SCHOOL BUILDINGS

PLANS, SPECIFICATIONS AND SUGGESTIONS FOR

SCHOOL BUILDINGS

FOR

RURAL AND VILLAGE DISTRICTS

Compiled and Published by
HOWARD A. GASS,
State Supt. Public Schools.

THE HUGH STEPHENS PRINTING COMPANY,
JEFFERSON CITY, MO.
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FOREWORD.

The frequent calls for plans and specifications for modern school houses compel the belief that some suggestions from this department with a few good plans for school houses at reasonable cost will be welcomed by many teachers and school boards of the State.

To this end the State Superintendent has secured some plans and specifications, not all of them new, but all good, which are submitted, with comments on sites, grounds, etc. No claim of originality is made. Others have thought and are thinking upon these subjects. Others have written and will continue to write in a helpful way. Doubtless better plans will be offered in the future. If so, we shall be glad to adopt them. Grateful acknowledgment is made to Messrs. Miller and Opel, architects, Jefferson City, and to J. H. Felt, architect, Kansas City. These gentlemen have given their services, without compensation, in the hope that the school children may be housed in buildings that are properly heated, lighted and ventilated.

By permission the plans and specifications of the "Model Rural School House," prepared by the Missouri State Commission for the St. Louis Exposition, 1904, is used, as is also some plans used in annual reports by former State Superintendents Carrington and Kirk. Thanks are extended to these gentlemen, and also to Supt. G. V. Buchanan, of Sedalia, for helpful suggestions.

All the plans given are in accordance with modern principles of ventilation, light, heating and sanitation.

If the contents of this bulletin lead to making our school houses and grounds more homelike, more healthful and more attractive, it will fulfill its mission in helping to develop a higher citizenship.

Howard A. Gass,
DUTIES OF THE BOARD.

The school board is the agent for the district. It is the duty of the board to act for the district in all business affairs. The board must secure a clear title to the site, and have the deed recorded. The board must issue bonds when same have been voted, sell them to best advantage, let contract for building, and see that all contracts are strictly complied with, and that all moneys belonging to the district are economically expended. Contracts should never be let to members of the board. Such action lays the board open to criticism, and often results in trouble. The board as the building committee cannot legally let the contract to one of its own members, and should never attempt to do so.

The board has the care and keeping of the school house and must keep it in good condition and repair, provide fuel and other material necessary for the use of the school and have the fires made and floors swept at the expense of the district. It is not the duty of the teacher to do janitor work; nor has the teacher power to employ a janitor. The board must employ the janitor, and pay him from the incidental fund. The teacher can not be required to do the janitor work, and the board should not seek to make such contract. No teacher who must take care of the school room, can render the best service to the pupils.

The most important duty of the board is the employment of a good teacher, and the second most important is to give the teacher loyal support. The board should not wait for the teacher to apply but should find and employ the best teacher the funds of the district will afford. A good teacher is cheap at the highest price and a poor one is dear at the lowest price. Get the best that money will command.

THE SCHOOL SITE.

The site should be not less than one acre, preferably two acres, in size; it should be as near the center of the district as possible, on or near a public highway. If possible, the site should be high and rolling to give natural drainage, thus avoiding mud and standing water in rainy seasons. It should be fenced and planted with shade trees, leaving ample space for school gardens, play grounds, etc. The school should be the educational and social center of every district. It is often the religious center as well. It should be made as homelike and attractive as possible. Here the children begin their education. Here most of them finish. Early impressions are
most lasting. Memories of school days should be a constant delight. There should be nothing lacking in the physical conditions that will add to the comfort and convenience of the children.

HEATING.

The best and most modern plan of heating is by furnace, and most of the plans herein provide that manner of heating. If heating is by stove, as is usual in the country, it should be placed in one corner of the room near the outside door. Thus placed, it will maintain a more uniform heat and be less in the way. The stove should be sufficiently large to furnish ample heat without constant firing. It should be surrounded by a sheet iron jacket. The jacket prevents direct radiation of heat, causes the air to circulate freely, and thus produces an even temperature in all parts of the room. There should be one or more thermometers in the room and the temperature should be kept between 68 and 70 degrees.

LIGHTING.

All modern school buildings are so constructed as to admit the light from the left and rear—never from the right or front. If light is admitted from the rear, it should be from near the ceiling. If the house has windows on both sides, those on the right should be closed by shutters or heavy shades. By the use of shades the light in old style school houses can be so regulated as not to be hurtful to the eyes. The room should be light and airy, but there should never be a glare of sunlight nor an unpleasant crossing of lights.

VENTILATION.

The plans in this bulletin provide for gravity ventilation, the best inexpensive modern method of keeping the air in the schoolroom pure and fresh. As most school houses do not have the modern system of ventilation, a cheaper method must be devised. A board four to six inches wide extending the full width of the window placed under each lower sash will afford ample and convenient means of ventilation. At recess and noon time the doors and windows should be thrown open for a few minutes. This will provide a complete change of air. Another inexpensive form of ventilation is the arrangement of a cold air shaft ten or twelve inches square, extending from the outer edge of the building to a point directly under the stove. Here a hole should be cut, the
shaft fitted in carefully. The end of the shaft should extend above the floor six or eight inches, and be covered with fine wire screen or perforated sheet iron. Both ends of the shaft should be fitted with sliding valves to properly regulate the admission of fresh air. This fresh air coming in under the stove will pass up between the stove and the sheet iron jacket and will be warmed before it is distributed over the room. There should be a wooden, tin, or sheet iron shaft placed by the flue, extending from the floor to the top of the flue. At the base of this shaft there should be an opening as large as the shaft, covered with coarse wire netting. There will be sufficient draft through this shaft to carry off all the foul air.

WATER SUPPLY.

It is very essential that the water supply for drinking purposes should be of the very best. Cisterns should be so located that the surface water cannot run into them. Too great care cannot be taken to secure pure, fresh drinking water. Sickness and even death may be prevented by exercising care in this regard. Cistern water becomes stagnant during vacation. Before school opens this water should be tested. If it is merely stagnant, it should be thoroughly stirred up so as to absorb the atmosphere. If the water is polluted, it should be drawn out, the cistern thoroughly washed and a fresh supply of pure water hauled and put in. Permanganate of potassium destroys organic matter, precipitating as manganate of potassium in the bottom of the cistern. One ounce is sufficient for the average-sized cistern. This prescription is cheap, effective and absolutely harmless. A few cents worth will be sufficient to make the water sweet and pure. A few days before school opens a member of the board should purchase an ounce of permanganate of potassium, put it in the cistern and stir the water thoroughly with a pole, or pump out and pour back several times. This will make the water quite wholesome and ready for use. This precaution should not be neglected.

THE SCHOOLHOUSE.

The first requisite for a good school is a strong, sensible, pure-minded teacher. Charts, a dictionary, a well-chosen library, and equipment for science are also essential. But there can be no assured permanency of a good school without a substantial, convenient and comfortable schoolhouse. The moral influence of a school is largely determined by the physical condition of the premi-
ses. Whether well kept or ill kept, the schoolhouse and grounds make their mark on the children. The situation of the schoolhouse too often renders cleanliness and decency within it and about it impossible. Where the aspect of the school grounds is forbidding, there is little wonder that the children go reluctantly to school and run away as soon as they can. It seems strange that school playgrounds should ever be allowed to look like a feed lot. But some of them present an appearance equally uninviting. In this respect all the States of the Union are much alike. Missouri, however, with her exceptional facilities for securing building material, pure water, grasses and trees, ought, without doubt, to lead all other States in the appearance and healthfulness of her school premises. In order to contribute as much as possible to the attainment of this enviable position among the States, there are certain requisites which no school board should ever overlook. Some of these requisites are as follows:

1. The schoolhouse site should be a high and healthful place.
2. Drinking water should be of undoubted purity.
3. Part of every school ground should be sodded with blue grass.
4. Every school ground should have some shade trees.
5. The outhouses should always be kept clean and decent.

NOTE.—The typical school outhouse has a very bad influence. It is commonly a specimen of physical filth and a source of moral poison. It is even more potent for evil than the deadly cigarette, because it infects like a pestilence great numbers of good children who otherwise could avoid impure ideals. Every school outhouse should be first coated inside and outside with paint containing coarse sand. Then a bucket of whitewash and a brush should be kept at hand so as to cover up promptly the vile language which the evil minded delight to display in such places.

6. A close board fence seven feet high should separate the boys’ playground from that for the girls, at the rear of schoolhouse.
7. Fences should be kept in good repair.
8. There should be a board or gravel walk from the front gate to the schoolhouse door.
9. There should be some kind of walk from the schoolhouse door to each outhouse.
10. There should be a wood shed or coal house in which to keep kindlings and some dry fuel.
Front View
A Practical and Economical
One Room School House
For a Rural School

Figure 1.
PERSPECTIVE
A PRACTICAL AND ECONOMICAL
ONE ROOM SCHOOL HOUSE
FOR A RURAL SCHOOL

FIGURE 2.
A Practical And Economical One Room School House For A Rural School

FIGURES 3 and 4.
The five preceding figures, taken together, represent a school house of one room and hallway or vestibule, outside measurements 24 to 26 feet by 36 feet. Figure 5 is to show relative positions of stove, bookcases, flue and stove pipe and the direction of air currents which furnish heat and ventilation. The cost of such house will depend upon the foundation, the kind of material used, the finish, and, to some extent, upon the locality. It will range from $600 to $750.

**EXPLANATIONS AND SUGGESTIONS.**

1. The stove occupies a corner and is surrounded by a sheet iron jacket. The brick flue is double, having one chamber about 8 by 12 inches for smoke, and one about 12 by 20 inches for ventilation. The stovepipe enters the flue at the side just over one of the bookcases. No one suffers on account of heat radiated from the stove or pipe.

2. Fresh air is admitted under the stove by a duct from the outside; it comes up under the stove, *but inside the sheet iron jacket*. The air in contact with the stove is warmed and rises. This draws in the cold, pure air from the outside through the duct. The air when warmed goes almost directly to the ceiling, descends into
other parts of the room, escapes from the room through eight little floor registers (indicated by the arrows), passes along under the floor to the opening into the ventilating chamber, rises through the ventilating chamber and escapes side by side with the smoke at the top of the double flue.

3. The temperature is gauged by a thermometer, which should be in plain view.

4. Four rows of seats occupy the middle of the room—only seats of the same size in a row. The teacher's table and chair are in a corner in front of the row of largest seats.

5. A table for primary classes is located in the front part of the room.

6. Bookcases fill up the corners at the rear of the room; a table for the dictionary and other large books is at the rear of the room.

7. The stronger light is admitted from the left side through four large windows. The weaker light is admitted from the rear through two windows. The windows in the rear may be smaller and higher than those on the side. Windows should have good rolling curtains.

8. There is an abundance of space in the front part of the room for the blackboard.

9. There are separate cloak rooms for boys and girls.

10. There is a storage room in which kindlings and wood (or coal), enough to last two or three weeks in stormy weather, may be stored.

11. The common hallway offers opportunity for the removal of wraps and for passing in and out without using the private cloak rooms.

12. The porch is of great value and adds much to both appearance and utility of the building.

Figure 6 represents a condition frequently found in rural and village school districts where the people spend their money freely enough, but without regard to convenience, comfort or health; where the accepted doctrine seems to be that four walls, a roof, a floor, several uncurtained windows and a door constitute a school-room regardless of the order of arrangement; where a few patent seats, a big naked stove and 30 feet of pipe are thought to be sufficient equipment, and these without regard to relative positions. Talk about discipline in such a school. Look at the conditions:

1. The seating arrangement is needlessly broken into by the stove.
Antiquated Specimen of One-Room School House.

FIGURE 6.

The Antiquated Specimen Transformed.

At Small Expense.

FIGURE 7.

S = STOVE.
W = WINDOW.
C = CHIMNEY.
D = DESK.
d = DOOR.
TT = TEACHER'S TABLE.
BC = BOOK CASE.
PT = PRIMARY PUPIL'S TABLE.
WB = WATER BUCKETS.
Wbb = WOOD BOXES.
2. Pupils near the stove suffer intensely; their heads and faces are overheated.
3. Those near the walls suffer too; their feet are cold much of the time.
4. The teacher is continually distressed by the heat of the stove pipe.
5. The blackboard occupies the left side of the room while the windows are on the right—a common fault even in town and village schools. Light should come from the left and rear.
6. The woodbox, an unsightly catch-all, should occupy a less conspicuous place.
7. No dictionary, book-case, maps or pictures are in sight.
8. The teacher's attention is frequently distracted by the unfavorable conditions, the children become dilatory, mischievous; study is extremely difficult; discipline, impossible.

Figure 7.

Now contrast figure 7 with figure 6. One school room costs about as much money as the other. One favors order, the other disorder. One contributes to comfort, the other to discomfort. One promotes health, the other breeds disease. One encourages study and good behavior, the other idleness and disorder. In figure 7 note the position of the children, the teacher, the stove, the pipe, the book-cases, the tables, the seats. Now look for the same things in figure 6.

HOW TO TRANSFORM THE ANTIQUATED, UNHYGIENIC, UNCOMFORTABLE, INCONVENIENT SCHOOLHOUSE INTO ONE THAT IS HEALTHFUL, COMFORTABLE AND CONVENIENT.

1. From figure 6 remove platform.
2. On dotted line H. K. build a partition.
3. Remove chimney to place shown in figure 7.
4. Remove stove to corner shown in figure 7.
5. Enclose stove in sheet-iron jacket as in figure 7.
6. Provide for ventilation.
7. Remove windows 5, 6 and 7 from positions shown in figure 6 to positions shown in figure 7.
8. Repair and complete blackboard.
9. Rearrange seats as shown in figure 7.
This work may cost $100; but think of the results.
Keep these two pictures in mind:
Fig. 6. **Badly arranged schoolhouse.** Results: Colds, headaches, catarrh, ear trouble, eye trouble, lung trouble and other bodily ailments, accompanied by "arrested mental development."

Fig. 7. **Hygienic and convenient schoolhouse.** Results: Greater comfort, better health, purer blood, better physical frame, more of bodily and mental vigor, better work, better sentiment, better and happier boys and girls.

**Description.**

This School Building, planned by Miller & Opel, Architects of Jefferson City and Springfield, Missouri, is specially designed for rural districts, and can be built of stone, wood or cement, as desired. In most rural districts the cost of a frame building will be from $1,000.00 to $1,200.00 or $1,400.00, depending on local conditions, wage scale, etc., in that locality. The cost of a stone, brick or cement building will probably be about 20 per cent more.

It is well to note that this plan contemplates a level site, but as this is not always available, the cost given above may be increased, depending upon the greater or less slope of the site.

Nor does the above cost include the plumbing and heating, which may vary somewhat, depending on the distance from water supply, sewer outlet, etc.

The prices of furnaces are as various as the different kinds
manufactured, hence it would not be possible to make a fixed price for heating. Either of these may be omitted without changing the plan of the building.

These prices are based on good, substantial construction, as outlined below, and the construction may be cheapened without damages to the utility of the building.

The capacity of this building is 48 pupils, and besides the cloak rooms and toilets, which have direct outside ventilation, a point of no small importance, there is a small ante-room between the cloak rooms, provided with ample light and designated manual training room, but which can be utilized for storage of school supplies, and for other purposes, as occasion may require.

The stationary book case indicated on the plan is a necessity in a well ordered school room, and adds greatly to the convenience of providing books for the pupils.

The pressure tanks for operating closets and the heating apparatus are located in the basement, and the ventilation is so arranged that a perfect system of gravity ventilation is secured. Cold air ducts are provided so that fresh air can be brought in from the outside during the school hours and an interior return is used while the building is being heated before school is in session, making an interior circulation and reducing the consumption of fuel to a minimum. This building can be arranged for an attic room if desired.

*Foundation.*—The foundation and basement walls may be made of brick, stone, concrete or cement blocks, the thickness and strength of same depending upon the nature of the superstructure. If a frame superstructure is contemplated, an 8” concrete wall or 9” brick wall, with proper 12”x5” footings for either kind of wall will suffice.

If masonry or cement superstructure is contemplated, a heavier foundation must be provided. Ordinarily an 18” wall with a 24”x6” footing is ample for this foundation. In all cases the footings for foundations should be below frost line, which in this locality, is placed at two feet below finished grade lines about the building.

*Superstructure Wall.*—The superstructure walls may be 12 ft. or 14 ft. high outside, but in no case less than 10 ft. high in the clear inside. If a good frame house is wanted, the wall should be made of 2”x6” studding set 16” on centers, boxed solid with boards at an angle of 45 degrees, covered with building paper, and finished
with siding or shingles as desired. These frame walls may be of 2"x4" studding to cheapen the cost if desired.

If brick are used the walls should be one and a half brick thick or what is commonly called a 13" wall.

If of rough rubble stone, the walls should be not less than 16" thick, and should be furred with 1"x2" strips inside to receive the lath and plaster; this method will exclude the dampness ordinarily in stone walls, besides making the building warmer. If dimension stone is used a thinner wall may be constructed.

Should a cement block wall be built, it should be made of blocks, providing a wall joint between the inside and outside face of the wall, parallel with the wall lines, and known to the trade as a wall joint. This joint effectually guards against dampness and moisture from the outside, as it provides an effectual barrier against capillary attraction of moisture from the exterior. Cement blocks are made providing for this joint in air spaces, etc., but none are so effectual as the wall joint. In the absence of a wall joint or of other provision for same in the making of the blocks, furring should be used same as for stone wall.

If an all concrete wall is built, re-inforcing iron wall ties or rods should be used, sufficient to guard against cracks in the wall caused by shrinkage. All concrete walls as a rule crack from shrinkage of material regardless of foundation. This all concrete wall need not be thicker than 9½" if sufficient reinforcing iron is used. This wall also requires the inside furring to guard against dampness.

Floors.—The floor joist should be not less than 2"x12" set 16" on centers, well bridged with three rows of 2"x2" bridging. A re-inforcing string piece under the center of the span would be better than the center row of bridging and allow short joist being used (provided said string piece be sufficiently strong). The flooring proper should be vertical straight grained yellow pine, or Factory Maple flooring. In no case should flat grained or poor flooring be used.

Roof.—To make a good roof 2"x6" rafters set 24" O. C. for wood shingles, or 16" O. C. for slate should be used.

If a cheaper roof is desired 2"x4" rafters may be used, but must have better bracing work than the heavier rafter.

The wide extension of the roof as indicated is desirable for both utility and appearance. Without this wide extension this style of building will not look well. This also admits of the omission of gutters and spouts if so desired.
Windows.—The windows to the left and rear of the pupils should begin about 3'-6" from floor line and extend to within 6" of the ceiling. The aggregated window light space should approximately equal to 1-6 of the floor area. All windows should be box frames with top and bottom sash weighted. When practical the principal lighting should be from the north-side of the room and left side of the pupil.

This lighting rule is not absolutely essential in regard to light area or direction of it, but experience has proven it the best known method. In houses with other than frame walls, the window casings may be omitted inside.

Doors.—There are several special features about school house doors worth mentioning.

First of all these doors should be strong, well made 2" doors. All single swinging doors should open outward.

The doors leading from school room proper to cloak rooms or corridors should be double acting to avoid the slamming noise unavoidable in single swinging doors.

Black Boards.—The standard black board for school room purposes is natural slate, but as this is too expensive for general use, artificial or imitation slate is substituted. This can be had in either black or green color, and because of the pleasant effect green boards are coming into general use. As a rule black boards are made 3'-6" high. For the primary pupils the chalk rail should be put about 26" from the floor, for the larger pupils 12" higher. This rule is not imperative, but simply adds to the convenience in using the boards.

Plaster.—The plaster work should be 2-coat brown work, floated to a uniform face and tinted with wall coloring. The green or buff shades being most suitable and generally used.

Finish.—The finish in a school building should be as plain as possible, using only enough wood work to hold the sash and doors in place.

In a frame building a very narrow strip casing need be used to close the window weight space. In a masonry building the jambs are to be plastered back to window frame and casings omitted. In either case a plain window stool and apron are required.

The base in a school room should not exceed 5" in height with quarter round nailed to floor only. This base to have a plain bevel top edge. A large quarter round only will answer the purpose very well.
Painting.—The paint work should be well done, as nothing adds so much to the appearance nor can anything take its place as a preserver of wood work. No less than three coats of good lead and oil paint should be used outside, and not less than one coat of stain and two coats of good interior varnish inside. If the very best result for inside work is desired, it can be had by properly brush rubbing all the interior varnish work.

Glazing.—All glass to be D. S. A. glass, and where doors are glazed, plate glass will be the most economical.

Hardware.—This item so generally considered of little importance is really important. All doors should have three good, strong, heavy hinges each, and where double acting spring hinges are used, none less than 6" should be considered.

The door locks should be heavy strong mortise locks, and so arranged that entire lot are master keyed, so that Janitor need have but one key for all doors in the building. Windows to have lifts and locks. Where doors are double acting, push and kick plates are essential to the proper preservation of the paint on the doors.

Plumbing.—The plumbing may or may not be installed. Where a city water supply is available and a system of public sewers established, it is a simple and easy problem to have this work installed at the least cost, but where pressure tanks are required and public sewers not established, the problem is not so simple and easy, but it is entirely practical, though more costly than the other method. Unless the work can be done in a first class and sanitary method, it should be omitted entirely and outside closets provided.

Heating.—Heating and ventilating a building is an important, and as a rule, a difficult problem, and should be worked out (in the plans at least) by an expert in this particular line, and not left to chance or inexperience, for the result will be bad in most cases.

Lighting.—As rural schools are often used for school entertainments, there should be a provision for lighting same.

Finally.—The above specification is not intended to fulfill the requirements of a building construction specifications, but is advisory only in its nature and intent, and is available as a general guide only.
A MODEL RURAL SCHOOL HOUSE.

FLOOR PLAN.
A GROUP OF CHILDREN STUDYING PLANT GROWING.

SECTIONAL VIEW.
A MODEL RURAL SCHOOL HOUSE ON CAMPUS OF STATE NORMAL SCHOOL, KIRKSVILLE, MISSOURI.

This model rural school house has been designed and constructed to show that a rural school in any part of Missouri can, for the investment of about $350.00 in addition to the ordinary cost of a good building, have all the conveniences and comforts that can be secured in any city school building of the State.

1. The front view of the rural school building.
2. The floor plans.
3. A group of children in connection with some simple exercises in plant growing.
4. Sectional view.

FOUNDATION.

1. The foundation is rectangular in form and 28x36 feet in size, outside measurement.
2. The outer foundation is a nine-inch concrete wall extending about two feet below the surface of the ground and about two feet above.
3. There is an inner wall enclosing the cellar, which is about 6x14 feet.
4. The cellar wall is of concrete about 12 inches thick. The floor is of concrete.
5. Between the cellar wall and outer wall, as may be seen, is an ample air chamber. This arrangement prevents possibility of damage from freezing.
6. The cellar is reached through a trap door in hallway leading to boys' toilet room. It contains the following:
   (a) Pneumatic pressure tank, 3x8 ft., with capacity of about 350 gallons, with good pressure.
   (b) The force pump connected with tank, also with well through underground pipes.
   (c) Soil pipes, water pipes and drain pipes reaching to and from toilet rooms above.
   (d) Connections with sewer.

Note: This sewer runs into city sewer system. In a rural community it would necessarily run into a cess pool or other similar place at rear of school ground.
FLOOR PLAN—DESCRIPTION.

1. The floor plan is 28x36 ft., the same as foundation plan.
2. The school room is 27 ft., 2 inches, by 21 ft. 6 inches—12 ft. from floor to ceiling.
3. School room lighted through six large windows on north side. Children face the east. Light comes from left. Blackboards at front and rear.
4. Door at rear on right side leads to girls' toilet room and to girl's outer door, porch and play ground. Cloak hooks in hall.
5. Furnace occupies alcove on right side of school room. Smoke flue is 13x13 inches in the clear and helps heat ventilating flue. The latter is 13x21 inches in the clear. Opening to ventilating flue is made into a neat fire place.
6. Cupboard at side of ventilating flue reaches from floor to ceiling and has a neat unfolding leaf for teacher's writing desk.
7. Manual training shop is 6x8 ft., in the clear and has abundant light.
9. Direct sunlight strikes the floor of schoolroom at 10 o'clock and 2 o'clock through glass in doors and at 4 o'clock through ground glass window.
10. Notice the ground glass window on west side at northwest corner for window garden. Ground glass prevents glaring light and yet gives benefit of chemical rays for flowers and for sanitary purposes.
11. Toilet rooms have hot water pressure tanks connected with furnace and with basement tank by gas pipe. They have cement floors and sides, being watertight, with drains in floors.
12. Notice wash bowls and toilet bowls.
13. Toilet rooms are separated from each other and from other rooms by double walls containing air chambers to deaden sound.
14. Through a small plate glass in middle of each toilet room floor direct sunlight reaches basement.
15. Every room of this school house has direct sunlight; but children's eyes are protected and the children study by an abundance of mild light from the north.
16. This school house is built upon the popular rectangular foundation, but foundation is about two feet wider than usual.
17. Appearance of undue width is overcome by form of roof.  
18. Flue may seem a little low. It is yet to have a six inch concrete top.  

This school house is in all respects built out of the best available material and in the best possible way. It was not built by contract. The Regents authorized the President of the school to purchase material, employ laborers and build. Cost can therefore be given in detail. By using ordinary material and ordinary skill in the construction such a school house as this can be built in most of the rural districts of Missouri for $1,200.00.

MODEL RURAL SCHOOL HOUSE ON GROUNDS OF ST. LOUIS EXPOSITION (1904)

SPECIFICATIONS.

Specifications of the labor and materials required in the erection of a “Model Rural School House,” to be built for school district No. ———, in the county of ————, State of Missouri, according to plans furnished by the Missouri State Commission.

DRAWINGS AND GENERAL CONDITIONS.

The several drawings herein referred to, are as follows and consist of:

- Plan of foundation and basement.
- Plan of floor arrangement.
- Plan of roof.
- Transverse section.
- Longitudinal section.
- Front and side elevations.

The several drawings must be carefully followed according to scale, and all notes, figures and explanations wherever they appear upon the drawings, must be carefully followed, as they, with the drawings and specifications, are all part of the contract.

The contractor shall make no alterations in the drawings or specifications. The contractor shall furnish all labor and materials, scaffoldings, etc., and everything needful for the completion of the work. Should the contractor introduce any materials or workmanship other than the kind specified, it shall be removed at his expense at any time during the progress of the work. All work must be executed in a good, substantial and workmanlike manner,
and nothing to be omitted which is necessarily connected with the proper completion of the work.

Excavations.—Do all necessary excavating required for the basement and all piers or other foundations, as shown and required by the drawings.

All heights must be taken from a grade stake.

Dig the banks in excavating 6" beyond outside line of stone walls.

Grading.—Fill in around and pack the earth against the walls after the mortar is dry, and level it off as directed by superintendent.

Footings.—Lay down footings under all the walls of the building of flat, well bedded stone not less than 8" thick and to project 4" on each side of the walls above. This footing course shall be composed of large stones, fitted close together, each filling the course in width and height.

Joints shall be flushed with spawls and cement mortar.

Foundations.—Properly lay up foundation and basement walls
16" in thickness, with good, flat building stone, laid on their natural bed, and well bonded, laid in clean, sharp sand and Fort Scott Cement mortar, in parts of one of cement to two of sand, laid to a line on both faces and properly flushed and pointed at completion. Lay down in like manner substantial foundations under the chimney, porch piers and exterior steps.

Underpinning.—From the top of foundation walls at grade level, lay the underpinning up in height, as shown by the drawings, with two courses of 8" lime stone range pitch faced, laid to a line, with close joints, and to be pointed at completion with raised joint of Portland cement mortar.

The window sills shall be of lime stone properly cut and set in place where shown on foundation plan.

Chimney.—Build the chimney to correspond with the drawings, using hard burned brick laid in lime mortar, as per size figured on drawings. Flue to be perfectly straight and true, and uniform in size throughout and made smooth, with cut joints on the
inside. Top out above the roof with select red brick, laid in white mortar and properly cleaned down on completion.

Furnish and set in the brick work of flue for furnace smoke pipe an 8" black iron thimble. The smoke pipe from furnace shall be made of No. 14 stack steel, properly supported and anchored in place.

Lathing.—All walls, partitions and ceilings throughout the building shall be lathed with No. 1 white pine laths, full thickness, laid on a quarter of an inch apart, with 4 nailings to each lath, joints broken every 12". Under no circumstances must the laths stop and form long vertical joints, neither permit any laths to run through partitions behind the studding from one room to another. All angles must be thoroughly spiked together before lathing.

Plastering.—All walls, partitions and ceilings throughout the building shall be plastered with Aggatite or Acme Cement Plaster mixed according to given directions, and properly put on and applied with sufficient force to secure strong clinches.

Level up and float the brown coat and make it true and straight at all points, angles and openings. All corners and angles shall be made perfectly straight and true, and finished in a workmanlike manner. All lathing and plastering shall extend down to the floor. All walls shall be straight and plumb and even with the grounds.

Leave all the floors broom clean; do all the necessary mending and patching after the workmen, and leave everything in a perfect state.

Timber.—The whole of the timber used in and throughout this building shall be well seasoned and free from shakes, knots, or other imperfections impairing its strength and durability.

Dimension stuff for joints, studs, rafters, etc., shall be No. 2 yellow pine. All exterior finish lumber for cornices, casings, base and other finish shall be of white pine, "C" select.

Framing.—Timber must be prepared and framed according to the plans, sections and details. All joists shall be placed with the crowning edge upwards. The figuring of heights of stories on the sectional drawing and figures on plans for interior work, are for the dimensions in the clear. All joists shall be spiked together at ends and to each other where they come together, and to all bearings.

Bridging.—Bridge the floor joists through the center of each room with two rows of 1"x3" stuff properly cut in between the joists and nailed at each end with two 8d nails.
Headers and Trimmers.—All headers and trimmers shall be properly framed and spiked together, leaving all openings of sufficient size for the finish of stairs, chimney, etc.

Size of Timbers.—Sills shall be framed as shown by the drawings with 2x8 inch plate below, outside member 2x10 inch, and 2x6 inch plate on top. Floor joists shall be 2x10 inch, placed 16" from centers, ceiling joists 2x10, placed 16" from centers; partitions and other studding will be 2x6, placed 16" on centers. Corner posts built of two pieces of 2x6, with a 2x8 between, thoroughly spiked together, roof rafters to be 2x6, 16" from centers, wall plates 2x6 double thickness, porch sills to be 4x6 and properly framed into...
main sills, porch joists 2x6, 16" from centers, porch rafters and ceiling joists 2x6-16" centers, porch plates, posts, etc., to be made according to the general drawings. All door studs shall be set double. All openings over three feet in width shall have double headers and thoroughly trussed overhead. All angles shall be framed solid by spiking studs together. Porch to be ceiled overhead with 5/8" yellow pine ceiling.

*Exterior Frame Work.*—Cover the frame of the building with No. 2 yellow pine, ship lap boards not over 10" in width, nailing through each edge into every bearing; these boards to be placed horizontally on the frame.

*Siding.*—Shall be "C" select white pine, 6" wide, with 41/2" exposed to the weather. All joints shall be closely fitted against corner boards, casings, etc., and nailed to the walls with 6th wire nails.

*Corner Boards.*—Cornice, bands, corner boards, water tables, etc., will be made as shown by elevations and sections.

*Roofing.*—The carpenter shall frame and construct the roof according to the drawings, in a thorough manner. The rafters shall project the walls as shown for cornices and gutters.

The gutters shall be graded on the inside so as to throw the water to the points indicated for the location of the down spouts.

For shingling; put on horizontally, 7/8" yellow pine strips 7" from centers, joints broken and nailed to each bearing with 10th nails.

*Shingles.*—Shingles shall be put on in the best manner, properly laid, joints broken and nailed with two 3d coarse cut nails, to stand away from all angles and valleys the proper distance. These shingles shall be of the best quality red cedar, six to 2", and laid 41/2" to the weather. Ridges shall be covered with 1x6 white pine boards nailed with 10th nails.

*Window Frames.*—All window frames for insertion in the woodwork shall be made with the outside casing 1x41/2", and pulley stiles 7/8" thick, properly housed at the head and sills and to have 7/8" sub sill, bottom sills to be made of 2"x8" white pine. All frames shall have parting strips and blind stops set back the proper distance for outside blinds. All frames shall have 2" lathe turned sash pulleys, bronze face, pockets for sash weights. Single sash in basement shall have three-inch steel butts and proper fasteners, Transoms shall be as shown on drawings. All sash shall be 13/8" in thickness. The basement frames shall be made of 2x10 clear white oak.
Inside Work.—The carpenter must run the flooring closely around all the walls, completely closing all spaces.

Grounds.—Put on grounds for finish of all doors before the plasterer. All these grounds shall be set perfectly straight, plumb and true to a line, and for lath work, not to exceed 5/8" in thickness.

Flooring.—Floor shall be laid with 1x4" Star yellow pine, secret nailed to every joist, well driven together and laid close to the wall. All flooring shall be tongued and grooved, carefully laid with joints broken.

Finish.—All inside finish will be made of strictly clear, well seasoned yellow pine. All doors that are marked for glass in upper panels will be glazed with D. S. A. glass. All transoms will be glazed with D. S. A. glass and hung at the top with 2"x2" brass butts and provided with a Wollensack Patent Transom Lifter.

Black Boards.—Furnish and set in place where shown No. 1 slate black boards four feet in height and finished with 2" lip mould on top and 4" chalk mould below.

Size of Doors.—Shall be as marked on floor plans for width, height and thickness. Hang all doors throughout with loose joint, bronze plate butts 3½"x3½". Front door shall have three butts 4½"x4½".
Locks.—The main entrance door shall have 5” mortise bronze faced locks with two keys. All other doors shall have 3½”x3½” mortise locks.

Sash and Windows.—All windows shall be cased to correspond with the doors, and finished with a rebated and moulded stool and apron worked and moulded as shown. Sash shall be of the best clear white pine with apron mould sash bar and weather lipped meeting rails. All sash shall be 1½” in thickness.

Every double hung window in the building shall have an Ives patent burglar proof sash lock on meeting rails, with bronze finish. Also provide a bronze bar handle lift for each window.

Glass.—All glass throughout the building, except as otherwise specified, shall be D. S. A. glass, well bedded, tacked and puttied.

Stairway.—Shall be built where shown on the floor plans in the best and most substantial manner, and shall be supported on rough carriages, cut from 2”x12” joists. Stairs shall have 1¼” treads and treads shall have nosing on front edge, and be provided with 2” side hand rails.
Toilet Rooms.—Shall be fitted up with clear yellow pine, wainscot 4 feet high, with $\frac{5}{8}$" V. P. beaded ceiling and finished with $2\frac{1}{2}$" lip mould, qr. round. Also put up four strong heavy coat hooks as directed.

Run wainscoting behind water closets. The school room and vestibule shall be wainscoted as shown by the section and finished in the same manner as specified for other wainscoting except that under black boards, where chalk rail shall take the place of moulding.

Angle Beads.—Shall be placed on all corners as required to protect the angles of plastered walls, to be 3' 6" in length, and $1\frac{1}{8}$" in diameter, and have ornamented turned heads.

Painting.—Furnish all materials and perform all labor for the full completion and proper painting of the building, cover all sap or knots in the exterior wood work, with a coat of strong shellac before priming; putty up all wood work smoothly before applying the last coat. On the outside work use for priming coat a mixture
of one part of white lead and two parts of ochre ground in oil, mixed with pure boiled linseed oil.

Exterior.—Paint the exterior wood work with three coats, the second and last coats to be pure white lead and boiled linseed oil, the lead to be used for this work must be of the best quality, strictly pure Collier's white lead and boiled linseed oil.

The colors shall be selected by the superintendent. Paint all the tin work with two coats of mineral roofing paint, the down spouts to be finished with trimming color same as used on the building.

Interior.—All the interior wood work must be thoroughly cleaned off and filled with Weeler's Patent Mineral Filler, by rubbing thoroughly into the pores and wiping off while wet.

Finish the wood work with two coats of Berry Bros. Hard Oil. The painter must see that all wood work is perfectly clean before filling. Putty all nail heads and other defects, using care to thoroughly match the putty in color with the wood work and to sandpaper smooth and prepare all woodwork before applying the second coat. The painter shall see that all spots are cleaned off the walls and glass, and leave everything in a perfect and finished state.
Gutters and Valleys.—For the gutters, valleys and down spouts and chimney caps use No. 26 galvanized iron and run the iron under the shingles at least 6". The gutter shall be riveted and soldered, and held in place with proper stays. Down spouts shall be put up where indicated on plans, with all the necessary curves to bring the water to grade level, and there connect into the drain pipe.

All joints shall be lapped, riveted and soldered tightly together.

Down spouts shall be thoroughly secured to the building, the sizes of leaders to be 3". Valleys to be flashed and counter flashed in a thorough manner. Also furnish all the other flashing ready painted for the use of the carpenter to enable him to make all parts of porch and windows thoroughly water tight.

Plumbing.—Burton’s System Domestic Water Works, Fairbanks, Morse & Co., St. Louis, Mo., furnish all materials and perform all labor necessary for the putting up and completing system of domestic water works, and all the plumbing work in a good and thorough workmanlike manner, according to the drawings and these specifications. All cutting for the pipes will be done by the carpenter. All horizontal and vertical pipe connections to be made with iron hooks, braces or hangers. All cast iron pipes shall be properly supported and secured and all joints calked with oakum and moulten lead.
All water pipes must be put up on 1" stripping, prepared by the carpenter, and all be put up so that they can be got at at any time for examination. The sewer connection will be made as shown on foundation plan, and must have all joints cemented together. The pipe must have a fall of at least $\frac{1}{4}$" to the foot.

All down spouts shall be connected into the cistern as shown.

*Cast Iron Soil and Waste Pipe.*—Connect the drain with 4" cast iron pipe continue up through the partition to toilet room and out through the roof, place a running trap in the main soil at the inside of the cellar wall, where it can be got at at any time to clean out.

*Water Supply.*—Shall be taken from cistern or well near building.

When pump and pneumatic tank are in cellar run $1\frac{1}{4}$" galvanized iron pipe from pump to cistern with foot valve on lower end. This pipe must be laid lower than freezing point. From the pump connect the pressure tank as shown. From the pressure tank run $\frac{3}{4}$" supply pipe to each fixture, as shown on plans. Leave out all necessary branches for the different works and place a $\frac{3}{4}$" round lever handle stop and waste cock in cellar to shut off when necessary. Care must be taken in grading this and all other pipes so that when water is turned off they will be drained perfectly dry.
Pressure Tank.—Place near cellar (or at some other convenient place selected by the superintendent) a 220 gal. wrought steel tank. Connections shall be made from bottom of tank.

Pump.—Place in cistern where shown, or in basement, a force pump properly connected with cistern and pressure tank, place swinging check valve in pipe between the pump and tank. Provide all necessary shut-off and waste cocks so that all pipes may be drained.

Urinals.—Furnish and set in place in the boys' toilet room a 3” flushing rim urinal, enameled, supported on painted iron brackets, perforated brass flush pipes, on trap standard brass vent and clean-out plug all complete, automatic copper lined oak tank. Furnish all fixtures, fittings, cocks, traps and pipes of every description to make the job complete in every respect.

Wash Basins.—Shall be white enameled iron, supplied with water through lead pipe, basin to be wasted into nearest soil pipe, to have ½” nickel plated bibs, lever handle, slabs to be counter sunk with moulded edges, and to have 7” moulded back.

Water Closets.—In toilet rooms shall be provided and located as shown, and have trap made of porcelain in one piece with the closet. Closets shall have a shut-off cock in the supply to control water to same. All pipes extending above roof must be thoroughly flashed with sheet lead.

Bibs.—All bibs throughout the building shall be the very best quality nickel plated. All cut-off and waste cocks shall be of brass.

Furnace.—Furnish and set in place in basement where shown a No. 10 Floral City Hot Air Furnace. Smoke pipe shall be of No. 14 sheet steel and extend from furnace to top of chimney as shown. All hot air pipes shall be made of a good quality of tin, properly connected and supported, and be of the various sizes required for each room to be heated, and each shall have a regulating damper.

All pipes shall be run where shown on plans, with all the necessary angles, bends and other connections. Furnish and set in school room registers of the required sizes for warm air, and also for foul air. All pipes must be thoroughly secured in place and everything furnished complete in every respect, including full set of firing tools.

The fresh air pipe shall be made of galvanized iron and connected with small opening in foundation wall, with wire screen over the opening.

The force pump and air pressure tank may both be placed in
the basement and connected with well or cistern by underground pipes.

If the air pressure tank is not placed in the basement, it should be buried deep enough to avoid any danger from freezing.

DESCRIPTION.

Plan A represents a typical rural one-room school building as it is commonly built, while the plan on the right indicates the manner in which the same building, with a very small additional cost, may be converted into a modern one-room school building with
a modern system of heating and ventilation, and with plumbing arranged in the building. In the remodeled plan it will be noticed that there are separate cloak rooms for the boys and girls, and opening off of each of the cloak rooms are their toilet rooms with direct outside light. Just to the left of the school room heater will be seen the fresh air intake, which takes the fresh air just under the cornice and carries it down below and up around the heater, exhausting it into the room about 8 or 9 ft. above the floor line. This pure warm air immediately rises to the ceiling, and if there were no arrangements to bring it down, would stay there, but by means of the vent flue seen just to the right of the heater the air is drawn off of the floor level, thus creating a vacuum at the floor line and pulling the warm air down from the ceiling. This makes a continuous circulation of pure warm air in the school building. The smoke flue is immediately back of the vent flue, and the heat from the heater smoke pipe warms the walls of the flues, thus accelerating the draft in the vent flue. The coal bin is in one corner of the building, and is so arranged that the fuel can be put in it from the outside and taken out from the inside. The school room is supplied with a book case, closet for the teacher's wraps, and the lower portion of this case could be used for supplies. It will be noticed that the old building has been turned one-fourth of the way around, and the windows on one side left in with three additional windows cut in between, thus giving us the modern system of lighting from one side only.

Perspective A is a perspective of the exterior of the building before the same has been remodeled, and as ordinarily built. When remodeled it will have very much the appearance of perspective B 1.
Plan B shows a one-room school building laid out along modern lines, and is given as a suggestion for an entirely new one-room school building. It will be noticed, first, that there are separate entrances for the boys and girls. Opening off of each vestibule is a cloak room and toilet room, thus completely separating the sexes. There is a built-in book case with spaces for storage of supplies below, and also a receptacle for the coal scuttle, so it can be set out of the way and not be kicked about the room. In front of the pupils, and in front of the teacher is a conservatory, with ample glass surface, for flowers and plants. The fuel room is so arranged that the fuel can be put in from the rear of the building, and by means of slats on the inside the coal can be taken out at the bottom, and thus prevented from scattering about the room. The school room proper is 23' x 30', and seats 48 pupils in single desks with ample aisle space between and all around the desks. The light is brought from the left of the pupils only, the windows being set within about 6" of the ceiling. The heater is set in a brick recepta-
cle, and immediately back of it is the smoke flue and vent flue. The air intake marked just to the left of this flue is supplied with fresh air through the circular lower windows in the gables, thus insuring pure air at all times. It is taken down under the heater and exhausted directly across the room towards the cooling surface, which is the windows, and by means of the vent flue the lower strata of air is constantly being taken out at the floor line and exhausted out above the roof, thus causing the pure warm air to descend equally all over the room. It will be noticed that the toilet rooms have outside windows opening directly into them, and that one waste and supply pipe will do for both toilets. One great advantage of this arrangement, in addition to separate entrances for the sexes, is the fact that there is but one exposure of the school room to the weather, and that is on the rear where the light is brought in, as the cloak rooms, vestibules, etc., protect the school room on three sides. This will make the room very much easier to heat in severe weather and effect a very great saving in fuel. The stairway opening into the boys' vestibule goes down to a small basement which contains the compressed air tank which furnishes the water supply for the plumbing. Should it be desired to have a small manual training room, it could be easily accomplished by lengthening the building, thus enlarging the cloak rooms, one of which could then be used as a manual training room, and the other one divided and used for the two cloak rooms. Whether this building is built of brick or wood, the heater should be set as shown by the plan, in a brick receptacle, which very much lessens the danger of fire.
Perspective B1 shows this building as it would appear if built of wood with stone foundations, while perspective B2 is of the rear of the building showing the manner of banking the windows so that there will be no heavy jambs between them to cast shadows and shut out the light.
Plan C is of a two-room school building, without basement, having the plumbing all on the first floor, and with the same system of ventilation and heat as designed in Plan B. If this building is built of frame, the entire rear portion which contains the heater, fuel room and fresh air intake, should be of brick. This portion need only be carried well above the top of the heater and the smoke and vent flues continued on above the roof.
Plan D is of a two or four-room school building designed to be built of brick, but of course can be built of frame just as well. In the basement are the furnace, fuel room, janitor's room and boys' and girls' toilet. It will be noticed that there are separate stairways leading to the different toilet rooms. On the first floor are two school rooms, with cloak rooms, book cases and teachers' closets. On the second floor are two school rooms and a principal's office.
Perspective D1 shows this building as it will appear if carried out as a two-room school building, while perspective D2 shows the building as it would appear if built as a four-room building.

In this building it will be noticed that the furnace is placed in
the basement and the heat is carried to the rooms through brick flues which have ample capacity to supply each pupil with 1800 cu. ft. of pure warm air per hour, or in other words, so designed as to completely change the air in the room from four to six times per hour.

The description given for plan D also applies to plan E, this plan being given to show the manner of arranging a building where it is desired to throw the two school rooms on the upper floor together, which would give an assembly room 32'x46', with principal's office and cloak rooms in addition.