lot with an area of an acre will be large enough for a one-room building. While being handy and easy of access, it should yet be sufficiently isolated to be unobjectionable to surrounding property owners. It should have, if possible, a southern exposure, be entirely free from dampness, and far removed from stagnant water, or low, marshy ground. Blind drains should be introduced for the drainage of any portion that may be springy, and for the removal of surface water.

As no public system of water exists in most of our suburban towns, we shall probably be forced to depend upon a well for the supply. It should be situated near at hand, so that water may be pumped from it into the building without difficulty. A force-pump, arranged with a two-way connection, should be conveniently placed in the building, and some simple pump in the yard. The "two-way cocks" will enable you to draw water directly from the well, or pump it into a tank in the upper portion of the building, from which it can be drawn for the use of closets and bowls.

In connection with the exposure, I would say, that of all lots, I should most prefer one facing the south and west, as by placing your building judiciously, you are enabled to obtain not only the coveted north light, but sunlight for the greater part of the day.

MATERIAL.

The only quality that can commend the universal use of wood in the construction of suburban school-houses is its cheapness. At the outset, it is unquestionably more economical to build of wood than of other material; but if during a series of years the cost of repairs and a consideration of the health and comfort of the occupants are taken into account, surely it is better to pay the difference in the beginning. Few are the localities where good brick cannot be obtained; and there is hardly a village in New England that does not contain within its limits quantities of excellent building stone, easily quarried, and comparatively cheap. Why, then, should not either of these materials be used? A building properly constructed of stone will withstand the storms of centuries; it will be warm in winter and cool in summer, and more pleasing to the eye than the slab-sided abominations that now deface our landscapes. Many people object to stone on the score of dampness; but there is not the slightest danger of this, with proper construction.

I would not have you think that I advocate the use of expensive hammered or sand-rubbed stone: all that I require is bold quarry-faced random ashler, laid with dark joints, and trimmed, for economy's sake, at angles and armed openings, with selected hard-burned common bricks. These materials to be used on all exterior walls.

The roofs may be covered with slate, or, what is better still, metallic shingles. These are now made in large quantities, and are rapidly growing in favor; they form a durable, tight, and light roof of pleasing appearance, at an expense not greater than that of first-class slate. Some of the composition roofs are very durable, if well laid, and have usually the merit of cheapness to recommend them.

THE PLAN.

The first thing to be considered by the designer is the size and arrangement of the entrances, class-rooms, principal's rooms, etc., and their connections with the school-room proper. The entrance must be handy and easy of access, the hat and cloak-rooms convenient, and so situated as to have direct communication from either the yard, play-ground, or school-room.

The water-closets for the girls and boys, while being perfectly isolated from each other, should be so situated that the children will not have to leave shelter in cold and stormy weather.

A good dry basement should always be placed under the entire building. I cannot too strongly condemn the practice of building only trench walls, or setting the building on piers close to the ground, whence the dampness is transmitted to the building. By the use of the basement, a play-room is always obtainable, where delicate children can exercise without exposure, and in stormy weather the pupils are not confined to one room during

the entire session. No school-building is complete without a play-room, and its introduction should always be insisted upon.

The school-room itself need not necessarily be a square or a parallelogram, although these are the usual forms. While I do not advocate vagaries of any kind, I fully believe in ingenious and well-studied plans, and am convinced that more pleasing rooms, better adapted for the purpose for which they are to be used, are often obtained by forms which are not run in the stereotyped mould.

The size of the room should be determined by the number of persons it is to accommodate. The number of pupils that should be assigned to a teacher has been fixed at forty-eight by the highest authorities. At least 20 square feet of floor space is required for each pupil, so that, with the teacher, we have 49 times 20, or 980 square feet, this being the smallest permissible amount. I prefer to provide a much larger space, so have shown a room in design No. 1, Plate I, with 1,152 square feet of floor space, or 23.5 per person.

In the design to which I have just referred, I have departed radically from the usual form of modern school-rooms, but in so doing have secured many advantages that could not be obtained in rooms of ordinary shape. Sittings have been provided for forty-eight pupils; the aisles between the desks are 20 inches wide; there are 12 feet between the front desk and the wall behind the teacher, and 6 feet in front of the platform; between the rear seats and wall there are 6 feet 6 inches, and on the sides there are 6 feet between desks and fire-places.

The windows are all in the rear of the pupils; by placing the building as indicated by the cardinal points, we obtain from the windows on the left, the steady north light, and from those on the right, the morning sun. The window-sills are 4 feet from the floor, and the openings run up to within 2 feet of the ceiling (see plate IX); there is provided for each person 411¾ square inches of glass surface, so that in case the east windows were shaded, there would still be over 200 square inches of glass surface per person, and that too on the north side of the building. By this arrangement of windows, there can be no dark corners, as the light has to travel but a short distance to reach the utmost limits of the room. Sunlight, so essential to the health of the

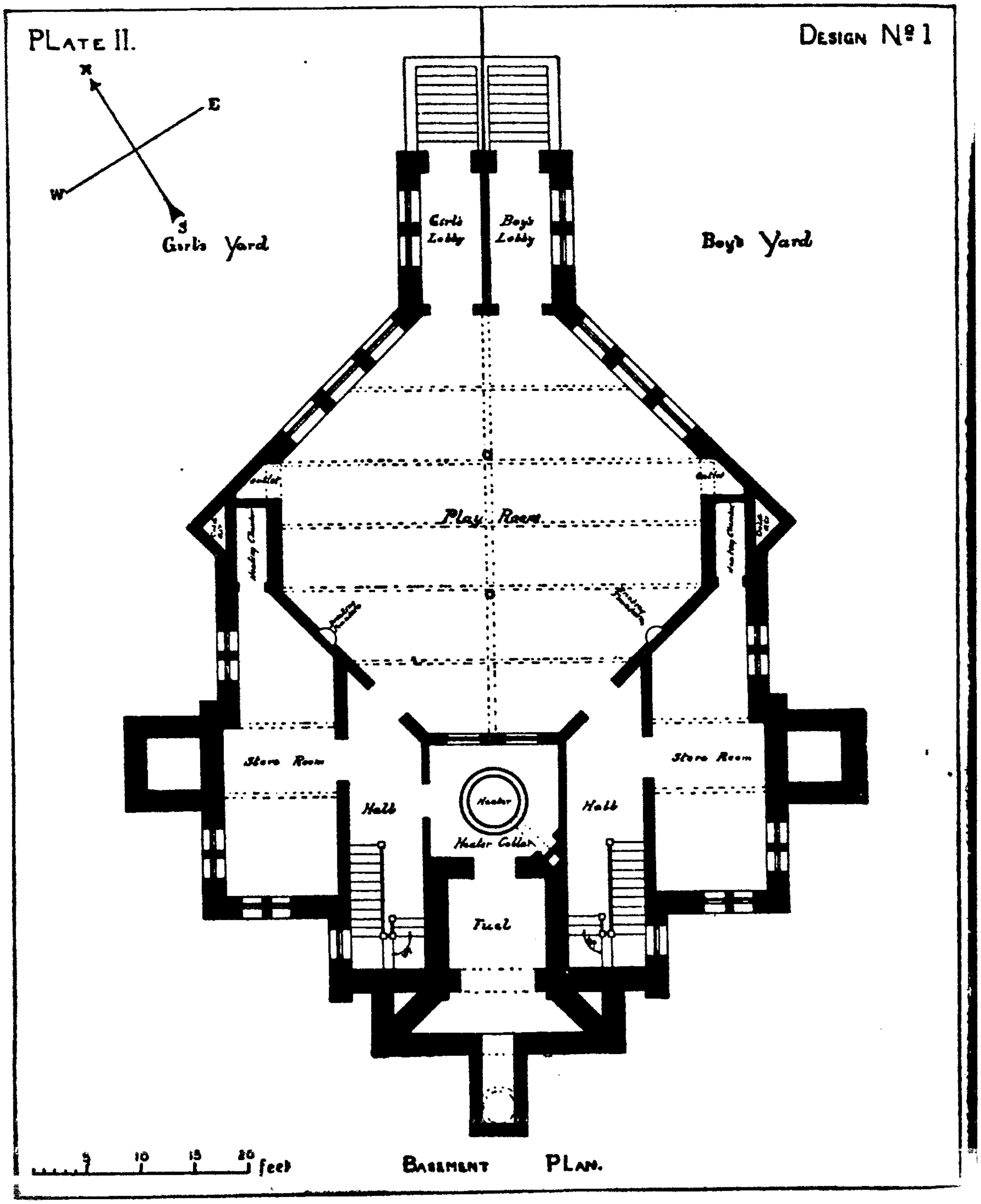


Plate II.
Design No. 1
N
E
W
S
Girls Yard
Girl's Lobby
Boy's Lobby
Boy's Yard
Play Room
Store Room
Hall
Heater
Heater Cellar
Hall
Store Room
Fuel
5
10
15
20
feet
Basement Plan.

occupants, is furnished in abundance, and in warm weather a free circulation of air in all parts of the room may be obtained, by the combined use of the windows, and the large transoms over the entrance doors. (See plate X.)

The arrangement of the pupils' desks is convenient and compact, and the situation of the teacher's platform such as to bring the pupils under his easy supervision.

A teacher's room in the front and a class room in the rear are entered from two angles of the room, while commodious fireplaces are placed in the others.

The blackboards are situated in the rear of, and to the right and left of, the teacher's platform. By this arrangement, all the pupils face the boards, so that there can be no twisting nor straining of necks in order to see. (See plate X.)

A study of the plan will clearly show the arrangement of porches, entrances, hat and cloak-rooms, and water-closets. While a common front entrance is provided, the sexes are completely isolated by the intervening teacher's room and entrance halls,—this too, without sacrificing, in any way, the convenience of the plan. Stairs descend from either side to the basement, the whole space under the school-room being used as a play-room. Doors in the rear of the play-room lead either to the boys' or girls' yards. (See plate II.)

The height of the main school-room is 14 feet in the clear, therefore it contains 16,128 cubic feet of air, or an allowance of 347 cubic feet for each person. This amount, with ample floor and glass surface, renders the room, hygienically, as perfect as it is possible to arrange a room, without, of course, considering the method of construction, or the heating and ventilating. If we are equally thorough with these, and the sanitary arrangements, I believe we will have produced a school-house in which children can pursue their studies with perfect safety.

While I should always advocate the use of stone or brick for the exterior walls of school-buildings, let it be understood that however strongly I might urge their use, it is not absolutely essential that they should be employed to produce a building based upon the same plan, and containing the same floor space and cubic contents, as the one just described; it is perfectly feasible to construct any of the designs, herein presented, entirely of wood, both exterior and interior. It is in the methods of construction usually employed that I do not believe; and I shall endeavor now to describe a building constructed upon what I consider correct principles, and embodied in the designs presented.

FOUNDATIONS.

Great care should be taken with this part of the work, as any settlement will cause cracks and injuries to the structure that it will be almost impossible to remedy. Heavy footing-stones should be placed under all walls. The walls themselves should be laid in half and half lime and cement mortar, with heavy bond-stones running through them once in every six superficial feet. Where basements are used as play-rooms, the inner surface of the walls should be faced with brick, laid with close struck joints; this surface to be painted with two or three coats of pure lead and oil, either in white or some light neutral tint.

UNDERPINNING.

At the grade level, on top of foundation walls, there should be laid a blue stone coping, 4″ × 12″, this to project one inch over foundation walls (see plate VI); the underpinning should start from this coping, and should be rock-faced random rubble, laid in black mortar, with one inch draft lines at angles, and around all openings.

WALLS.

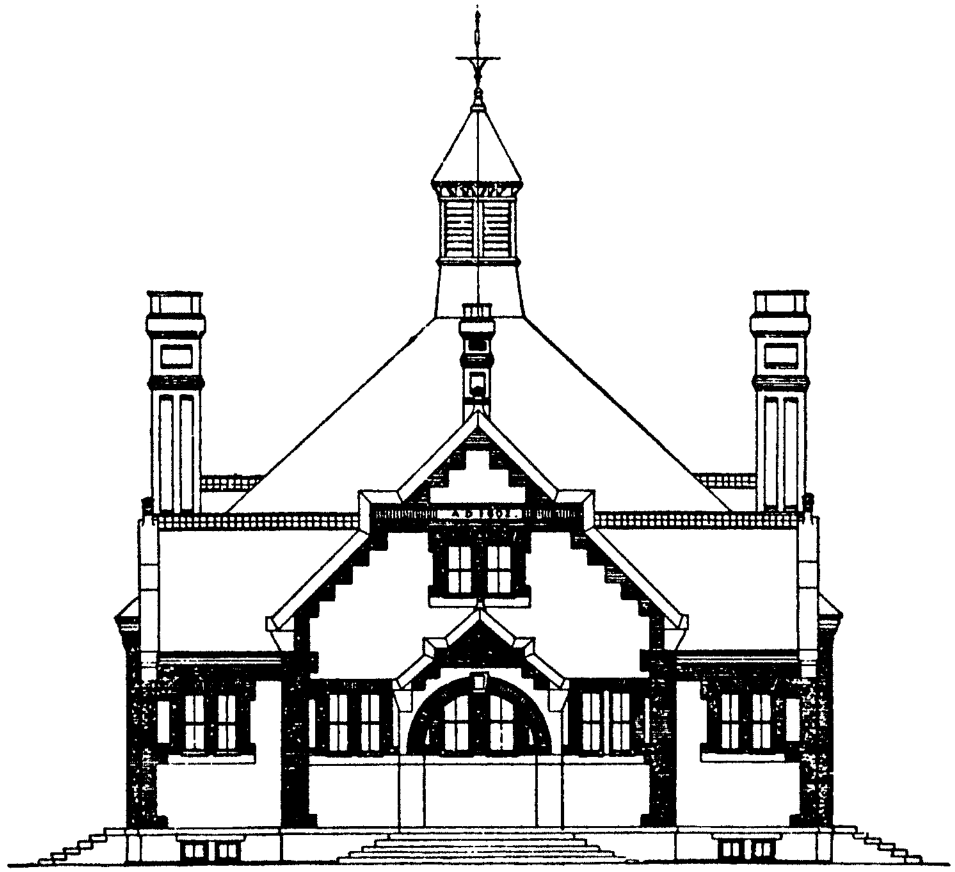
If stone with brick trimmings is used, the walls should be 26 inches thick; 16 inches of stone work, 2 inches of air space, and 8-inch brick backing (see plate X); the backing should be bonded to the outer wall by brick headers, or ties of thin iron or copper;—the latter is much the better, as it does not rust out, and will not transmit dampness, as is the case with the brick ties. The angles and armed openings may be laid with brick, as indicated on the elevations and details. The cornice may be entirely of stone and brick (see plate VI), and the gutters of iron or copper.

ROOFS.

The roofs should be covered with metallic shingles, and the ventilators and belfries constructed of light iron, which may also be used for cresting.

PLATE III.

DESIGN No. I



FRONT ELEVATION

5 10 15 20 feet

With a structure built as above described, you will have an exterior comparatively imperishable; and if the work is well done, it will be many years before any expenditure will have to be made for repairs.

INTERIOR—FLOORS.

Wood is almost universally used for floor beams;—indeed, with one or two exceptions, I have never known of iron being used, even in the most expensive buildings for schools. Far better and more durable floors can be obtained by the use of iron, and costing but little more than first-class wood-work.

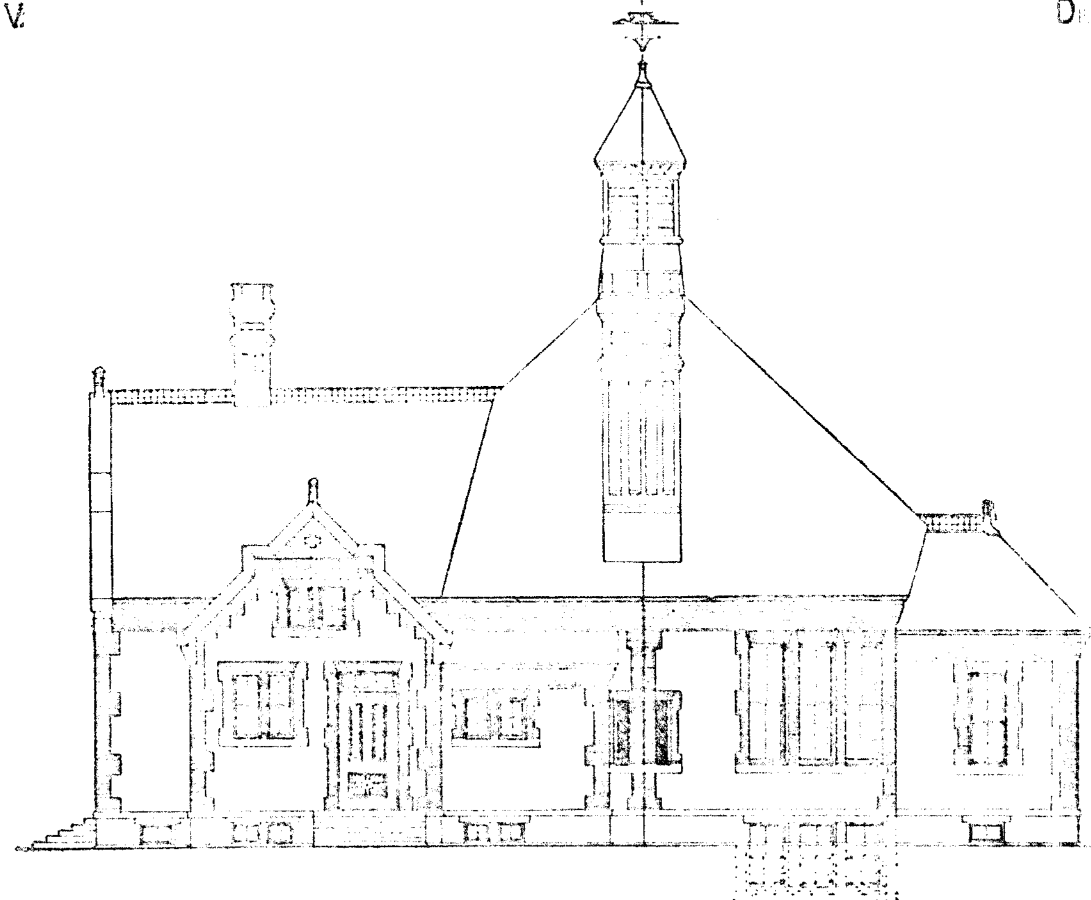
The common way of constructing floors is to lath and plaster the under side, and lay flooring over the top of the timbers. No better way could be devised for the circulation of air and fires, and no finer highway for the use of vermin who make use of the receptacles furnished by the builder for the storage of garbage collected on their marauding expeditions. The mischievous urchin also delights to poke rubbish into every convenient knot-hole he can find. I remember, when a boy, to have seen a venturesome schoolmate cap the climax by introducing a lighted match into a time-honored hole which had received the donations of generations of school-children. The result must have been entirely satisfactory to my friend, as he succeeded in breaking up the school for some time, after causing a serious panic and much damage.

To construct a floor of wood suitable for school purposes, extra heavy timbers must be used, which should be strongly bridged and stayed; they should be cross-furred on their under side, and wire netting should be fastened to this, on which to plaster; double floors should be used above, with heavy deadening felt between. This makes the best wood floor that can be laid, but it is expensive, and is open to all the objections I have mentioned. Sound is easily transmitted, and the spring and oscillation caused by marching or calisthenic exercises produce a jar that is felt throughout the building, often so severe as to cause the walls to crack and ceilings to fall.

Iron floor-beams are far preferable, and for ordinary spans need not be over ten or twelve inches deep, and can with safety be placed from five to eight feet on centres. Arches of hollow fire-

PLATE IV.

DESIGN Nº I



SIDE ELEVATION.

5 10 15 20 feet

proof brick should be turned between these beams, so formed as to entirely cover them. (See plate V.)

Strips of wood two inches square should be firmly secured to the top of the beams, to which to nail the floor, and the spaces between these strips, on top of the arches, should be carefully levelled up with solid cement.

A single hard wood floor may now be laid and firmly nailed to the strips, and the plastering may be applied directly to the under side of the brick arch, without cross-furring, lathing, or any wood-work whatever. If hard-wood ceiling should be desired, it is only necessary to screw strips to the under side of beams, as described for the upper, and nail the ceiling directly to these strips. For play-room or basement ceilings, the surface of the hollow tiles is all that is necessary, with carefully struck joints, to make a perfectly neat job. If the holes at the outer ends of the lines of hollow tiles are carefully stopped, as they should be, you will have a floor that is not only absolutely fire-proof, but through which vermin have no chance to circulate; sound cannot be transmitted through it; it is perfectly rigid, and will support five times the weight of a wooden floor without deflection. The flooring boards should be oak or maple, laid in narrow widths and blind-nailed.

INSIDE WALLS.

It is the universal custom to line all our stone or brick walls with wood,—that is to say, that we fur the inside surfaces of brick or stone walls, with wood strips on which to nail lathing: even when wire lathing is used, furring strips cannot be dispensed with. This method of construction introduces highly inflammable material on walls that otherwise would be incombustible. Again: we cover the lathing with a thick coat of plaster—a substance of a most perishable nature, and which is, moreover, an absorbent which becomes loaded with impurities; dampness is often perceptible upon its surface, and it is no rare thing to see mould. However much care may be taken in its preparation, and carefully as it may be applied, it is but a short time before a dirty, grimy appearance is noticeable.

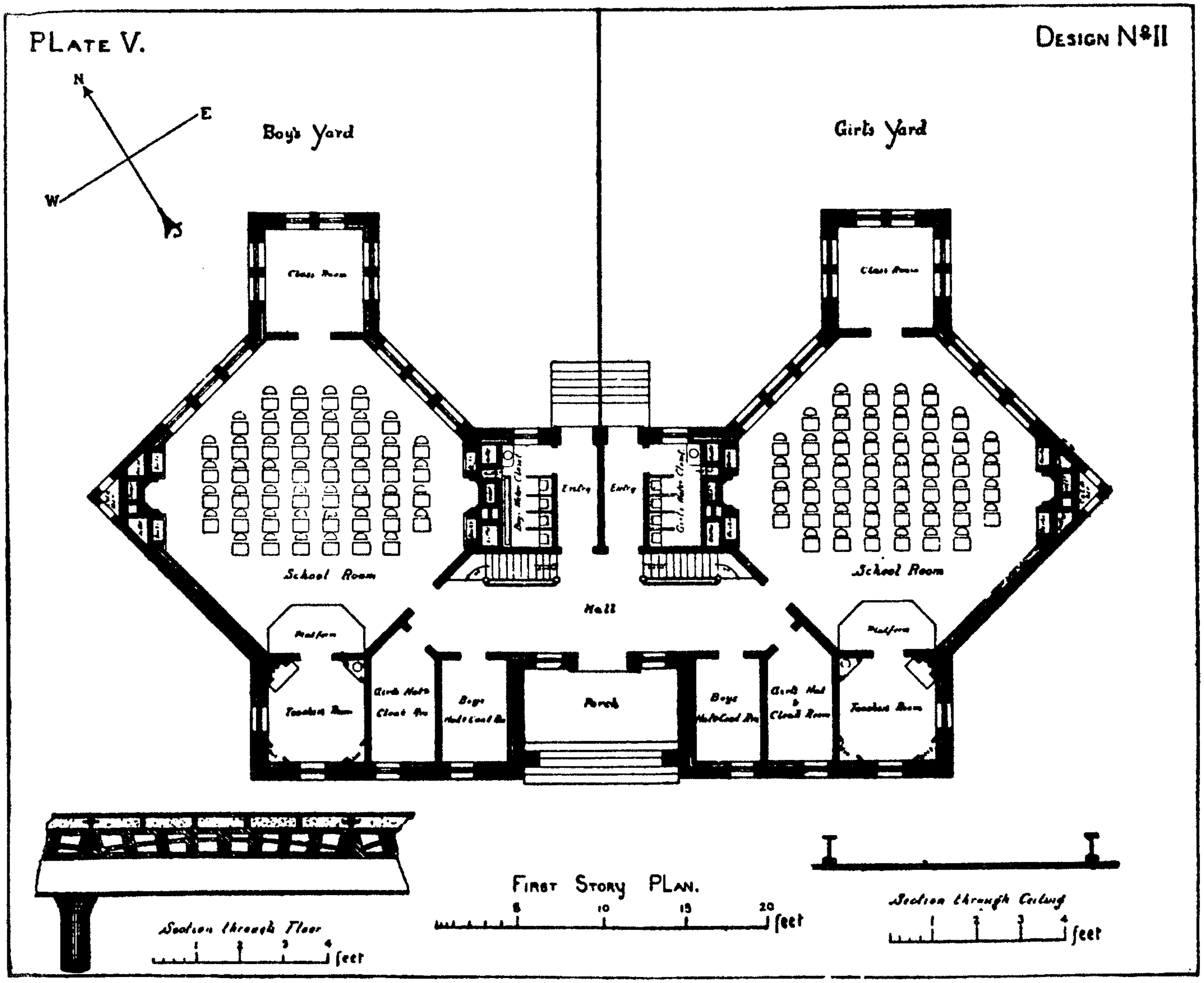


PLATE V.
DESIGN No II
N
E
W
Boy's Yard
Girls Yard
School Room
School Room
Entry
Entry
Hall
Porch
First Story Plan.
Section through Floor
Section through Ceiling
feet
feet
feet

You ask how all this is to be remedied; and I would answer, By the use of enamelled brick. These are made in large quantities and of excellent quality, in all colors; their surface is like porcelain, and as hard as adamant; if they are laid with cement to match their color, they form a wall not easily marred, non-absorbent, and very pleasing to the eye. Not only the walls, but the door and window casings may be built of these bricks, and there need be no more wood about the doors and windows than their actual operation requires, which is very little, as may be seen from the detail drawings on plates IX and X.

A dado may be carried around the room, of dark brown or chocolate colored bricks, the door and window casings being of the same; above the dado, a slate blackboard of suitable size is set, and above this a field of buff or neutral tinted brick, finished by a frieze laid in fancy patterns of different colored bricks. A picture moulding, from which to suspend maps, &c., should run entirely around the room at a suitable height, this being, with the blackboard band and chalk rack, all the wood, outside of the doors and windows, required on the inside wall. This wood, so far as practicable, should be of ash, filled with a heavy coat of stone filler, varnished in two coats, and carefully rubbed down.

A room well built, as I have described, would last, with ordinary care, for a century. The walls could at any time be scrubbed down with hot water, or a hose turned upon them, without injury. The effect of a room finished in this way is far more pleasing than the ordinary glaring white walls, and I can see no sustained objection to the introduction of this class of work.

For the ceiling, I should recommend, in rooms that have nothing over them, light iron beams, upon which narrow ash ceiling boards are firmly fastened (see plate V); where there is room over room, ceil them, as I have before mentioned, directly on the hollow flooring blocks. These wooden ceilings may be panelled and made as elaborate as desired, according to taste and the length of the purse. By all means, do away with plaster: it is an abomination, and the sooner it is banished from our schoolhouses the better it will be for the health of the children.

The main argument against finishing walls, as I have described, will be, I presume, the expense; but when it is considered that we do away with, entirely, the furring, lathing, and grounds, all

You ask how all this is to be remedied; and I would answer, By the use of enamelled brick. These are made in large quantities and of excellent quality, in all colors; their surface is like porcelain, and as hard as adamant; if they are laid with cement to match their color, they form a wall not easily marred, non-absorbent, and very pleasing to the eye. Not only the walls, but the door and window casings may be built of these bricks, and there need be no more wood about the doors and windows than their actual operation requires, which is very little, as may be seen from the detail drawings on plates IX and X.

A dado may be carried around the room, of dark brown or chocolate colored bricks, the door and window casings being of the same; above the dado, a slate blackboard of suitable size is set, and above this a field of buff or neutral tinted brick, finished by a frieze laid in fancy patterns of different colored bricks. A picture moulding, from which to suspend maps, &c., should run entirely around the room at a suitable height, this being, with the blackboard band and chalk rack, all the wood, outside of the doors and windows, required on the inside wall. This wood, so far as practicable, should be of ash, filled with a heavy coat of stone filler, varnished in two coats, and carefully rubbed down.

A room well built, as I have described, would last, with ordinary care, for a century. The walls could at any time be scrubbed down with hot water, or a hose turned upon them, without injury. The effect of a room finished in this way is far more pleasing than the ordinary glaring white walls, and I can see no sustained objection to the introduction of this class of work.

For the ceiling, I should recommend, in rooms that have nothing over them, light iron beams, upon which narrow ash ceiling boards are firmly fastened (see plate V); where there is room over room, ceil them, as I have before mentioned, directly on the hollow flooring blocks. These wooden ceilings may be panelled and made as elaborate as desired, according to taste and the length of the purse. By all means, do away with plaster: it is an abomination, and the sooner it is banished from our school-houses the better it will be for the health of the children.

The main argument against finishing walls, as I have described, will be, I presume, the expense; but when it is considered that we do away with, entirely, the furring, lathing, and grounds, all

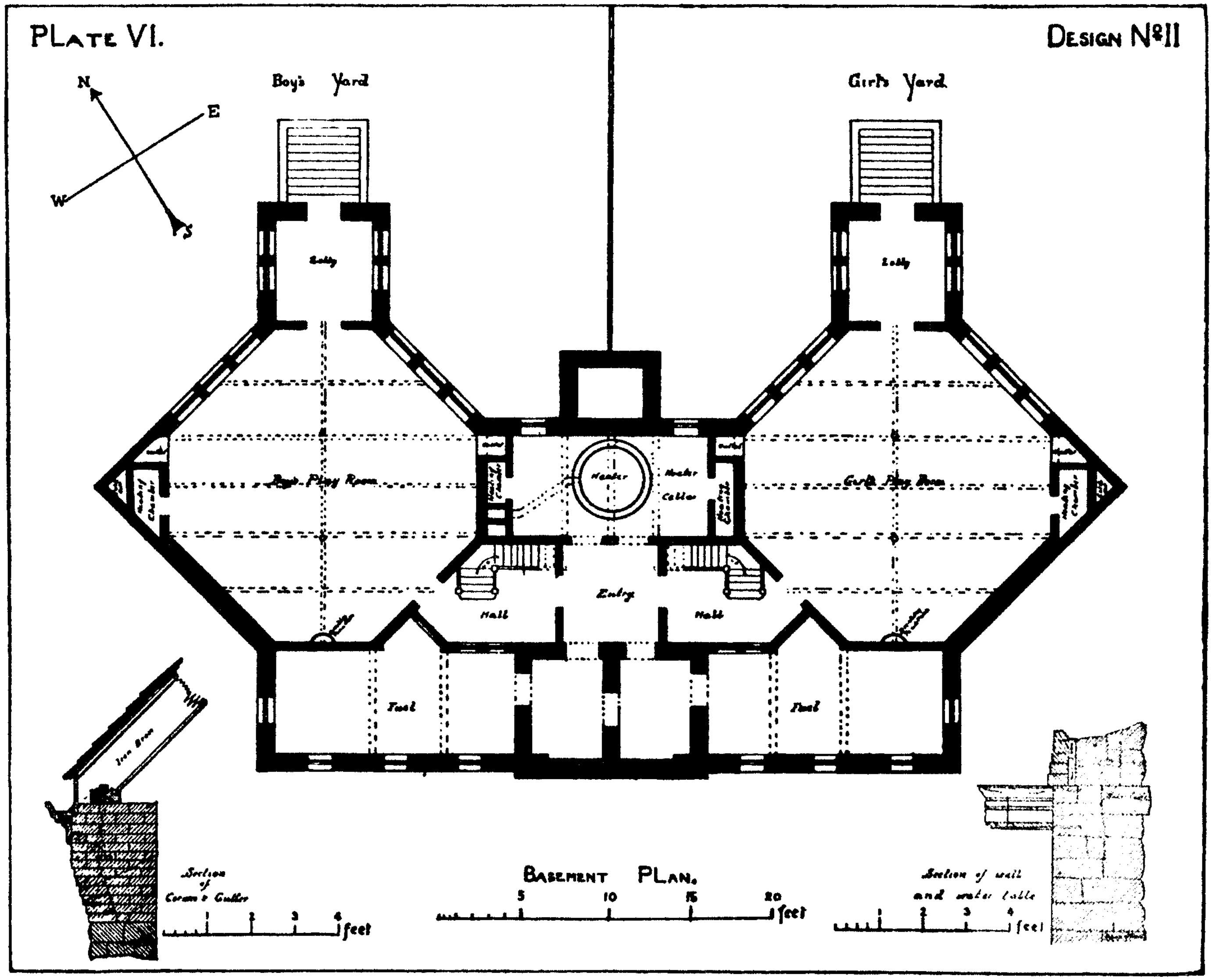


PLATE VI.
DESIGN No II
Boy's Yard
Girls Yard
N
E
W
Lobby
Lobby
Boys Play Room
Girls Play Room
Heater
Heater Cellar
Entry
Hall
Hall
Fuel
Fuel
Iron Brace
Section of Cornice Gutter
1 2 3 4 feet
BASEMENT PLAN.
5 10 15 20 feet
Section of wall and water table
1 2 3 4 feet

plastering, door and window casings, wainscoting, base-boards, and plinth blocks, surely the difference in cost cannot be so great.

MISCELLANEOUS.

It would be well to make the floors of all rooms, except the school, teacher's, and class rooms, of encaustic tile, firmly bedded in cement. The entire basement should be treated with a heavy coat of concrete; the play-room and adjacent hall may have an additional covering of asphaltum, such as is used for sidewalks.

The windows of the school and class-rooms should have two thicknesses of glass, set in the same sash, about one half inch apart (see plate VII); this will answer all purposes of outside sashes, is always in place, and between the sessions the room can be flooded with pure external air, which is prevented by the use of the outer sash. Four lights per window are best adapted for school use; a greater number of sash-bars only cast disagreeable shadows and obstruct the light. Sash should be carefully adjusted and balanced, and metal sash-chain used instead of cord; fixtures should be so arranged that they may be easily worked by the teacher at all times.

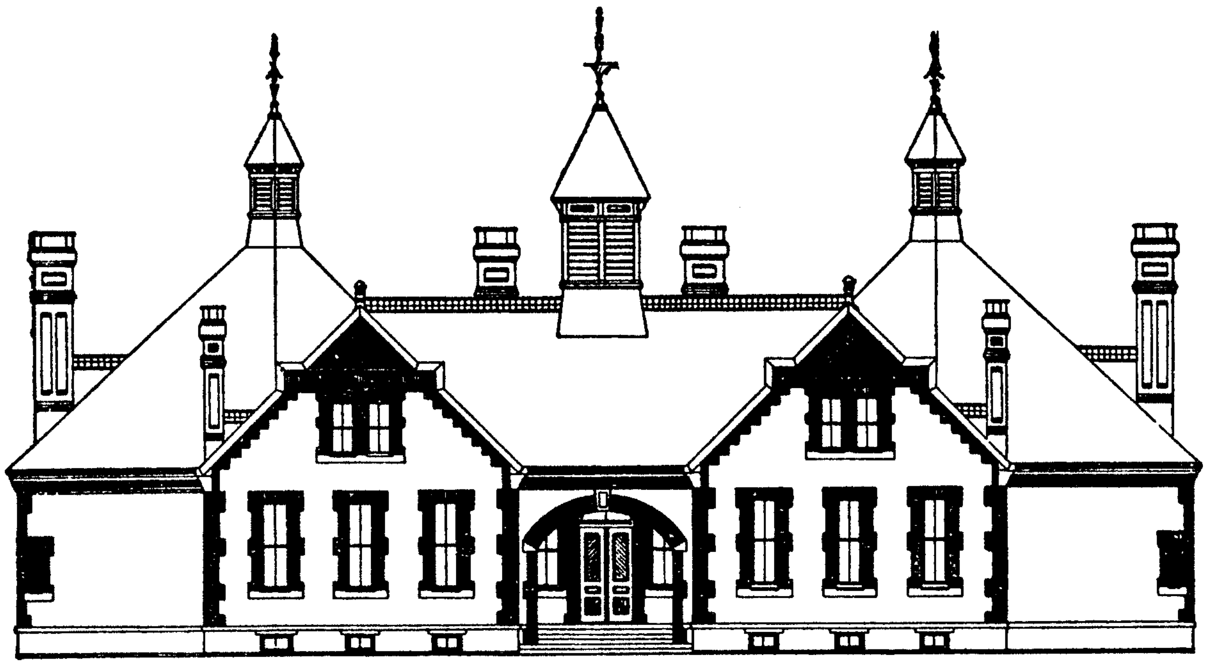
Outside blinds are not wanted on a school-house, inside blinds are noisy and in the way, and the ordinary Venetian blinds and the common shade are invariably out of order when most needed, and are objectionable on account of flapping and blowing in the wind. The best shade that I have yet seen is what is known as the Wilson Rolling Venetian Blind. It is made of any wood desired, and is light, strong, and durable, noiseless in operation, and cannot blow or flap. While completely screening the room from the sun's rays, it still admits of a free circulation of air. Special provision has to be made for it in the construction of the building, as it coils up neatly either above or below the window opening. (See plate IX.)

Doors should always have a transom over them as large as is practicable, operated by cords or rods; the latter is the better method, as the transom can be made stationary at any desired point. Doors should always swing out, so that in case of a panic there may be no obstruction to the effort to leave the building.

It is better to have the teacher's platform movable, so that the

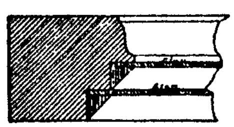
PLATE VII.

DESIGN No. II



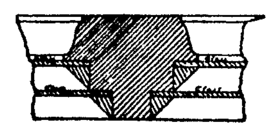
FRONT ELEVATION

5 10 15 20 feet



Section of Sash showing double glass

1 2 3 4 feet.



Section of Center Bar

1 2 3 4 feet.

floor can be thoroughly cleaned under it: by the use of hooks or bolts, it can be firmly fixed in position.

Slate blackboards, although expensive, are by far the best, and cost nothing for repairs.

In seating, I believe in the single desk. While it takes up more room, it is much better for the child in many ways, and the teacher has better control over the school. Each child should be given all the floor space possible, and there should be a free circulation of air all around him.

I would say a word just here concerning the modern school-desk. While there is an unlimited number of patent desks before the public, neat and even elegant in style and finish, I do not know of one in which the seats are even comfortable; the backs are concave where they ought to be convex, and vice versa; the seats are usually too high, and their shape is such that only monstrosity would fit them; and it is a shame to force any child to occupy, day after day, chairs so ill adapted to the requirements of health and comfort. I am glad to be able to say, that under the direction of the energetic Board of Education of the city in which I write, a large New York firm have undertaken to manufacture desks and chairs for their new school-building, designed upon a common-sense principle, combining simplicity, utility, comfort, and elegance.

WATER-CLOSETS, ETC.

Whatever care may be taken in the construction of other parts of the building, if the sanitary arrangements are neglected, the structure, so far as its healthful usefulness is concerned, will be a failure.

I am aware that it is an uncommon occurrence to find water-closets in any school building outside of a city. Privies situated in the yard are considered sufficient. They are usually poorly built, and are only accessible by exposure to the weather, and are anything but elevating to the morals of the children. In some instances, you will find privy-vaults under the same roof that covers the school-room—this, too, without any attempt at ventilation. The evils arising from a vault so situated cannot be estimated. In some cases earth-closets have been introduced with

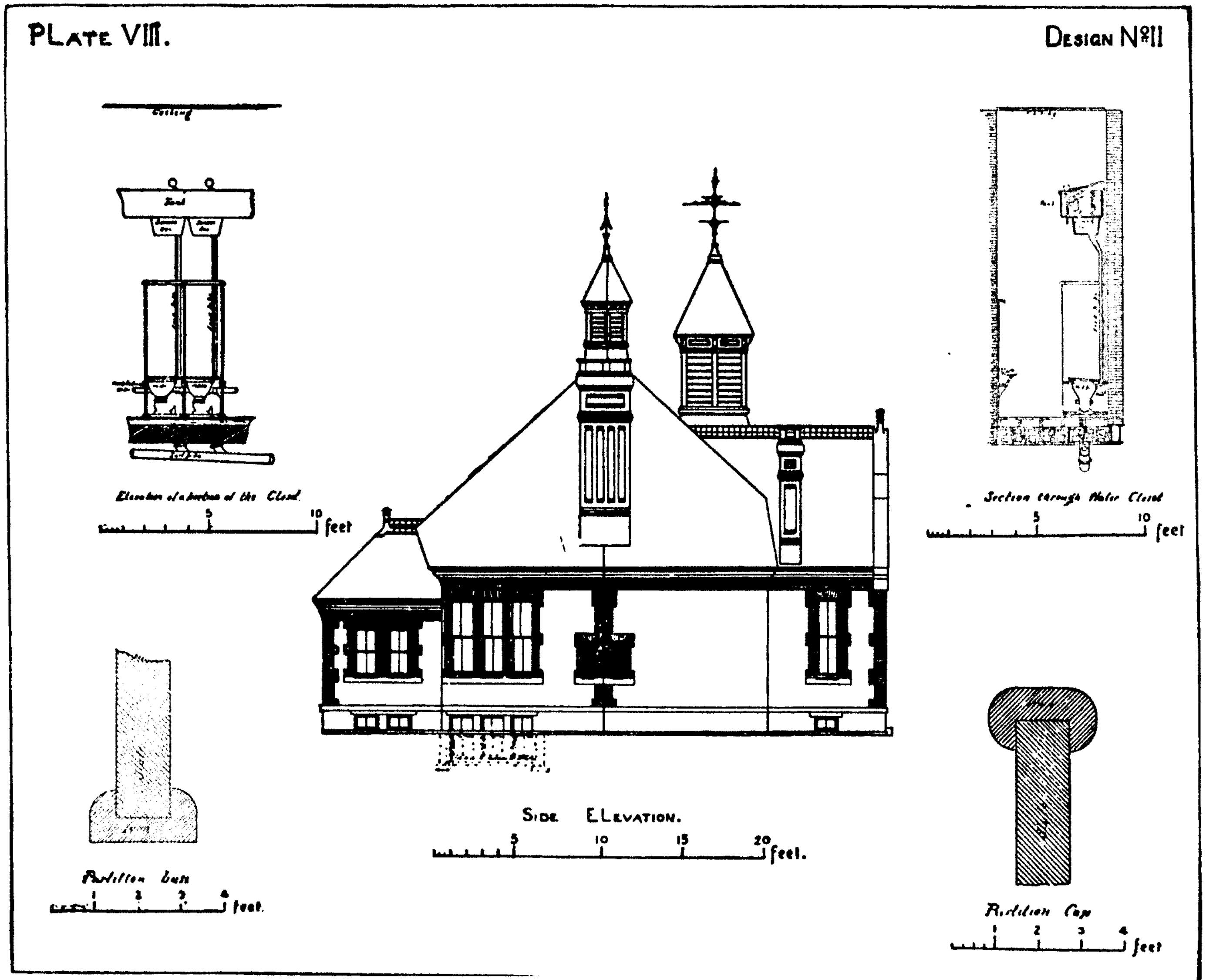


Plate VIII.
Design No. II
Elevation of a portion of the Closet
5
10
feet
Section through Water Closet
5
10
feet
Side Elevation.
5
10
15
20
feet.
Partition base
1
2
3
4
feet.
Partition Cap
1
2
3
4
feet

success, and if properly built and systematically looked after, they work well, and can be placed in such a position that a child need not be exposed to the cold or wet in passing to and from them.

I think there is nothing better than a good water-closet properly set, and can see no reason why they should not be generally used in suburban school-houses. From the roofs of ordinary structures large quantities of rain-water may be collected and stored in cisterns conveniently located. These, with a good well, should furnish an ample supply of water, that can be pumped by an ordinary force-pump, supplied with a two-way cock, from the well or cistern into a tank in the attic. A few minutes' work daily will keep the tank properly filled. As the school is closed during the hot, dry months, when sometimes we have a drought, there can be little danger of the water failing, provided a reasonable amount of care is exercised in its use. With a good circulation of water assured, there can be no objection to the use of closets. A simple hopper of porcelain is the best, arranged with iron service and feed-boxes overhead, the valves in the boxes to be connected with the wooden seat over hoppers in such a manner that the weight of the occupant will cause a flow of water, flushing the closet thoroughly each time it is used.

The floors of the closets, except under hoppers, should be of tiles, and the side walls of enamelled brick, as before described. That portion of the floor upon which the hoppers stand should be of dark-blue slate, about 2 feet wide and 2 inches thick. The hopper should be firmly bolted to the slate with brass bolts, an outlet being cut through the slate for the mouth of the hopper. There should be a slate partition between each hopper about 6 feet high, 2 feet broad, and 1¼ inches thick. A light iron frame and capping (see details on plate VIII) should hold this in position. The seats should be of wood, resting on cleats that should be bolted through the slate partitions.

The urinals may be simply slate troughs with backs of the same material, or the individual porcelain urinals that are in common use.

A marble wash-bowl should be provided in each dressing-room, and drinking water pumped directly from the well. The hoppers should be of white porcelain exposed to view. The soil pipes and

199

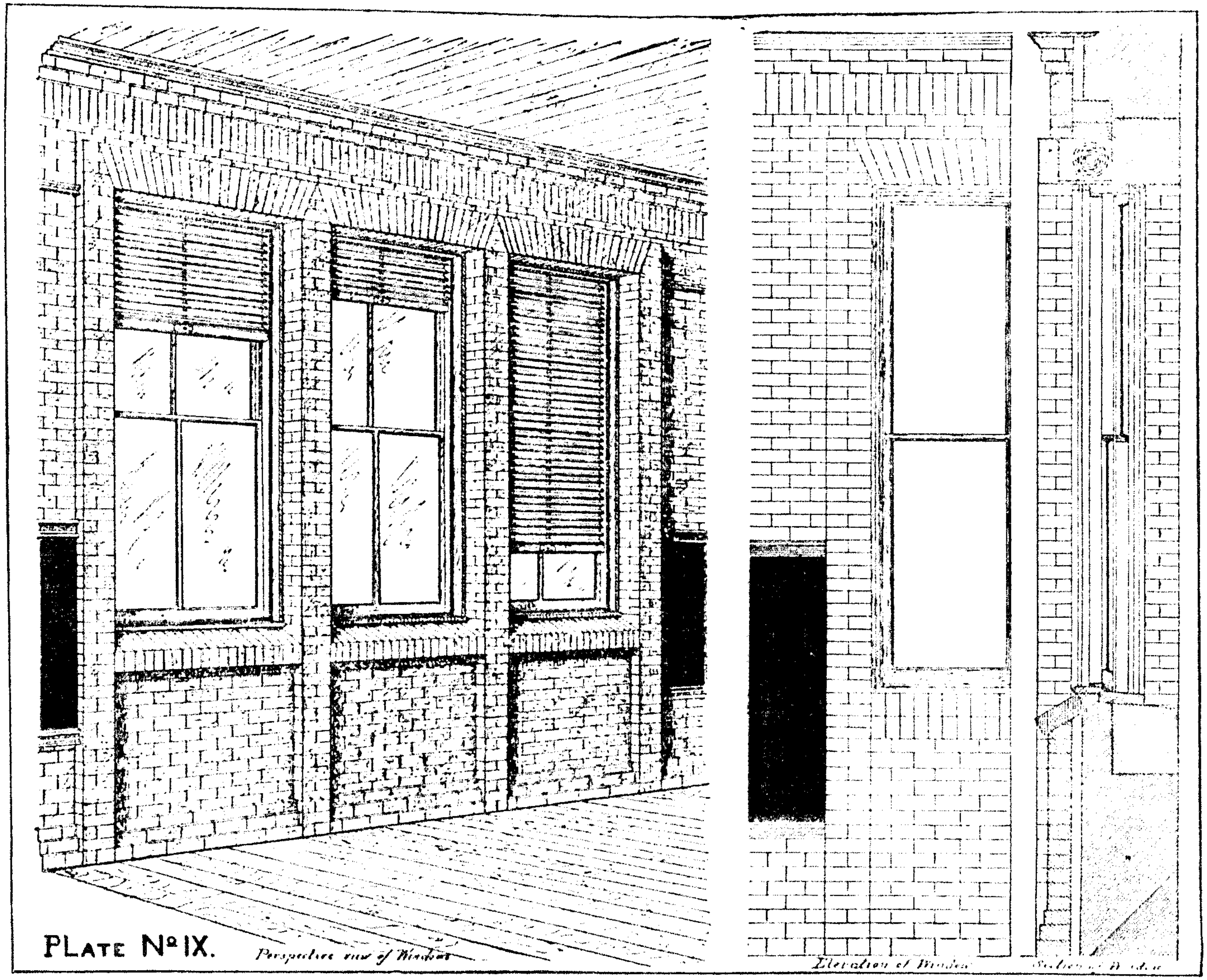


PLATE No IX.

traps should run out of the building as quickly as possible, and be easily accessible for inspection at all times. It is well to paint their outer surface white, as any leak or escape of gas quickly causes discoloration, and is at once detected.

The utmost care should be taken in the ventilation of the traps, pipes, and drains, as, however costly the fixtures may be, unless they are properly ventilated they will be objectionable.

As no public drainage is likely to exist, a cesspool will probably have to be used for the reception of sewerage. Let this be as far as possible removed from the building, and placed in some remote, unfrequented corner of the lot. By all means use a tight cesspool, and do not on any condition use the leeching cesspool, as it is impossible to tell what course may be taken underground by the filth discharged from it. Pollution of well or spring water at long distances has often been traced to this cause, while hundreds of undiscovered cases now exist. A tight receptacle of ample size, thoroughly built and properly ventilated, will not be obnoxious, and can be pumped out once or twice a year at a small expense. It would be useless to attempt a system of sub-irrigation for a single building of small size, for while this disposal of liquid waste has much to recommend it when planned upon an extensive scale, I do not consider that it can be practically applied upon a single building without a very large expenditure of money.

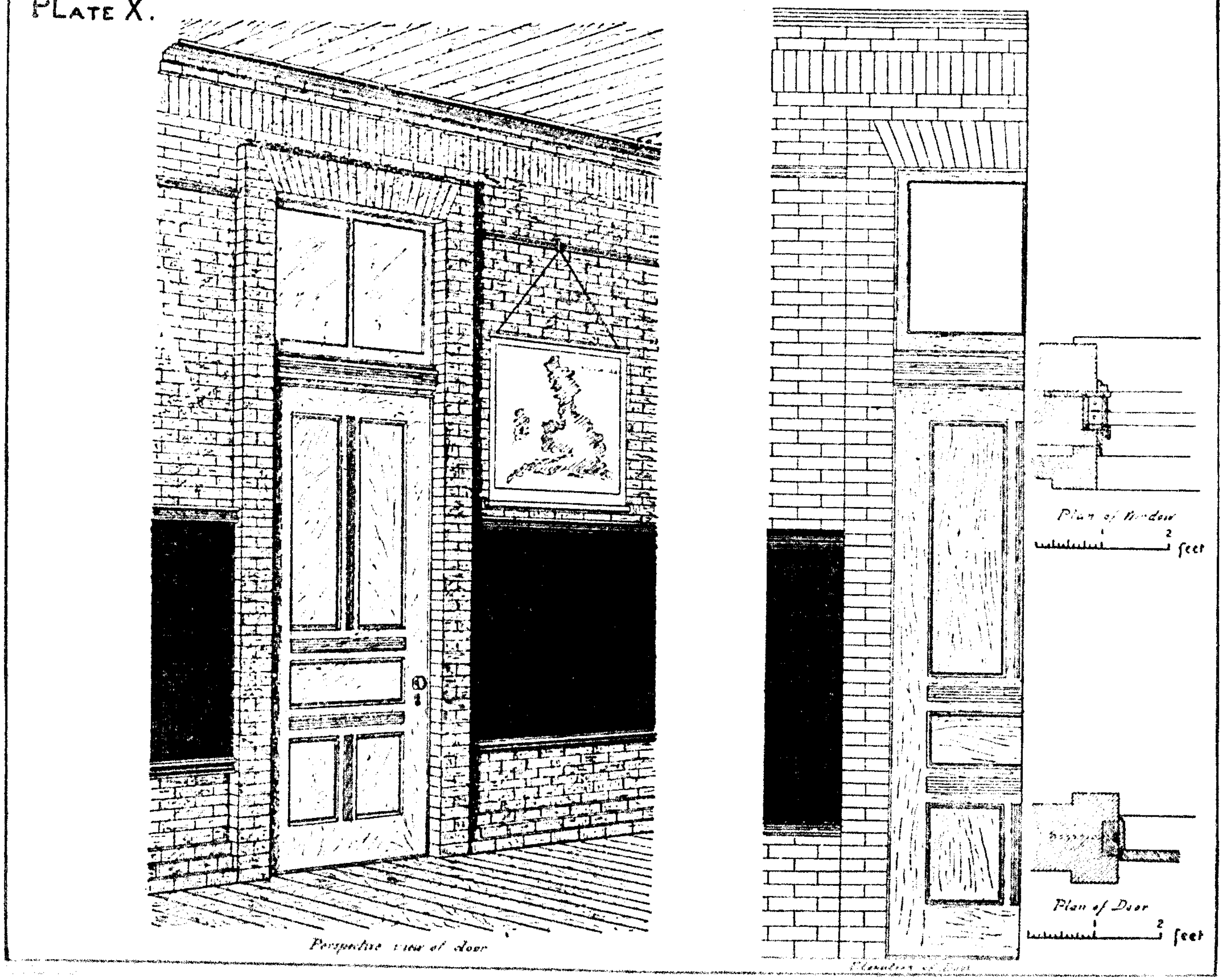
HEATING AND VENTILATION.

Under this head will be found the true test of the successful hygienic construction of a building. To heat any room to a required temperature in the coldest weather is a very simple matter. To bring into the room a sufficient supply of pure, warm air, to remove the vitiated air, maintaining at all times and in all parts of the room a steady circulation or mixing of the air without causing unpleasant draughts, is a far more difficult thing to do. That it can be satisfactorily done is only a question of understandingly applying the means that are at hand.

In the smaller rooms and the halls of the accompanying plans I would use direct steam. In the main school-room the indirect system will be far better.

Before going into the details of the heating apparatus, it would

PLATE X.



Perspective view of door

Elevation of Door

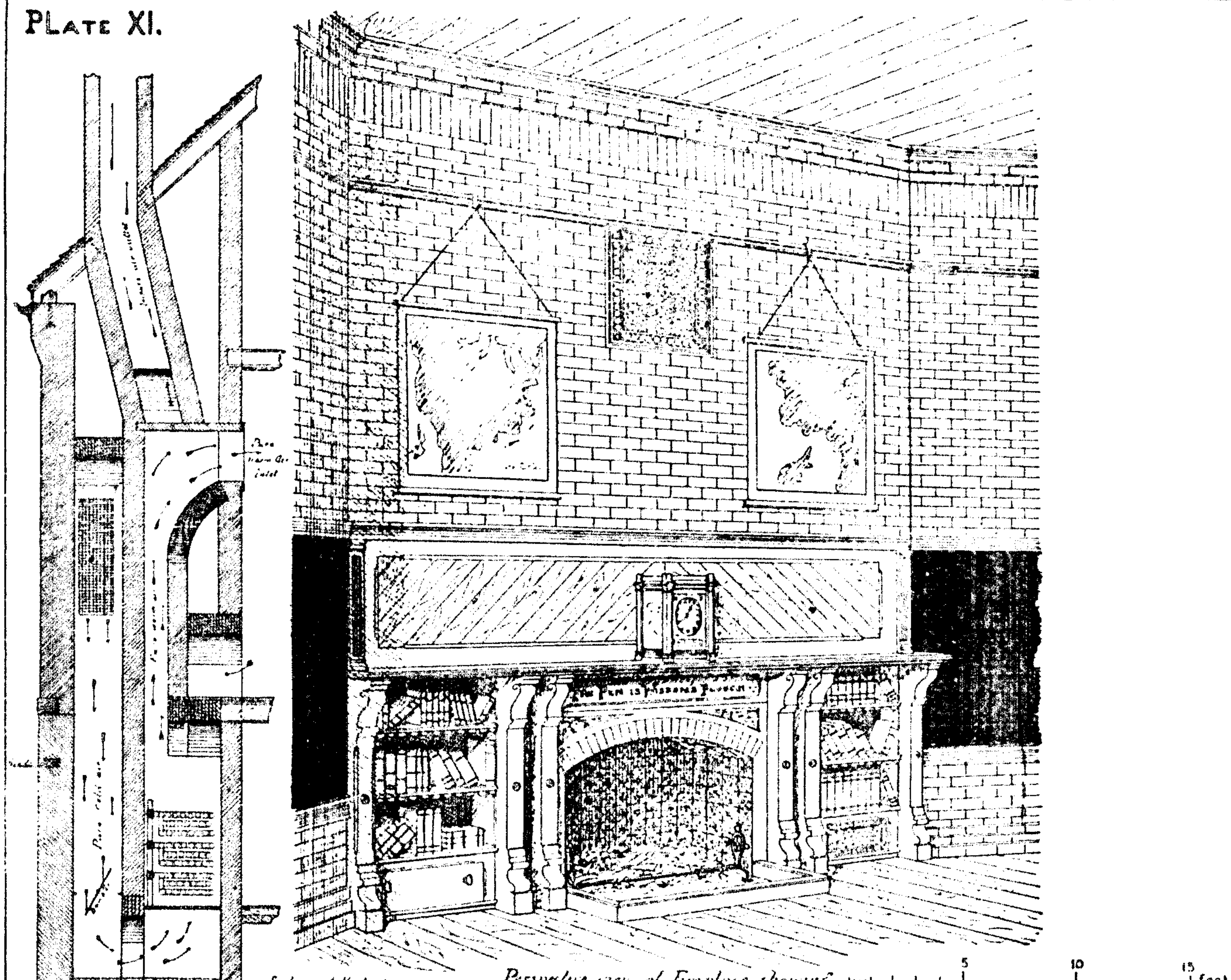
be well to consider briefly the requirements of the school-room, the quantity of air that it is necessary to supply, the capacity and position of the incoming and outgoing registers, and the general laws governing the movements of air.

The school-rooms that I show on the accompanying plans contain about 16,128 cubic feet of air, an average of 347 cubic feet per person. I believe in supplying to each occupant as near 30 cubic feet of pure warmed air per minute as possible. To do this, we shall be obliged to bring into the room every hour 1,800 cubic feet per person, or a grand total of 88,200 cubic feet. Of course, if this amount is brought in, proper provision must be made for its removal as soon as it has become vitiated, which will cause the displacement of all the air in the room 5½ times each hour, or once in about eleven minutes. Some may consider the quantities I have named in excess of the actual requirements, and that it is not possible to introduce and move such quantities of air, unless a gigantic apparatus is used and an enormous amount of fuel consumed. In answer to the first objection, I would say, that the highest medical authorities insist upon about the same amount as a standard;—and to the latter, if the apparatus is properly constructed, and understandingly handled, no unnecessary expense will be incurred.

There is much diversity of opinion among experts as to the position of incoming and outgoing registers. Many advocate placing the incoming registers in the floor, some on the side walls near the floor, and a few high up on the side walls. The latter is the only proper place for them, and it seems to me the worst kind of bigotry, with our knowledge of the action of warmed and cooled air, to insist that the floor is the best place. We all know that warm, pure air is light, and will rise rapidly to the top of the room, no matter at what point it is introduced. It is an equally well established fact, that foul air is heavy and settles in the lower part of the room. I cannot understand why, with these facts before them, it is still sometimes argued that the floor is the best place for registers. If you introduce the pure, warmed air there, you are bound by natural laws to carry it through a stratum of impure air before it reaches the top of the room; and I think no one will have the hardihood to claim that it has passed through the impure stratum without becoming contaminated.

203

PLATE XI.



Section of Heating and Ventilation Flue

Perspective view of Fireplace showing incoming hot air register & outgoing foul air register

Why, then, is it not better to avoid this contamination, and bring the air into the room as near the ceiling as is practicable? Your registers will cost no more, and the additional pipe required is a very small matter.

Another strong objection to floor registers is, that dust and dirt are continually deposited in them, especially when not in use: this dust is mixed with the incoming air, and carried directly to the lungs of the occupants of the room. Another objection some will make to wall registers is, that children cannot warm their feet at them. Much better arrangements for this purpose are "foot-warmers," consisting of coils of steam pipe placed between the floor-beams, encased in tin, and packed in coarse sand to temper the heat; on the top they are covered with flat iron plates, counter-sunk, and flush with the top surface of the floor. These plates should have their top surface roughened with some neat pattern to prevent slipping. The plates may be placed with advantage in the entrance halls, and hat and cloak rooms, and by their use a steady, uniform heat is obtained. The tight iron plate renders the collection of dust upon the surface of the pipes impossible.

The outlet registers should be placed at the floor level, as we know that the air settles there as it cools and becomes laden with impurities, and it should be our aim to remove it as quickly as possible. Outlets are invariably made too small: it is absurd to attempt to bring large quantities of pure warmed air into a room, unless ample provision is made for its removal. It is safe to assume, that if the foul air is withdrawn, enough pure air will find its way into the room to supply the vacuum, the greater portion coming, of course, from the heating apparatus.

It has been repeatedly proved by experiments, that from two to three times as much air will flow through an outgoing as through an incoming flue, which indicates, in rooms of ordinary construction, a continual suction into them of the outer air. It is a mistaken idea to think that foul air will obligingly meander through the small and intricate passages laid out for it, without some motive power for its propulsion. The exhaust flues must not only be of large dimensions, running with as few turns as possible directly to the outer air, but some means must be employed to assure a steady outward current. An exhaust or suction fan placed in the outlets would undoubtedly be the surest way of accomplishing this, but this must be operated by an expensive apparatus, and can only be successfully applied to a very large building. The simplest and most practical method of maintaining the current is by the introduction of heat into the outgoing ducts. This may be generated from a steam pipe running through the flue, by a small stove placed at the lower end, with the smoke pipe running up through it, by a gas-jet kept continually burning during the sessions, or even by a lighted lamp set in the flues.

For the reasons before cited, the outgoing flues should be at least twice as large as the incoming, no matter how large the latter may be: they should be placed in the side walls of the room at the floor level. No better ventilator can be had than the open fire-place, and no more useful, healthful, and pleasant feature can be arranged in a school-room. In the early fall or late spring, it will give all the heat required to render the school comfortable.

I have shown, on my plans, a room arranged with two fireplaces, one on either side of the room, and have also arranged a neat mantle so built that there are shelves for books of reference, or a small school library. Beneath these, on one side, is a drawer, and on the other an exhaust register, for I do not consider even two large chimney flues of sufficient capacity to properly ventilate this room. One or two large ducts are also required, which can, with advantage, be placed in close proximity to the fire-place flues, and so arranged that there need be nothing more than the usual four-inch brick wall to separate them. Enough heat will be obtained in this way to maintain a strong, steady, outgoing current in the foul air ducts.

The hot-air registers, for the introduction of pure warmed air, I have place directly over the fire-places, and high up on the side walls. By this plan I am enabled to concentrate all the heating and ventilating apparatus in the two sides angles of the room.

The situation of the water-closets is such as to secure for them exceptional facilities for ventilation through the same stacks.

The flues for the introduction of pure warm air are all intended to be large, and the flow of air through them moderate and steady. The pipes, where they enter the room, should be splayed or trumpet-shaped, the register being one third larger than the flue. The flue itself should be of tin or galvanized iron encased in brick, and should extend vertically from the register in the room, downward to the heating surface placed in the basement. This heating surface may consist of coils of one inch pipe staggered, and placed one above the other, or of some one of the many indirect radiators that are in the market.

One great fault that I have to find with most of the radiators now in use is, that there is not sufficient provision made for the flow of air through them. The air which does flow through them is usually over-heated, and while the temperature of the room is easily maintained at the required point, the supply of air furnished is inadequate. I have had great trouble in finding radiators with sufficient air space, and have resorted to various expedients, more or less successful, to overcome this deficiency. Whatever radiators may be used, they should be enclosed in metal jackets tightly fitted to the flue at the top, extending down over the sides, and closely connected with metal plates on the bottom. These plates should be in direct communication with the cold air duct, and perforated over their entire surface with one inch holes, placed two inches on centres, thus serving as distributers for the cold air to the radiating surface, which should not be placed in one mass, but sub-divided into at least three sections, supplied with one main supply pipe, having branches controlled by gate-valves to each radiator. By this arrangement, one, two, or three sections may be used at pleasure, and the supply of air, while remaining always the same, is raised or lowered to the temperature required by the turning of a valve.

The cold air flue should be of brick, laid close-jointed in cement, protected at its outer opening with a register plate, or coarse wire netting. The supply of cold air should always be taken at least ten feet from the ground, and should flow as directly as possible to the heating surface; the flue should be provided with a damper by which the flow of air may be regulated.

I have not as yet given the size of the incoming and outgoing flues for a room of the capacity of the one here presented. This depends much upon its length. The longer the flue, the greater the velocity of the flow of air through it; consequently its size may be reduced in proportion to its length. The flues in question are about 12 feet long; and, according to Montgolfier's formula, a flue with a capacity of 2½ square feet, 12 feet long, will discharge into a room, allowing 30° difference in the temperature, 750 cubic feet of air per minute, or 45,000 cubic feet per hour. Two flues of this capacity will introduce 90,000 cubic feet each hour, which is slightly in excess of the amount actually required, but it is better to increase rather than diminish the supply. The introduction of this air will change the atmosphere at least five times each hour, rendering it perfectly healthful at all times. It is safe to assume that for rooms of the size here shown, one flue with a capacity of five square feet, or two flues with a capacity of 2½ square feet each, will be required for the incoming hot air. The outlets must have an area of at least 10 square feet, in this case partly contained in the fire-place. Both incoming and outgoing registers must be one third larger than the flues.

The best of our steam heaters require, for indirect heating, 1 foot of heating surface to every 40 feet of air. At this ratio it would require about 400 feet of indirect heating surface for the room of which we are writing. When it is considered, however, that every hour we are introducing 90,000 cubic feet of air, and that this amount must be properly warmed, it can be readily seen that more heating surface will be required. It will be found that one foot of heating surface to every 20 feet of air will be amply sufficient to heat the room, even in the coldest weather. I should prefer to use three 150-feet radiators in each stack, a total of 900 feet of heating surface for the room. This will give one foot of heating surface for every 98 feet of pure air introduced, or one foot for about every 17½ feet actually contained in the room. It is to be understood that this amount is not to be used at all times: one third of it will answer for ordinary cool weather, two thirds for sharp winter weather, the whole capacity only being called into use on the coldest days.

It is short-sighted economy to construct a small apparatus to commence with, hoping it will prove of sufficient size. It is better far to have the capacity in excess of what is actually required, than below it. Bear in mind that it is cheaper to run a large boiler at two thirds its actual power, than a small one when taxing it.

In the foregoing calculations, I have not taken into consideration the heat generated from the fire-places. If these be of the ordinary form, the heat will amount to but little; but if some of the improved ventilating and heat-saving grates are used, it will be considerable, and the steam-heating surface may be reduced in proportion.

For the play-room, water-closets, hat and cloak rooms, and halls, direct heat may be used in the form of circulation pipes. These should be hung from the ceiling, and be of sufficient quantity to allow one foot of heating surface for every 60 cubic feet of air. By hanging these pipes from the ceiling, they will be out of the way, and the heat will be where it should be, at the top of the room. They may be bronzed over, and will not be unpleasant to look at. The outlets for these rooms should be, as in the school-room, large, and at the floor level. The teacher's room may have in addition to the fire-place a small direct radiator.

The position of the boiler is clearly shown on the plans. The make should be decided by the architect employed by the committee. There are so many first-class boilers in the market, that with ordinary precautions a suitable one may be obtained,—only insist upon a large size, and upon ample grate surface.

I have not spoken of other methods of heating in this article, for the reason that I consider steam the only suitable one for school buildings. The best of the hot-air furnaces are abominable, and stoves are equally as bad; in the use of either, you are debarred from securing even a moderate supply of fresh warmed air. The small amount that it is possible to obtain has all the life burned out of it by contact with overheated surfaces, and enters the room usually laden with gas. The supply of air should always be large, but in no case overheated. The volume introduced should be relied upon to maintain a pleasant temperature. The use of stoves or hot-air furnaces will not permit of this, and for this reason, if for no other, they should be banished from school structures.

I have thus far spoken only of the heating and ventilating of the rooms during cold weather. For that portion of the year when no artificial heat is required, there can be no better inlets for fresh air than the windows. There are many simple devices that a little ingenuity will arrange successfully for the outlets.

With the windows dropped at the top, and the transoms open, little more will be required in clear weather. On damp and stormy days, a large circular register, placed in the centre of the ceiling, and directly connected with the ventilator on the main roof, will be found sufficient. The ceiling registers in the water-closets and hat and cloak rooms may be connected with the main ventilators by metal pipes, an up-going current being maintained in them at all times by artificial heat.

A thorough "flushing" of the rooms with outside air should be insisted upon, both in summer and winter, before and after sessions, and at recess. As soon as the children leave the room, all doors and windows should be opened to their fullest extent, and the air be allowed to sweep through them unimpeded. With a proper apparatus, the required temperature of the room will be quickly restored.

I would say, in conclusion, that the buildings shown in both designs can be easily doubled in capacity by placing a floor above the one now shown. As I said before, I have not tried in either design to produce a cheap building, but have endeavored, by the use of the best materials, combined with sound construction and a careful consideration of the requirements of the occupants, to show that structures can be built having all the comforts of ordinary ones, without their objectionable features.

While many of the theories I advance may be new, and consequently not looked upon with favor, it will still be acknowledged that an honesty of purpose in my plea for better buildings for the young has alone actuated me. If the perusal of these pages will in any way help to improve the condition of existing schools, or show a better way to construct those about to be built, my aim will be accomplished.