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Plans and specifications
for a
Dairy Building
for
M. A. C.

apart from Agriculture.

THESIS

Plans and Construction of a Dairy Building at the M.A.C.

-:Introduction:-

Relation of Dairying to Agriculture.

The art of dairying or dairy husbandry has received considerable attention from quite an early period, although it has been limited in extent almost entirely to the rural districts. Not until late years has it received the consideration and study necessary to entitle it to a place in the scientific as well as in the industrial world.

Dairy husbandry and Agriculture are both departments of the farm. Although the two are entirely different, yet the one depends primarily upon the other. Agriculture naturally preceeds Dairying, and until quite recently has held entire sway over the farming industry, the latter being merely a side issue; but now we see this department springing up and threatening to predominate over Agriculture, making it secondary to a certain extent, to Dairying. Throughout the best cultivated districts both of England and Scotland which claim the birth place of dairying, the growing of corn and green crops. and the rearing and feeding of stock, were at one time carried on to a considerable extent in conjunction with the dairy. This mixed system of husbandry, though it may have reduced the farmer's risks, has gradually decreased, and the dairy is now regarded as a separate institution apart from Agriculture.

In no department of the farm are carelessness and irregularity more injurious and ruinous than in the dairy portion. On many farms where dairying is not made a special feature, much of the value of the cows is lost by imperfect and careless milking.

What we need is a wide spreading of the most intelligent dairy information, and this labor must rest largely on the Agricultural colleges where instruction in the various farm industries is given the farmers. But in order that this instruction may be successfully carried on a complete course in dairying must be started with all the modern appliances and conveniences necessary to obtain the best results.

Objects of the Dairy Schools.

The Dairy School is designed to aid in developing the dairy interest of the state by furnishing to farmer's boys instruction in the care of the herd and the management of the home dairy and to the factory men instruction in the best methods of manufacture. By extending the faculty and equipment of the school of Agriculture in the line of dairy work, the Board of Regents offer unexcelled opportunities for acquiring a thorough knowledge of chemical principles relating to the dairy and an acquaintance with the details of breeding, feeding and management of cows as well as the best methods of manufacture of both butter and cheese.

(Uni. of Minn. Dairy School)

Special Dairy Course.

During the winter a Special Dairy Course was given at the College, beginning January 4, and continuing six weeks. Circulars announcing the proposed course were not issued until late in the preceeding fall, yet before the beginning of the term more applicants presented themselves than we could accommodate. The total number in attendance was 27, of whom 23 completed the course.

The sole room available for the practical work was the large room in the basement of the agricultural laboratory, in which the heater was located. By a partition this room was divided into an engine and boiler room and a dairy room. The utensils were washed and stored in a smaller room adjoining.

The dairy room had capacity for eight churns in operation although interfering to some extent with the hand and steam separators and the four creamers located in the same room.

The milk testing was done in still another room near the foot of the stairs.

Beginning with the milk as it came to the building from the farmers or the herd, the students learned first to test it with the Babcock tester. The importance of this apparatus can not be overestimated and its presence in every creamery is a certainty in the near future. Much attention was therefore given to inculcating careful habits of skillful manipulation and correct reading.

From the testing room the student went to the separators. These costly machines he studied and handled until he understood every detail of their construction and management, and until he could be safely entrusted with one in actual operation in a creamery.

He then studied the various creamers and learned the general principles governing their operation and the details of setting and skimming milk, where the cold deep setting process is used.

Then came a careful study of the conditions requisite to the development of the right flavor in ripening cream. Cleanliness, right temperatures, and the right set of bacteria were described as necessary, and the student was shown how best and easiest to attain the desired results. Constant daily practice in churning, washing, salting, working and packing the butter followed. The student preformed all the operations of the dairy, thermometer in hand, carefully noting and recording every detail of every operation, temperatures, acidity, time required, weights and all other matters. As a result the records of the work done at the dairy school last winter form an almost inexhaustable mine of information bearing on practical dairy work.

Notwithstanding the fact that the utensils used were just such as the ordinary farmer should be provided with, and the methods employed pertained rather to the private dairy than the pub-

lic creamery, yet the general principles, the requirements for properly handling milk and its products are the same the world over, and we find that a large proportion of the young men attending the school last winter have taken places in some of our best creameries in the State, and are doing work creditable alike to themselves and the College.

Along with this practical work, explaining the reasons for the various processes and giving a rational basis for the methods employed, was given a course of lectures on dairy chemistry and physics. This set of lectures included discussions of such topics as the composition of whole milk, skimmed milk, butter and buttermilk; variations in the composition of normal whole milk due to lapse of the period of lactation, changes of feed, or other causes; relation of bacteria to the ripening of cream; relation of temperature to the efficiency of churning and methods of preventing losses in skim-milk or buttermilk.

With this course there was also given a somewhat full description of the methods of factory management, the use of the test in factory work, methods of factory bookkeeping, paying for milk according to its content of butterfat and other details, a knowledge of which is necessary to the successful operation of a modern creamery.

Dr. E.A.A. Grange gave to the class a course of lectures on bovine anatomy and the care of cows from a hygienic standpoint.

Dr. W.J. Beal taught the use of the microscope, and gave the students a clear insight into the appearance of the fat globules, and other microscopic peculiarities of milk and its products. He also gave a course of exercises of great value to the class on grasses and forage plants.

Under the skillful supervision of Mr. M.F. Loomis the class had practice in the management of boilers and engines. They were taught how to economize fuel, how to detect adulteration of lubricating oils, how to set up, run, oil, speed, and operate engines, calculate the speed of shafts and the size of required pulleys, and such details of mechanics as would be valuable to them in creamery management.

A feature of the course that proved of benefit to the class was the set of lectures delivered by prominent dairymen in the State invited to the college for that purpose. The thanks of the Board are due to the following gentlemen for their valuable addresses: Mr. John I. Breck, Jackson; Hon. F. E. Mills, Ann Arbor; Mr. J. H. Brown, Climax; Mr. E. E. Rockwood, Flint; Mr. J. N. McBride, Burton.

After the close of the special dairy course, opportunity has been afforded the regular College students to take dairy work. Hereafter this work will be required of all agricultural students and will form an essential part of their course.

(Mich. Report of '94)

It is quite obvious that the present quarters of the Dairy School are too small, as may be seen in the cuts on the opposite page, and because of the absence of a proper building in which to carry on this work, the course must be discontinued until suitable quarters can be obtained.

In order that the dairy work may be continued in the future, more advantageously than in the past, a building or laboratory must be built to meet the requirements of such a school, and equipped in such a manner that the course of instruction may be carried on in the most systematic way and on the most improved plan. The subject matter of this Thesis is the Plans and Specifications of such a building, together with a description and arrangement of the necessary equipment.

Specifications.

Location.

In choosing a site for the Dairy Building, there are a few conditions to be borne in mind; first, it is quite necessary that this building should be in the immediate vicinity of the Agricultural laboratory, as those persons who will be connected with the dairy school are in a few cases connected with the agricultural department and have offices in the agricultural laboratory, hence, the passing from the one building to the other should be as convenient as possible.

The location should be such that there will be easy access from the college herd to the dairy as possible, and third, the proximity to sewers, pig-sties, or any offensive odors must be seduously avoided.

The only site available meeting the requirements, is that of the grain barn and silo, about fifty feet South and a little to the West of the agricultural laboratory, with a gentle slope to the East. Here the building may be erected, facing West, with a northern exposure for the butter and cheese rooms, also the ice house, and a very good Southern exposure for the cheese curing room, all of which are very desirable.

Excavation.

A five foot hole should be dug with dimensions as shown on the Basement Plan, allowing a foot all around for caving etc.

In front of the main wall, there shall be an excavation made for a terrace, allowing light to pass into the Basement windows, as indicated in the Basement Plan.

Foundation Wall.

This wall shall be built of granitic rock (field stone) with the surface stones, or those composing the outer and the inner surface of the wall, roughly cut so as to rest securely in place: The whole shall be well cemented together with the best Portland cement. The first course of stone shall be laid 6" below basement grade, and 2 ft. wide, extending to a height of 9 1/2 ft. to the water table with a width at the top of 18 inches.

Coping:

The stone coping on water table shall be made of gray sand stone, cut in lengths of 3 ft. each, and each length 6" x 6" with a bevel of 1 1/2 inches on the upper outer edge. The coping shall extend around the entire building including the porch, South Wing, and ice house. It shall be placed on the outer edge of the foundation wall with a projection of 2 inches. (See detail No.1)

Exterior Walls. (Main Structure)

These shall be constructed of white pressed brick, second firing, of the regular demensions (2" x 4" x 8") cemented together with Portland cement, and 12 inches thick, arranged so as to be equivalent to three courses laid lengthwise.

The height of the different wall shall be as follows, with references to design:

(See Plans and Elevations)

Wall	Kind of Roof	Width of Wall	Feet to Eaves	Feet to Peak	Dimensions.
Of Front Projection	Gable	26 2/3 ft.	24 1/2 ft.	38 ft.	26 2/3 x 16ft. S. Side 5" N. "
S. Wing	3/4 Hip	21 ft.	14 ft.	-----	21 x 21 ft.
N. Wing. (Office)	Mansard	20 1/2 "	22 "	-----	20 1/2 x 16-8
Main.	Gable	See Dem. on Plan.	24 1/2 "	38 ft.	

There shall be a nitch at top of wall 8 inches from the inside, to support the roof beams, leaving 4 inches for a course of brick on outside. (See detail No.2) Upon the wall supporting the two main roofs, shall be placed gray stone slabs, cut in 4 ft. lengths 1 foot wide, and 4 inches thick. At the two peaks where these slabs meet shall be placed a stone cut as in detail No. 3, and at the other end above the Eaves, shall be placed stones cut as in detail No.4

Ice House.

The walls of this wing shall be frame structure 18 inches thick, allowing 1 inch for outside boarding, of White Pine, 4 inches for scantling, 1 inch inside boarding, and the space between outside and inside boards to be filled with charcoal, and the interior surface of inside boards to be covered with the heaviest tar Paper. There then shall be a 6 inch air space, 1 inch inside boarding, 4 inch scantling, and 1 inch outside boarding of

Norway Pine, this to be covered with tar paper and the intervening space to be filled with charcoal, the same as the outer part of wall, making a total of 18 inches.

There shall be a cold storage room built inside of the ice house, 6 ft. x 10 ft. and divided from the main part by a 6 inch partition of Norway Pine. This cold storage room shall extend only to the first floor, terminating in a ceiling sloping toward the outside of the house, and provided with a trough on the lower edge, and on the inside to carry off the water from the ice above.

Roofs.(Main Roofs)

These two roofs shall be the ordinary gable, joining as shown in the Roof Diagram, and supported as shown in the section drawing:

A. - King-post.
B. - Tie beam
C.C. - Struts
D.D. - Purlins.
E.E. - Backs or principal rafters.
F.F. - Common rafters.
G.G. - Wall plates.
H. - Ridge piece.

All of the roofs shall be covered with slate of the ordinary size, with the exception of the N. W. corner wing.

South Wing.

This roof shall be a three quarter Hip supported by 2" x 4" rafters 16 inches apart. The ridges shall be made of inch stuff 6 inches wide, set on edge.

North Wing. (Office Wing)

This roof shall be constructed somewhat like the Mansard, only on a small scale. It shall have flat area on top 10 ft x 14 ft., then sloping away to a collar beam, and finally sloping to the eaves: The whole shall be covered with tin, and varnished with asphaltum to prevent rusting.

Roof of Ice House.

Shall be a Hip roof supported in about the same way as the South wing. All ridges shall be capped with ornamental ridge capping, made of Galvanized iron, and at the peaks shall terminate in a raised triangular point.

Eave troughs.

Shall be made V shape, galvanized iron, and set in the lower edge of roof. (See section detail No. 5)

Conductor pipes.

These shall be made square, and made of fluted galvanized iron, located as shown on elevation.

Porte-cochere.

This structure is attached to the front of the building for convenience in driving under and for protection from the weather. It shall be square in plan, supported by two stone foundation pillars 1 ft. square at the top, upon these shall be placed two wooden posts turned 6 inches in dia. with flat surfaces at top and bottom, which support the outer portion of the roof, the re-

mainder being supported by two 4" x 6" scantlings 4 ft. long, securely bolted to the brick wall. The roof shall be a pyramidal Hip supported and finished same as the roof of the wings.

Ventilator Cupola.

The cupola shall be built at the top of the ventilator shaft (See plans) of pine, 3 1/2 ft. square in plan, 4 feet in height to cover a 60° roof. The sides shall be provided with two rows of slats each, separated by a 4 inch strip, thus allowing a free circulation of air. The sides below the slats shall slightly curve out until meeting the roof. The roof shall be covered with slates a little smaller than those on main roofs.

Openings. Windows.

In the foundation wall shall be 17 openings for windows, each 2 1/2 ft. x 3 ft. and slightly rounding at top, radius of 4 1/2 ft. Each of these openings shall have a gray sand stone sill 3 feet long, 8 inches wide and 5 inches thick on inside, sloping to outer edge, which shall be 4 inches thick, making a slope of 1 inch. Each opening shall have a sash made of 2" x 12" white pine, painted black, and flush with inside of wall. The window frames shall be made of white pine painted black, and glazed with a good quality of glass, two panes to the windows, and each pane 15 3/4 "x 27" Special Cut. They shall have a lateral swing from center for opening. (Also large door from porch).

The foundation wall of ice house shall have an opening 1 1/2 ft. square, opening into the cold storage room; the windows shall be finished same as the others, except it shall swing vertically from two hinges on the edge.

In the rear wall there shall be an opening 4 ft. x 7 ft. for a basement door; the doors shall be double, made of white pine, panneled, and finished in natural wood and hard oil. The two upper panels of doors shall be glazed.

In the first floor wall there shall be 17 openings for windows, each 3 ft. x 7 ft.; with gray sand stone sill, each 3 1/2 ft. x 8" x 5" with a bevel of 1/2 inch along center to within 5 inches of the ends. The window sashes on outside shall be painted gray, and a hard oil finish on the inside; the frames to be painted black outside and hard oil finish on inside. There shall also be an opening in the front wall, 4 ft. x 7 ft. with rounding top, for double doors of the entrance, and another 2 1/2 ft. x 5 ft. for sliding door to receiving room. These openings shall be furnished with stone sills same as windows, only longer; the doors shall be made of Norway pine, paneled, and finished in natural wood and hard oil.

In the second floor wall there shall be 11 openings, 3 ft. x 7 ft. with rounding tops, radius 1 1/2 ft. These windows shall be finished the same as those of the first floor. Over and connect-

ing each window, shall be a gray stone frieze, as seen in the elevations. In the office wing there shall be 4 openings, 3 ft. x 4 ft. with rounding tops, radius 1 1/2 ft. and surmounted by a stone cap 6" thick. In the third floor wall there shall be an opening in each gable, 3 ft. x 5 ft. with rounding top, 1 1/2 ft. radius.

Porches and Steps.

There shall be two porches to this building; the one to the main entrance shall be simply a platform 5 ft. x 7 ft.. From this veranda to the ground shall be a flight of steps, (See first floor plan) each step to be 8" high x 12" wide, and built of 2" oak stuff.

The porch to basement entrance shall be built into the main wall and of the same materials, and covered with a pyramidal roof, also covered with slate. This porch shall have an opening in the front side for entrance, 4 ft. x 7 ft. and rounding at the top, radius of 2 ft.

In the South side shall be an opening 4 ft. above ground, and 2 ft. x 4 ft. also rounding at the tops, radius of 1 ft. The floor of this porch shall be made of flag stone, slightly raised above ground, with a stone step to it, on the outside.

In the rear of the building, there shall be a flight of stone steps to the basement. The width of the flight shall be 6 ft.

and each step shall be 10" wide and 8" high. On three sides of this opening, and laid on the wall of said opening, shall be a gray stone coping, 1 ft. wide and 4" thick.

There shall also be two platforms, one under the porte-cochere, 5 ft. x 6 ft. for receiving the milk cans from the wagons. It shall be supported by two 3" I beams cemented into the brick wall. The other platform shall be fixed to the N. side of ice house and 4 ft. x 5 ft.; it shall be supported same as the one under the porte-cochere.

Interior.

Basement.

The entire floor of the basement, exclusive of the ice house shall have a cement floor with a smoothly finished surface, thus allowing flowing water to pass over without any ill effects, and for conveniences in keeping clean. Running lengthwise of the floor of the separating and churning room, shall be a trough of cement, sloping slightly to the South to allow the water which is almost constantly passing over this floor, to pass off.

In each room of the basement, with the exception of the separating and churning rooms, the brick walls shall be smoothed and whitewashed down to the floor; this gives a clean appearance and the whitewash tends to purify. In the separating and churning rooms, if the cost is not objected to, the walls may have a wain-

scoting of glazed tiles, to a height of 5 feet, and the brick walls smoothed and whitewashed above the tiling.

Separating the Test room and the Corridor from the Butter room, shall be a 1 foot brick partition; and separating the wardrobe and Lavatory shall be a partition of Norway pine, supported from the floor by 3/4" iron bars, 8" long. The Lavatory shall be furnished with the necessary conveniences as shown on the plan.

Separating the churning and separating rooms shall be a glass partition, supported upon a 4 ft. freme partition, and this again separated from the floor by 3/4" iron bars, 6" long.

The ventilator shaft, shown on plan, shall extend from basement to roof, and shall be constructed of two courses of brick.

All doors of this and the two other floors shall be made of Norway pine, paneled and finished in natural wood and hard oil, and of the dimensions indicated on the drawings. The ceiling of the basement shall consist of the flooring and floor beams of the first story, well whitewashed. Extending lengthwise of the Separator room, or from East to West shall be a line shaft, supported at each end by sockets set in the brick wall, and held from above by brackets 1 1/2 feet in length. This shaft shall have the necessary pulley wheels to run, two rows of separators, and one row of churns, unless this arrangement shall be changed.

First Story.

The floor of this story shall be made of 2" pine boards, covered with an inch coating of smoothly finished cement, to prevent warping when not in use, and the whole supported by 10" x 10" beams, the ends of which shall rest on the basement walls.

'll of the brick wall of this floor shall be smoothed and painted white, with the exception of the office which shall be plastered, with a baseboard 1 foot wide extending around the room, and the Cheese room, which shall have a wainscoting of white glazed tile, 4 ft. high, same as in the butter room. The partitions of this floor shall be about 6" thick, depending upon the finish in the different rooms.

The walls of the Wash room shall be sealed with 3" wide stuff, and covered with Marine Varnish so as to make them impervious to water. The walls of the corridor shall be plastered, and shall have a wainscoting 3 ft. high all around.

Along the angular wall of the wash room, shall be a sink 4 ft. long, 2 ft. wide and 1 ft. deep for washing cans and utensils; a draining bench, having same length and width as the sink; and a steam jet for drying the cans and utensils, arranged in the order as mentioned. In the front part of the wash room and adjoining the porte-cochere, shall be a small receiving room with a floor on a level with the exterior platform; this room shall be separated

from the wash room by 1" pine partitions, and provided with two swinging doors, as shown on the plan. This room is for the scales and receiving can. The ceiling of this story, with the exception of the office, which shall be plastered, shall be the finished boards of the second floor of the second story.

Second Story:-

The floor of this story shall be made of inch matched stuff, and placed on this, hard wood flooring. The floor of the lecture room shall be supported by two 15" I beams extending across the room, and these beams supported by two iron columns, with their resting on the first floor.

All the brick walls of this story, with the exception of the wall, which shall be plastered, shall be smoothed off and painted with white lead. All frame partitions shall be plastered, and have a wainscoting 3 ft. high, of white pine, finished in natural wood and hard oil. The Lecture room shall be provided with the necessary seats and black boards, the latter to be of slate. The ceiling of this story shall be the same as that of the first story.

Attic:-

The floor of the attic shall have a floor of matched inch stuff, and supported the same as the floor of the Second story. The attic shall be finished only in rough.

Elevator:

This building shall be provided with an elevator the same as

that of the agricultural laboratory, only this to be 5 ft. x 5 ft. It shall run from the basement to the second story, and shall have all of the working mechanism at the top of the second story, and extending as much as possible into the attic.

Stairways.

The students entrance to this building shall be by the porch on the South East of building; from the porch they pass through double doors to a platform or landing, 4 ft. above the basement floor, and 5 ft. below the first floor. From this landing a flight of steps, opposite the doors, passes down to the basement floor, and on the right of the landing from entrance, a flight of stairs ascends to the first floor. (See on Basement Plan)

From the first floor a flight of steps, directly above short flight in basement, ascends to another landing, 4 ft. above first floor, and 7 ft. below second floor; this landing serves as the ceiling for the landing in the basement. To the left of this landing, ascending another flight passes up to the second floor. (See --> on 1st. Floor Plan) The wall indicated by a.a' shall be left out making the stairway open. The stairway on the second floor shall all open with a balustrade around it. (See 2nd. Floor Plan)

The entire flight of stairs from the basement to the second floor shall be made of white oak, and the balustrades shall be

made of the same material with a design similar to those in the Botanical laboratory.

Pluming, Draining & Heating:

This building must be exceptionally well drained because of the character of it. The tile drainage, sewerage system, and ventilation of lavatory must be left to the expert who is more capable of specifying this work than the student. The water shall be piped from the college plant. The building shall be heated by steam, and this also supplied from the college plant.

Miscellaneous.

Handling the milk.

The milk as it enters the building from the wagons, is received in a Way-can upon a pair of scales and weighed; the way-can and scales rest upon a platform 2 ft. above the floor, making the bottom of way-can 2 1/2 ft. above the floor. The milk is conducted through jointed tin pipes, by gravity to a large receiving vat in the Cheese room; the top of this vat must not be more than 2 ft. above the floor, as it would then interfere with the flow of the milk. From this receiving vat, the milk may be drawn off into smaller vats for use in the Cheese room, or else piped directly down into a heating tank in the Butter room, the bottom of this tank shall be 6 ft. above the floor so that the milk may flow from

it into the separators. The flow from the receiving vat down into the heater, may be regulated by stop cocks. From the separators the cream and skim-milk may flow into their vats respectively.

All pipes carrying milk must be kept clean by thoroughly washing and scalding them.

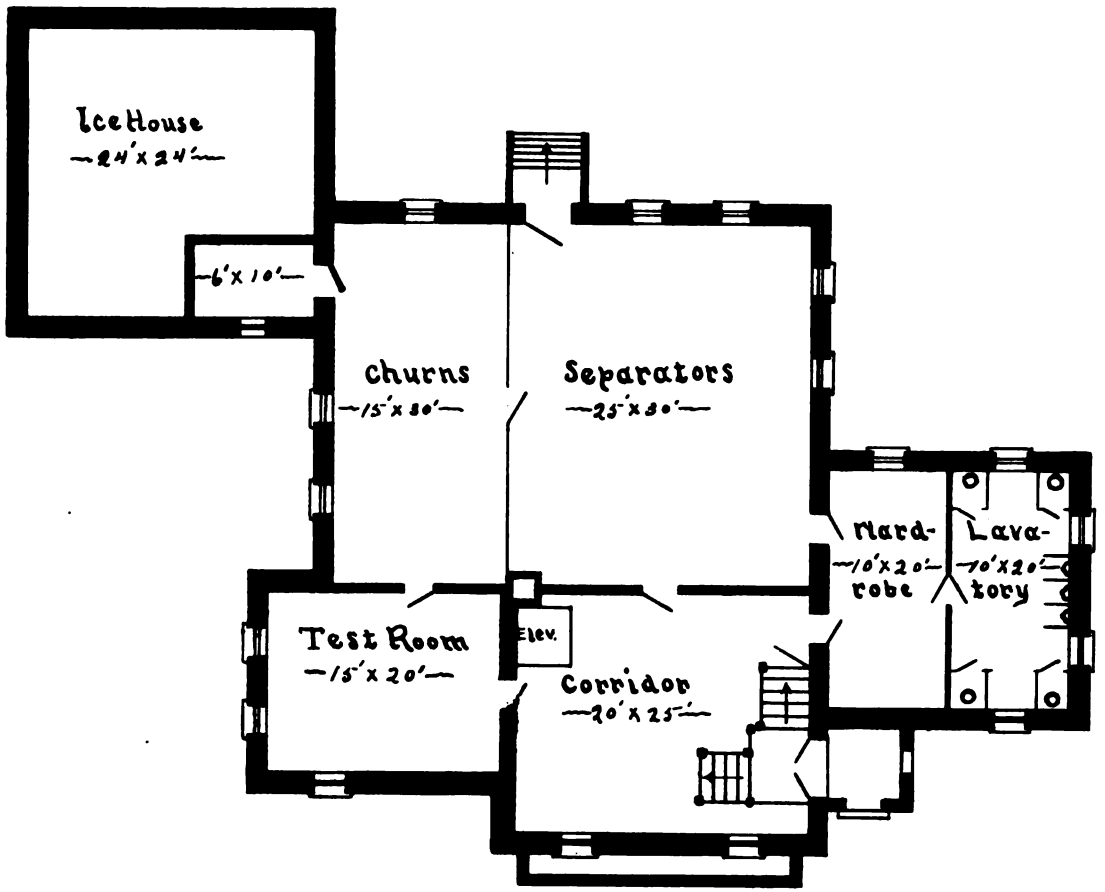
The system of conducting the milk from the Way-can to its terminus is called the Gravity system, and by using it, the expense of pumping the milk from the way-can into the heating tank, is done away with.

In the Butter and Cheese rooms, it will be necessary to have a number of shelves for convenience in keeping the dairy utensils when not in use. By far, the neatest and best shelves are of stone or slate, 2 ft. wide, raised on stout iron rods about 2 ft. from the cement floor, and as many tiers high as necessary.

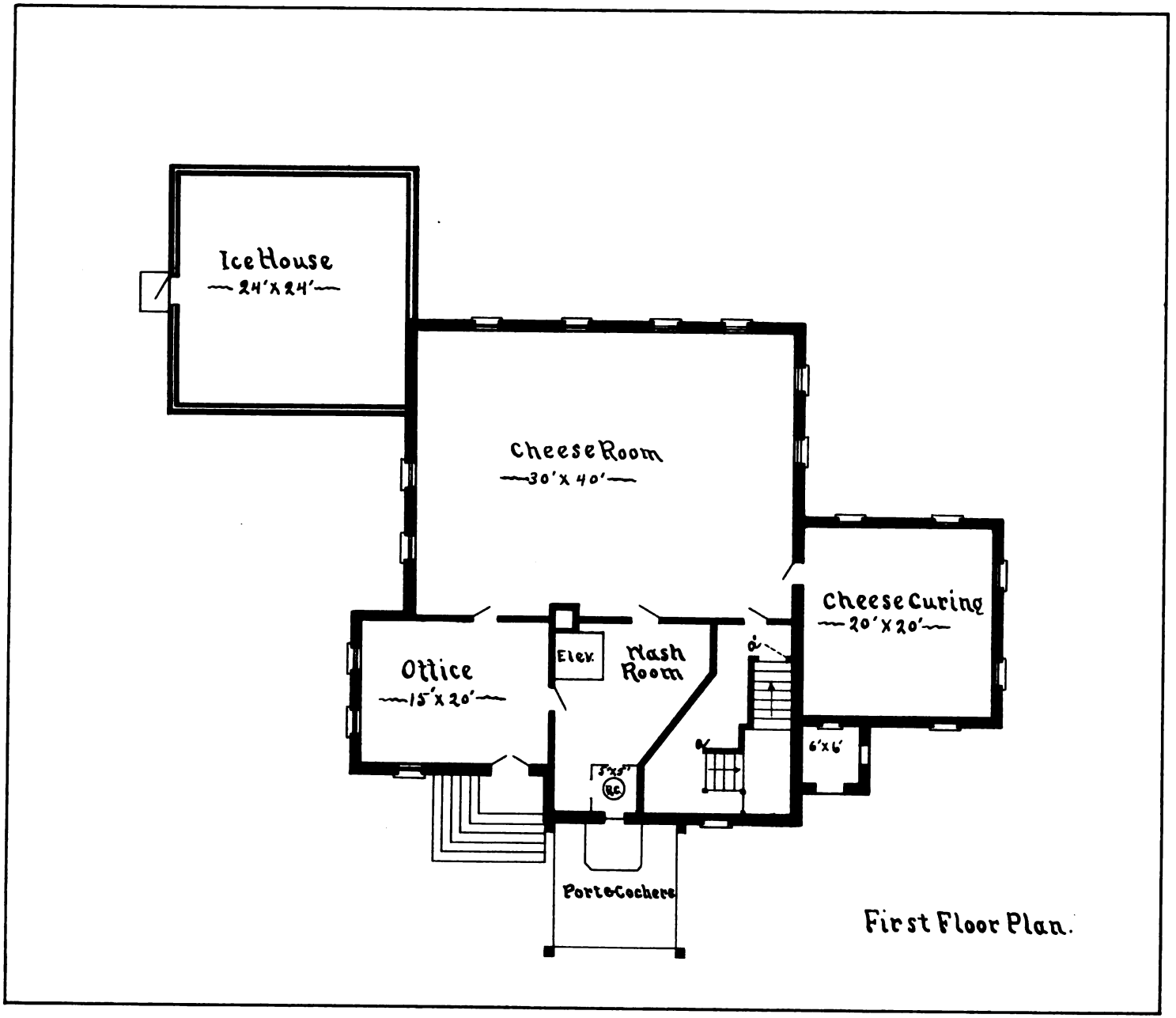
Owing to the writer's lack of knowledge of the cost of the various building materials, and the labor necessary to construct such a building, he is unable to make an accurate estimate of the cost of the structure. But by a very rough estimate, he would consider the cost not to exceed $14,000.

Finis.

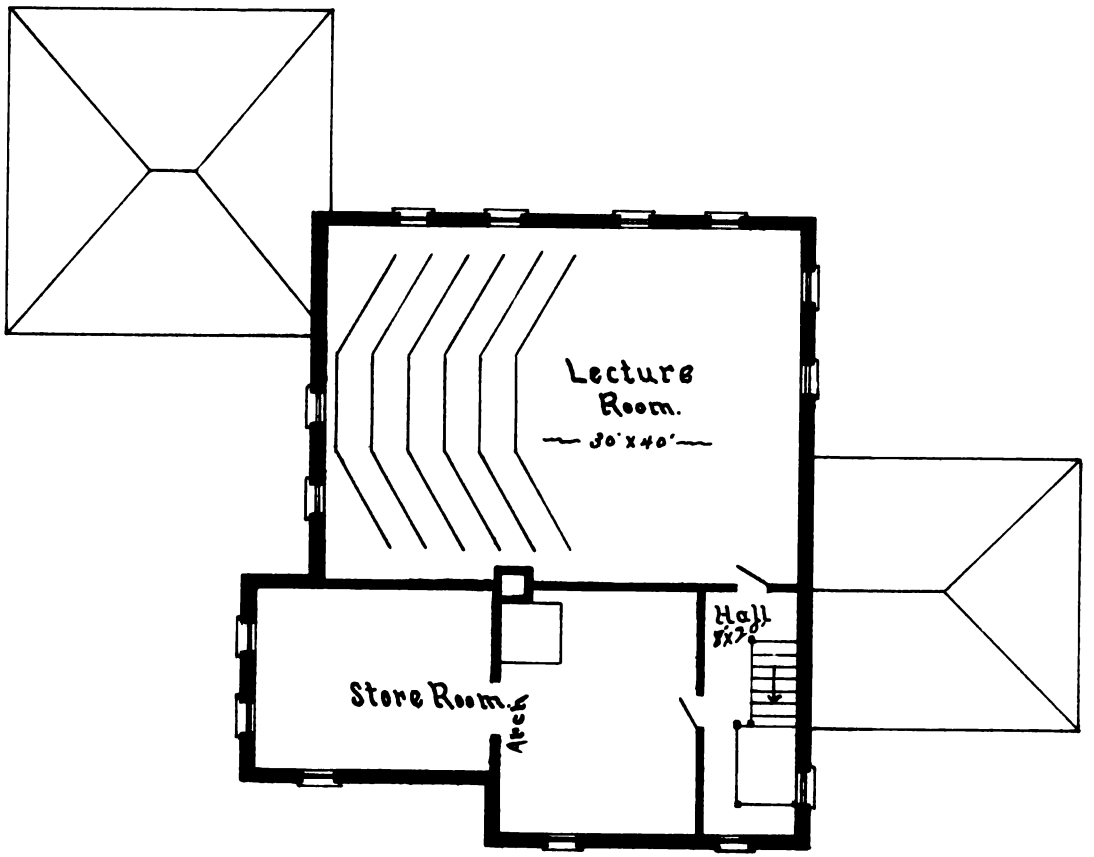
Basement Plan.



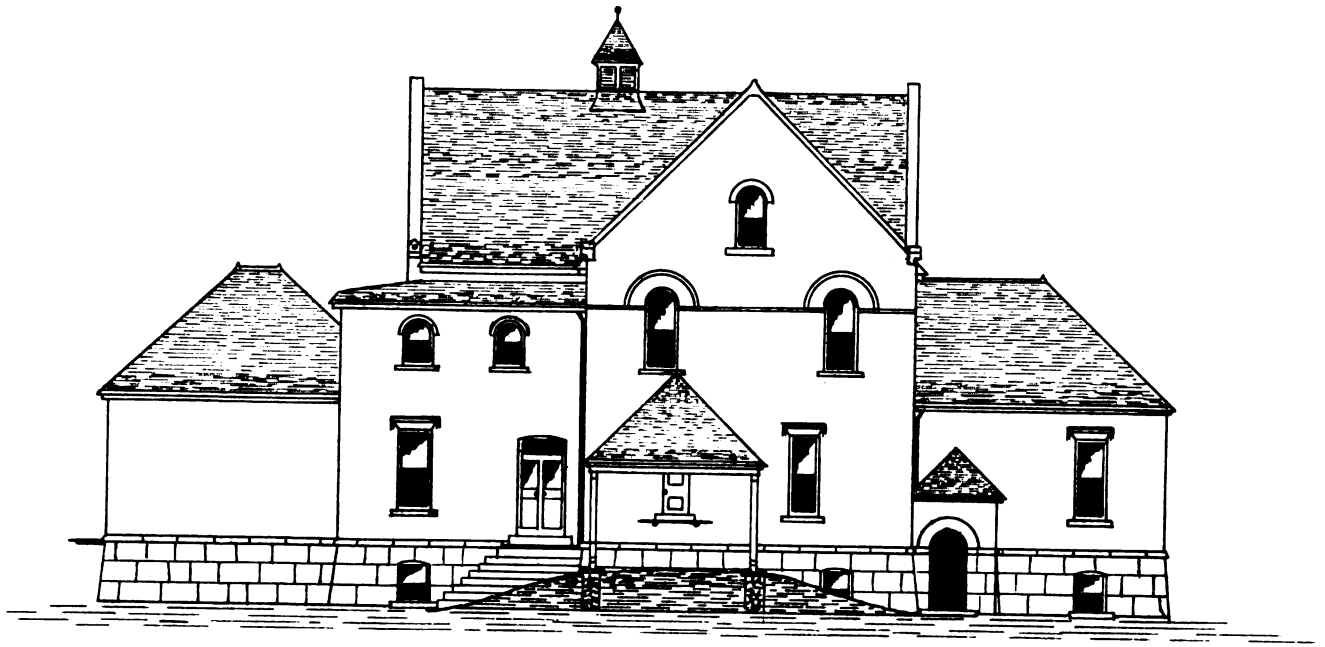
Basement Plan.



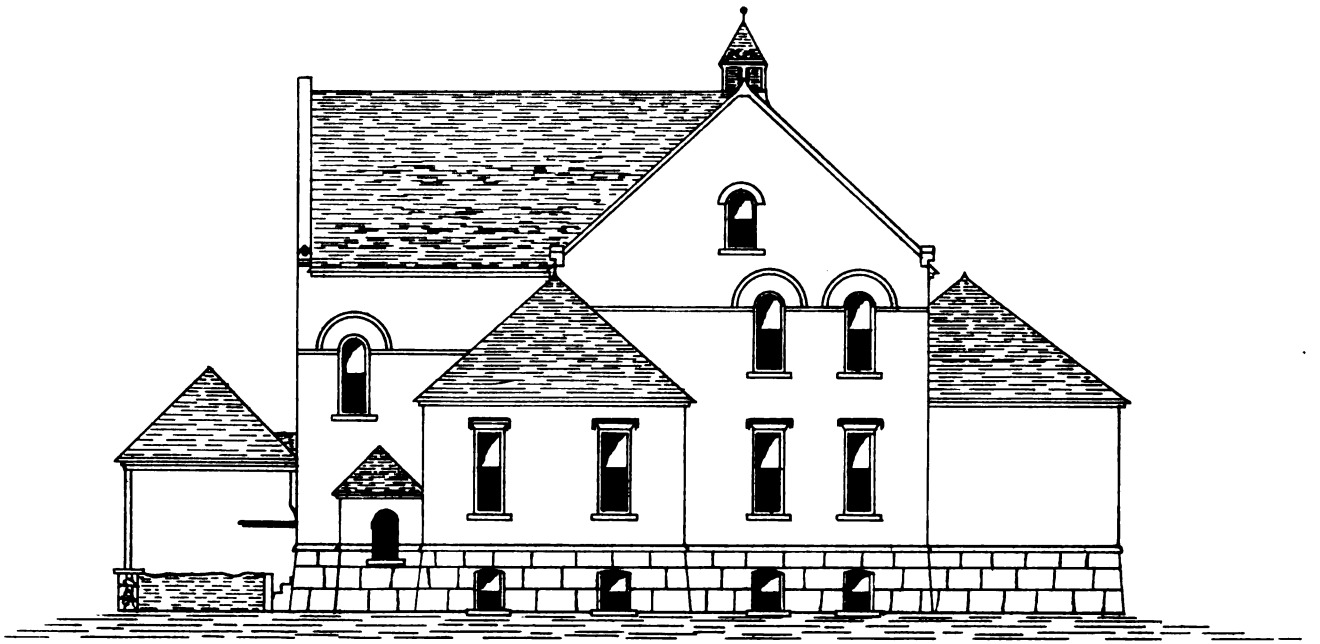
First Floor Plan.



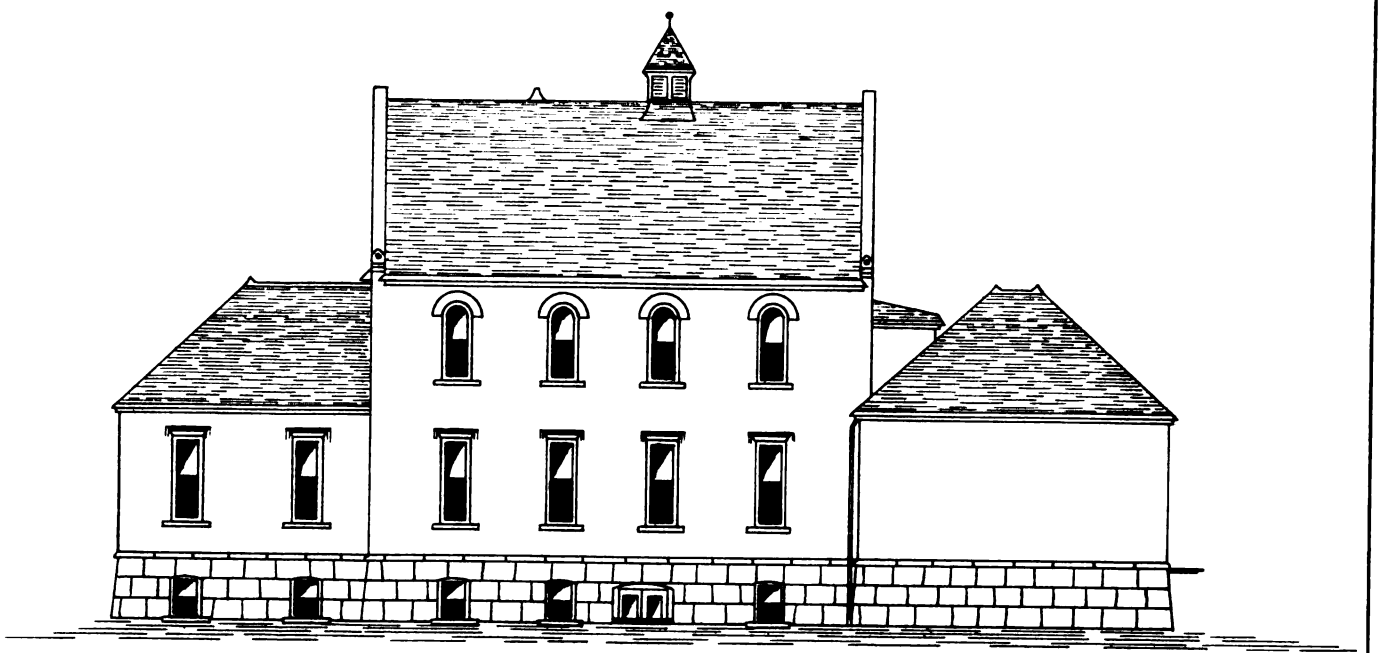
Second Floor Plan.



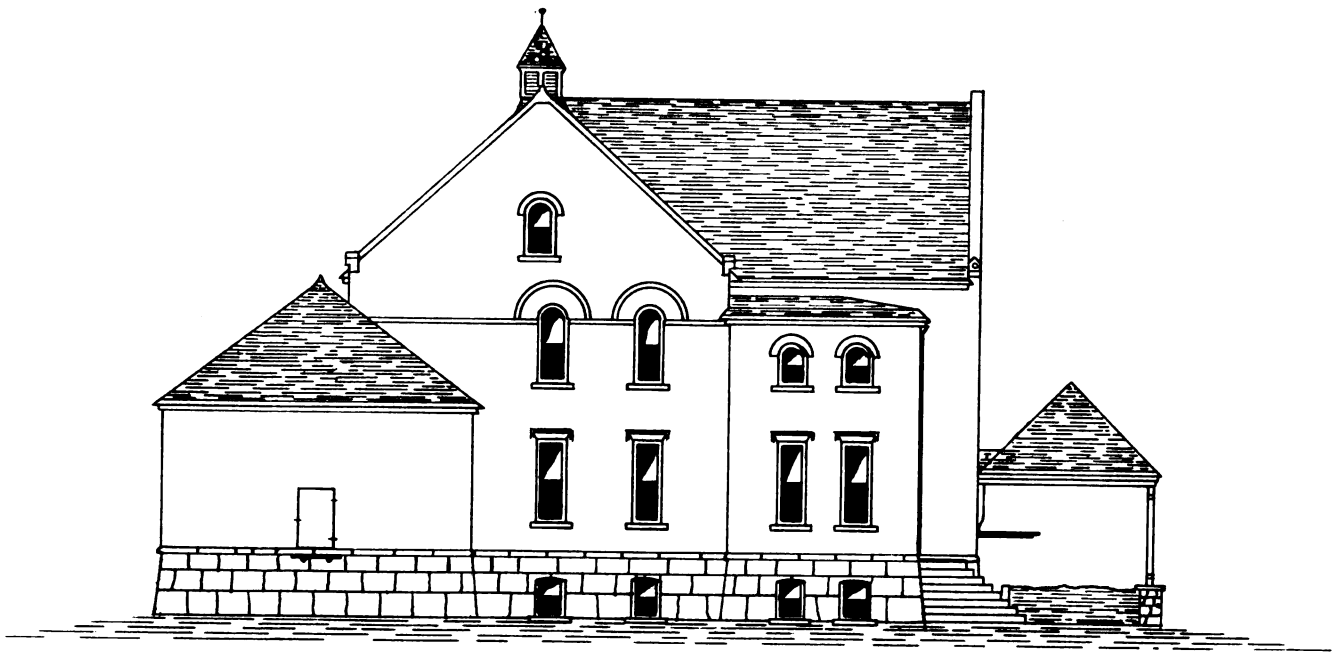
Front Elevation.



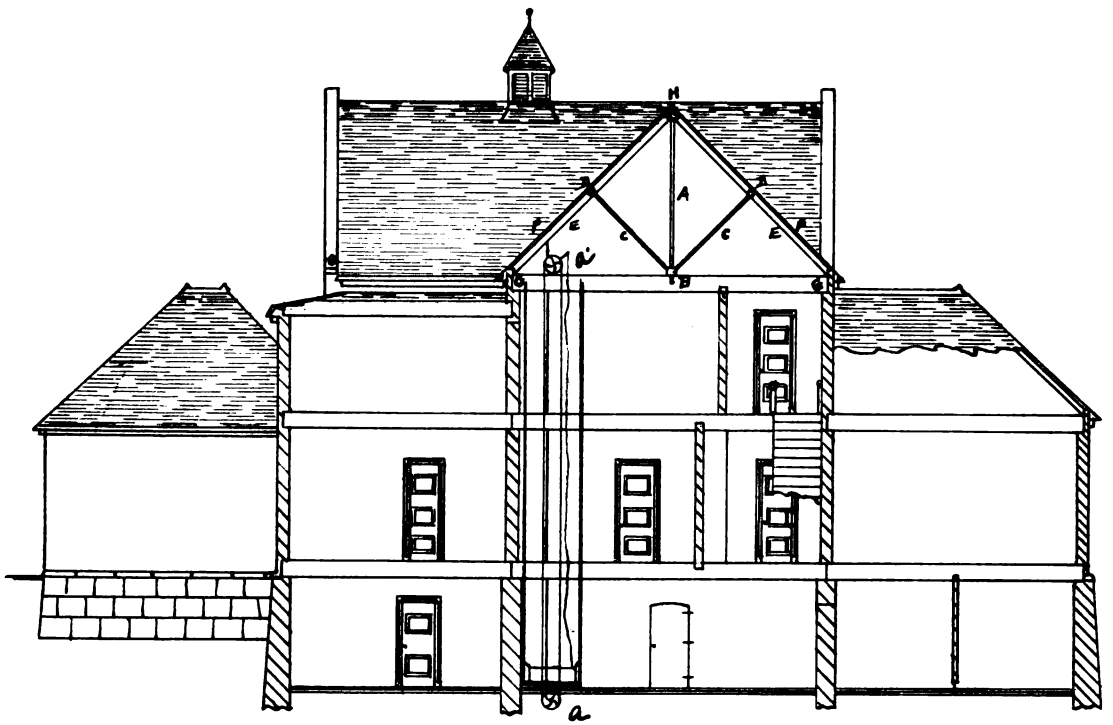
S. Side Elevation



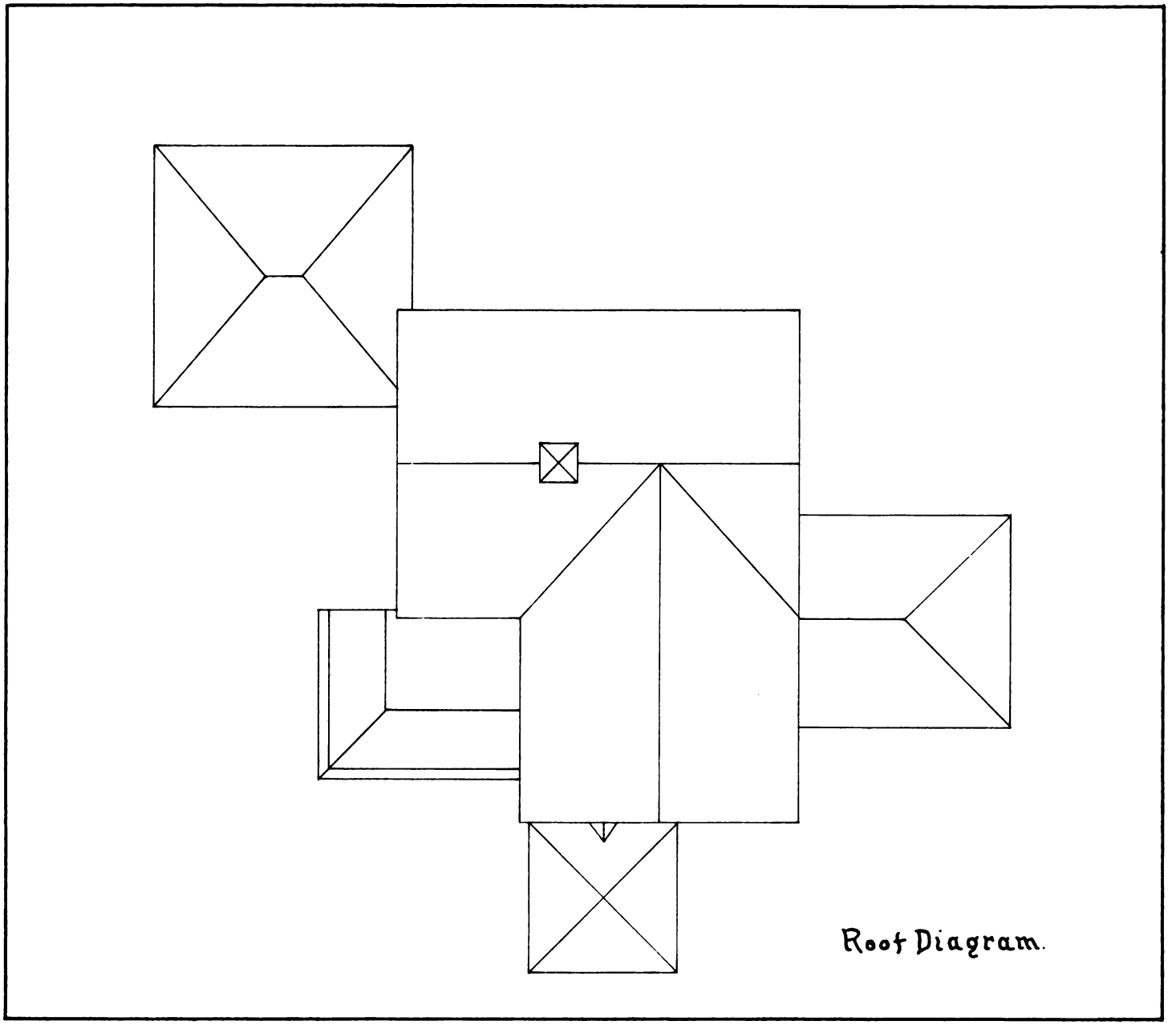
Rear Elevation.



N. Side Elevation.

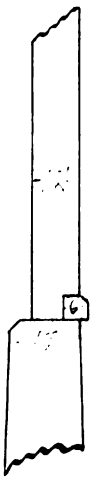


Cross Section



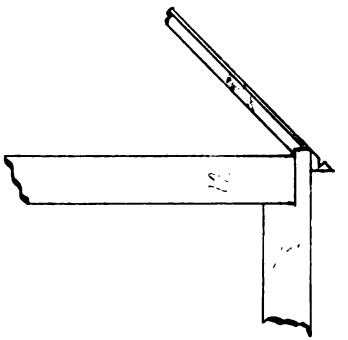
Roof Diagram.

I

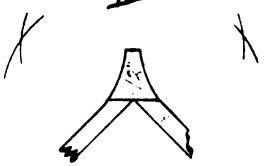


Scale $\frac{1}{4}$" per Ft.

II



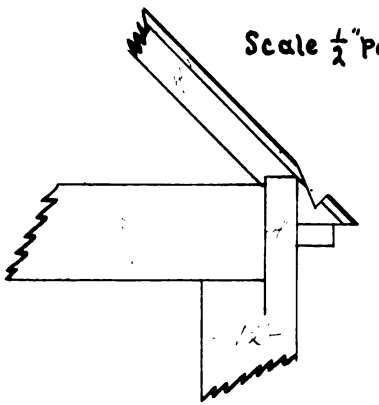
III



IV

V.

Scale $\frac{1}{2}$" per Ft.



Detail Sheet.