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Barns for Wisconsin Dairy Farms

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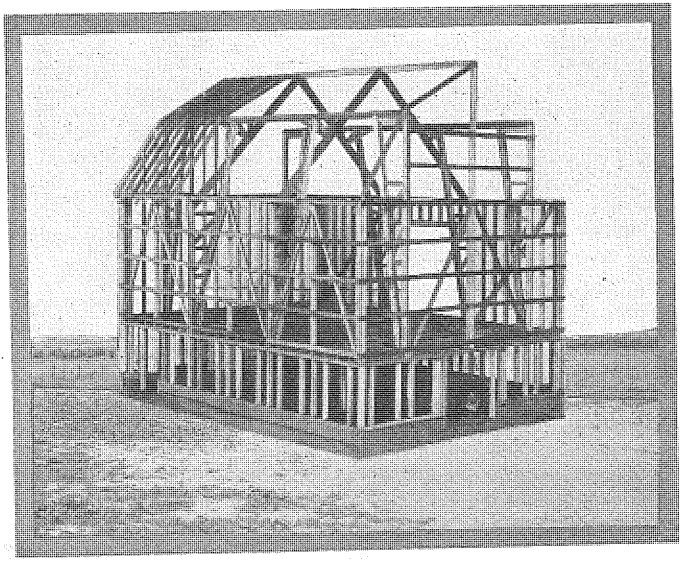


PLANK FRAME CONSTRUCTION REDUCES THE LUMBER BILL

In building a farm barn it is important that the cost be kept as low as possible without sacrificing comfort, convenience or strength.

AGRICULTURAL EXPERIMENT STATION
OF THE UNIVERSITY OF WISCONSIN

MADISON, WISCONSIN

DIGEST

A Well-built, well-lighted, well-ventilated, and well-planned barn is a necessity on nearly every live stock farm. The cost of the barn may vary, for some farmers will install more elaborate conveniences and pay more for architectural style than will others. Page 3.

Barns are practically standardized, in regard to framing and interior arrangement. The cost of wood and other materials makes it necessary to make a more careful study if savings are to be made. Page 3.

Build a barn large enough to meet future needs and to permit the handling of the maximum capacity of the farm. If the new barn just holds the stock at time of building another barn will probably be needed soon. Page 4.

The location and drainage of the barn are important. The location should be at least 200 feet from the house and handy to a well, sheds, and granaries. Drainage is necessary if the stock is to be kept healthy. Page 5.

Rectangular shaped barns are more satisfactory than round ones. In Wisconsin, the barn should have its length run north and south if the largest possible amount of direct sunlight is to be let inside. Pages 5–8.

A ventilation system is required if the animals are kept healthy. It also regulates the temperature and furnishes fresh air. The King system is best adapted to Wisconsin conditions. Pages 9–15.

The barn must be kept clean. The manure can either be removed every day or the stalls bedded heavily and the manure removed every week. It is best to clean out the barn every day. Pages 16–22.

Gambrel roofs give more room for hay than do the gable roofs. This is an important point to consider. Pages 23–26.

Concrete is the best product that can be used for the foundation ground floor and wall of the barn. Sand and gravel are often found on the farm where the barn is built. Concrete must be well mixed and reinforced if it is to give the best of satisfaction. Pages 26–28.

Plans are described in this bulletin for three general purpose barns, one single story dairy barn, and a pioneer barn. Blue prints can be secured from the Agricultural Experiment Station. Pages 29–32.

Barns for Wisconsin Dairy Farms

While Wisconsin's climate is ideal for the production of vigorous and healthy live stock its rigor makes a well constructed, well lighted and well ventilated barn a necessity on every well equipped stock farm.

> Successful animal husbandry requires not only healthy stock but adequate and sanitary quarters in which to rear them. Climatic conditions which prevail in Wisconsin require that specific attention be given the matter of housing live stock. Fresh air is essential to health. Sunlight is one of the most powerful disease-destroying agencies known. To retain as much of these properties as possible and at the same time give adequate shelter from winter cold and summer heat is the object sought in the construction of the barn of the live stock farmer. The cost of such an improvement is considerable; consequently the prudent manager will carefully study his needs so as to secure the best equipment for his money.—H. L. Russell, Director.

Conditions, however, in the various sections of the state and upon the various types of stock farms are not sufficiently alike so that one plan will meet the demand of everyone. The right barn for one man or for one farm may not in any way meet the requirements of another. One man may, in building his barn, consider, mainly, ways of reducing the need of labor; another may plan his barn so as to aid him in the display and sale of his stock. Then, too, one may care more for architectural style and modern conveniences than his neighbor and be willing to spend more in order to secure these features.

Barn building, however, so far as design of framing and interior arrangement are concerned, is rapidly becoming standardized. The general requirements of barns are very similar, and the four designs described at the end of this bulletin and which may be secured by writing to the agricultural engineering department are planned to meet as nearly as possible the needs of Wisconsin farmers.

The high price of materials and the too often extravagant use of them in building, has caused the majority of farmers to reduce the amount of wood used in constructing their barns and to make a judicious selection in order to secure the best kind of wood.

In the past, barn framing has been done by "rule of thumb." In order to save material and to insure the necessary rigidity of the structure, more attention is now being given to the strength of materials and to matters of design.

BUILD TO MEET FUTURE NEEDS

A barn should not be built just large enough to accommodate the stock on the farm at the time of its building. A good manager considers his farm as a factory and expects to work his "plant" to its maximum economic capacity. The barn is an important part of the farm factory plant and should be large enough to accommodate all the animals the manager can care for efficiently. The size can be determined only after a careful study of the number of acres in the farm and the quality of stock.

Over capitalization is perhaps as poor a policy as under capitalization. But the dairy farmer, especially, can afford to have a substantial, well arranged, well lighted, and well ventilated building.

BUILD ON WELL DRAINED SITE

The first essential of a barn site is proper drainage. With basement barns, which are the most common in Wisconsin, it is difficult to obtain perfect drainage. The chief object in building a basement barn is, as a rule, to provide an easy driveway into the second floor; but as hay and grain can be elevated easily or a bridge built leading to the second floor, light and drainage should not be sacrificed for the doubtful advantage of having a basement.

A driveway can be built to the second floor that will not shut out indirect light. In order to do this a concrete wall needs to be built about eight feet from the barn and either a reinforced concrete bridge or a wooden bridge should connect the drive with the barn. The driveway in the barn should be from 12 to 14 feet wide, and the drive approaching the barn

about 10 feet in width. It is expensive to give up space in the barn for a driveway for in reality, very little use is made of it. Ordinarily such a driveway is used largely to drive into if caught with a load of hay on the wagon during a rain storm. Several tarpaulins large enough to supply this need can be purchased at a less annual expense than that incurred by the driveway.

LOCATING THE FARM BUILDINGS

The arrangement of the yards and fields, and the location of the well, machinery shed and granaries should be considered carefully in locating the barn. It should be at least 200 feet from the house and in such a position that the prevailing winds do not carry the odors from the barn towards the house. Under the best sanitary conditions possible there will be some odor from the barn and the amount of time saved in going to and from the barn by having it close to the house, will not be due compensation for enduring the obnoxious odors. The barn should not be made the most conspicuous farm building. It is secondary to the house and should be so located as not to obstruct views from the house. Usually a location at one side and somewhat to the rear of the house will be found the most suitable.

If it is impossible to have drives leading both to the barn and to the house, the barn should be so located that either the service drive or a branch of it may be made to serve the house. This does not mean that a drive must come within a few feet of the house, as is so many times the case, but it should be convenient. It is undesirable to have the service drive for the barn, over which heavy hauling and delivery of hay and straw is to take place, close to the house. The drive should be so located that it may be screened off by the proper planting of the lawn surrounding the house.

RECTANGULAR BARNS MOST COMMON

There are two general shapes of barns, round and rectangular. The great majority of barns are rectangular. While there are differences of opinion as to the relative merits of the two shapes it is generally considered that the rectangular plank-frame construction is the more standard and satisfactory.

The best arguments for the round barn are:

(1) As a greater area can be enclosed by a circle than by a rectangle of the same wall length, it is cheaper to enclose a given floor area by a circular than by a rectangular wall, (Figure 1); (2) Circular construction is claimed to be stronger and to give greater convenience.

Some of the objections to the round barn and the advantages claimed for rectangular construction are:

(1) In a round barn the silo must, for convenience in feeding and for roof support, be located in the center. This location is inconvenient for filling, and unless care is taken in keeping silage cleaned up the odor from it is objectionable; (2) Unless designed for a dairy barn and all interior arrangements are circular in form, there is much waste space. A certain sacrifice of stable and hay-mow-room is made by locating the silo in the barn; (3) As the hay must be unloaded inside a barn bridge leading to the second floor is required. Barn bridges are not always convenient and much space is wasted from the floor to the roof where hay is drawn up; (4) The center of the barn is poorly lighted which in a dairy barn is a very objectionable point; (5) The construction of a round barn prohibits the economic use of rafters for if they are placed the proper distance apart at the plate they are too close at the top; and (6) There is considerable difficulty in securing carpenters experienced in round barn construction; (7) It is more difficult to secure proper ventilation in a round than a rectangular barn.

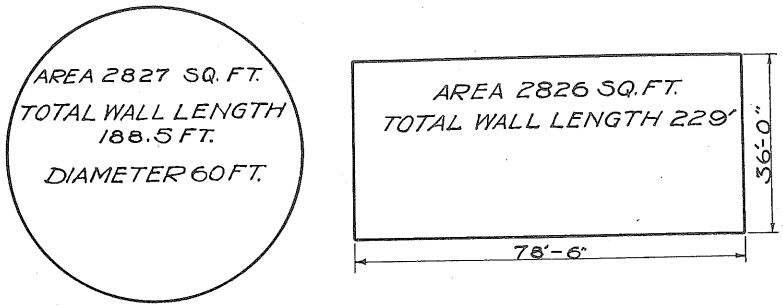


FIG. 1.—MORE AREA ENCLOSED BY CIRCULAR THAN BY RECTANGULAR WALL

Because a circular wall will enclose more area than a rectangular wall of the same length it is cheaper, from the standpoint of area enclosed, to build a round barn.

SUNLIGHT IS THE BEST DISINFECTANT

A barn should be lighted, so far as is possible, by direct sunlight. Sunlight is a great disinfectant and the best sanitary conditions can be obtained only in a well lighted barn. Darkness and dampness are serious objections to bank barns. The only good point in favor of the bank barn is warmth. Warm basements with good walls may be secured by building in a sheltered spot or by having a bank not over four feet high on one side. Window space should never be sacrificed for a bank barn.

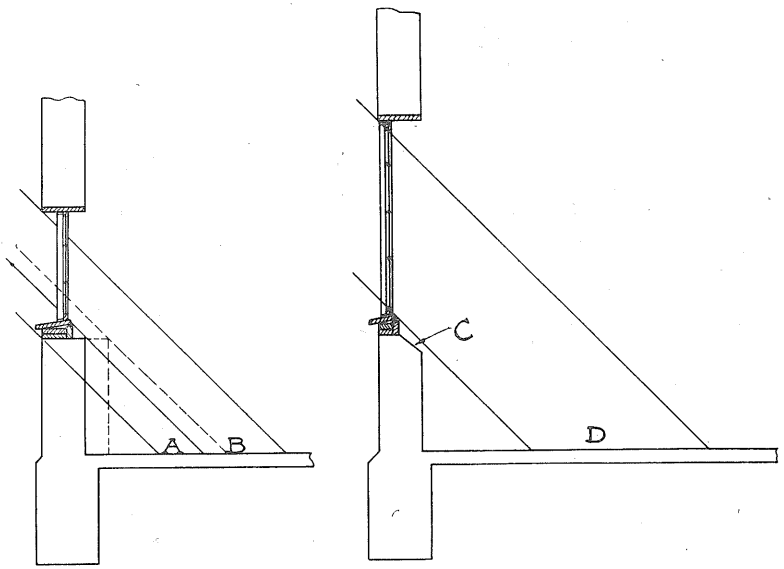


FIG. 2.—LONG UP AND DOWN WINDOWS BEST.

The long up and down window admits direct sunlight farthest into the barn and over a greater area as showed at D. Dotted lines show sunlight which would be cut out by 18 in. wall. Wall should be finished as shown at C.

The amount of lighting surface required in a barn is four square feet of window glass to each animal, or one square foot of glass for 20 square feet of floor space. The amount of direct sunlight entering through any window will depend on the length of the window, rather than on the width, the length of the overhanging eves and the thickness of the wall. The long dimensions of all windows for barns should be up and down as shown in Figure 2.

It is a mistake to put windows in a barn with the long dimensions horizontal. Up and down windows admit the sunlight further into the barn. The dotted lines represent the amount of sunlight cut out by the ordinary 18 inch stone wall.

The direction in which the barn stands has much to do with the amount of direct sunlight that enters it. In Wisconsin, if the barn stands east and west, direct sunlight enters only through the south, east and west windows, and

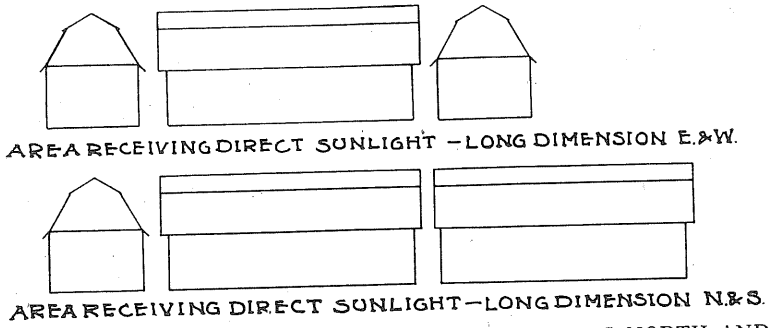


FIG. 3.—MOST SUNLIGHT ADMITTED IF BARN RUNS NORTH AND SOUTH

If the long dimension of a Wisconsin barn is placed north and south the sun shines on the two sides and one end; if placed east and west, on two ends and a side.

only indirect sunlight on the north. A barn standing north and south receives direct sunlight on both of the longest dimensions each day, or on the east and west, as well as on the south side, and indirect on the north side. As far as possible, buildings should be lighted from the south in the middle northern latitudes, as the maximum amount of direct sunlight may thus be obtained, by either an east and west or north and south arrangement, provided windows are not obstructed in either position. The barn should be placed with long dimensions north and south if a bridge or bank is to be built to the second floor. A barn standing north and south is generally cooler in the summer time as the prevailing winds from the south and southwest create a draft through the barn. In the winter time there is very little difference as far as temperature is concerned.

VENTILATION NECESSARY TO ANIMAL HEALTH

Barn ventilation is necessary to regulate temperature, to remove the moisture and bad air and to provide fresh air. When human beings live in poorly ventilated rooms their efficiency is reduced and they are easily attacked by disease. The effect on animals may be expected to be the same. Poor ventilation in stables is easily detected by an accumulation of moisture on the walls and ceiling during warm weather, and by frost in cold weather. In Wisconsin, where it is necessary to keep animals in the barn during the winter, it is absolutely essential to have a ventilating system.

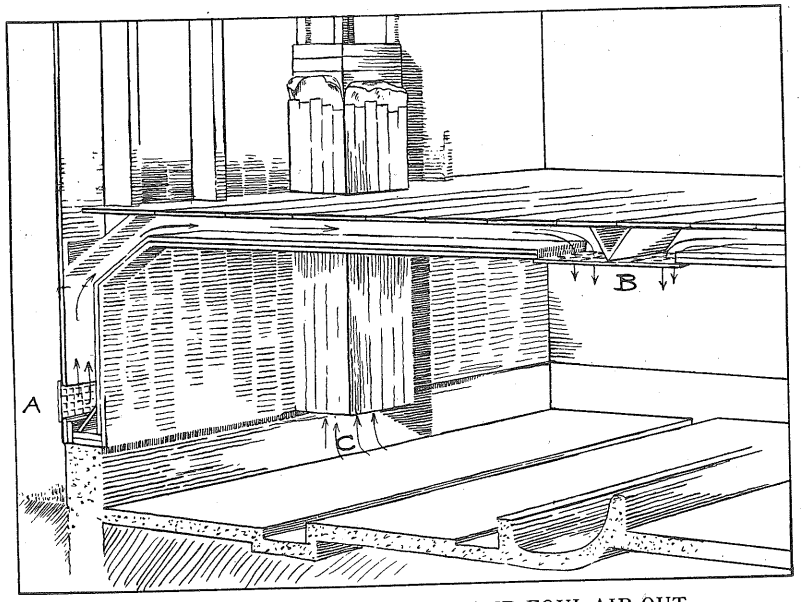


FIG. 4.—LETTING FRESH AIR IN AND FOUL AIR OUT

The arrows show how the air is brought into the barn through the inlets and the foul air drawn out at the outlets.

The King system of ventilation, devised by the late F. H. King, for years connected with this Station, has come to be generally adopted for barn ventilation. It has been widely used in all climates and has proven as satisfactory as can be expected from a partially automatic system. No ventilating system yet devised is entirely automatic so even the King system will need some attention. In the upper part of the

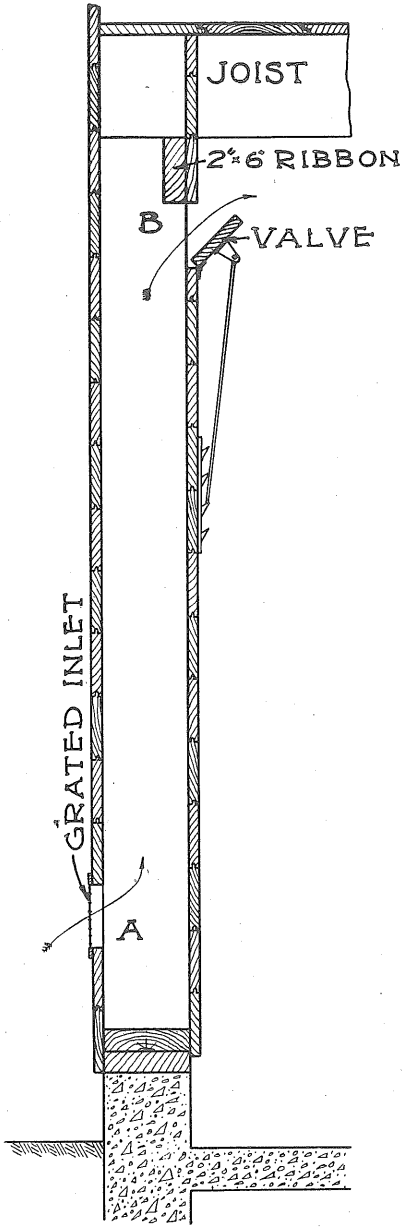


FIG. 5.—A VALVE INTAKE

The amount of air entering barn can be controlled by the valve built in some intake flues.

state the temperature is at times so low that an adequate supply of air cannot be furnished without producing too low a temperature in the barn, but under general temperatures conditions it is possible to ventilate the barn adequately, if the proper attention is given to the King system.

The efficiency of the King system depends upon the location, size and straightness of the intake flues and outlet flues, practically air-tight, non-conducting walls and ceiling, and good tight doors and windows. As in any natural or automatic system of ventilation, no provision can be made to warm the incoming fresh air except the heat supplied from the bodies of the animals. The fresh air is warmed by mixing it with the warm air of the barn at the ceiling before it is breathed.

These fresh air intakes are located at 12 to 14 feet intervals along the side of the barn wall. The minimum length of the flue must be five feet between A and B, Figure 5, so as to guard against

air flowing outward. It is very important that the inlet flue be covered with fine wire screening to prevent the flue from becoming obstructed. The valve or register should be arranged to open and close so as to prevent drafts in the barn and to keep the stable from becoming too cold during

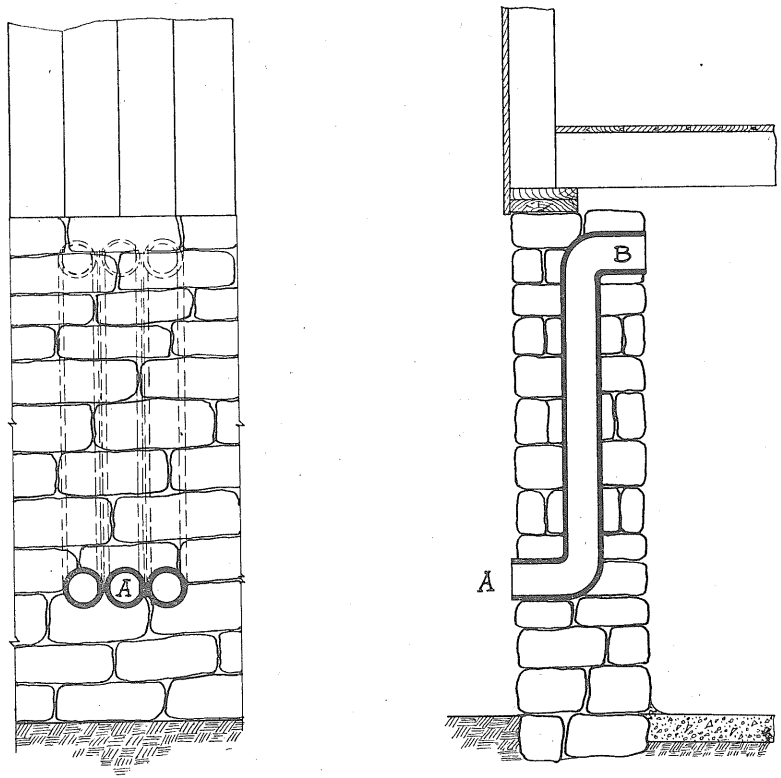


FIG. 6.—INLET FLUE IN STONE WALL

Vitrified sewer tile or galvanized iron pipe may be used to provide the air passage in masonry wall.

the extreme winter season. A register, similar to those used for hot-air furnaces, may be installed in place of the damper.

The foul air flues are made of galvanized iron, insulated, or of paper and lumber. The design of these flues is of the greatest importance to the success of the ventilating system. They should be as straight and smooth as possible for every turn or bend reduces the carrying capacity of the flue. If it is necessary to pass around a bend, the flue should be en-

larged so that its capacity will not be reduced. The ventilating flue acts as a chimney and should therefore, rise above the highest part of the building in order to receive the full

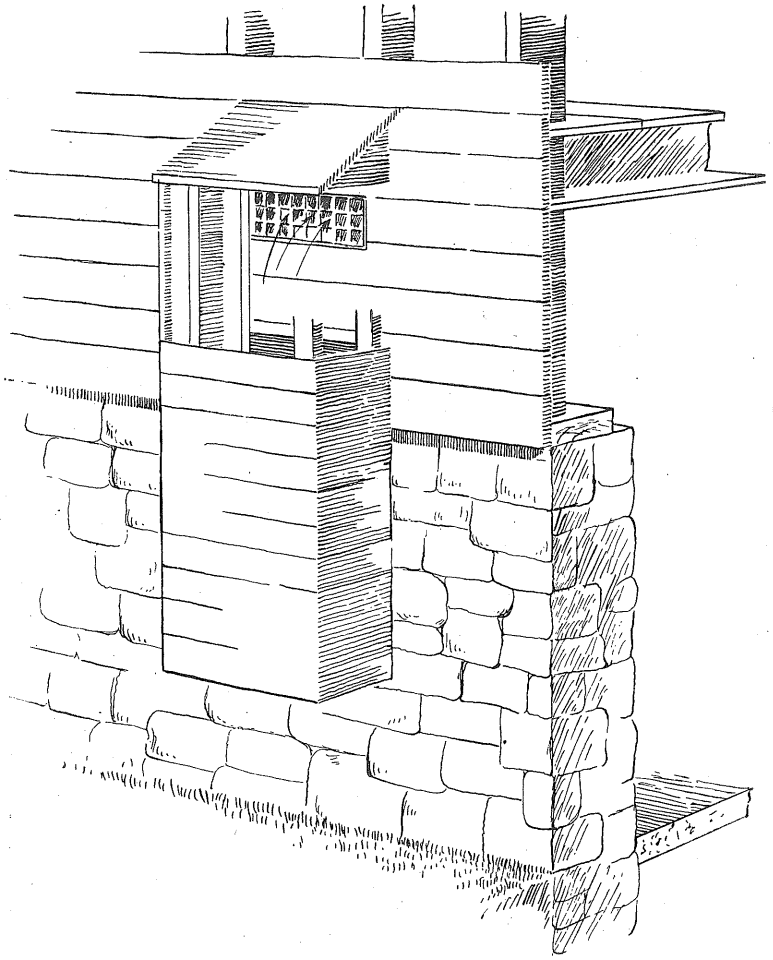


FIG. 7.—INLET FLUES ADDED TO OLD BARN

Fresh air inlet flues can be added to any barn with but very little expense.

force of the wind. The velocity of the wind, as well as the difference in temperature between the inside and outside make the flue draw.

It is important that great care be taken in locating the outlet flues. These should not be placed too close to the heads

of the cattle for if they are, all of the foul air will pass directly by the animals and much of it will be breathed in by them. Neither should the outlet flue be placed near the entrance where the opening of the door would break the drawing action of the flue. The outlet flues should be so located as to be out of the way as much as possible and yet be so distributed about the stable as most readily to draw out the foul air.

Windows may be so arranged as to provide ventilation but in this climate should never take the place of the King system. In case windows are to be used for ventilation they should be hinged at the bottom and open inward from the top. At either side is a galvanized iron shield which prevents air entering at the sides of the window and blowing directly on the cattle.

FLUES MUST BE PROPERLY CONSTRUCTED

Much of the success of the King system of ventilation depends upon the construction of the flues. Figure 8 shows detail of construction of an outlet flue. The cost of such a flue will average 75 cents a foot of length. If made of galvanized iron, the flue should be well insulated, otherwise the moisture passing through the flue will be condensed and fall as water. Insulating a round or square galvanized flue is generally impossible except by a commercial concern. This will increase the cost of installation.

BUILD FLUE THE RIGHT SIZE

In this system the total area of the outlet flues should practically equal the area of the inlet flues. If the windows and doors are not tight the number of inlet flues should be reduced so that their total area should only equal two-thirds of that of the outlet flues as there will be enough air entering the cracks to furnish plenty of fresh air.

A convenient size of outlet flue is 18x24 inches or 16x22 inches. In figuring the size of flue the number of animals should be carefully considered. The following data taken from King's Physics of Agriculture will be found to be of service in computing the size of inlet and outlet flues.

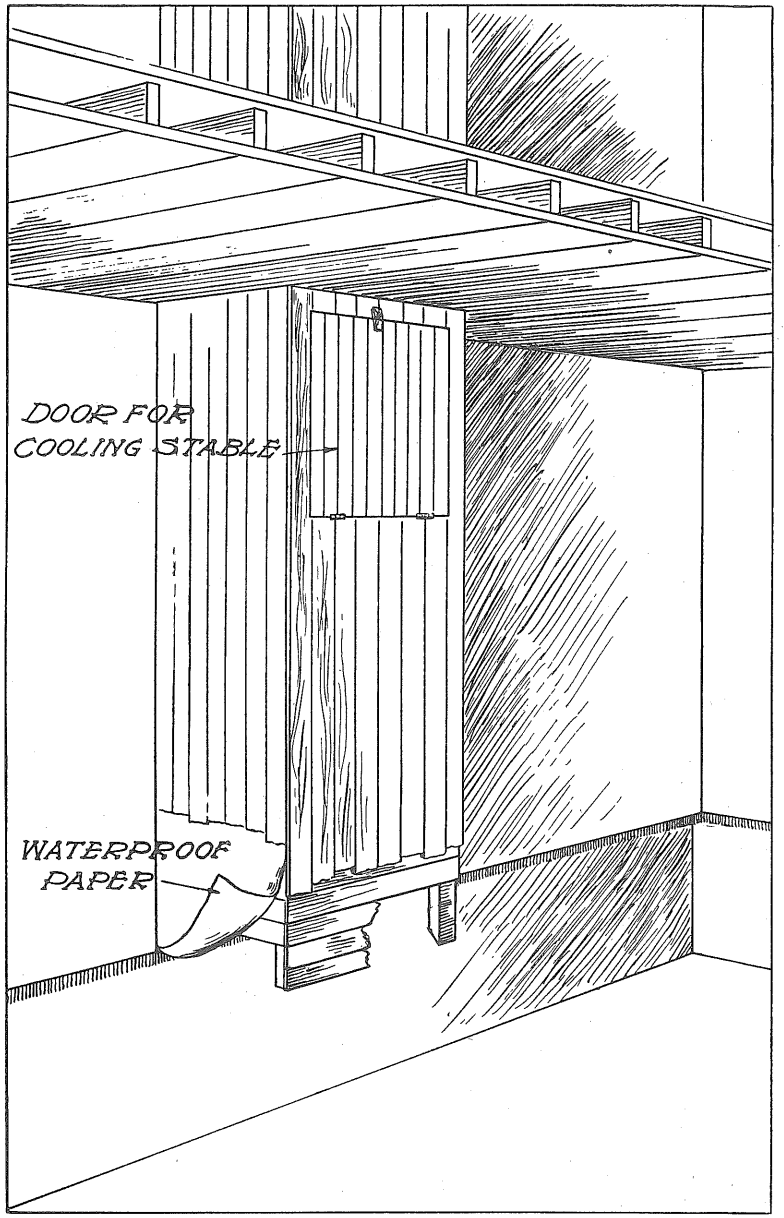


FIG. 8.—MUCH DEPENDS ON OUTLET FLUE

The success of a ventilating system depends to a considerable extent upon the outlet flue. The opening of the foul air flue is placed one and one-half feet above the floor. In this construction water-proof building paper is placed between the two layers of seven-eighths inch flooring.

AMOUNT OF AIR REQUIRED FOR BARN VENTILATION

Horses	71 cubic feet an animal a minute
Cows	59 cubic feet an animal a minute
Swine	23.2 cubic feet an animal a minute
Sheep	15.3 cubic feet an animal a minute
Hens	.52 cubic feet an animal a minute

Assuming that air travels through a flue from a stable at the rate of 290 to 300 feet a minute, the size of outlets and inlets may be determined as follows:

$$\frac{\text{Total no. of cu. ft. of air required}}{300} \times 144 \text{ sq. in. in 1 sq. ft.} = \text{Total cross-sectional area sq. in. of inlets or outlets.}$$

$$\frac{\text{Total cross sectional areas of outlets}}{\text{No. of outlets}} = \text{Cross-sectional area of each outlet.}$$

$$\frac{\text{Total cross-sectional area of inlets}}{\text{No. of inlets}} = \text{Cross-sectional area of each inlet.}$$

To estimate the amount of air required for a herd of 27 head of cattle and for five horses we would multiply 27, the number of cattle by 59, the number of cubic feet of air required for a cow, which is 1,593. To provide fresh air for the horses multiply 71, which is the number of cubic feet of air required for one horse by 5, the number of horses to be kept. This equals 355 cubic feet. The total requirement then would be 1,593 cubic feet for the cattle and 355 for the horses or a total of 1,948 cubic feet.

In order to get the total cross-sectional area of either outlets or inlets divide 1,948 by 300 (the rate at which air travels a minute in the flues of a stable) and you would have 6.49. Multiplying 6.49 by 144 (the number of square inches in a square foot) would give 934.5, the total cross-sectional area in square inches of inlets or outlets for this barn. Now the total required area 934.5 will be divided by the number of flues to be provided. A sufficient number of inlet flues should be provided so that the fresh air will enter the barn every 10 to 12 feet. This barn being 36x86 feet, the inlet flues spaced at 12 feet intervals would require 18 flues.

To get the area of each inlet divide the total cross-sectional area of inlets by 18 ($1{,}948 \div 18 = 52$) and each flue should

have an opening of 52 square inches. A 6x8 inch inlet flue comes nearest to providing this amount.

The total cross-sectional area of the outlets divided by four (1,948 ÷ 4 = 234), which is the number of outlets that will remove the foul air from all parts of the barn, gives a total area of 234 square inches for each outlet. This area will be secured in a flue 16 x 16 inches. The area of the outlet flues should be a little greater than that of the inlets.

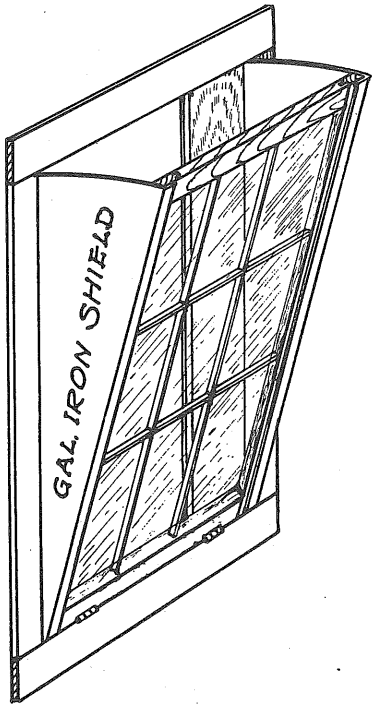


FIG. 9.—HINGED WINDOW VENTILATOR

The galvanized iron shields prevent the air from entering at the sides and blowing directly upon the stock.

TAKE CARE OF THE MANURE

A dairy barn or a general purpose barn, must be kept clean as it is a place where human food is produced. The barn floor should be so constructed as not to allow water to pass through it, should be free from cracks and crevices, and reasonably smooth so that it may be cleaned easily. There are two methods practiced in caring for manure. One system is to bed stalls heavily and to clean out the manure every week. The other is to clean the barn daily, hauling directly to the field or storing the manure in a manure pit. The latter system is, from the standpoint of cleanliness, the only satisfactory one.

SUPPLYING FRESH WATER

If a water supply system is available, running water can be piped directly into the barn. There are several companies making satisfactory automatic water systems that require little attention. A common method of watering is that of using the manger as a watering trough. This is satisfactory if proper attention is given to cleanliness.

CONVENIENT ARRANGEMENT SAVES WORK

The width to build.—The width of barns is practically standardized at 36 feet. This width is most satisfactory for a double row arrangement of stock. More than two rows of stock

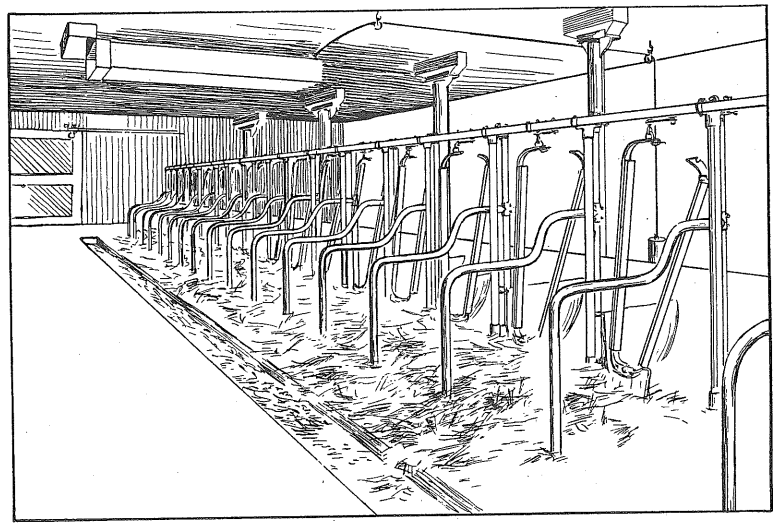


FIG. 10.—A HINGED VENTILATING FLUE

If the main ventilating flue is connected with the stable by means of a hinged ventilator, this can be drawn out of the way during warm weather. This outlet flue should not be located in center feed alley if the cattle face in.

are undesirable on account of the difficulty of lighting and because of the narrow alley which results even in a 40 foot width. A barn 34 feet wide is fairly satisfactory although the alleys must necessarily be narrower than in a barn 36 feet wide.

It is difficult to design an interior arrangement of a barn to meet all requirements. The exact dimensions of stalls, mangers, gutters, alleys and driveways are partially a matter of individual opinion. There are, however, some dimensions that should be adopted in the building of every well designed barn.

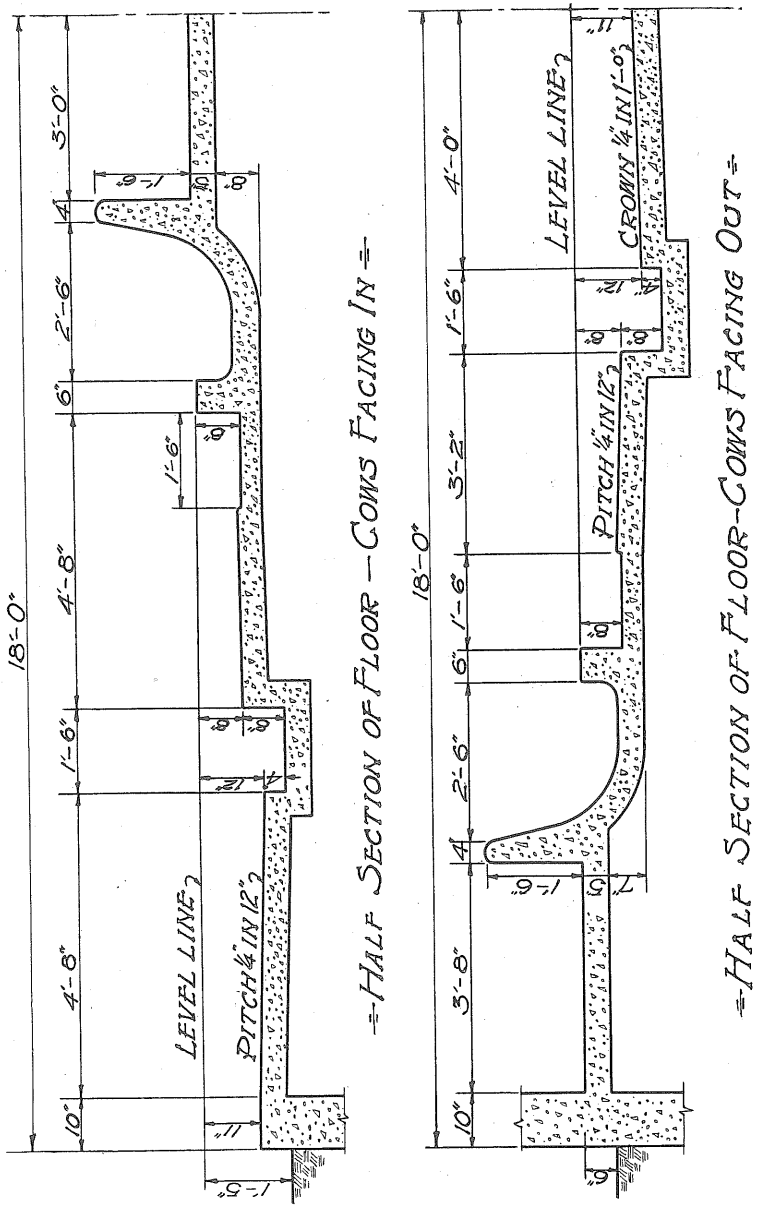


FIG. 11.—THE COW STALL FLOOR SHOULD BE CAREFULLY PLANNED

It is important to have the feeding alley, the manger, the stall platform, the gutter, and the litter alley or driveway of good dimensions.

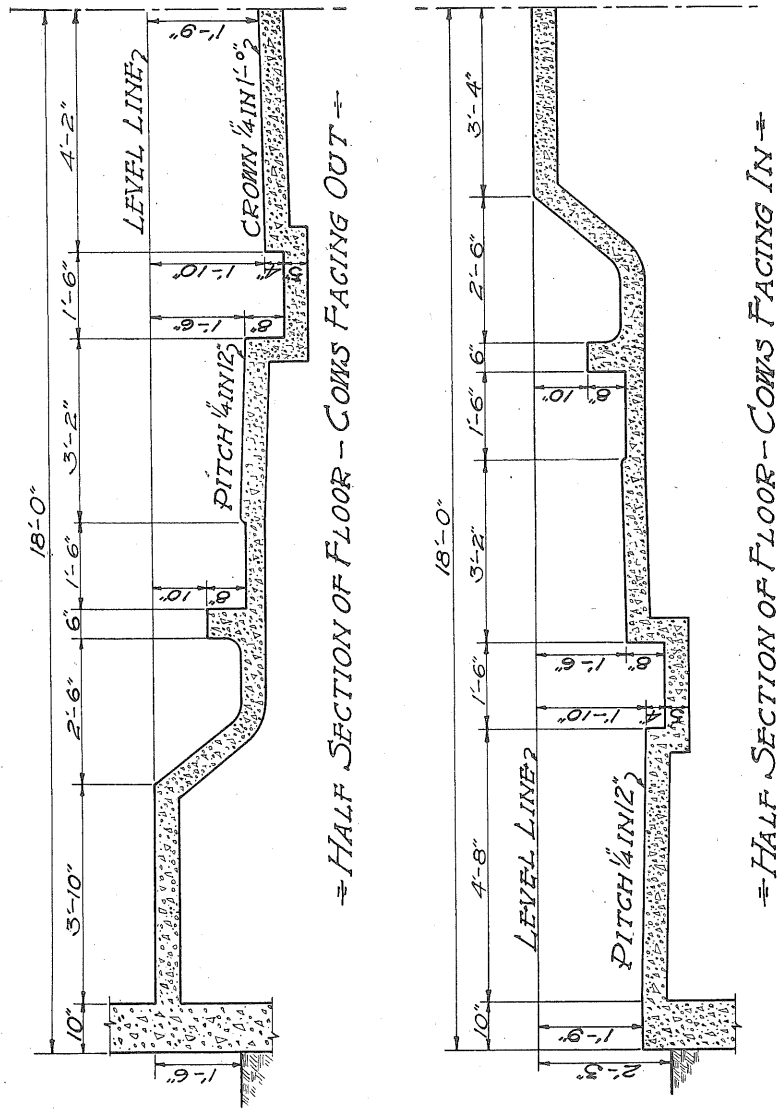


FIG. 12.—FEEDING FLOOR LEVEL WITH TOP OF MANGER

It is largely a matter of choice whether the feeding alley be raised above or be built upon the level of the stall floor.

The size of stalls varies.—The width of mangers is practically standardized at two feet six inches. The average length of a cow stall, from the manger to the edge of the gutter, is four feet eight inches. If it is necessary to vary this length, the stall could be constructed four feet six inches at one end, slanting to five feet or more, at the other. By having the stall of correct length all the manure can be confined to the gutter and the cows kept clean. The width of the stall is standard at three feet six inches. For large cattle, weighing 1,400 to 1,600 pounds, it will probably be necessary to make the stall three feet eight inches wide and five feet long.

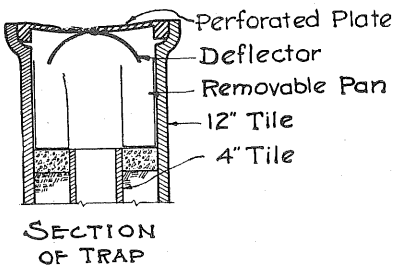


FIG. 13.—A GUTTER TRAP

To prevent clogging of the drain pipe leading from the stable gutter a homemade trap may be built in.

While the gutter width varies from 14 inches to 20 inches, 18 inches is the most satisfactory width. The depth of the gutter at the edge next to the cow should not be more than eight inches. The depth at the rear of the gutter should not be more than four inches as shown in Figure 12. The gutter should have a slight slope away from the cows. It should also be given a slope of two inches in 50 feet lengthwise of the barn so that the gutter may be flushed easily. This slope is desirable for flushing the liquid manure especially where a cistern is provided. In long barns of more than 50 feet, the slope should be from the ends towards the center. For such a slight slope, the gutters must have a very smooth finish. To prevent clogging of the drain pipe some means should be used to prevent the entrance of chaff and other coarse materials. A homemade trap as shown in Figure 13 will serve this purpose.

WIDE FEED ALLEYS BEST

Feed alleys should be four or more feet in width. Cows have a habit of pushing forward in their stalls which makes it all the more difficult to feed from alleys of less than four feet. Passageways between long rows of stalls or at ends of stalls can be two feet when used largely at milking time to save time in walking around long rows of stanchions.

SHALL COWS BE FACED IN OR OUT?

Whether it is better to face cows out from, or toward a center isle is an open question; good arguments can be made in favor of either arrangement. One of the chief advantages for having the herd face the center isle is that this arrangement provides a central feeding alley. It, of course, is more convenient to feed from one alley, especially if feeding ensilage. Careful feeding is very necessary to successful dairying and as cattle are fed two or three times a day this point deserves considerable attention. Then, again, when the cows are faced in there is no danger of the direct sunlight affecting the cow's eyes. This arrangement places the milkers nearest the light so that they can see that the cow's udders are clean. Cleaning out the manure is as easy, if a litter carrier is provided, as driving through the barn between two rows of cows. A feed carrier can be installed running between the two rows of cattle and be used to carry feed to various parts of the barn.

The advantages of having the cattle face out are: first, less alley space is required, (when cattle face the center aisle the back walks must be wide or the walls will be spattered with manure); second, a manure spreader can be loaded in the barn and hauled directly to the field, thereby saving handling the manure twice; third, sale cattle can be shown to better advantage when facing out from the center and it is claimed by some that it is easier to get cows in and out of the barn with less danger of crowding.

STALL FLOORS SHOULD BE SANITARY

Wood floors are insanitary and last but for a very short time. A good concrete floor, well drained, with a wood overlay, or well bedded, is entirely satisfactory. In constructing the wood overlay (Figure 14) the boards should be laid lengthwise of the stall. It should be made so as to be easily removed, thus permitting cleansing. A concrete floor, to be satisfactory, must be finished with a wood trowel which will leave the surface rough enough to prevent the cows from

slipping and also to make it possible to keep bedding on the floor.

Cork brick are quite extensively used for flooring and are very satisfactory, but more expensive than concrete or wood. These are sanitary and are not cold, as is the case with concrete. They will last much longer than the ordinary wood floor.

Wood blocks soaked in creosote and laid on a concrete foundation are cheap and serviceable for cow stall floors.

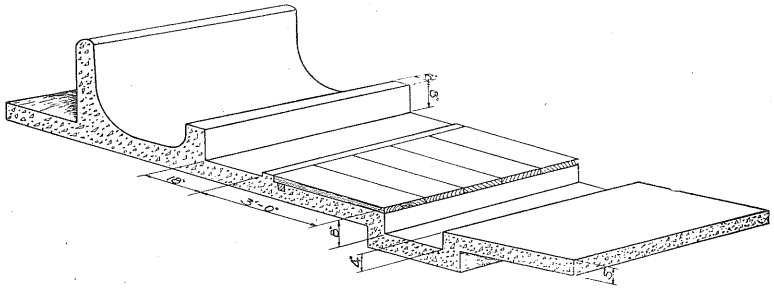


FIG. 14.—A WOOD OVERLAY FOR THE STALL FLOOR

A concrete floor should be covered with bedding or a wood overlay. It can be kept in a sanitary condition.

One living near a city where a wood block pavement is being constructed can usually secure the blocks either from the contractor or from the city.

HAVE FEED ROOM CONVENIENT

In a dairy barn the feed should be stored in a convenient place at either end of the feed alley. The feed-bin is usually placed on the second floor and should be connected directly with the feed room by means of a chute. This feed room should be close to, or a part of, the silo room and so arranged that it may be entirely shut off from the main part of the barn.

PROVIDE A BULL PEN AND MATERNITY STALLS

A bull pen and one or more maternity stalls are needed on a dairy or stock farm. The maternity stalls should be approximately 10x10 feet and be provided with an abundance of light. A convenient arrangement for the bull stall is

shown in Figure 15. Itprovides for two outside doors, one for the bull to come in through, the other to go out. Such an arrangement makes it unnecessary to enter the stall, the exit door can be opened from the outside, the bull untied from the front and allowed to go out and exercise. It will be noticed that in this arrangement the bull cannot turn around and that there is no necessity of getting into the pen either to turn him out or to tie him.

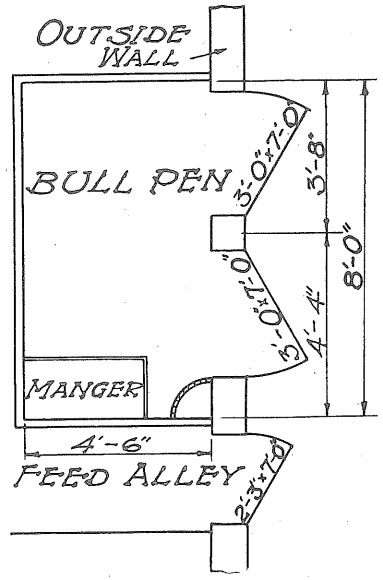


FIG. 15.—SAFETY FIRST

This pen is so arranged that the attendant can care for the bull without entering the stall.

SEPARATE MILK ROOM PREFERABLE

A milk room should be located near, but preferably not inside the dairy barn. The entrance to the milk room, it is often urged, should be gained from the barn only after going entirely out of the stable. Milk, of course, is easily contaminated by odors. This room could be conveniently located underneath the barn bridge or near the entrance of the barn. It is exceedingly important that the gas engine for operating the separator be outside the milk room. Gas contaminates milk and the odor can be detected in the butter.

DETAILS OF CONSTRUCTION

Too many of us when thinking of building a barn start at the wrong end. A fixed dimension is generally considered and then the problem is to get all the stock on the farm into this building. A better method of arriving at the size of a barn is to consider the number of cattle or horses to be put into the building. Thirty-six feet seems to be the standard generally adopted for the width of a barn.

Many in planning their farm structures desire permanency. Concrete, brick, stone or concrete block are very satisfactory for walls. The walls, if built of solid concrete, should be from 10 to 12 inches thick, and well reinforced around corners and doorways as shown in Figure 16. The walls may be of any height but it is advisable to build them either to the bottom of the windows or to make an entire masonary basement.

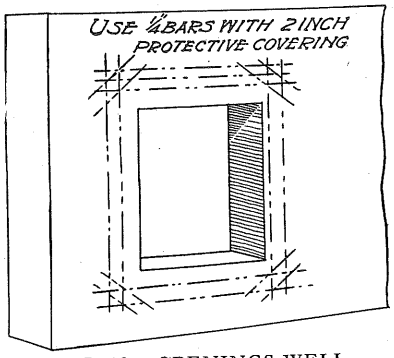


FIG. 16.—OPENINGS WELL REINFORCED

It is important that concrete walls, especially about openings and around corners be well reinforced. The material used to reinforce the wall should be protected by two inches of concrete; otherwise the rust will weaken it.

An all fireproof barn is of doubtful value. The hay and straw, stored in the haymow are of such a character that the great heat in case of fire would be likely to cause the solid wall or roof to crack on the explosion of the gas generated from the fire. There is no doubt, however, of the value of a fireproof basement.[1] Such a construction is within the reach of any man who can afford to put $4,000 into a barn.

PROTECT AGAINST LIGHTNING

Barns are less likely to be damaged by lightning if rods are used. Investigations by the farmers' mutual fire insurance companies proves that the damage to rodded barns by lightning is low in comparison with the damage to unrodded barns. Many reports on the use of the lightning rod show that it is from 80 to 99 per cent efficient on farm buildings.

Iron and copper or combinations of the two are the commercial materials available for lightning rods. Both of these materials give equal satisfaction. The important points in selecting and installing the lightning rod are:

(1) Do not use insulators. Fasten the rod directly to the building; (2) The rod should be made of a material which will resist the action of weather and soil; (3) Joints must be rigid and permanent. Screw joints are considered best; (4)

[1]The complete design of a reinforced concrete barn basement can be secured for five cents by applying to the Agricultural Engineering department, University of Wisconsin, Madison.

Earth connections should be made to a point of permanent moisture; (5) Terminals must be rigid, well supported and should be made of solid material; (6) Terminals are placed at distances of about 25 feet, on ventilators, silos and chimneys; (7) All metallic parts on the surface of the barn should be connected with the rod. The lower inside end should be connected with the earth. For example, a wind mill placed on top the barn should be connected with the lightning rods on the outside and grounded to the earth on the inside.

A barn, in fact all farm buildings, are inadequately protected from fire. Some type of a water supply system which would also furnish a supply for the house ought to be provided for fire protection. A tank placed in the haymow or a pressure tank located in a separate building would be cheap fire insurance.

STRENGTH IMPORTANT IN BARN FRAMING

The plank frame type of construction is most generally used at the present time. The old timber frame type of construction is too expensive with the present high cost of large timbers and the difficulty of securing them at the local lumber yards. Two inches is the thickest material used in plank frame type of construction. It is a distinct advantage to use the plank frame type of construction for it saves in the cost of lumber, is more easily handled, takes less time to construct, and requires less skilled labor in framing the barn.

Either horizontal or vertical siding can be used. Drop siding or shiplap is ordinarily used for horizontal siding and 1x10 inch boards with three inch battens placed over the cracks for vertical siding. In this climate if the basement is not built of stone or concrete it should be lined on the inside with flooring or ceiling.

MORE HAY MOW ROOM UNDER A GAMBREL ROOF

There are two general types of barn roofs, the gable and gambrel. Many times the latter is called incorrectly the "hip" roof. The advantage of the gambrel over the gable roof is that increased hay room can be secured without building the barn any higher either at the plate or ridge.

The height of the gambrel roof should be equal to the width of half the building. The first rafter should have a rise of one-third the width of the building and a run of one-sixth. The second should have a run of one-third the width of the building and a rise of one-sixth. Then in the case of a 36 foot barn the lower rafter would have a rise of 12 feet and a run of 6 feet, the second rafter a run of 12 feet and a rise of 6 feet.

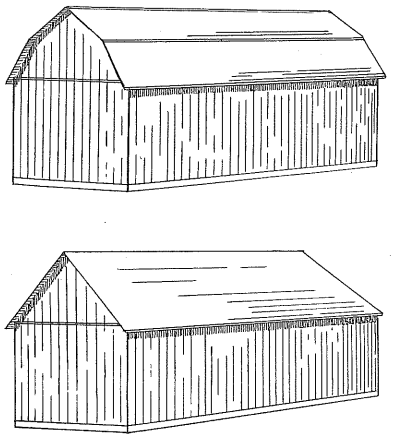


FIG. 17.—GAMBREL AND GABLE ROOFS

The hay mow is increased in size in a gambrel roof barn without increasing the height of the roof at the plate or ridge.

END BRACE ADDS STRENGTH

The end brace shown at A in Figure 18 is designed to prevent any end racking of the barn as well as to prevent the end of the barn from springing. Many plank frame barns constructed without this brace are likely to spring out at the end, in some instances, as far as from two to six inches. As there is no other truss work or ties bracing the end of the barn, it is very desirable that the end brace be built in a barn of the plank frame type of construction.

USE CARE IN MAKING CONCRETE

Concrete is the best home-made product that can be used as barn building material. In many parts of the state sand and gravel for concrete work can be found very near the structure in which it is to be used. Concrete can be used to a decided advantage for walls, mangers, floors, gutters.

In selecting the material for such work the sand and gravel should be clean and free from loam, the presence of which prevents a good bond being secured between the sand and cement and gravel and eventually causes the structure to crumble. The best concrete results from properly graded materials. As sand and gravel are ordinarily found in the average gravel bank, there is an excess of sand. It should

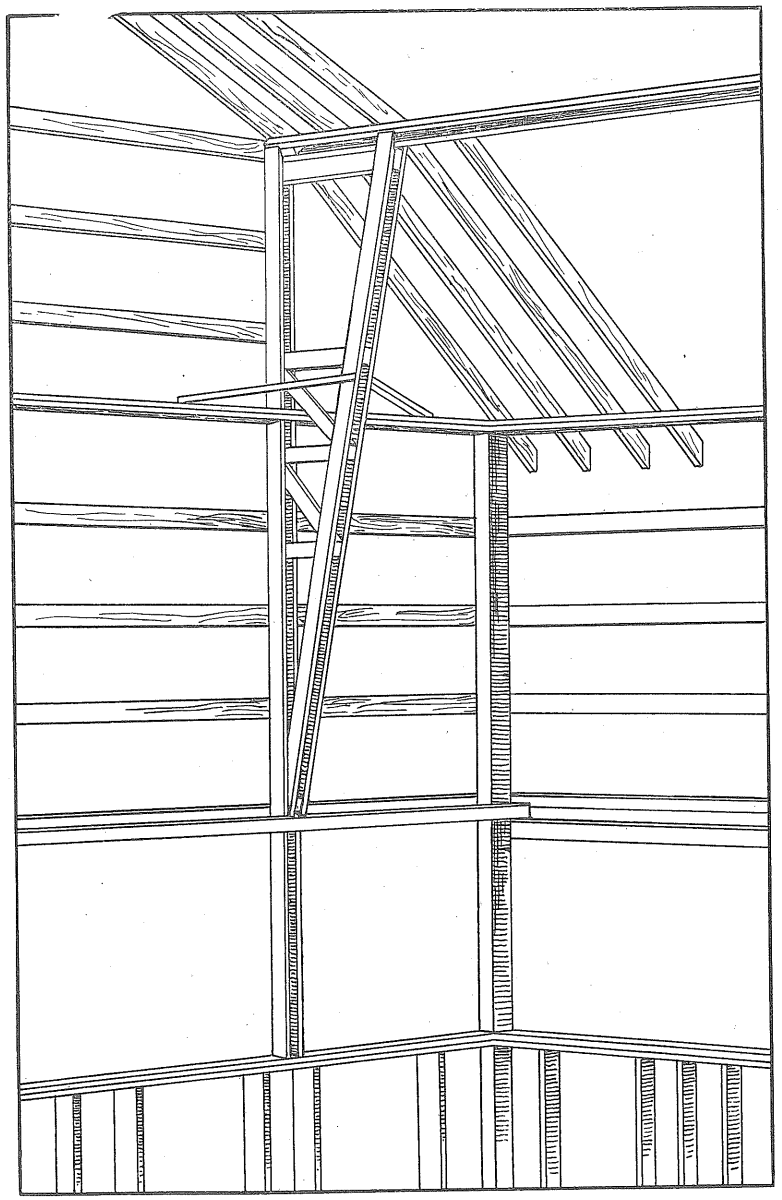


FIG. 18.—THE END BRACE ADDS STRENGTH

In some plank frame barns the ends often bulge out. The end brace prevents this at a very slight additional cost.

be in proportion of one part of sand to two parts of stone. Ordinarily it is found in just the opposite proportion.

To obtain the strongest concrete with the minimum amount of cement it is very important that the cement, sand and gravel be properly proportioned. If bank-run gravel is to be used and the mixture is in the proportion of one part sand to two parts stone, a mixture of one part cement to five parts of bank-run gravel would be sufficiently strong for the walls and basement floors. For a reinforced concrete hay mow floor, however, a mixture of one part cement to four parts of gravel (1–4), should be used, together with the proper amount of reinforcement. If the sand and gravel

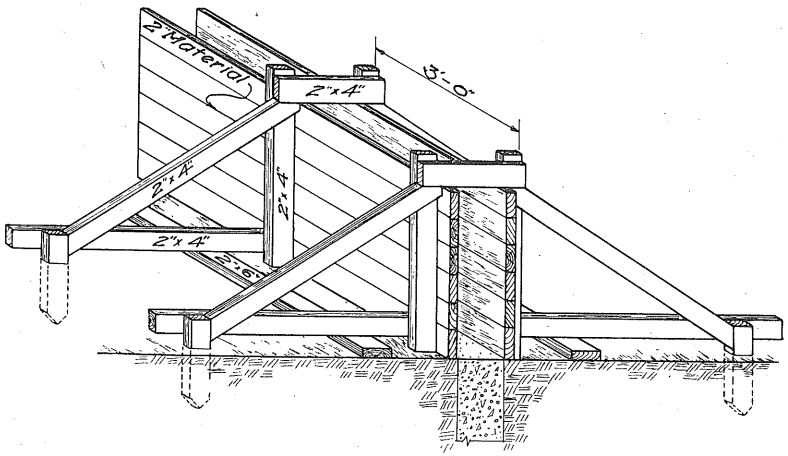


FIG. 19.—A FORM FOR BUILDING A CONCRETE WALL
In building a concrete wall much depends upon having the bracing in the form of sufficient strength and properly spaced.

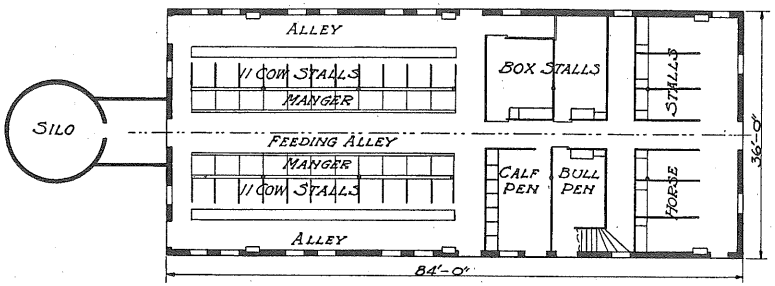
are separate, a good mixture to use for a wall is one part cement, two and a half parts sand, and five parts stone or gravel (1:2½:5), and a one, two, four (1:2:4) mixture in the hay-mow floor where reinforcement is neccessary.

Another essential for good concrete is proper mixing. The entire mass should be so thoroughly mixed before water is added that it will be of uniform color. Enough water should then be added so that it will be of a rather sluggish consistency. If too much water is added there is danger of separating the particles in the process of placing, or of the heavy stones sinking to the bottom and the cement and fine sand coming to the top. No rocks larger than one-third of the thickness of the wall should be placed in the center and puddled down into the mass of concrete. If a smooth finish is

desired on the wall, a flat spade should be worked up and down the sides working to the outside some of the finer materials while the larger materials are pushed back.

A form for building a concrete wall requires good bracing and judicious spacing of braces. Figure 19 shows the detail construction of a form for building from a three to a nine foot concrete wall.

In continuing the placing of new concrete on a previous day's work the old concrete should be thoroughly wet first and then sprinkled with fresh cement and the first concrete placed should consist of finer materials thoroughly tamped so that a good bond will be secured between the old and the



PLAN NO. 1—GENERAL PURPOSE BARN

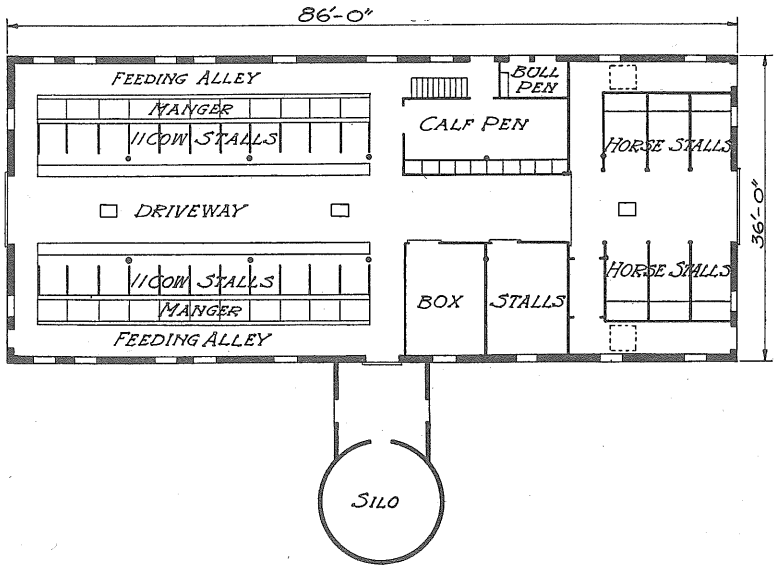
new concrete. It is advisable to keep concrete covered during hot weather and to keep it well sprinkled for three or four days.

AVAILABLE FARM BARN PLANS

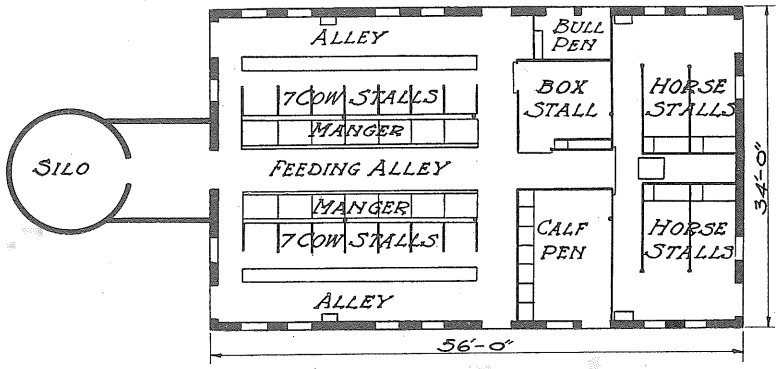
Detailed drawings and bills of material for the following barns may be secured from the Department of Agricultural Engineering of the University of Wisconsin, Madison, in accordance with the following schedule:

Plan No. 1—General Purpose Barn.—This general purpose barn is 36 feet wide and 84 feet long and in planned to accommodate 22 head of cattle and six horses. It also contains a calf pen, a bull pen and two box stalls. The cows face in and the silo is placed at the end of the central feedingalley. The horse barn is separated from the cow barn by sliding doors. The barn loft is divided into six bents of 14 feet each. Hay is elevated into the barn from the outside and feed bins are provided on the second floor. The feed room and silage room are combined. A root cellar is provided just below the

feed room. The drawings consist of a floor plan, elevations, cross sections showing all framing details. Price (for postage and blue printing) 20 cents.

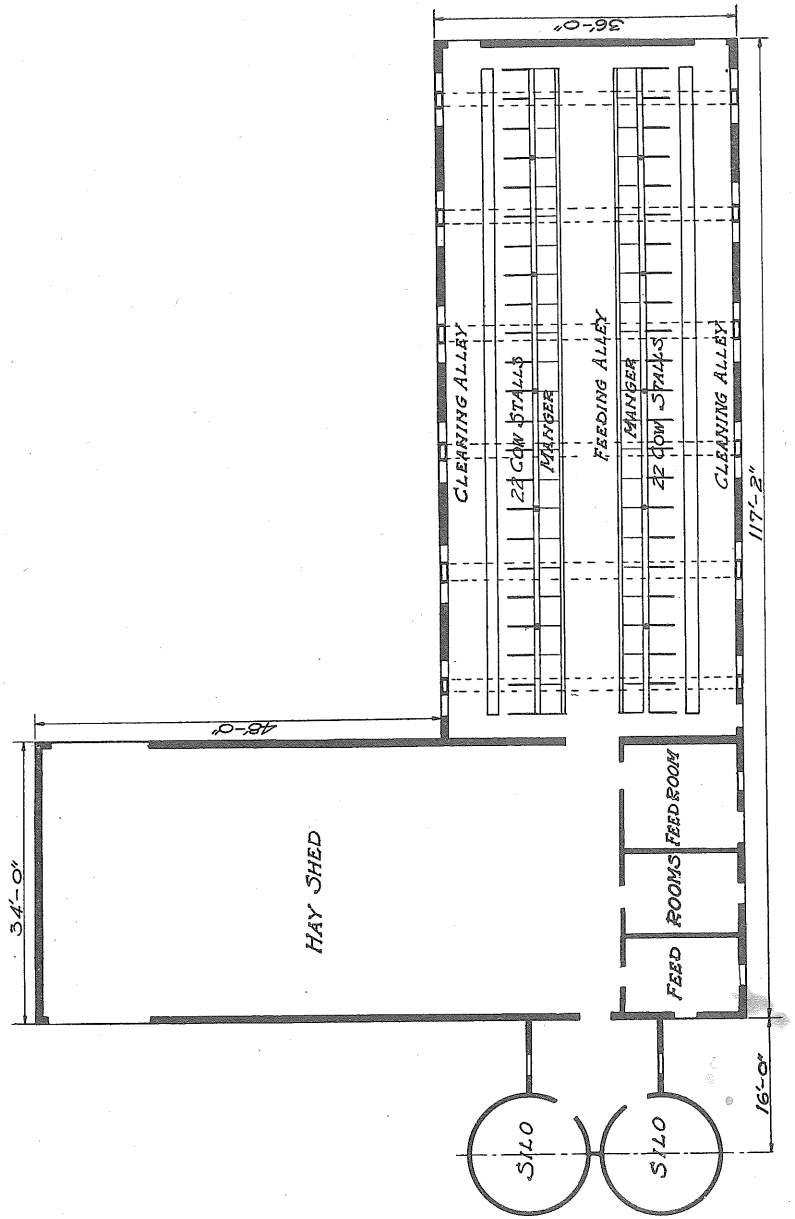


PLAN NO. 2—GENERAL PURPOSE BARN



PLAN NO. 3—GENERAL PURPOSE BARN

Plan No. 2—General Purpose Barn.—In this general purpose barn which is 36 feet wide and 86 feet long the cows face out. In all other respects it is essentially the same as Plan No. 1. The silo has been placed at one side of barn in order to permit a driveway through the center. The draw-

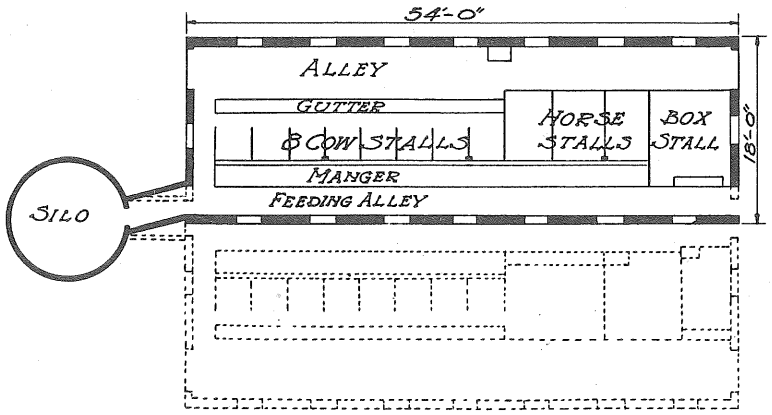


PLAN NO. 4—DAIRY BARN

ings consist of floor plan, elevations, cross sections and framing details. Price (for postage and blue printing) 20 cents.

Plan No. 3.—General Purpose Barn.—This general purpose dairy barn (34 feet x 56 feet) is designed to meet the needs of the farmer on about an 80 to 120 acre farm. It will accommodate four head of horses and 14 head of cattle. It also contains a calf pen, a bull pen and a box stall. The cows face the center aisle. The drawings consist of floor plans, framing details and elevations. Price (for postage and blue printing) 20 cents.

Plan No. 4.—Dairy Barn.—This shows a one story type of barn with hay shed and feed room placed on the north side. The floor plan provides for 44 cows and except that no room for horses is provided is practically the same so far as ar-



PLAN NO. 5—PIONEER BARN

rangement is concerned, as that of No. 1. This type of construction is somewhat cheaper than the regular two story barn and permits of expansion at a lower cost without the waste storage space. Floor plans, framing details and elevations can be furnished. Price (for postage and blue printing) 20 cents.

Plan No. 5.—Pioneer Barn.—This pioneer barn is 18 feet wide and 56 feet long, and is designed for the settler farmer. It is planned so that the barn can be added to easily and eventually be 36 feet wide and hold just double the present capacity of eight cows, three single horse stalls, one double stall and one box stall. Floor plans and framing details can be furnished. Price (for postage and blue printing) 10 cents.