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Manitoba Agricultural College

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PLANS FOR FARM BUILDINGS

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Manitoba Agricultural College,
Winnipeg, Canada,

May 28th, 1913.

To The Hon. George Lawrence,
Minister of Agriculture and Immigration,
Parliament Buildings,
Winnipeg, Manitoba.

Sir:

I take pleasure in presenting herewith Bulletin No. 10, "Plans for Farm Buildings," by L. J. Smith, B.Sc., Professor of Agricultural Engineering, and Robert Milne, B.S.A., Lecturer in Agricultural Engineering.

Owing to the increasing interest being taken in mixed or diversified farming, more consideration is being given to the erection of farm buildings than heretofore. Numerous requests for assistance have been received at this College during the past year, and this bulletin has been prepared for the purpose of showing those who contemplate building some of the most up-to-date plans that have been worked out. I have no doubt it will prove of great value to Manitoba farmers.

Yours very truly,

W. J. Black,

President.

Plans for Farm Buildings

INTRODUCTION

At the present time, when the tendency of agriculture in this Province is more and more toward mixed, instead of grain farming, there is naturally a good deal of interest in the subject of farm buildings. Stock must be well housed if the best results are to be secured from them. A building is built but once, and mistakes are costly, since they are difficult, if not impossible, to remedy after the building is once put up.

The College receives a large number of enquiries for plans of the various farm buildings. These requests come largely in the winter when, on account of our work with the students, it is the most difficult to find time for getting out the desired information. It was therefore thought advisable to publish a brief bulletin on farm buildings to at least in part meet this demand for information along building construction lines.

WHY SO MANY MISTAKES ARE MADE IN PLANNING FARM BUILDINGS

Someone has aptly said that one must build at least two houses before he can plan one that is in every respect satisfactory to himself. The same might have been said concerning barn planning. It is the common experience of many men to build a barn only to find, after the building has been in use for a time, that serious mistakes have been made which cannot be remedied without the expenditure of a large amount of time and money. There are two main reasons why these mistakes are made. In the first place, the prospective builder often does the planning in the reverse from the proper order. He decides to build a barn about 40 x 60, or whatever the dimensions may be, and afterwards tries to divide this space according to the stock that he wishes to put in the barn. The enquiries coming in to the Agricultural College, papers, and builders of barn equipment, are most often worded along the above mentioned lines. In a large percent. of these letters no definite statement is made as to just what is to be put in the building. The only satisfactory way to go at the proposition is to first decide just what shall go in the barn—how many stalls for cattle, how many for horses, how many box stalls, etc.—then look up and decide on the proper dimensions for these items; and finally proceed to see how a plan can be best arranged to meet one's individual and local needs.

In the second place, there is a strong tendency for farmers to closely follow the practice of barn building in their own locality. This is partly due to the owner, and partly to the carpenter who puts up the building, with whom there is a tendency to get into a rut along building lines. By studying plans of buildings erected in different localities one is certain to get more suggestions, and will therefore benefit by the broader experience of many builders of barns.

The plans shown in this bulletin are not to be understood as being models. It would be impossible to lay out a plan of any farm building—except some of the smaller ones, such as portable pig cots and colony houses—that would successfully meet the great variety of local needs and conditions. The few plans offered are rather to be considered as suggestive. They represent quite a variety of types and arrangements. Some of the plans are of barns used at public institutions, where a great many people pass through to see the stock and the arrangement of the buildings. The alleys and passage ways are often made larger than would be necessary for the regular farm building, in order to better accommodate these visitors.

It is hoped that the reader who is about to build will gain valuable suggestions from the plans submitted, which suggestions he will be able to group into a plan satisfactory to his own future needs.

CONSIDERATIONS IN BARN PLANNING

It is well for one who is about to plan a barn to have in mind a definite list of things that would make an ideal building. This list would be of almost equal value to keep in mind when looking at plans of other buildings for ideas and suggestions. By following this method one can better criticise any plan, for he is not so apt to be carried away by some good features to the extent of not being able to see the poor points. Then, too, sometimes a very good feature causes a poor arrangement at some other part of the plan, and one has to weigh the two features and decide if the good one shall be used, even though it carries a poor one with it.

The following is an outline of a number of items to be considered in planning a barn. They have been grouped for convenience under three main headings.

CONVENIENCE

ARRANGEMENT FOR FEEDING:

- Layout of feed passages.
- Animals to face in or out.
- Location of feed room.
- Location of feed boxes.
- Location of grain bins.
- Location of hay chutes.
- Location of doors.
- Location of hay and feed racks.
- Location of root cellar (and capacity).
- Arrangement for using feed carriers (if any).
- Arrangement to provide easy access to, and proper location of a future silo, if none is to be installed with the erection of the building.

ARRANGEMENT FOR CLEANING:

Location of doors.
Arrangement for feed carriers and tracks.
Location of milk room.
Location of water troughs.

Location of water tank in loft (if any).
Location of stairs to loft.
Arrangements for harness storage.
Method of storing hay.
Provision for installing hay forks.
Arrangement of posts and girders for supporting loft floor in connection with stall partitions and purlin posts.
Carriage storage.

ECONOMY.

Shape of barn: to get least wall area.
to get economy of floor space.
to save building material.
to save in cost of construction.
to reduce heat loss through walls.

Common types: round.
square.
rectangular (nearly square).
rectangular (long and narrow).
L shaped.
T shaped.

Type of roof: ∧ or gable roofed.
gambrel or hip roof.
shed roof used on one or both sides of the gable or gambrel.
Appearance.

Proper dimensions of stalls, passages, doors, mangers, gutters, hay racks, posts, beams, bracing, etc.

Windows: size of frames.
size of lights.
with few sizes of panes of glass, for economy of repairs.

Ladder to roof to be readily available in case of fire or for doing repairs, putting up lightning rods, etc.

SANITATION.

Lighting: Location of windows for distribution of light.
Obstructions to light.
Height of windows from floor.

Kalsomine walls.
Concrete floors.
Proper slope to stall, passages, and gutters for good drainage.
Ventilation: Location of intakes and outtakes.
Number and size of outtakes.
Regulation of outtakes.

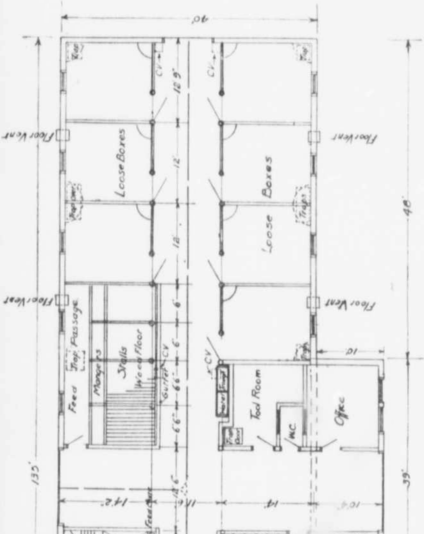


Figure 1

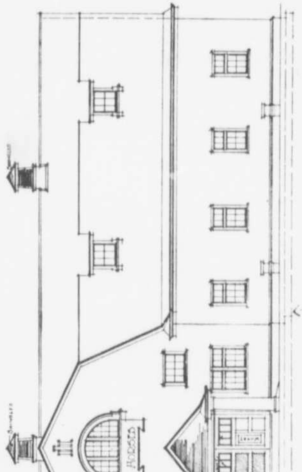


Figure 2

HORSE BARNS

The two plans of horse barns shown offer many suggestions to those especially interested in a separate barn for horses.

Figure 1 is the general plan of the horse barn being built at the new College site, south of Winnipeg. The main part is 40 x 135. The plan here shown is not accurate in every detail, but covers the features in which the farmer is interested. There is a driveway running a short distance along one side of the barn (shown in the end elevation), which elevates loads of grain sufficiently so that it can be easily gotten into the loft through a side door. The horses head out, ample feed passages being provided. Note the convenient location of the feed and harness rooms.

The dotted squares marked "trap" locate the hay chutes. Ample ventilation is supplied by the Rutherford system. There is a root cellar underneath the tool room and office. The cut-off for the water connection to the barn is in this cellar. The stalls have a plank floor, so arranged that it can be renewed when necessary.

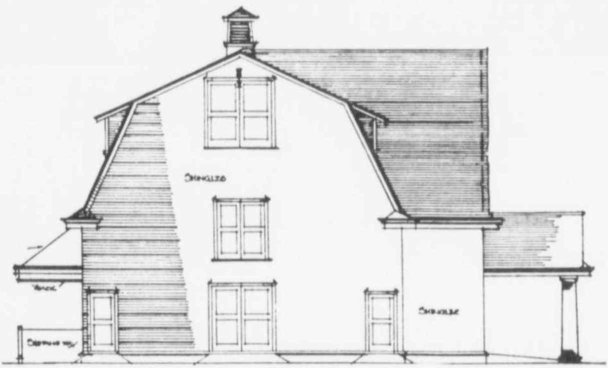


Figure 3

Figure 2 shows the front elevation of the barn. It has a gambrel roof which is strongly supported by purlins and heavy purlin posts. Instead of the usual siding, the College barns will be shingled. The surface will be broken at intervals by double rows of shingles to give a better appearance.

Figure 3 shows the end elevation of the horse barn. The sloping driveway and track are shown at the rear.

Figure 4 shows the floor plan of the horse barn at the Michigan Agricultural College. It is 48 x 94, with 18-foot studding. It also has a gambrel roof. The King system of ventilation is used. The horses

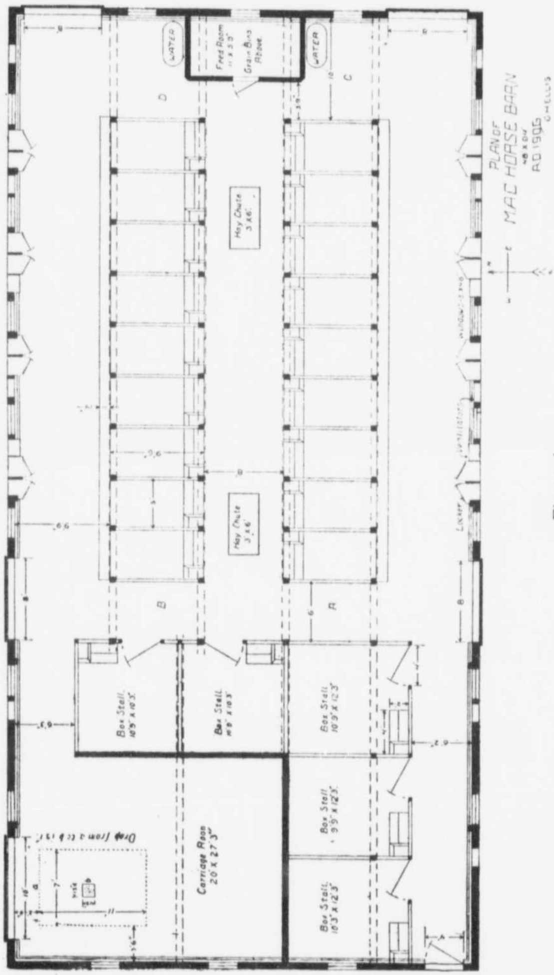

WATER
Feed Room
Grain Bins Above
WATER
Hay Chute 3'x6'
Hay Chute 3'x6'
Box Stall
Box Stall
Box Stall
Box Stall
Box Stall
Carriage Room 20' X 27' 3"
Locker
PLAN OF
MAC HORSE BARN
AD 1905

Figure 4

head in to a central feed passage, at the end of which is located the feed room with water troughs on each side and near the doors through which the teams enter at the end of the day's work. There is a large carriage room with the concrete floor sloping to a central drain for carriage washing.

HORSE STALL. Figure 5 shows the construction of a horse stall. The stall has a plank floor which is generally believed to be better for the horses to stand on than cement. Where the horses are sharp shod they dig holes in the floor and it is easier to repair the floor by putting in a new plank than to repair the cement. If the floor is cemented over, two 2 x 4s are bedded in the cement to spike the plank to. At the end of the plank there is one inch drop in the cement floor; this allows for drainage from beneath the plank. The floor slopes toward the gutter about one inch in five feet. The stall posts are 6 x 6 plowed to receive

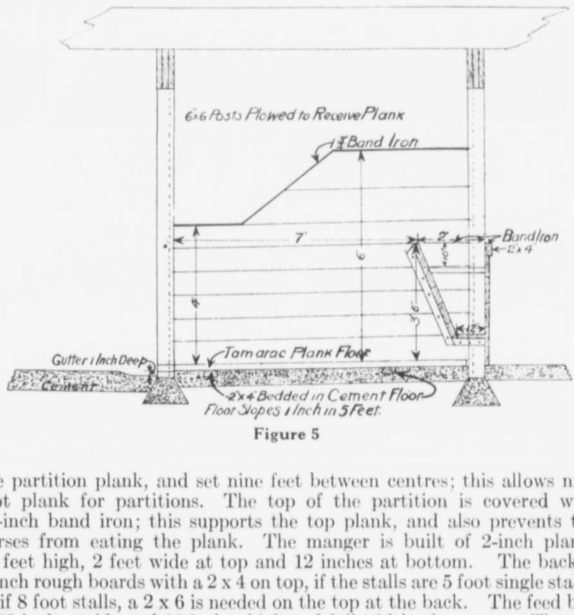


Figure 5

the partition plank, and set nine feet between centres; this allows nine foot plank for partitions. The top of the partition is covered with $1\frac{3}{4}$-inch band iron; this supports the top plank, and also prevents the horses from eating the plank. The manger is built of 2-inch plank, $3\frac{1}{2}$ feet high, 2 feet wide at top and 12 inches at bottom. The back is 1-inch rough boards with a 2 x 4 on top, if the stalls are 5 foot single stalls; or if 8 foot stalls, a 2 x 6 is needed on the top at the back. The feed box is 10 inches wide and 10 inches high and full width of manger. The top of feed box and manger should be covered with light band iron to keep the horses from eating the wood. Some prefer a crack in the bottom of the manger to allow the dirt to drop out into the passage. This keeps the manger nice and clean, but any grain that is threshed from the sheaves or spilled from the feed box is lost, unless it is cleaned regularly and fed to the chickens.

DAIRY BARNS

Several years ago Wisconsin offered a prize of $1,000.00 for the best plans of a model dairy barn to suit the conditions of the average farm of that great dairy state. The cost of the barn was supposed not to exceed $2,000.00. The prize was awarded to Mr. W. D. James, of The James Manufacturing Company, Fort Atkinson, Wisconsin; and the barn was erected from the plans, at the State Fair Grounds, in order that the visiting farmers might get the benefit of the many good features of the plan. Figure 6 gives a very good idea of the general appearance of this barn. The silos are not shown, being at the far end of the building.

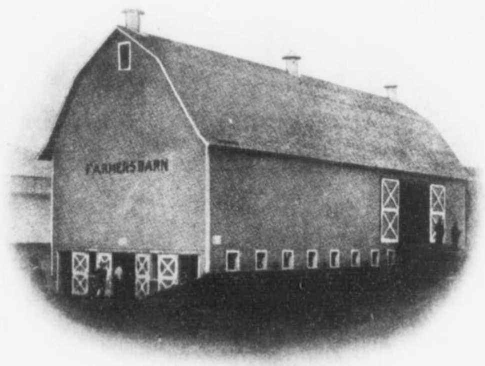


Figure 6

It has a gambrel roof, which adds to its general appearance. An incline driveway leads to the hay loft. Figure 7 shows a ground plan of the barn. It is not, strictly speaking, a dairy barn, a number of stalls for horses (which are of course necessary on a dairy farm) being provided with a convenient outside entrance. Another plan of this barn that has been published, shows another stair going up from the feed room to the grain bins above. The plan can be readily altered to suit any number of stock.

The above picture of the Wisconsin barn shows it as a semi-bank barn. Many do not like bank barns on account of dampness and loss of light; but where there is good drainage, a bank barn should not be damp.

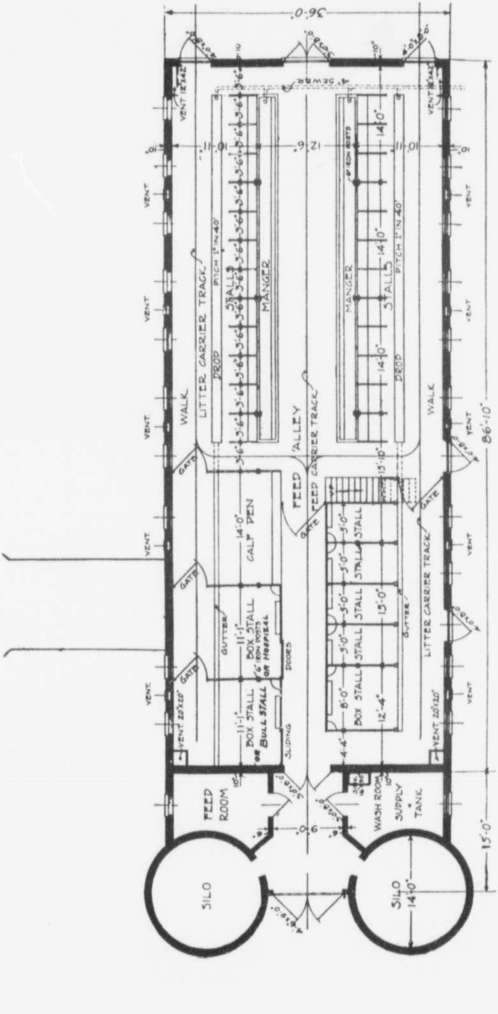

SILO
FEED ROOM
SILO 14'-0"
WASH ROOM
SUPPLY TANK
BOX STALL OR BULL STALL
BOX STALL 6" IRON POSTS OR HOSPITAL
CALF PEN
SLIDING DOORS
GUTTER
GATE
FEED ALLEY
FEED CARRIER TRACK
LITTER CARRIER TRACK
WALK
DROP
PITCH 1" IN 40'
STALLS
MANGER
BOX STALL
STALL
VENT
VENT 20"x20"
VENT 12"x42"
4" SEWER
36'-0"
86'-10"
15'-0"

Figure 7

Bank barns are considered warmer than the ordinary barn. They should not be put at so low a level as to make it impossible to have windows on the high side, both for light and ventilation. The bank barn makes it easy to put in the inclined driveway, which allows for many conveniences.

Figure 8 shows an excellent type of a dairy barn. It is the plan of the model dairy barns used on the Alberta Experimental Farms located in different parts of that Province. The plan shows a central feed room in the most convenient relation to the feed alleys. The grain bins are overhead in the loft. The plan can be readily extended or re-arranged. If one wanted an inclined driveway into the loft, it could be easily arranged for just outside the bull pen, or at the opposite end of the feed passage. A root cellar could then be put under the incline. It could be extended to the left enough to take in the feed passage, thus affording a convenient entrance to the roots. If desired, a very nice

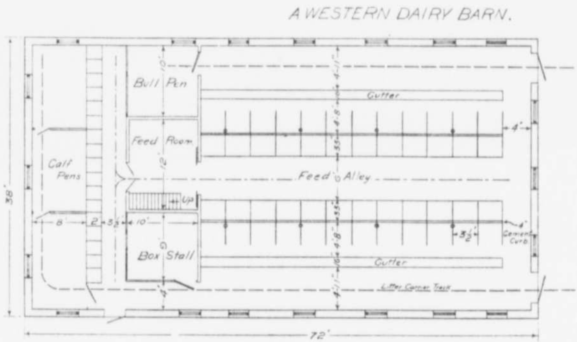


Figure 8

concrete milk room could be put under the driveway. The cross feed passage at the end makes it very easy to put on an additional wing at either side, making an L-shaped barn, with the added space available either for more cow stalls, or for a horse barn if so desired. Again, a root cellar might be had at one end of the cross passage, and a silo at the other; the silo being placed on the **sunny** side of the barn. The private individual might cut down the width a little if he so desired by economizing in the width of the feed passages.

The barn has the gambrel roof that is being so widely used in modern barn construction.

The new College dairy barn (figure 9) is L-shaped. One wing contains two rows of dairy stalls, facing in. The feed rooms are in the corner near the silo. A large milk room is convenient to the dairy cows.

There is a large root cellar underneath the feed rooms. The narrow wing has a row of calf stalls on the outside and one of bull stalls on the inside, connected to exercising yards. The wings can be entirely shut off from each other by means of sliding doors. It is unfortunate that the cut has to be made so small as many interesting details on the plan cannot be readily seen.

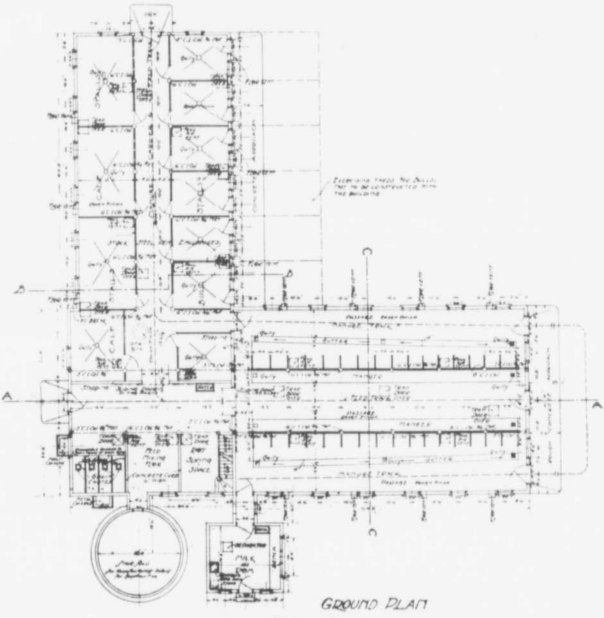


Figure 9

An elevation of the dairy barn is shown in Figure 10. The dotted lines below grade line and to the left of the silo foundations show the location of the root cellar.

The plan of the College beef cattle barn is shown in Figure 11. It is also L-shaped, with large feeding pens in the narrow wing. The rows of cattle stalls run crosswise in the wide wing. The feed room is at the corner. One silo will be provided, though provision will be made for locating an additional one as shown by the dotted circle. There is a large root cellar underneath the feed room. The front elevation is quite similar to that of the horse barn.

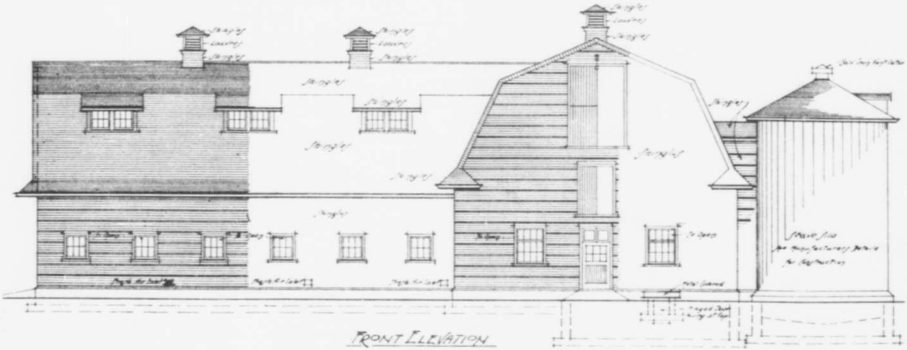


Figure 10

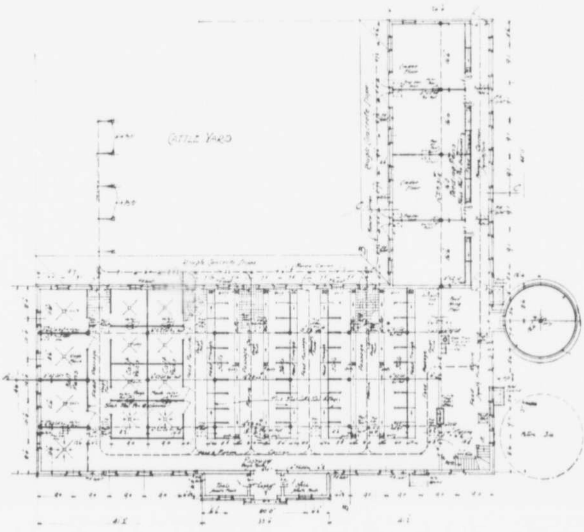


Figure 11

ROUND BARNS

A bulletin on Farm Barns would not be complete without at least some reference to the round barn, though it was not intended to take up much space in the bulletin with descriptive matter but rather to present a number of ideas mainly by use of drawings. While it has of course been known that one could get more floor space in a round barn than in one of any other shape with the same length of outside wall, little effort has been put forth to utilize this knowledge in economical barn building. Very little has been written concerning round barns as compared with the amount of literature covering other types. A number of round barns have been built in recent years in various parts of the American middle-west, probably more being used in Illinois than in any other State.

Figure 12 is a plan of a 60-foot round dairy barn, used on the 20-acre Demonstration Dairy Farm of the College of Agriculture, Urbana, Illinois; showing the present arrangement of the stable. The barn was designed for 40 cattle, but accommodation was provided for but 28 at the start. A 12-foot silo in the centre of the barn affords a most convenient method of feeding. This central location of the silo should protect it from freezing where winters are severe. Wooden stanchions, somewhat similar to those used for calf feeding (Figure 48), are used for feeding and at milking time only. The cattle are left loose behind the stanchions the rest of the day, there being 2,200 square feet of floor space in which they can run, no stall partitions being used. Gates are provided for making a number of box stalls when needed.

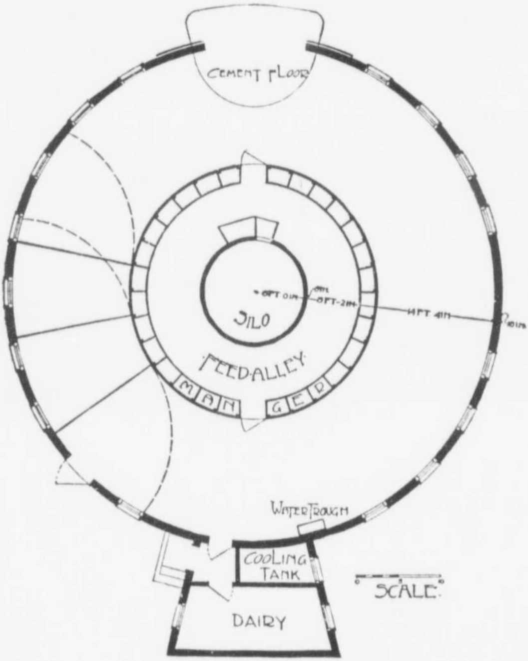


Figure 12

Figure 13 gives an idea of the appearance of the barn. The stable wall is of brick, 10 inches thick, with a 2-inch dead air space to prevent dampness inside. The picture shows the dairy under the driveway. The barn has been in use for over five years and, quoting the words of the Professor of the Dairy Husbandry, "has given entire satisfaction."

The Demonstration Farm was started in 1908, "the sole object being to produce the largest amount of milk per acre at the least possible cost. To meet the requirements of a barn for this purpose it became imperative to build one that was convenient for feeding and caring for the cows, economical of construction, and containing a large storage capacity in both silo and mow. These are the requirements of a barn for every practical dairyman."

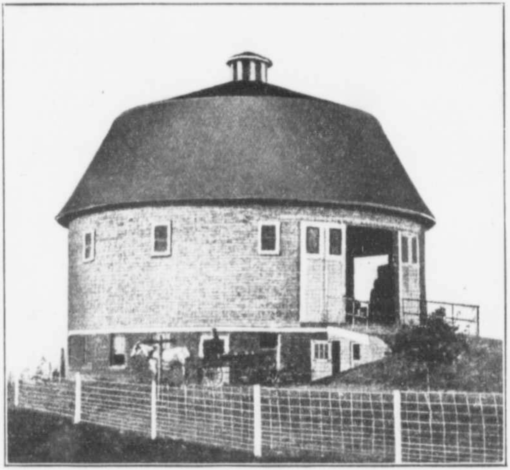


Figure 13

Figure 14 is the floor plan of the 60-foot barn as it will ultimately be used to accommodate 40 cows in stalls. The 370-ton silo, 18 feet in diameter and 56 feet deep, has sufficient capacity to supply the herd with ensilage 8 months of the year. The circular feed passage is 7 feet wide, the manger $2\frac{1}{2}$ feet, the stall proper 5 feet in depth, the gutter or drop 18 inches wide, and the walk $3\frac{2}{3}$ feet. The circle of the mangers at the stanchion edge is 38 feet in diameter, or $109\frac{1}{3}$ feet in circumference. The stall partitions, which are on radial lines, diverge at the back, which conforms with the shape of the cow and makes possible a very economical use of stall space; the stalls being 2 feet $10\frac{1}{2}$ inches at the stanchion, and $3\frac{1}{2}$ feet at the drop. This shape also results in economy in bedding down the stalls.

The dairy is under one of two inclined driveways leading to the loft for filling the hay mow and silo. The hay chute is used for the outtake ventilation flue. The openings in the loft are hinged at the top so that they close automatically. It is a very easy matter to install any number of outtakes, running up along the outside of the silo, independent of the hay chute.

The silo in the centre makes possible a very strong, self-supporting roof construction, as the peak of the roof rests directly upon the top of the silo. The more recent roofs are built with three slopes instead of the two shown in Figure 13.

The round barn can be used for both horses and cattle if desired.

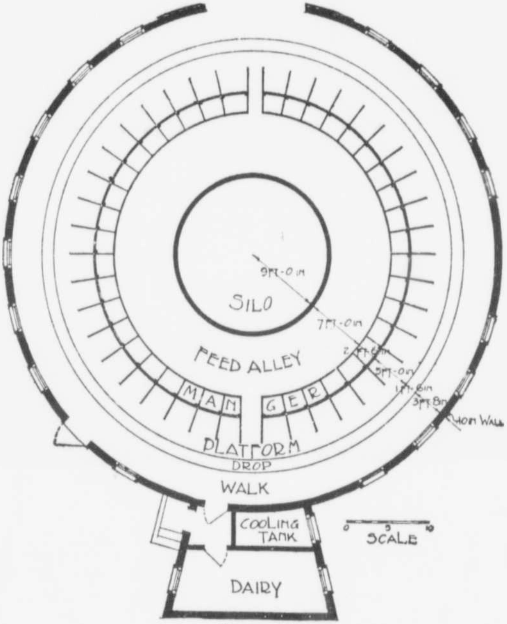


Figure 14

*ADVANTAGES CLAIMED FOR THE ROUND BARN OVER THE RECTANGULAR TYPE

1. Most convenient in storing, feeding and cleaning.
2. Cheaper; rectangular barns requiring about 20 per cent. more wall and foundation, and 30 to 50 per cent. more material.
3. Warmer, having less wall surface.
4. Easy to light and ventilate.
5. Greater strength secured with less lumber.
6. Smaller cost of upkeep, as painting, etc.

DISADVANTAGES

1. Cannot be enlarged.
2. Difficult to get builders, inexperienced in round barn construction, to undertake the work.

* For more information write the College of Agriculture, Urbana, Ill., for Bulletin No. 143

A Round Barn in Saskatchewan. To the writer's knowledge, few round barns have been built in the Northwest up to the present time. It will therefore be of value to learn what satisfaction such a barn gives in our climate and conditions; for what will give the utmost satisfaction in one latitude, or set of conditions, may prove of no value in a different locality. This point is worth while keeping in mind when seeking new ideas in many of the phases of agriculture.

Figure 15 shows a round barn belonging to Earl Parmenter, Rouleau, Sask., and described by him in the February 5th, 1912, number of the "Nor'-West Farmer," which description is given below in part, and from which—allowing for any possible personal leanings in the matter—

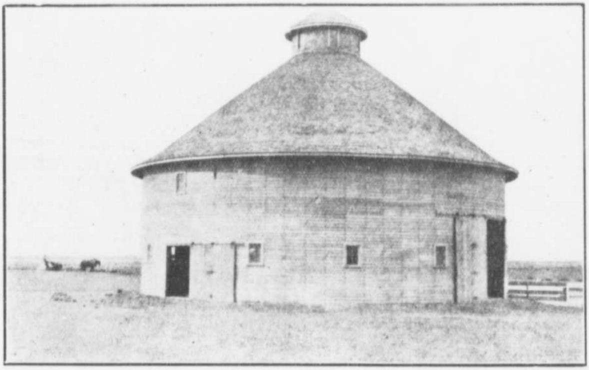


Figure 15

it would seem evident that the round barn can be well adapted to our conditions.

"I built a round barn on my farm in August, 1910, and, having used it through one very long, hard winter and one summer, I find it entirely satisfactory.

"It is 60 feet in diameter, a perfect circle, with 20-foot posts.

"One of the principal advantages of the circular barn is its strength and lack of outside surface, and in this country where the snow drifts badly around the buildings it has the peculiar faculty of diverting the snow away from the building for a distance of at least 25 feet, leaving a clean sweep clear around the barn. Such was my experience last winter. When the snow was drifted 6 feet deep all around, I had a clear space about 25 feet wide all around my barn, and never had occasion to use a pick or shovel to remove the snow from the doors before being able to enter. This makes a good place to leave vehicles, if one has occasion to leave them outside, as you know you may hitch on to them at any time, whether the next morning or the next month, without first having to dig them out of a snowdrift.

"In speaking of strength, there are two items of importance, i.e., there are no flat sides or high gables to catch the wind, and in the circular construction every board that goes on the outside goes on in the same form and purpose as the hoops on a barrel; so, in siding the barn up it is a matter of all hoops. We know that a barrel is the strongest of all containers on account of its construction.

"A so-called round barn, built with many sides, from eight to twenty-eight, has the disadvantage of having as many corners, which in every case is the weakest point, all siding boards ending in the same studding.

"In the actual test of the strength of building materials, it has been found that the tensile strength of lumber is from 16 to 30 times greater than the transverse strength; so in the construction of a round barn, as in a round silo, there is no bulging at any place.

"Although my barn has neither plate nor sill (Figure 16) it is absolutely impossible for it to bulge at any place, in spite of the fact that the roof is put on in one great span (60 feet) with no supports but the outside row of studding. There was not a brace used in the entire construction, nor is there need of any.

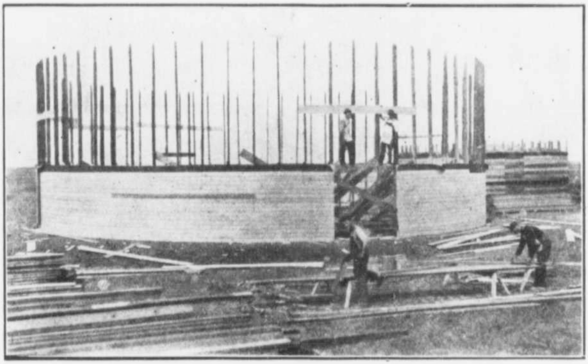


Figure 16

"The foundation is of concrete, ranging from 16 inches to 40 inches in depth, according to the grade, cast with gains in the top surface, 1 inch deep by $1\frac{5}{8}$ x $5\frac{5}{8}$ inch to receive the ends of the studding which were set 32 inches apart on centres, or to be exact, 31.42 inches, there being 60 studding in the entire circle of 188.5 feet.

"The form for the circular part of the foundation was made by driving two circles of stakes into the ground the right distance apart, and also from the centre and half-inch resawn lumber used for the form boards, nailed to the stakes. The ties for the top of the form were placed at the points where the studs were wanted, and had a block 1 x $1\frac{5}{8}$ x $5\frac{5}{8}$ inches secured to the underside against outside board of form. This, after being removed, would leave the desired gain in the foundation to receive end of stud.

"The barn was first boarded up with half-inch resawn, followed by one ply of paper, then finished with No. 1 spruce "drop" or barn siding.

"If I were building again I would first side up with common inch lumber, then paper, followed with novelty lap siding, which is the beveled lap siding, rabbeted on the back side for the lap. We experienced some difficulty in driving together the drop siding as it had a tendency to carry the paper with it, and cause it to pucker, which caused rather slow progress at times. The novelty siding would go on with no difficulty whatever.

"There are 30 rafters in the roof that are 30 feet long, the upper ends resting against a circle 12 feet in diameter, which also forms a base for a cupola, with side walls, 5 feet 4 inches high, containing 6 windows of 2 lights each, 12 inches by 18 inches.

"There are also 30 rafters (each alternate one) that are 20 feet long (Figure 17) secured at the upper end to a header, placed between the longest ones, the lower ends of all resting on top and against the inside edge of the outside studding. The eaves were constructed by nailing lookouts of desired length to each rafter.

Figure 17

"The sheathing went on in 16-foot lengths to begin with, but became shorter the farther up the rafter it was laid, until a 14-foot board would reach, at which point the joints were broken or lapped, and so on.

"One-half of the interior (Figure 18) is arranged for 16 head of horses in the main stable, with all heads towards the centre. I will state here that in a round barn of less than 60 feet in diameter, the stalls would naturally be nearer the centre than in a larger barn, thereby giving the partitions more flare than would be economical.

"The feed rail in my double stalls is 6 feet long, the manger or breast rail is 7 feet, while the width at the rear is 9 feet. This might be reduced 6 inches in the length in front, making the rear 9 inches less without any sacrifice. The front side of the manger is 16 feet from the outside wall, thereby giving plenty of room for passage way behind the horses.

"The remaining half of the barn has a driveway passing through just to one side of the centre with a stable of three double stalls and two box stalls on the opposite side.

"The driveway is 14 feet wide, extending in for 20 feet, where it is reduced to 9 feet for the remaining length. A load of hay can be driven into the driveway where it can be unloaded with the hay outfit at any time.

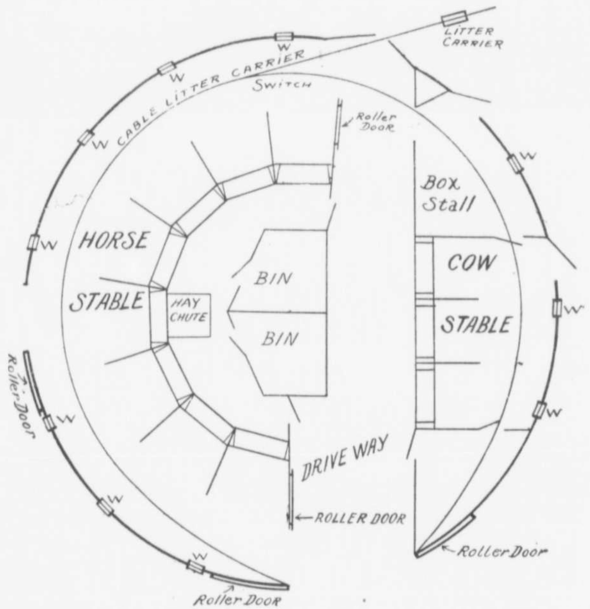


Figure 18

"Directly in front of the horses, and in the centre of the barn, are two grain bins of 800 bushels capacity each, the grain being put into them from the driveway. Between the mangers and the bins is ample room for feedway, there being a clearance of 7 feet in the widest place. Both hay and grain are fed from this feedway very handily.

"The joists under the hay mow are placed the same distance apart at their outer ends as the studding, and as they near the centre, where more strength is required, they become closer together ($14\frac{1}{2}$ inches) at 16 feet from outside.

"As to the cost of such a barn, I will say that for actual material used throughout the entire construction, the cost is much less, considering strength, capacity and convenience, than could be built otherwise, the extra cost coming in the labor required.

"Circular construction, being out of the ordinary line of architecture, one desiring to build such a building would meet with more or less discouragement from contractors and builders, but if he is fortunate enough to get a good man that is a genius, one that is not afraid to tackle the job after giving the matter no little forethought and planning, he would never regret having built in that manner.

"Before fully deciding to build a circular barn, I sent to the Experiment Station at Urbana, Illinois, U.S.A., for Bulletin No. 143, which deals with the circular construction of barns, and, after fully noting contents, I went at it with the result that I have a fine barn that suits me in more ways than a square or rectangular barn could do, and I have built a good many barns before I built the round one, as that was my trade before coming to Canada."

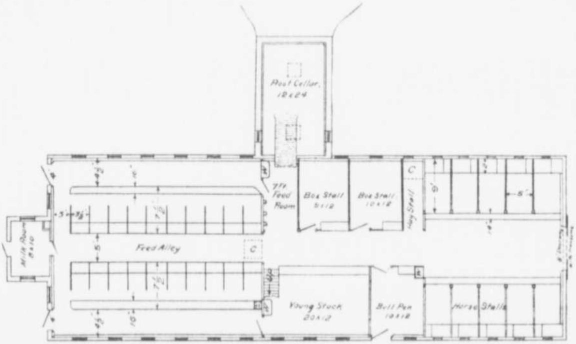


Figure 19

GENERAL PURPOSE BARNS

Many of the farm plans shown are of wide buildings. The one in Figure 19 is 30 feet from outside to outside of studding. A building of this shape could be easily extended if only part of it were built at first. In the cattle portion, the width allows of sufficiently large passageways, but with nothing to spare. Possibly it would be better to allow 4 feet for the feed passage, and make the alleys behind the animals 5 feet wide. If steel stanchions were used some of the stalls might be made $3\frac{1}{4}$ feet wide. A 4-foot door at the end of each passage allows the cattle straight access to their stalls. There is a water trough "W" at the end of each alley. The hay chute for the cattle is convenient to the feed room where the morning's hay might be left over night in winter time.

It might be better for the young stock to have an outside door, though having the door as shown was with the object of cutting down the number of outside doors. The bull pen has an outside door that could lead to a strongly-fenced paddock.

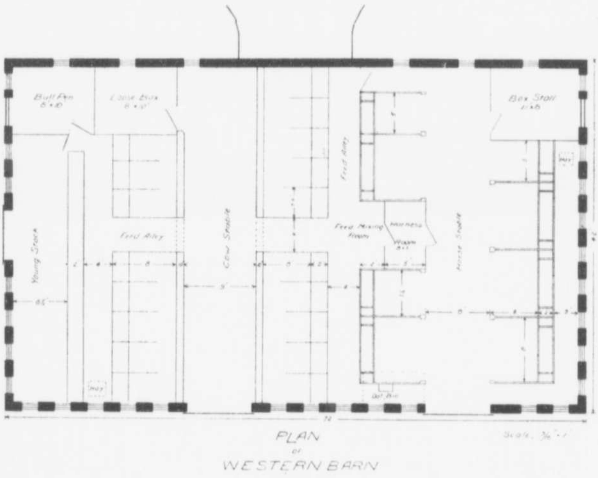


Figure 20

The 7 x 12 feed room is in about the centre of the barn. It connects with a large root cellar that is underneath the driveway leading to the hay loft. At the right, as one enters the loft by way of this driveway, and over the near corner of the cattle stable, are the grain bins whose spouts connect with the feed room below. The water is handy to the feed room. The floor of the root cellar is shown several feet below the stable floor level, the object being to get a greater storage capacity with a minimum amount of wall surface above ground level. An incline makes it easy to wheel the roots into the feed room. The root cellar wall would need a couple of dead air spaces to keep out the frost. It might need vertical strips on the inside wall, on which narrow boards would be nailed horizontally with open cracks, to keep the roots away from the wall and give ventilation.

The horse stalls face out. They are 5 feet wide from centre to centre of partitions. In a barn 30 feet wide there is a good sized passageway between the gutters so that a team can be unharnessed inside. Each horse stall has a small window placed quite near the ceiling. These windows can be hinged to open in all except the colder months. There is a box stall for horses, and one for cattle if so desired. A 4-foot hay stall is provided for the horses. In it the hay for the morning can be stored the night before, to save going into the loft when the morning feeding is being done. This space might do for stabling a horse for a short time.

The incline to the hay mow of a barn has a number of advantages. It provides for root storage underneath. It allows a load of hay or grain to be run under cover if a storm is coming on. The space from the incline across the barn, if left open, allows for some winter storage of vehicles. Also, when part of the loft has no hay stored in it, the inclined driveway makes this space available for a variety of purposes.

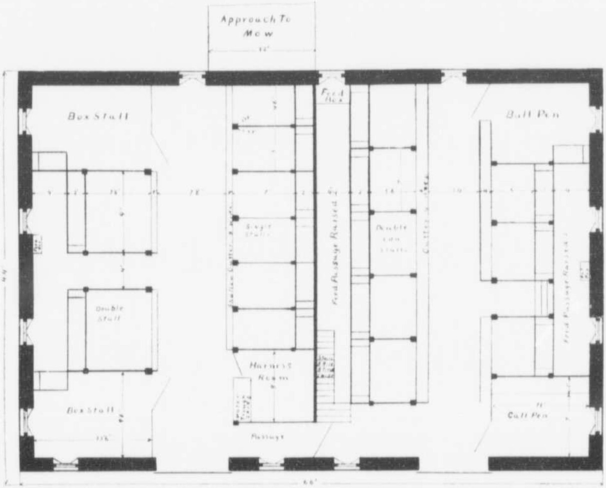


Figure 21

STUDENTS' PLANS. Figures 21, 22, 23, 24 and 25 are a few of the plans that were prepared by students of the Manitoba Agricultural College for the last Annual Barn Plan Competition, held by the Louden Hardware Specialty Company. Since they were competitive drawings, the students were given no assistance in preparing them. The competition called for plans and elevations for a mixed barn for from 10 to 15 horses and 20 to 30 cattle. The plans represent many good ideas, and readers will be able to get suggestions from them.

Next to the round barn (not including the octagonal type which has not given the best of satisfaction) the square barn allows the most floor space, with the least building material. Square barns are not often built. There is, however, little difference in economy between a square barn and one nearly square.

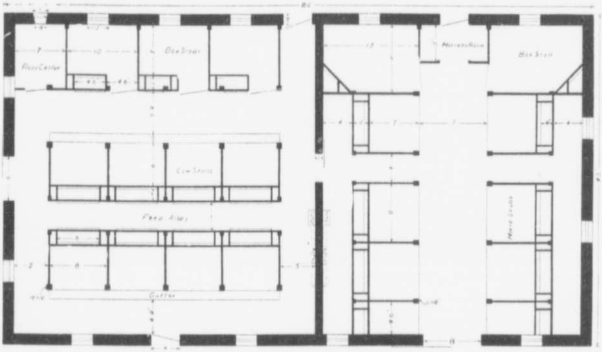


Figure 22

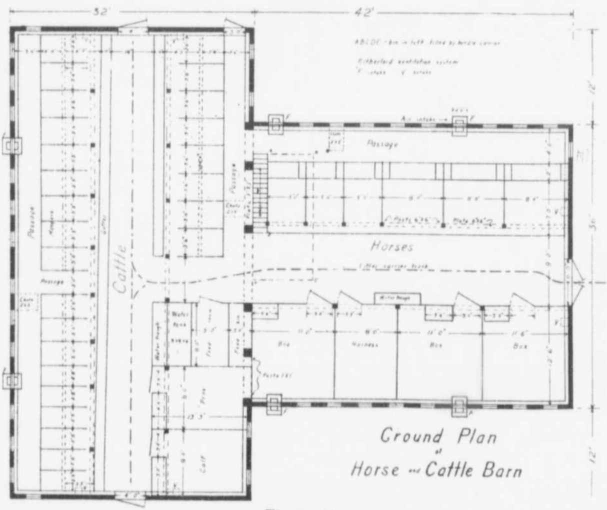


Figure 23

Figures 20, 21 and 22 show plans of barns more nearly approaching the square in shape, in which type the rows of stalls are generally put in crosswise. In Figure 22 the double cattle stalls run lengthwise, allowing room for box stalls on one side. This type of a barn makes possible some very convenient arrangements.

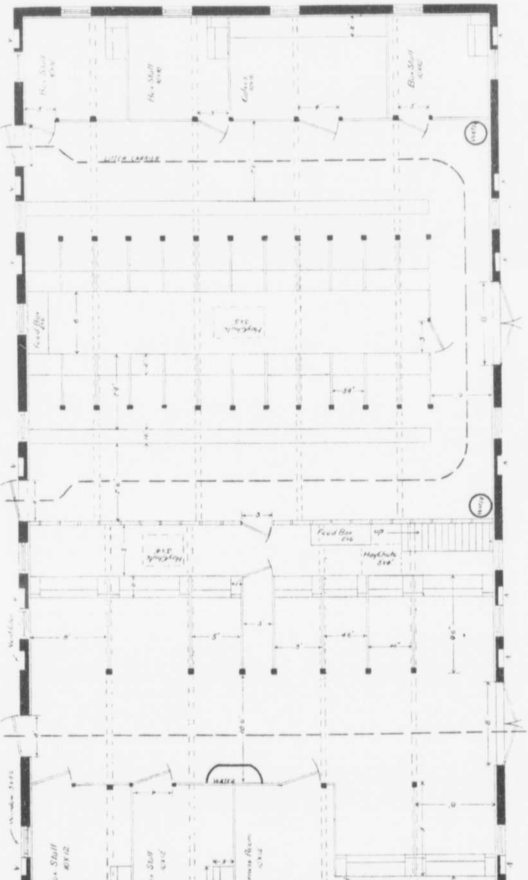


Figure 24

The T-shaped barn offers opportunity for economical and convenient planning as does the L-shaped barn. Where one part is used entirely for cattle, the width can be closely figured for that purpose only. The width of the other wing can then be economically figured for horses or

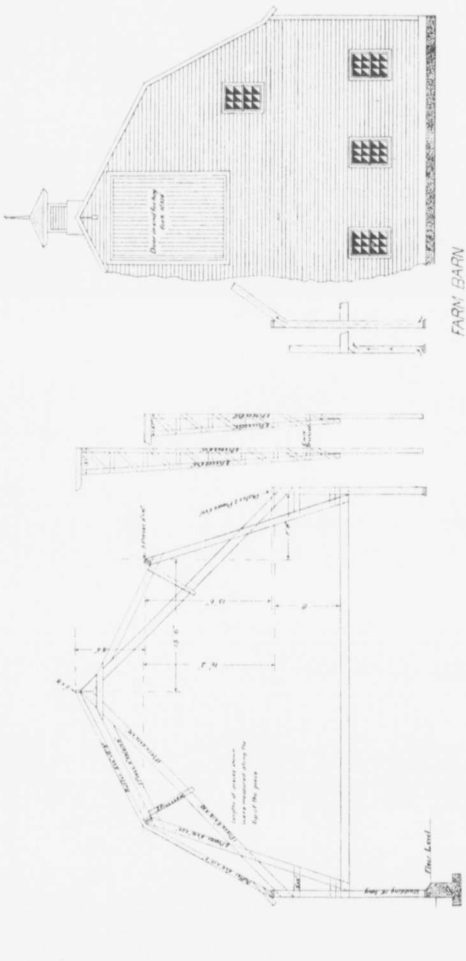


Figure 25

box stalls, or whatever might be desired in it. Figure 23 shows a very good arrangement of a T-shaped barn with many desirable features.

Figure 24 shows a very large barn, with the space well used, and conveniently laid out. This plan gained the first prize in the competition. A partial end elevation and sketch of the framing is shown in Figure 25. A barn 48 feet wide needs strong bents to carry the roof without purlin posts. The system of bracing is known as the "Shawver." The framing shown is similar to that used in the horse barn (Figure 4). The bents are put in every 16 feet. Purlins built up of three 2 x 10s support the roof between bents. To the right is shown the end bracing. The King system of ventilation is planned for the barn.

SHEEP BARNS

Figure 26 shows a plan of a small sheep barn for about thirty sheep. It is 16 by 46 outside, and has a feed room $4\frac{1}{2}$ by 12, which could be used temporarily as a lambing room in the spring by setting up a small heater in it. The pens have an earth floor, the rest concrete; the concrete floor being eight or ten inches above the earth in the pens.

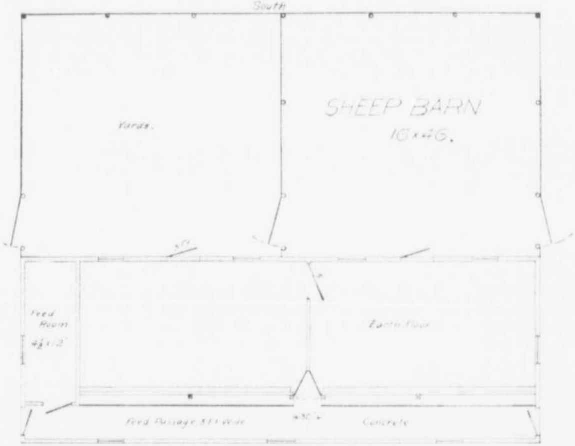


Figure 26

The doors from the pens open to yards on the south, and being on the same side of the barn should prevent drafts if the passage way doors are kept closed. These south doors should be in two parts so that either the upper or lower half can be opened or closed independently.

Only two pens are shown, though any number of partitions can be put in to suit.

The pens should be connected near the south wall by a good sized door so that the sheep can be moved easily, and the pens can be used separately, or all open together as desired. The partitions between the pens need not be over $3\frac{1}{2}$ feet high.

The plan shows a common method of getting from the feed passage to the pens without unduly sacrificing the length of the feed rack. The doors shown are 30 inches wide, and 30 inches between the feed racks gives enough room for the two, as one door swings over against the other.

Figure 27 shows a side view and a sectional view of the system for feeding. The rack is supported at intervals of about 10 feet by 4 x 4 posts resting on a 4 x 6 set in the concrete. A 2 x 4 is nailed at B to the 4 x 6 to nail the bottom of the one-inch stuff to. The short

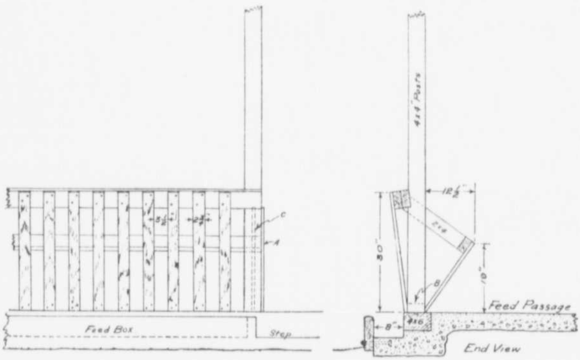


Figure 27

one-inch boards on the feed passage side of the rack are nailed tightly together; while the slats on the pen side have $3\frac{1}{2}$ inch spaces between. The feed box underneath the rack is 8 inches wide, and about 5 inches deep. The outer edge is formed by a 2 x 8 bolted to the concrete, though this could be made of concrete if so desired. The ends of the hay rack on the feed passage side are boarded up, as shown at A, or better still, this boarding could be made to come up against the middle of the 4 x 4 on the passage way face at C, instead of overlapping the other face as shown.

Another type of feed box and rack is suggested by Figure 28. This can readily be put in any barn that is going to be used for sheep, it being nailed directly to the wall studding. In the sketch shown the studding has no inside sheathing. If the studding were so sheeted the rack would have to set farther into the barn to let the hay work far enough down for the sheep to reach, as this hay rack is boarded tightly, and the sheep get the hay through the $4\frac{1}{2}$ inch space and between the studding. The idea of the tight boarding is to keep the sheep cleaner. The feed box is made of one-inch stuff, and slants outwards to make the cleaning easier. The hay rack is supported at intervals of 6 or 8 feet by 2 x 4s as shown. This rack system could be used between a feed passage and the pens, by making suitable modifications.

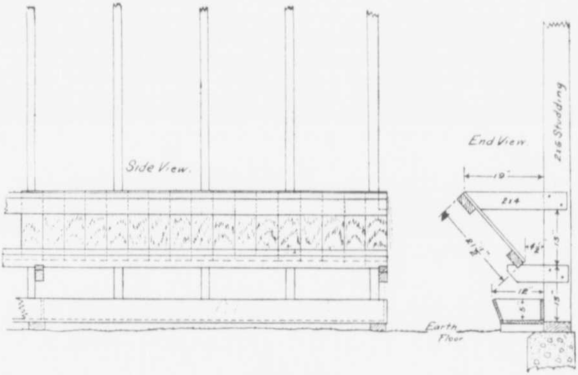


Figure 28

The ceiling of the barn can be made low to save material and keep the barn warmer. Eight feet from the earth in the pens to the under side of the loft joist should be ample. Twelve foot studding would be long enough. The roof could be the ordinary gable roof of one-half pitch. This would require little bracing. It would be well to have double doors in each end of the loft, and to have grain bins over the feed room. The loft floor would be fairly low in a building of this kind, and grain could be gotten into it without difficulty.

POULTRY HOUSE CONSTRUCTION

The accompanying cut (Figure 29) illustrates a type of colony house used by the College Poultry Department. As Bulletin No. 6 includes drawings of various types of poultry houses suitable for Manitoba conditions, no attempt will be made to give additional suggestions.

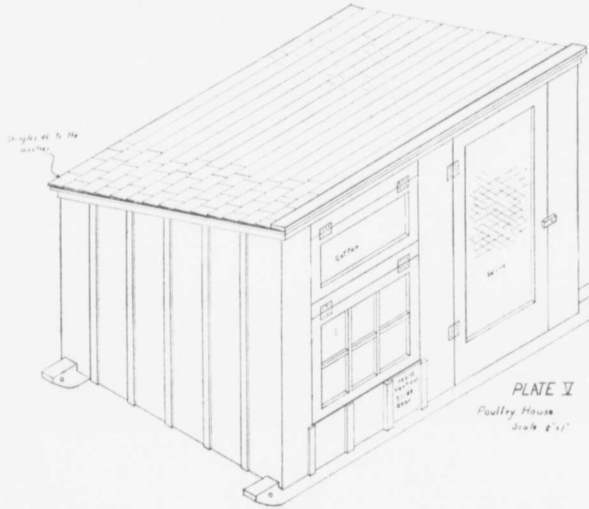


Figure 29

HOG HOUSE CONSTRUCTION

The portable hog house has been universally found so satisfactory in northern climates for use in connection with the stationary piggery that two types will be shown. Figure 30 gives a side and end view of the standard Λ-shaped portable pig cot that is now being so widely used in hog raising, both in the cold and warmer climates. They vary but little in their construction. Half of the outside finish is shown cut away in the two views, so that the framing can be seen. This is the pig cot referred to in the recent Bulletin No. 7, entitled "Hog Raising in Manitoba." It is 8 feet square at the base of the frame. The oak runners are 3 x 8, with $\frac{3}{4}$-inch holes in the ends for putting in clevises to facilitate hauling from place to place. The runners are so arranged as to be quite easily removed if they rot, because of poorer material being used, where oak was not available.

The three pairs of 2 x 6 rafters rest on 2 x 6 plates. Two pieces of 2 x 4 are let half way into the rafters on each side of the roof, and form nailing strips for 1 x 10, or 1 x 12 roof boards. The cracks are covered by 1 x 3 batten boards. There is no floor in the pig cot, though in some localities it might be advisable. The swinging door is built up of one-inch stuff nailed crosswise, as indicated by the dotted lines. The

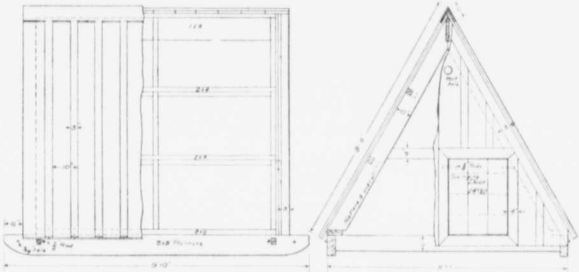


Figure 30

ends are covered with vertical boarding, the cracks being covered by 1 x 3 inch batten boards.

Figure 31 shows the framing of the pig cot. Note that the 2 x 6 cross pieces are mortised into the 3 x 8 runners. Only one 2 x 4 is shown on each side between the rafters, though two should be used. The $\frac{5}{8}$-inch tie rods that run just inside the cross pieces are not shown in this cut.

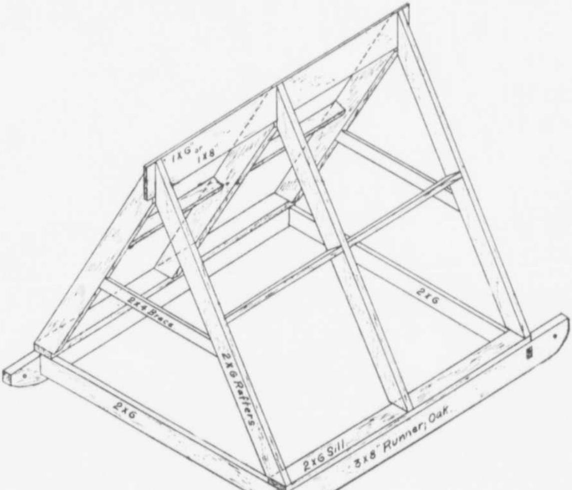


Figure 31

Figure 32 shows a shed-roofed portable hog house, 6 x 8, which is easily constructed. The side sills, which act as skids for house, can be made from 3 x 6, or two 2 x 6 spiked together. The ends are slightly rounded and project about six inches beyond end of building. The end sills are two 2 x 4 spiked together. The top 2 x 4 is left long and mortised into the side sills and securely spiked; the lower 2 x 4 is cut to fit between the side sills, thus making a secure corner.

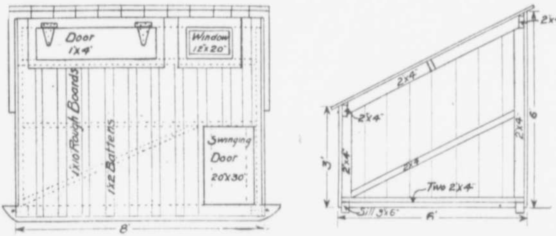


Figure 32

The frame is built of 2 x 4s, six feet high in front and three feet at the back. There are four corner posts and plated all the way around. The ends have a 2 x 4 diagonally across; this supports the siding and forms a brace which keeps the building from swaying. The front has a 2 x 4 twelve inches below the plate; this makes a frame to support the window and ventilating door. Thirty inches from the sill is another 2 x 4 which forms the top of the swinging door, and is also needed to support the boards. Another diagonal brace is put in from top of door to bottom of opposite corner. The back also needs a diagonal brace. The roof has one 2 x 4 to support centre of roof boards. The frame is covered with rough boards 1 x 10 with 2-inch battens nailed over the cracks. Battens can be used on the roof, but prepared roofing makes a better roof as it is waterproof and at the same time protects the boards from the weather, thus preventing them from warping.

Figure 33 shows a plan of a model piggery, planned by the Professor of Animal Husbandry. It is shown 32 x 78, but can be made any length desired, according to the number of pens wanted. A 10-foot feed room is at one end of piggery, giving ample space for storing and cooking feed. Grain bins can be located in the loft above. The farrowing pens are 8 x 12, with 5 x 6 sleeping platforms. There is a 36 x 42 window above each platform. The windows are 4 feet from the floor, thus letting the sunlight well into the piggery. They are hinged at the bottom. The outside entrance to each pen has two doors; a vertical sliding door on the inside wall, and a double swinging door similar to the one in the portable pig cot, even with the outside wall surface. The partitions between the pens are 4 feet high as shown in Figure 34. Concrete floor of feed passage is one inch higher than the concrete in the pens. The

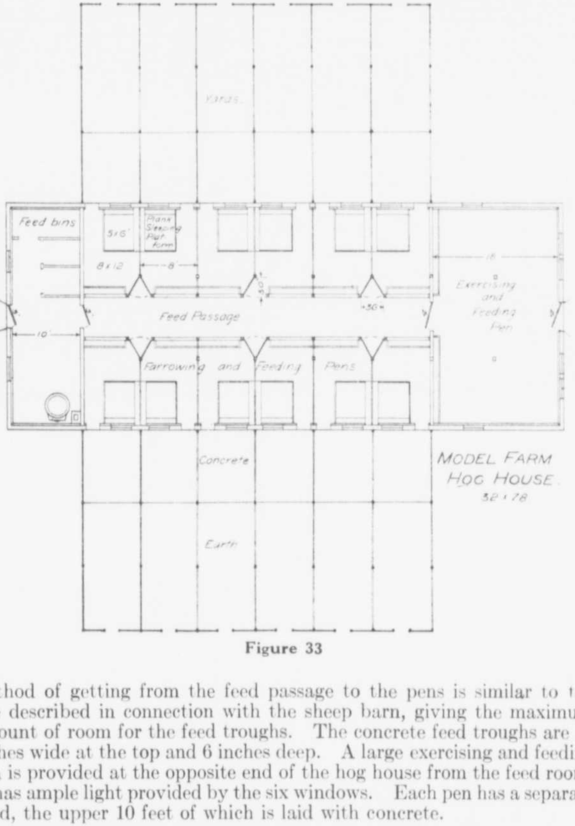


Figure 33

method of getting from the feed passage to the pens is similar to the one described in connection with the sheep barn, giving the maximum amount of room for the feed troughs. The concrete feed troughs are 10 inches wide at the top and 6 inches deep. A large exercising and feeding pen is provided at the opposite end of the hog house from the feed room. It has ample light provided by the six windows. Each pen has a separate yard, the upper 10 feet of which is laid with concrete.

The building has a $\frac{3}{8}$-inch pitch roof over 12 foot studding. The hog house has an 8-foot ceiling.

Figure 35 is an isometric drawing calculated to give a better idea of the sleeping platform, and the swinging partitions above the feed troughs. The sleeping platform consists in 2-inch plank resting on concrete that is an inch higher than the concrete floor of the rest of the pen. Pieces of 1 x 2 run round the edge to bind the planks together and help hold the bedding in place. The 2 x 8 and 2 x 10 planks are about 8 inches above the platform. They protect the pigs from being

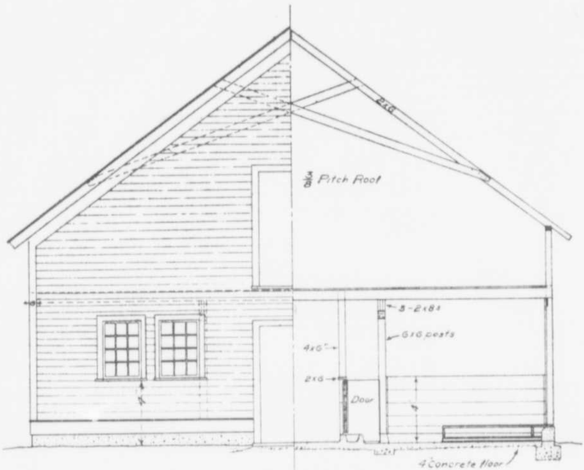


Figure 34

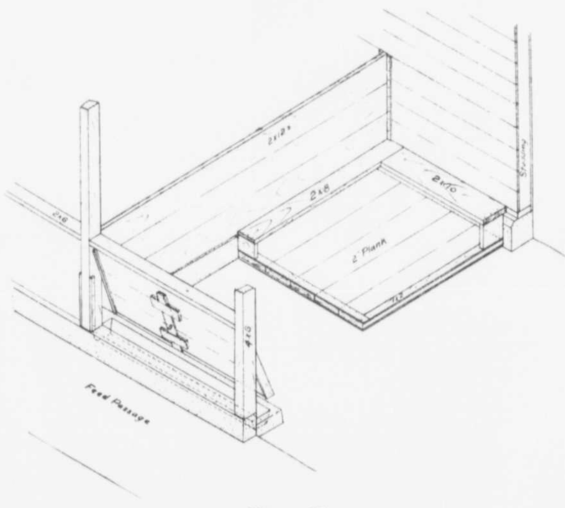


Figure 35

crushed by the sow. It is a good idea to have a partition between the pens rest on a narrow concrete wall that comes level with the outer foundation wall of the building. The swinging partition is shown in position for putting feed into the trough without being disturbed by the pigs. These partitions are made up of planks with 2 x 4s nailed flat against the ends. They swing at the top on $\frac{3}{4}$-inch iron pins that are one half way in the 4 x 6 post, and the other half in the partition. The partition is held in the position shown by 1 x 5 inch slide "S," which has a one-inch block nailed to the upper end to prevent the slide from dropping down too far. The drawing does not show all the details according to the preceding figures.

A Portable Fence. Figure 36 shows a drawing of a section of the portable fence that has proved very useful around the College farm. One section is hooked into the next, making a fence not unlike the old-fashioned rail. It can be put up in any shape, and is found very handy for fencing in pig cots as they are moved from place to place about the farm. It can be used for fencing in calves. It also does very well for a temporary enclosure for sheep, though it is a little low for that purpose.

In the winter they are often used as wind breaks for piling up the drifted snow, thus preventing it from drifting and settling in undesirable parts of the yard.

The fence is made entirely of one-inch lumber. The sizes given in the figure need not necessarily be followed, but care must be taken in the building of the ends in order that they hook together in good shape. The 22-inch opening should be the full 4 inches. The 3-inch top rail might well be made 4 inches wide. When nailing on the vertical pieces and diagonal braces, every other section should have them nailed on the opposite side from the preceding section, in order that the fence may be set to follow a straight line if so desired.

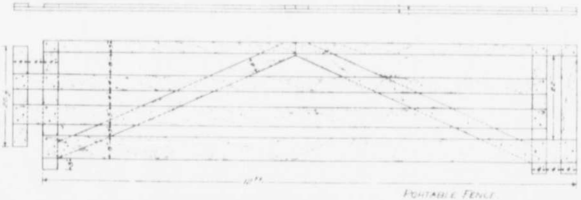


Figure 36

The bill of material for one section is as follows:

Rails: 1 piece 1 x 3, 12 feet long.
1 piece 1 x 4, 12 feet long.
1 piece 1 x 5, 12 feet long.
1 piece 1 x 6, 12 feet long.
Styles: 1 piece 1 x 4, 12 feet long.
Braces: 1 piece 1 x 4, 12 feet long.

The accompanying illustrations (Figures 37 and 38) are of the piggery planned for the new College. It is 30 x 120. The barn has a concrete slope on three sides. The cut was made from a large tracing, and therefore the dimensions are very small; but the arrangement can be seen

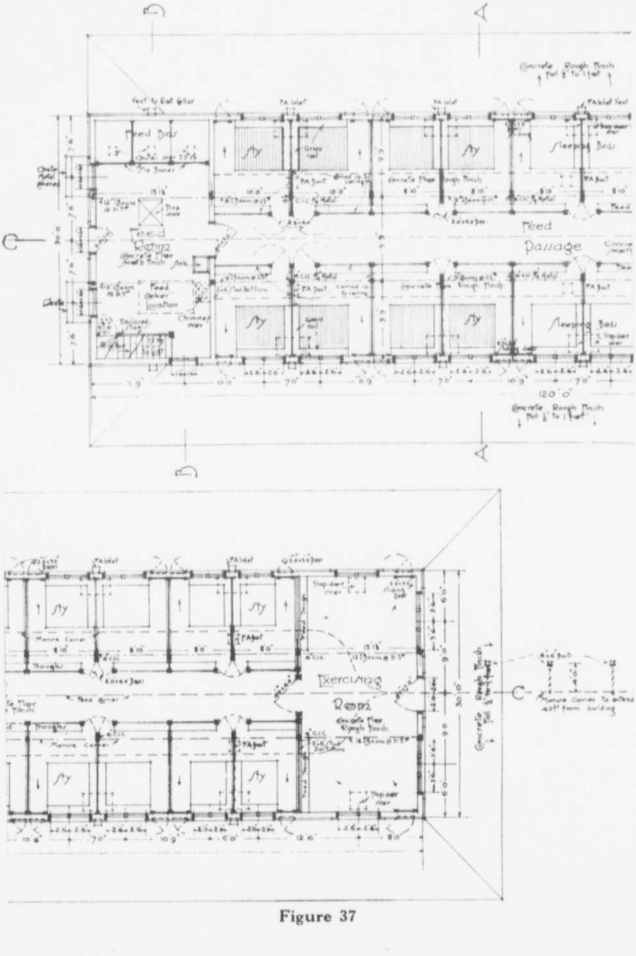


Figure 37

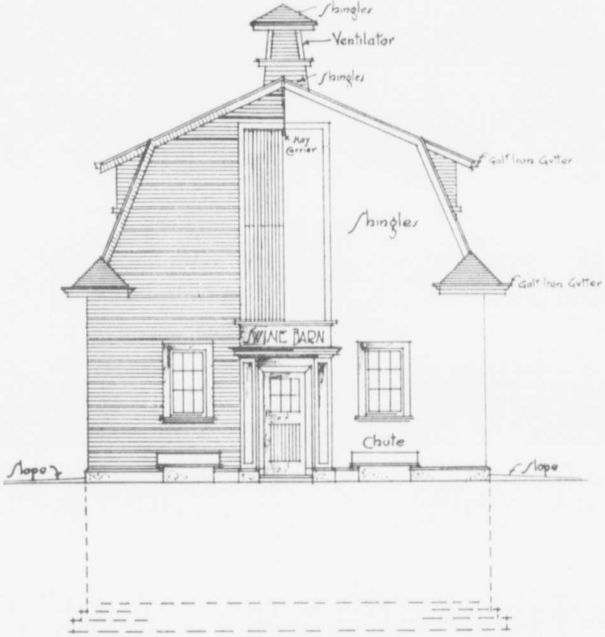


Figure 38

without much trouble. There is a large feed room in one end, and an exercising room in the other end, with pens between. There is a large root cellar underneath the feed room, with four chutes for filling. Figure 38 is an elevation of the piggery, showing the main entrance. Two of the chutes to the root cellar are here shown.

BARN DETAILS AND INTERIOR VIEWS

In many of the barns more recently built, the part of the hay track projecting beyond the end of the barn wall is supported and protected by an extension of the peak of the roof. The framing for this is nicely shown in Figure 39 where the 2-inch ridge pole extends the necessary distance beyond the wall, and is supported by jack rafters the same size as the longer rafters. If desired, the projection can be made to extend more than $4\frac{1}{2}$ feet beyond the end wall.

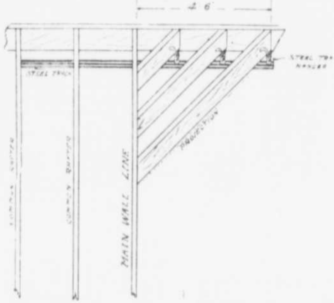


Figure 39

Figure 40 illustrates three of the common types of stanchions on the market. They can be purchased independent of other barn equipment, and come in a number of lengths and widths to suit the different types of cattle, or individual cases. They can be adjusted or aligned horizontally at the connections above and below, in order to bring the animal to the desired position in the stall and in relation to the gutter. The rectangu-

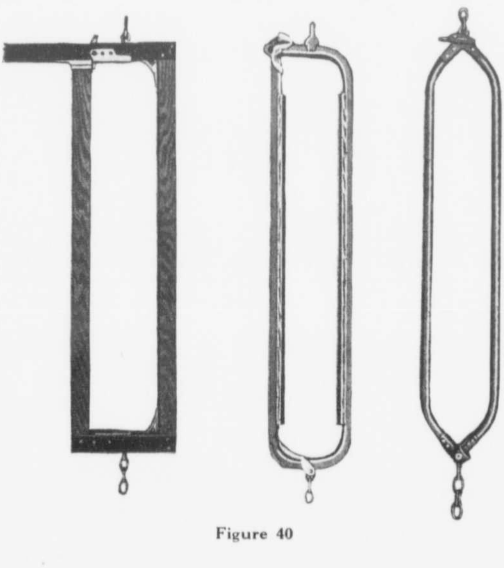


Figure 40

lar stanchion to the left is made chiefly of maple. The stanchion in the centre, and the one to the right, are made of steel pipe. The centre one is shown with wooden strips on the inside of the pipe to make the stanchion narrower, as may be desired.

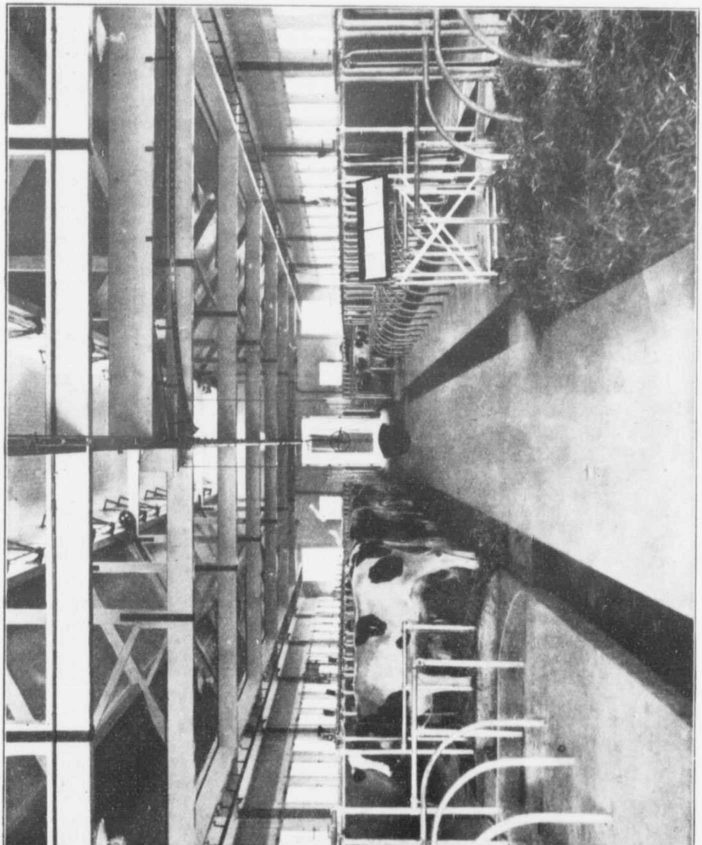


Figure 41

Figure 41 shows the interior of one-half of the new dairy barn at the Government Mental Colony Farm, Coquitlam, B.C. It is a splendid illustration of what can be done in a barn along lighting and sanitary lines. There is a feed track system above the feed alleys, and a litter carrier at the centre. The centre alley behind the animals has a crown to ensure drainage. Note also the slope of the concrete stalls. The feed alleys are about six inches higher than the central alley. Note the tabular box stalls at the end of the barn.

Figures 42, 43 and 44 show three sections of stalls, showing standard dimensions valuable to prospective builders in planning their stables. The floor in the front part of the stalls is made one inch low to help keep the bedding in place, and in order that the animal shall stand on the

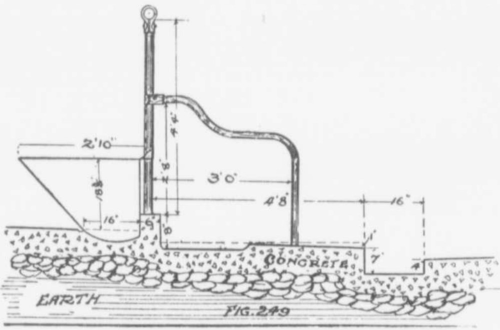


Figure 42

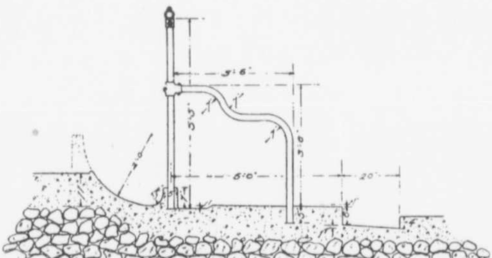


Figure 43

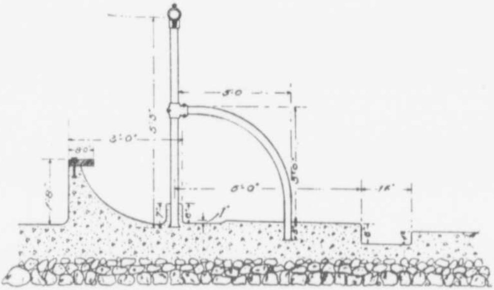


Figure 44

level. The remainder of the stall floor has a one-inch slope to the gutter to insure good drainage. The gutters vary from 16 to 20 inches in width, 18 inches being the figure used to a large extent. Fourteen inches is sometimes used, but that makes a pretty narrow gutter. Figure 42 shows the feed passage hollowed out 16 inches to fit the steel manger. Figure 43 is designed for a steel manger, but if none is to be used the front is raised, shown by the dotted lines. In Figure 44 a 2 x 8 is bolted along the top of the concrete to prevent the feed from working over. It would seem best to have the level of the feed passage floor not more than a few inches above the concrete in the stalls. This would save a good deal of filling, or the putting in of an extra depth of concrete, which depth is unnecessary so far as the required strength of the floor is concerned. Four inches of good concrete should be sufficient for the ordinary barn. The mangers, in Figures 43 and 44, can be equipped with steel partitions if desired.

Figure 45 shows a steel manger. They can be had with, or without bottoms as desired. They are hinged at their point of connection with the vertical posts, so that they can be readily raised for cleaning out the feed trough below.

A wooden manger on the same principle is shown in Figure 46. In the left view, a number of wooden mangers are used in connection with wooden posts.

Another type of steel stall is shown by Figure 47. It has two vertical uprights for each division, making a rigid construction. Steel stalls are built with one, two and three uprights for each partition, as may be desired.

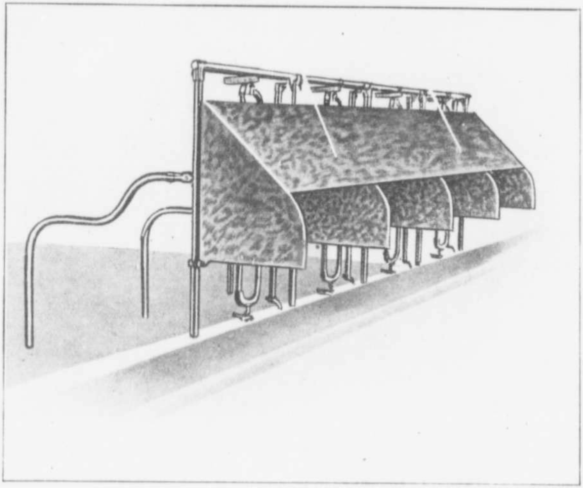


Figure 45

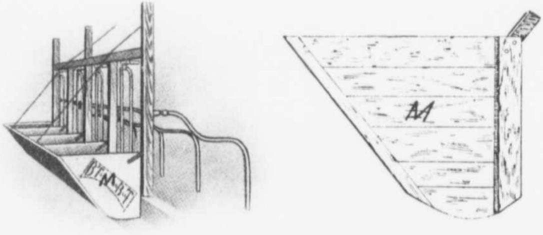


Figure 46

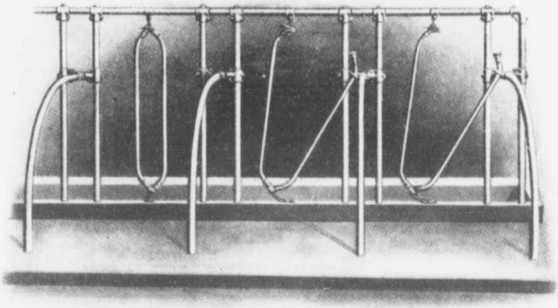


Figure 47

CALF MANGER AND STANCHIONS. Where calves are being pail-fed in loose pens, it is very desirable that there be a good arrangement for feeding. Figure 48 shows a side and end view of such an arrangement, which has been developed and found very satisfactory in the cattle barns at the Michigan Agricultural College. No one should find it difficult in doing the woodwork. Each calf has 2 feet of manger between the partitions "C.C." which extend up to the top of the stanchion to prevent the animals from interfering with each other when feeding.

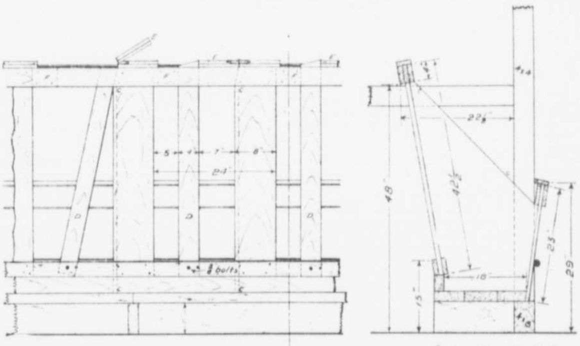


Figure 48

Each calf can be given its individual food with the certainty that it will be allowed to feed undisturbed. The stanchions are used for feeding only, the calves being loose in the pens the remainder of the time. Ordinarily, the stanchion allows 5 inches for the neck of the calf; but by changing the ⅜-inch bolt at the bottom of the swinging piece "D," the opening can be made larger as desired. The swinging board is held in closed position at the top by means of a 1 x 3 inch board "E," which is hinged so as to drop into position as the movable piece goes to the left. 1 x 4 inch blocks are placed at "F" to prevent the swinging part of the stanchion from moving too far to the left. This arrangement for feeding works very well, and prevents the forming of bad habits at the pail-fed stage. As the calves grow larger, so that their horns interfere with the use of the stanchion, the movable pieces "D" can be entirely removed.

A WOODEN RACK AND MANGER. Figure 49 shows another type of manger with a hay rack that has been developed at the above mentioned College, and is proving very satisfactory. The feeding system is used on the alley side of large loose stalls or pens. It has been found equally valuable for baby beeves and the more mature stock. The rack and manger are built on 6 x 6 posts that support the loft floor. If the barn cannot be arranged so as to utilize these posts, two 2 x 6 pieces can be put in position at the proper intervals to support the woodwork. They can be easily nailed to the floor joist above, and pinned to the concrete floor below. If pipe cannot be easily obtained at the town junk yard, 1 x 2 inch hard wood strips could be used with 5-inch spaces between.

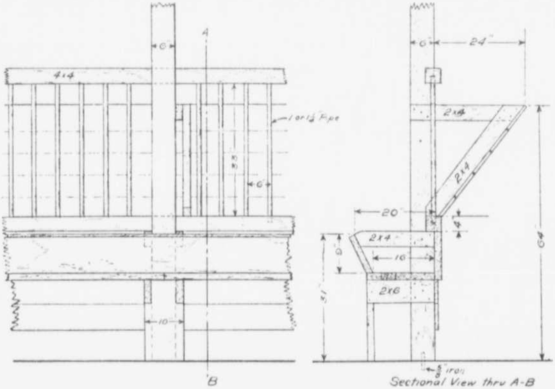


Figure 49

WOODEN DOUBLE CATTLE STALL. There seems to be a growing tendency on the part of many to use a double stall for cattle, instead of individual stalls. In the Northwest, where the reduction of the wall surface is an important item, the double stall means a saving of space and a corresponding smaller barn. Instead of $3\frac{1}{2}$ feet per stall, or 7 feet for two cows, 6 feet is sufficient where the double stall is used. Figure 50

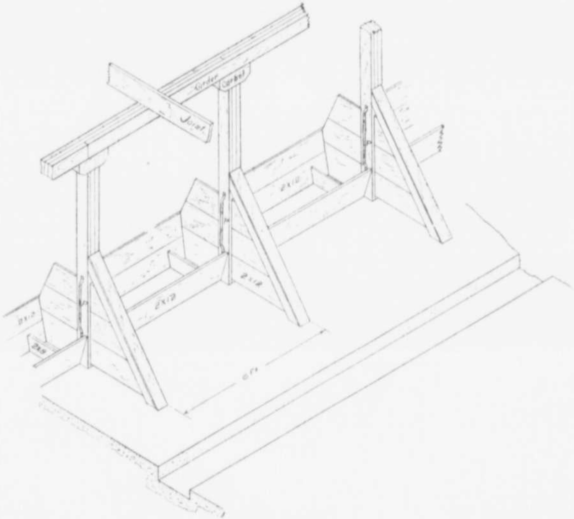


Figure 50

shows an isometric drawing of a type of double wooden stall that has points of durability and simplicity of construction. It is intended for barns where two rows of cattle head in. In such a type of barn, the posts supporting the loft floor will work out nicely in the position shown in the sketch. The posts herein shown are built up of three 2 x 6s. The 2 x 12 planks that form the stall partitions pass through between the outer 2 x 6s that form the post, and also form the partitions for the mangers. The middle 2 x 6 of the post rests upon these 2 x 12 partition planks. The stall partition (Figure 51) starts 4 feet above the concrete floor and slopes down to the floor at a point 3 feet back from the posts, and 2 feet from the gutter. Two pieces of 2 x 4s nailed one on each side of the 2 x 12 plank, form the edge of the stall. A piece of 1 x $5\frac{1}{2}$ is then nailed to the edge of the 2 x 4s to give a good finish. The lower 2 x 12 is kept 2 inches above the concrete to facilitate cleaning. There is a feed box 8 x 12 (bottom measurements) at each end of the manger. The stall has a slope of one inch to the gutter. The feed alley floor is on the same level as the front of the stall, making it very easy to lay the concrete

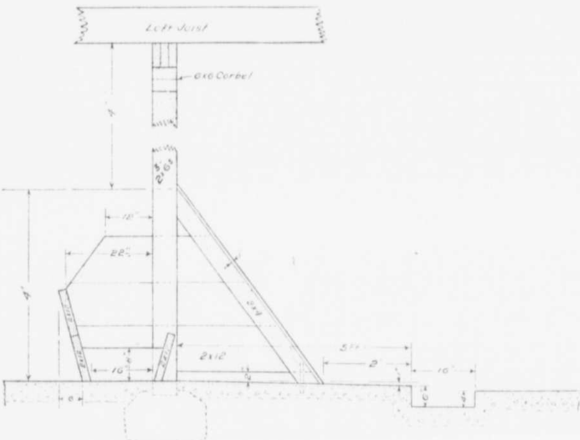


Figure 51

barn floor. One-inch pipe "P" is screwed to the post to tie the cattle to. The stall partition is pinned at the point where the 2 x 4s rest on the concrete.

Figure 52 shows the feed passage of a dairy barn with the cows heading in. The rows of posts that support the loft floor form part of the divisions between the animals. Note the perfect freedom of the animals in their steel stanchions. Figure 53 is a good example of the raised feed passage and curved concrete feed troughs. From the lights and shades across the passage, it is clear that there is ample light, even in the centre of the stable. Note the feed carrier with the scoop and measure.

Figure 54. This view is of the same stable as Figure 53. The windows are hinged at the bottom; in the picture they are all open. Germs could scarcely resist such a flood of sunlight as is here shown. This is a view from the dairy barn at the New York State College of Agriculture.

Figure 55 affords an excellent view of a well lighted row of stalls and stanchions. There is an attractiveness about the clean looking, uniform arrangement that makes one wish that he owned such a barn filled with good dairy cattle. On the extreme right can be seen the second row of stalls. The feed passage is level with the front of the stall.

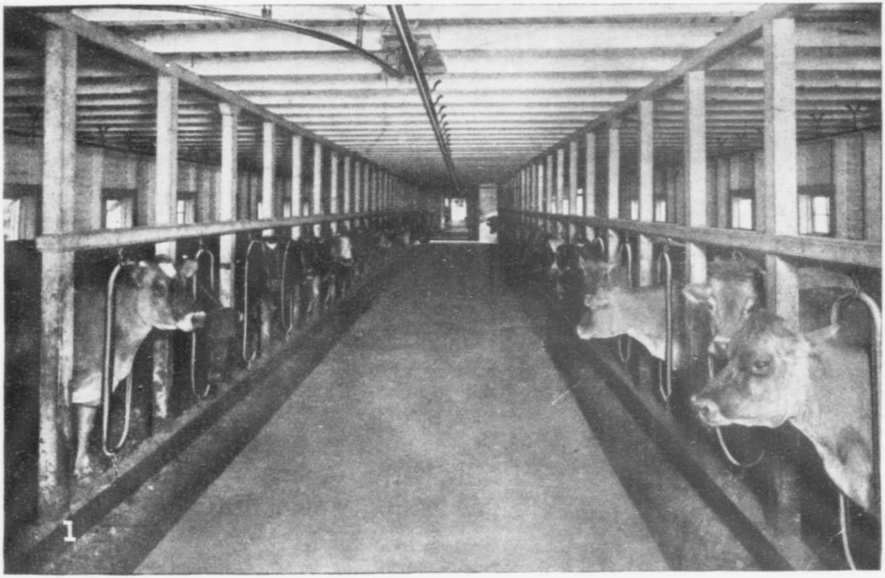


Figure 52

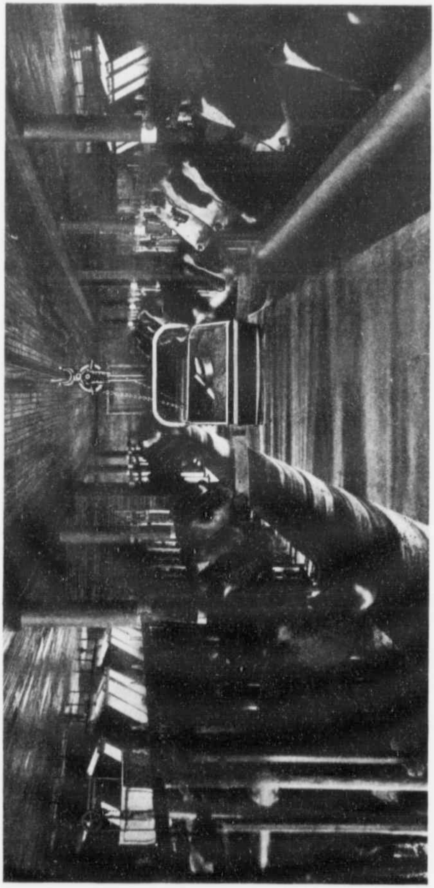


Figure 53

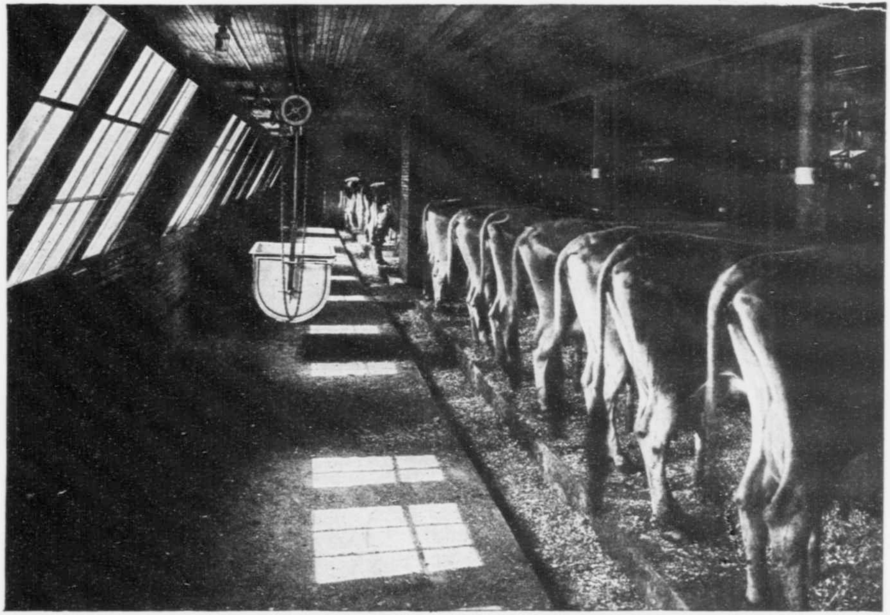


Figure 54

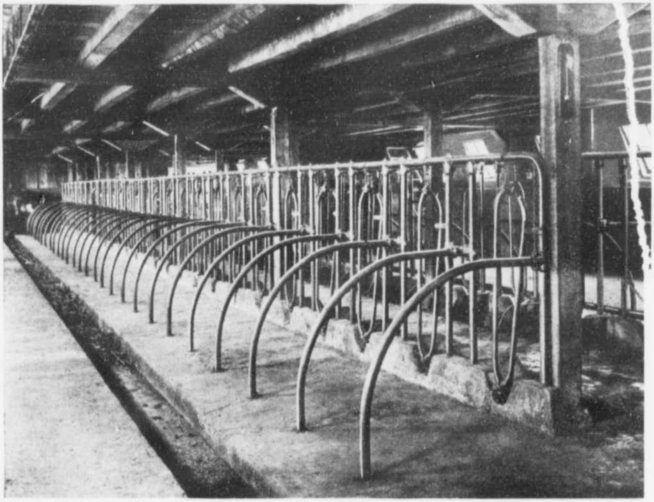


Figure 55

ROOF FRAMING. Figure 56 gives a fairly good idea of one method of framing the gambrel roof. It also gives a good proportion of such a roof, the rafters being equal in length and the cuts easy to work out. The sketch is for a 36-foot barn. The studding, rafters and braces forming the bent are all 2 x 6s. There are two kinds of framing, one on each side of the centre line. The bent shown on the left side is put in every fifth or sixth rafter, and of course is the same on both sides of the peak, only one half being shown in the cut. The sets of rafters in between these bents are tied together as shown on the right side, with 1 x 6 inch stuff. The hay track can be hung from the intersection of the scissors truss at the peak. All the upper parts of rafters can have this scissors truss if desired, or a 2 x 6 collar tie can be used at the same level as the intersection just mentioned. The lower 2 x 6, that projects out into the loft at the bottom, is not always used as it cuts up the loft to a certain extent. It would not necessarily have to extend out as far as shown; but the brace should not be left out. Often two studs are used at each bent, and it is a good practice for barns much over 30 feet in width and height.

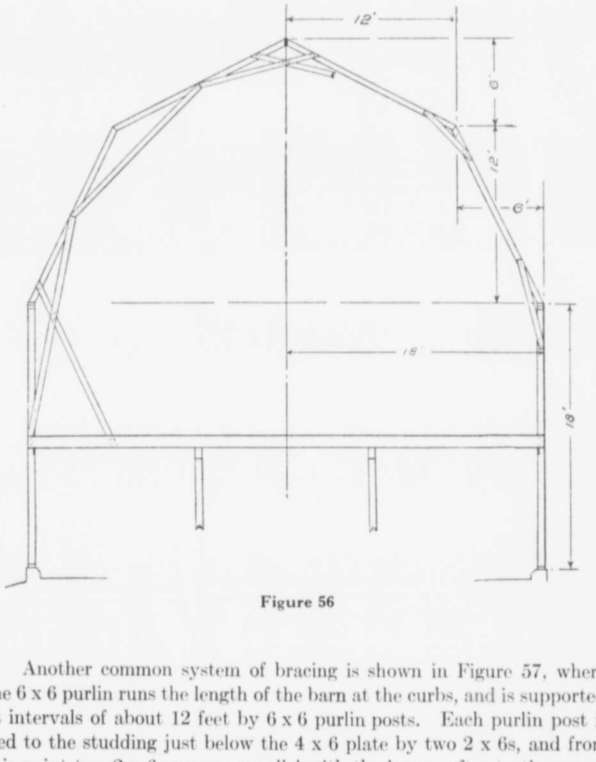


Figure 56

Another common system of bracing is shown in Figure 57, where the 6 x 6 purlin runs the length of the barn at the curbs, and is supported at intervals of about 12 feet by 6 x 6 purlin posts. Each purlin post is tied to the studding just below the 4 x 6 plate by two 2 x 6s, and from this point two 2 x 6s run up parallel with the lower rafter to the upper end of the purlin post. In all gambrel roof barns, the overhang of the roof should curve up slightly, to give a better appearance to the barn. The posts and section of the floor in the stable are arranged for two rows of horses heading in. The same method of supporting the loft floor might also be used in connection with two rows of cattle. The rafters and studding in the loft should be well braced by plenty of long 1 x 6 pieces nailed diagonally to the under or inside edges of the rafters or studding. These strips will steady the frame against any end thrusts, such as might be caused by heavy winds.

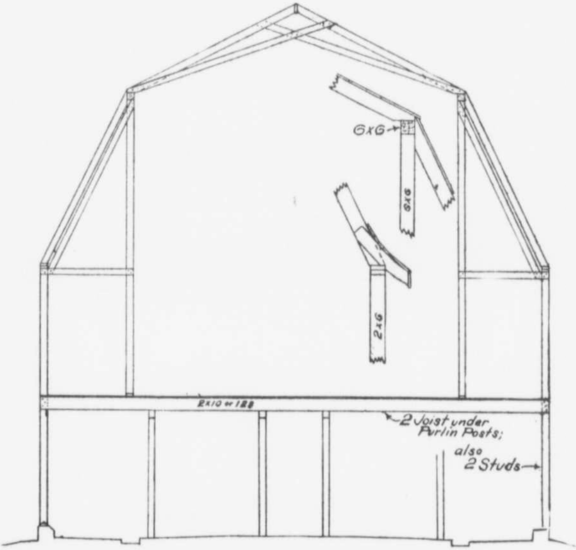


Figure 57

MANURE STORAGE

One of the main objects of mixed or diversified farming being to keep up the fertility of the soil, it follows that the manure must be carefully utilized to that end. In order to get the full value from the manure, it is necessary to provide some means for storing it until such times as it can be put on the land. Figure 58 shows a concrete pit that can be used fairly satisfactorily in many localities for this purpose. It can be constructed with but little expense. The one shown is 12 x 24 and 5 feet deep at the low end. It can be placed near one of the barn doors. In some barns, where a door or a square opening could be had for this purpose only, the pit could be put against the wall of the building. A plank can be laid across the pit, and the manure wheeled over and dumped directly into the manure spreader. The incline of the pit floor is sufficiently gentle so that the spreader could be pulled out without difficulty. The upper part of the incline should be grooved to give the horses a good footing. If a manure carrier is used, a post for the track can be put in near the side opposite the barn door, thus affording a very easy method of dumping. A 10-inch wall should be sufficient for the pit, while 4 inches of concrete should do for the bottom.

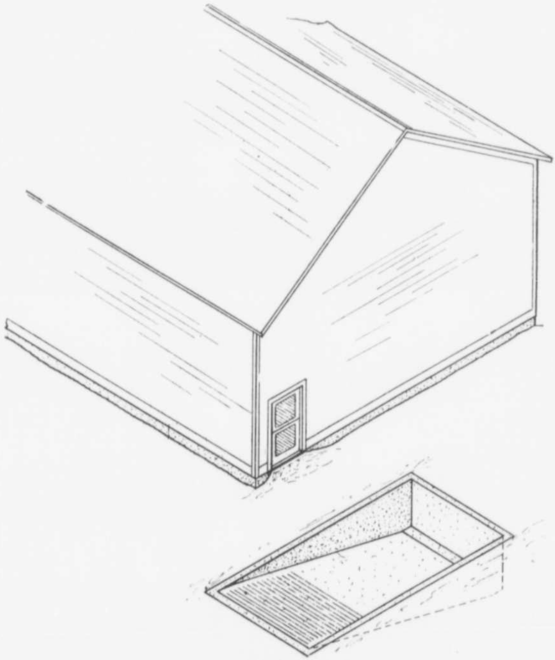


Figure 58

When a large number of stock is kept, it would pay to build a manure shed. Figure 59 is a plan of a concrete manure shed, similar in shape to the one in use at the Michigan Agricultural College. There is a passage way on one side for manure spreaders, where they might be loaded directly from the litter carriers. The litter carrier track would better distribute the manure in the shed if the tracks coming into the shed did not meet, but passed each other. In this case, two carriers would probably be used. The concrete wall runs up about 3 feet (Figure 60), the roof being supported by 4-inch pipe filled with concrete mixed very wet, pipe flanges being screwed to the upper end of the pipe, as shown, with two $\frac{5}{8}$-inch coach screws holding the flange securely to the plate, which is built up of three 2 x 8s.

Figure 61 is an isometric drawing of such a shed. The roof is comparatively flat, and is covered with prepared roofing. It is seen that the manure can be readily pitched into the spreader over the concrete wall from any part of the shed.

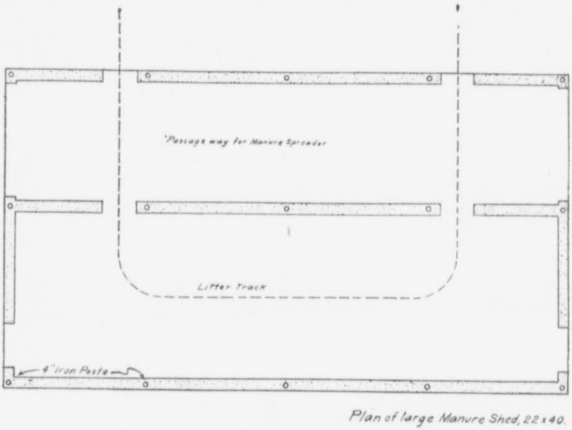


Figure 59

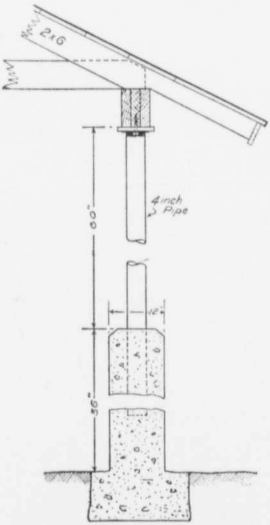


Figure 60

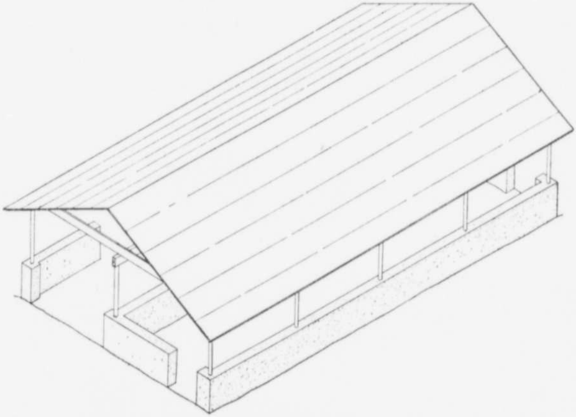


Figure 61

Figure 62 shows the concrete manure shed at the Michigan Agricultural College. To the right are two sets of 2 x 12 timbers for the litter carrier track. They are supported by posts at the fence and by rods with turnbuckles from the barn timbers and from posts passing up through the roof of the shed. These 2 x 12s are in two spans, the longer being 36 feet, being made up of two 20-foot lengths spliced.

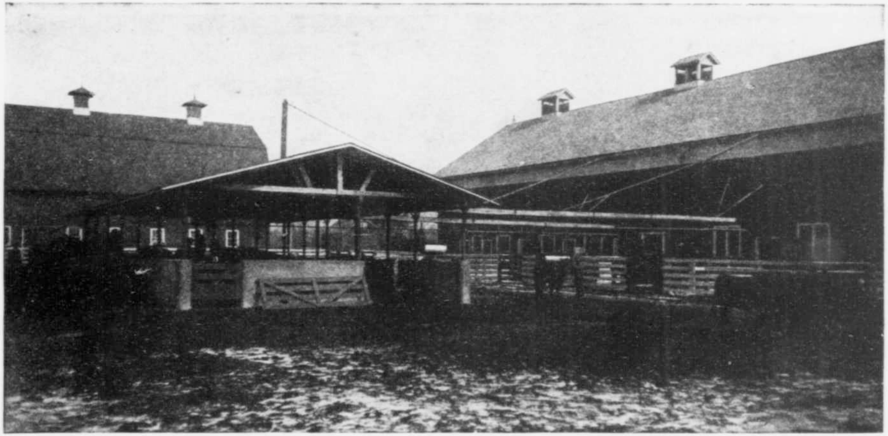


Figure 62

PORTABLE GRANARIES

Portable granaries are almost indispensable in the Northwest on large farms, where the threshing is done in the fields and by big threshing outfits; and on smaller farms where the haul to the elevator or barns is quite a distance. The common granary will hold 1,000 bushels, or about the capacity of an ordinary car. A number of metallic granaries are now on the market, but most farmers choose to build their own. Figure 63 shows a side and end view of a portable granary of about 1,000 bushels capacity. It is 16 feet long, 10 wide and has 7-foot stud-

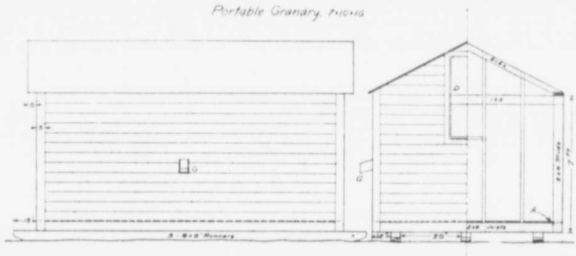


Figure 63

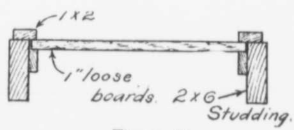


Figure 64

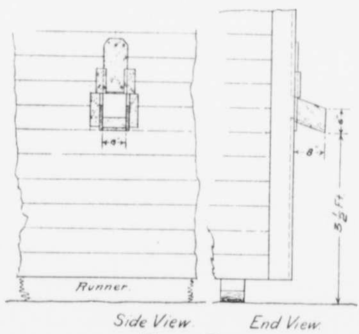


Figure 65

ding. In the end view the left half is finished, and the right half exposed, showing the method of framing, which is simple. The joists are 2 x 6, 10 feet long, and 2 feet on centres. The studding is also 2 x 6 and on 2-foot centres, and are nailed securely at the bottom to the side of the joist as shown at "A." Sometimes the joists are extended four inches beyond the studding, and a 2 x 4 nailed on the top to give additional strength.

The joists are securely toe-nailed to the 6 x 6 runners. Often pieces of 1-inch material are nailed on the runners between the joist to add greater strength to the connection between the runners and the granary proper. A 2 x 6 plate runs along the top of the studding at each side of the granary. The end studdings are notched over the end joist and are cut at the top so that the outer edge of the stud is flush with the outside face of the end pair of rafters. The flooring runs lengthwise as do the roofing boards. Shiplap can be used for flooring, though for the small additional cost regular 6-inch flooring would be better. Two 1 x 6 crossties prevent the sides from buckling outwards under the pressure of the grain. They should be nailed about 6 feet from each end. The rafters are of 2 x 4 stuff, and are set at quarter pitch, which brings the peak $2\frac{1}{2}$ feet above the level of the plate.

At one end there is a 22 x 50 inch spout door, the bottom being a little over five feet from the ground. The drawing shows the opening at "D." One-inch loose boards are put in between the studding from the bottom of the door upwards, to take the pressure of the grain. They can be easily kept in position by use of 1 x 2 strips as in Figure 64. Often instead of having a spout door at the end, an opening for the spout is made in the roof between two rafters, and at the centre of the granary. At the opposite end a $3\frac{1}{2}$ x 7 foot door is put in at floor level. This is large enough to put a fanning mill right in the granary when it is nearly empty and clean the grain for next season's seeding.

The building is carried by three 6 x 6 runners, bored at each end to take a $\frac{3}{4}$-inch clevis. Two runners are often used, but three will make a much stronger and more durable job, though it is a little hard in turning. If only two runners are used, they should not be set more than 5 feet apart for a 10-foot building. The 2 x 6 floor joists should be selected with care. Spruce will not stand under the load when the granary is filled with wheat. Tamarac or fir should be used.

A 6-inch spout is shown at "G." It is at the centre of the side of the granary. A good portion of the grain can be bagged here as it flows out by gravity. Figure 65 gives a better idea of the spout. It has a vertical slide for shutting off the flow. When the grain gets too low to run, one could get inside and shovel a good bit of the remainder over against the opening. The spout should be strongly nailed to the side of the granary, or the stock will be apt to rub against and loosen it.

The roof can be shingled or covered with roofing; or the rafters could be put in the proper distance apart and the corrugated metallic strips nailed to the rafters.

Some build the granary with a curved roof as shown by Figure 66. A 2 x 6 plate runs around the four sides of the granary, and a 2 x 8 or

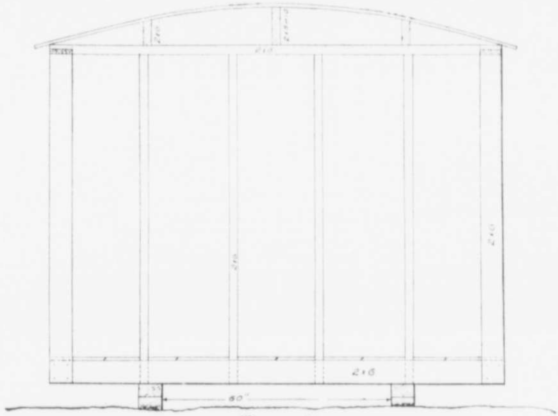


Figure 66

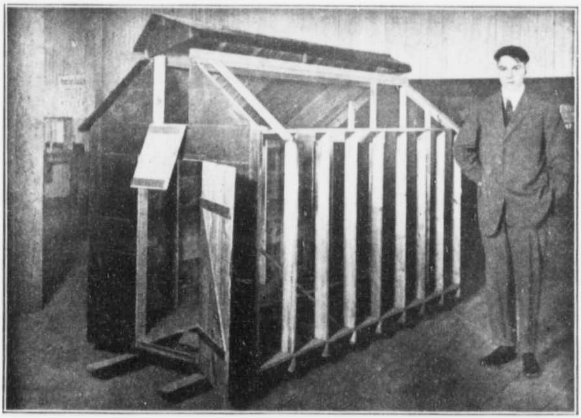


Figure 66a.

2 x 10 piece runs down the centre to support the peak of the roof. Two 2 x 6s support the roof nearer the sides. The roof boards then run across the building. They are ½ or ¾ inches thick, and can be bent to this

curve without difficulty. The boards can then be covered with metallic roofing or roofing paper.

Figure 66A shows a model of a portable granary with a hinged peak. It was purposely left unfinished to better show the construction. The connection between the joists and studding is different from the figures already discussed, and is not so strong.

The following is a bill of material of the portable granary shown by Figure 63.

		Board Ft.
Runners	3 pieces 6 x 6 inches—18 feet long	162
Joists	9 pieces 2 x 6 inches—10 feet long	90
Studding	4 pieces 2 x 6 inches—18 feet long, for ends 9 pieces 2 x 6 inches—14 feet long	198
Rafters	9 pieces 2 x 4 inches—12 feet long	72
Plates	2 pieces 2 x 6 inches—16 feet long	32
Cross Tie	1 piece 1 x 6 inches—16 feet long	8
Corner Boards	4 pieces 1 x 6 inches—16 feet long	32
Doors & Trim, &c.	8 pieces 1 x 6 inches—16 feet long	64
Siding	500 feet of 6-inch stuff	500
Floor	200 feet of 1 x 6-inch stuff	200
Roof Boards	250 feet of 1-inch stuff	250
Roofing	$2\frac{1}{2}$ squares	

MACHINERY SHED

Another building which is indispensable on the farm is the machinery shed. A low building to protect the machines from the weather is all that is needed. Figure 67 shows the construction of a shed that might be suitable for an ordinary farm, or at least offer a few suggestions to the intending builder.

The foundation is made of cement blocks or flat field stone. The footings for the posts in front should be in the ground a sufficient depth to be sure they will not get moved by some one bumping against them.

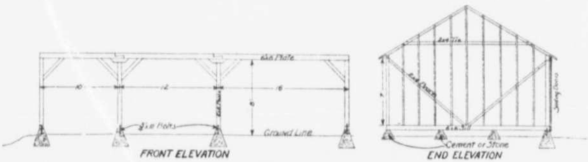


Figure 67

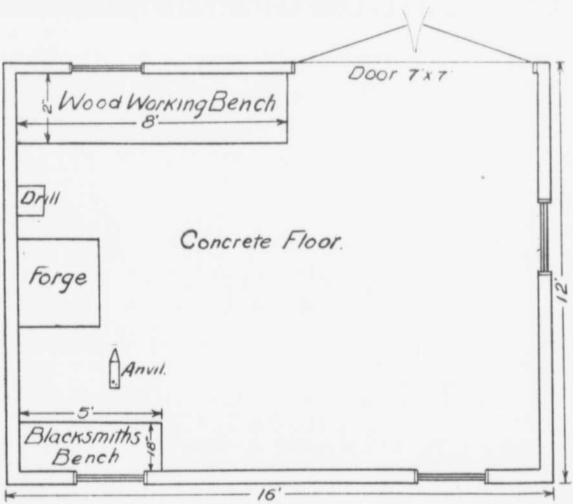
The sills are 6 x 6 on three sides of the building. The front is constructed by framing 6 x 6 posts into a 6 x 8 plate. This frame forms the doors. There is one 16-foot door which is necessary to get eight foot binders in. The other doors are 10 and 12 feet, or can be made any size to suit machines to be stored. There is a double track all along the front so that one door will slide past the other and any one can be opened. The studding is 2 inches x 4 inches x 7 feet set at 24-inch centres if lumber is used. If metal siding and roofing is used they can be set according to the width of the metal. Corrugated metal siding is usually about 30 inches wide. For the walls a lap of one corrugation, which is $2\frac{1}{2}$, is sufficient; for the roof, a lap of two corrugations is better.

The walls are braced with 2 x 4 diagonally from the corners on the ends and back. The roof has 2 inches x 4 inches x 16 feet collar ties on every second pair of rafters.

FARM WORKSHOP

Every well equipped farm should have a small workshop with a few carpenter tools, a forge, and a few blacksmithing tools. Figure 68 shows a plan that might be suitable for the average Manitoba farm. The proposed building is 12 x 16 feet with 7-foot studding and a common gable roof. The building should be set on a cement or stone foundation. One ply of boards for the wall, and an earth floor does very well for a shop; but if a better finish is wanted it should be boarded up inside, and a cement floor put in.

The workshop should be in a building of its own rather than in one end of the machinery shed, because there is always a certain danger from fire. It seems like too big a risk to have a lot of valuable machinery stored in a building where there is danger of fire.



PLAN OF FARM WORKSHOP.

Figure 68

LIST OF BULLETINS

Prepared by Manitoba Agricultural College, Winnipeg, Canada

No.	Title	Author
1.	"Classification of the Horse"	PROF. W. H. PETERS
2.	"Twelve Noxious Weeds"	PROF. S. A. BEDFORD PROF. C. H. LEE
3.	"Care of Milk and Cream"	PROF. J. W. MITCHELL
4.	"The Protection of Farm Buildings from Lightning"	PROF. L. J. SMITH
5.	"The Farm Garden"	PROF. F. W. BRODRICK
6.	"Farm Poultry in Manitoba"	M. C. HERNER, B.S.A.
7.	"Hog Raising in Manitoba"	PROF. W. H. PETERS
8.	"Cow Testing"	PROF. J. W. MITCHELL INSTRUCTOR E. H. FARRELL
9.	"Repairing Farm Equipment and Roads"	ASSISTANT PROF. W. J. GILMORE LECTURER ROBERT MILNE

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