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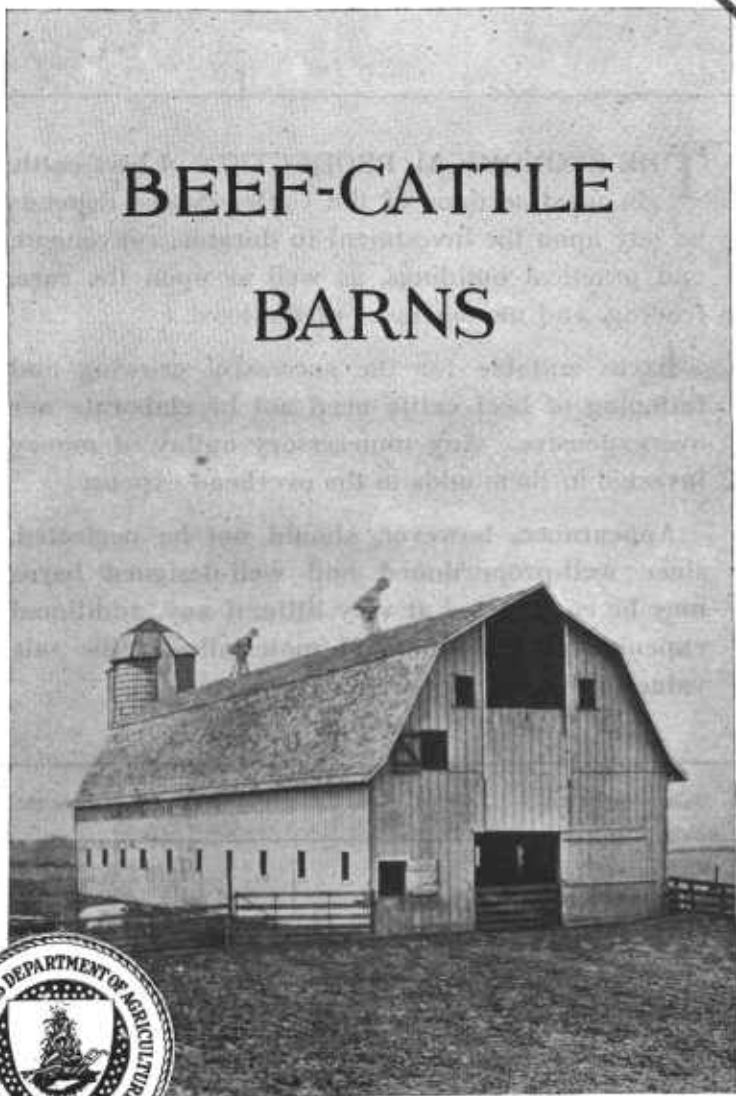
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BEEF-CATTLE BARN



THE ECONOMICAL PRODUCTION of beef cattle in most sections of the United States depends largely upon the investment in durable, convenient, and practical buildings, as well as upon the care, feeding, and management of the herd.

Barns suitable for the successful growing and fattening of beef cattle need not be elaborate nor overexpensive. Any unnecessary outlay of money invested in them adds to the overhead expense.

Appearance, however, should not be neglected, since well-proportioned and well-designed barns may be constructed at very little, if any, additional expense. Such barns add materially to the sale value of a farm property.

BEEF-CATTLE BARN.

By E. W. SHEETS, *Senior Animal Husbandman, Animal Husbandry Division, Bureau of Animal Industry*, and M. A. R. KELLEY, *Barn Architect, Division of Agricultural Engineering, Bureau of Public Roads.*

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TYPE OF BARN.

NO ONE TYPE of barn can be recommended for all conditions because of the many factors to be considered, such as climatic conditions, number and kind of cattle kept, method of handling the herd, availability of material and labor, and individual preferences with regard to details. The choice of type should be influenced by the intended use, whether for fattening cattle, a breeding herd, or for the growing and finishing of cattle. Those just entering into the industry are often confronted with the question whether to build a small temporary shelter providing for immediate needs or one that is substantial, permanent, capable of expansion, and so arranged that it will meet future as well as present needs.

LOCATION OF THE BARN.

The selection of a proper site for the barn is very important and often difficult.¹ Too frequently the matter is given little or no consideration, which generally results in an arrangement that is inconvenient for handling the stock and possibly detrimental to their welfare. After the building is erected and found to be poorly located it is usually impracticable to change its location, except at excessive cost.

The most desirable location is one that will facilitate the movement of stock to and from all fields with the least inconvenience. The barn should be located near the other buildings and in such relation as not to detract from or obscure the attractiveness of the home. Southern slopes underlaid with gravel or sandy subsoil permitting natural drainage are recommended. If the location is level and the ground low or damp it should be well drained before attempting to build on it. Open sheds and feeding lots having a southern exposure will pro-

¹ In this connection Farmers' Bulletin No. 1132, *Planning the Farmstead*, will be found helpful. It may be secured free from the United States Department of Agriculture.

tect the stock from winter winds and storms. The location should be such that the prevailing winds will carry objectionable barnyard odors away from the house.

It is also important that the barn be placed where sufficient space is available for its possible expansion or for the erection and use of additional buildings, and for lots in which to feed and care for cattle at certain seasons. Provision for the storage of feed, removal of manure, and accessibility to water supply should be carefully planned.

SIZE OF THE BARN.

The size of the barn depends largely upon the number and kind of cattle to be kept, the size of the farm, the type of farming to be followed, the climatic conditions, and the amount of space required for the storage of crops.

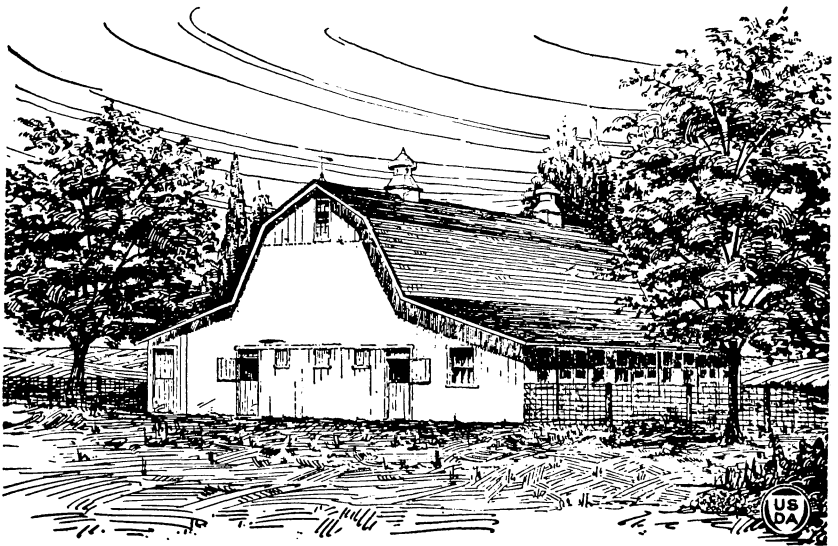


FIG. 1.—General-purpose barn, design No. 612.

It is desirable that the barn be of a size that will meet the existing conditions, but so built as to permit the erection of additions without disturbing the convenient arrangement of or the tearing down of any part of the structure. Sufficient space should be provided for the storage of hay or other roughages to last the entire feeding period. This will eliminate loss of time, labor, and an appreciable amount of the most valuable part of the roughage due to handling in transfer.

The feeding space should accommodate all animals to be fed, so that there will be no crowding. If space sufficient for each animal to stand at the feed trough is not provided, the cow, steer, or calf with a nervous temperament or less voracious appetite may not attempt to eat until the others have finished, and as a result will not do so well. A 30-inch space per animal is usually allowed at the

feed trough for fattening steers. They should also have sufficient room to lie down comfortably after eating, to make most efficient use of the feed consumed.

ARRANGEMENT IS IMPORTANT.

The general arrangement of the barn, unless carefully planned, may cause many unnecessary steps and greatly increase the labor

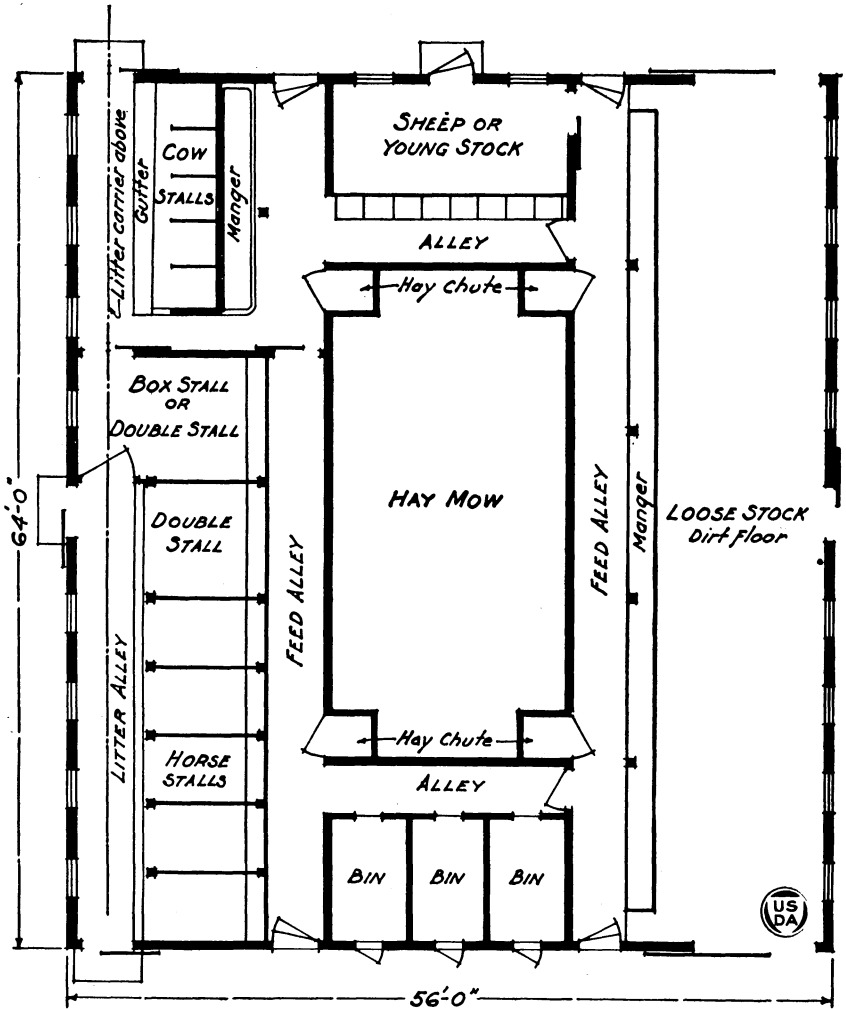


FIG. 2.—Alternate floor plan for design No. 612.

in feeding and caring for the cattle. Among the more important points to be considered are the locations of the silo, water tanks, feed room or bins, hay chutes, driveways, feed alleys, stalls, doors, and windows.

Hayracks and feed troughs should be arranged so as to permit the feeding of the cattle with the least labor. The use of feed car-

riers, carts, wagons, or other labor-saving equipment is desirable and the barn should be planned to provide for these features. Time and labor may be saved in removing manure if the barn and lots are made easily accessible for a wagon or manure spreader.

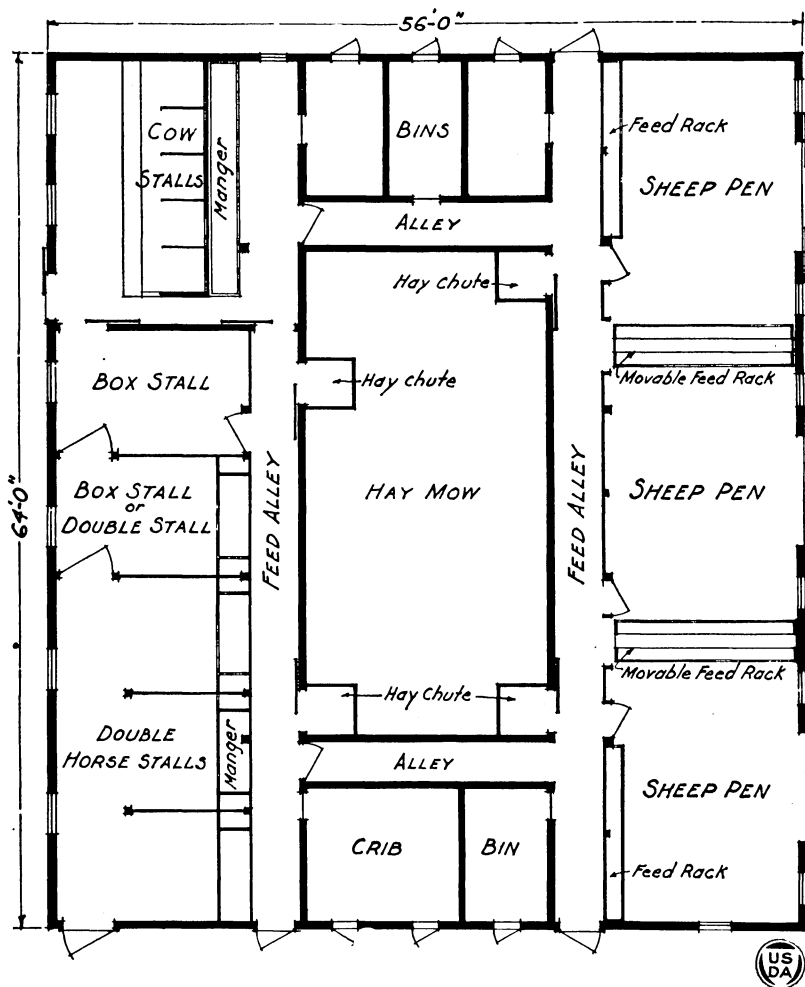


FIG. 3.—Floor plan of design No. 612.

THE FEED LOT.

The location of the feed lot or lots with relation to the barn, fields, and lanes has a decided bearing on the ease with which the stock may be handled. The arrangement of the lots will depend on the surrounding conditions, which vary widely because of different methods of handling. Lots should be capable of being well drained, either naturally or with tile; muddy lots are responsible for losses in manure, also for losses of feed in the droppings which hogs following the cattle make use of. In addition to

this, cattle fed in a dry or paved lot have a better appearance, which is attractive to buyers.

The loss in market value of the stock, added to that of manure and grain, when hogs follow the cattle, may amount to enough to pay in a few years' time for the construction necessary to prevent the waste.

A concrete pavement,² with rough surface, laid over a good layer of broken stone or gravel and covered with a reasonable amount of bedding, is the most desirable means of avoiding a muddy feed lot. The pavement may be of brick or cobblestone laid on a gravel bed and flushed with a cement grout. The edges of any such paving should be protected by a wall which will prevent undermining and raveling. Broken stone covered with gravel makes a fairly good surface, especially if underdrained with tile. The paving should be sloped to gutters that will lead the liquid manure to a water-tight tank, or pit, from which it may be taken and applied to the land. Surface water from an adjacent slope may be kept out of the lot

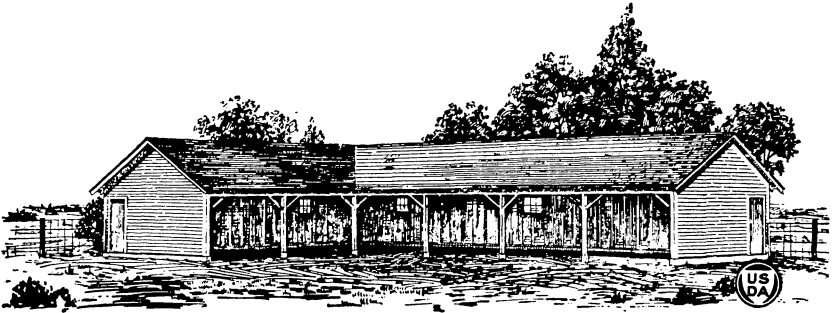


FIG. 4.—Design No. 763, open shed for shelter.

by ditching. Roof water should be led through drains to a point outside of the lot.

Board or plank fences are the most satisfactory for inclosing small lots adjoining barns and sheds. Woven-wire fences are comparatively short-lived when used to confine stock in small inclosures. The strain put upon a woven-wire fence by cattle rubbing, fighting, or reaching over will sooner or later break the wires or reduce the tension so that the fence will cease to serve its purpose efficiently.

A board fence 5 to 6 feet high constructed of from 5 to 7 horizontal 2 by 6 inch planks, of a durable wood, 16 feet long, nailed preferably to strong posts set 8 feet apart, is quite satisfactory. While the life of the posts may not be materially increased by setting them in concrete, yet the greater stability and better anchorage will usually warrant this construction. It is especially desirable that corner and gate posts be so set. The concrete should extend 8 to 12 inches above the ground and the butts of the posts should be treated with a preservative.³ The feed-lot gates should be arranged so as to be convenient for handling the cattle and removing the manure.

² Directions for the construction of such floors will be found in Farmers' Bulletin No. 481, Use of Concrete on the Live-Stock Farm, which may be had free on request to the United States Department of Agriculture, Washington, D. C.

³ See Farmers' Bulletin No. 744, The Preservative Treatment of Farm Timbers.

BARN VENTILATION.

The importance of proper ventilation in dairy barns is now generally recognized by successful dairymen, but ample ventilation in beef-cattle barns is not so widely appreciated. This probably is due to the fact that it is not thought necessary to provide such warm structures for beef cattle as for dairy cows, and since more open structures are used, there is more or less leakage of air through the barn walls.

It is impracticable to make barns air-tight, and uneconomical to make the walls highly efficient as nonconductors of heat. In the northern parts of the country, where it is necessary to provide warm structures for stock, the importance of ventilation increases in pro-

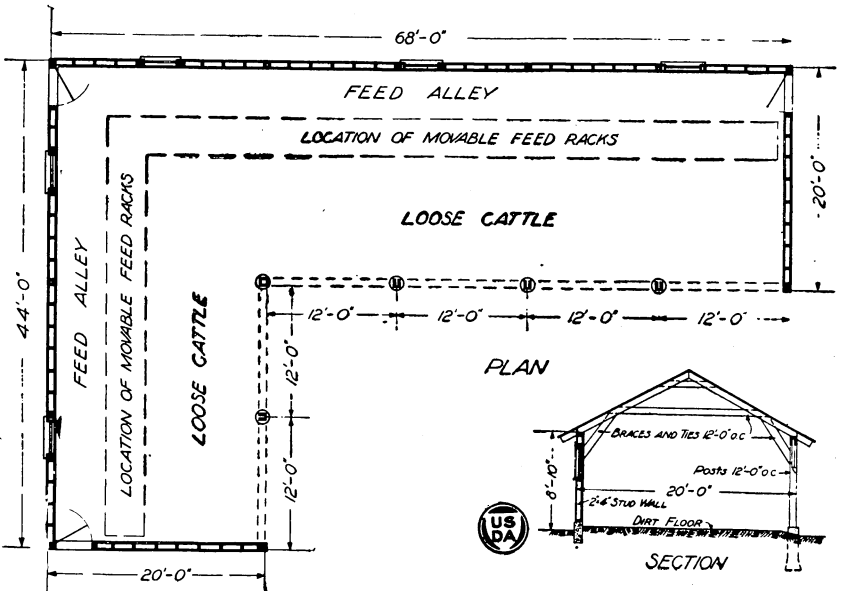


FIG. 5.—Floor plan and section of design No. 763.

portion to the tightness of the building. In order that the ventilation may be made most effective and the least amount of heat be carried off, it is necessary to direct the currents of air entering and leaving the barn into proper channels, so that the amount of circulation may be properly controlled.

There are three elements which are essential to animal life, namely, feed, water, and air, and upon the quantity and quality of all three depends the physical welfare of the animal. It is not necessary to know the least amount of air essential to animal life, any more than it concerns us how little feed is required to maintain life. We expect more than mere existence from our farm animals, and in order that they may be productive they must be well fed and watered and must have an abundance of fresh air. All animals are not affected to the same extent by breathing vitiated air, and often the effects are not noticed until it is too late to correct the condition. Fresh air is the first thing prescribed for patients suffering with tuberculosis. Tuberculosis in livestock is not only a menace to the animals, but it

is disastrous as well to human life, and many cases of tuberculosis found among children are of bovine origin.

The greatest safeguard against disease is a well-nourished body; hence it is obvious that an abundant supply of pure air is essential. Breeding animals especially should be kept strong and vigorous. They can not be expected to thrive if compelled to breathe vitiated air in poorly ventilated barns. Recent investigations indicate that a 1,000-pound cow throws into the air approximately 10 pounds of moisture a day. From a herd of 40 cows there would be given off 400 pounds or more than 50 gallons of water per day. This amount of moisture must be removed daily in order to keep the stables sweet and free from dampness. Only by proper ventilation of the barn can this be done.

If moisture is allowed to condense on the walls, the dampness, combined with offensive odors, will make the air in the stables oppressive. Disregarding any effect this condition may have on the

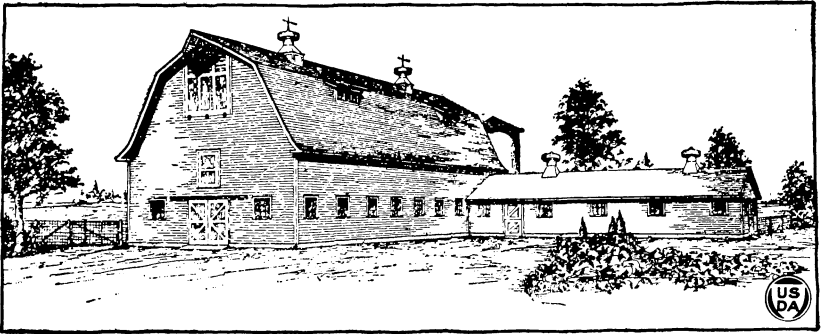


FIG. 6.—Barn for the breeding herd, design No. 1495.

health of the livestock, it is still important that the moisture be removed in order to prevent mold and decay of the timbers of the barn.

Hay chutes are sometimes used as foul-air shafts. In the colder sections of the country this practice often causes frost to collect on the underside of the roof, and as the temperature rises the underside of the sheathing in the mow becomes damp and water drips on the hay. This frequently renders the hay less nutritious and palatable. The condition is also conducive to rot in the sheathing and roof timbers. The best results are to be obtained by ventilating systems properly installed and all hay chutes closed with either a hinged or sliding door, so as not to interfere with the ventilating system.

It is not within the scope of this bulletin to discuss the principles or details of barn ventilation. It is sufficient to state that the King system, or some modification thereof, is suitable for the barns described in this bulletin. The King system consists essentially of two sets of flues, one used for the removal of impure air and the other for the addition of fresh air.

The flues should be arranged so that all the foul air is taken from near the floor and discharged through ventilators on the roof, the fresh air coming in near the ceiling of the stable. In mild climates

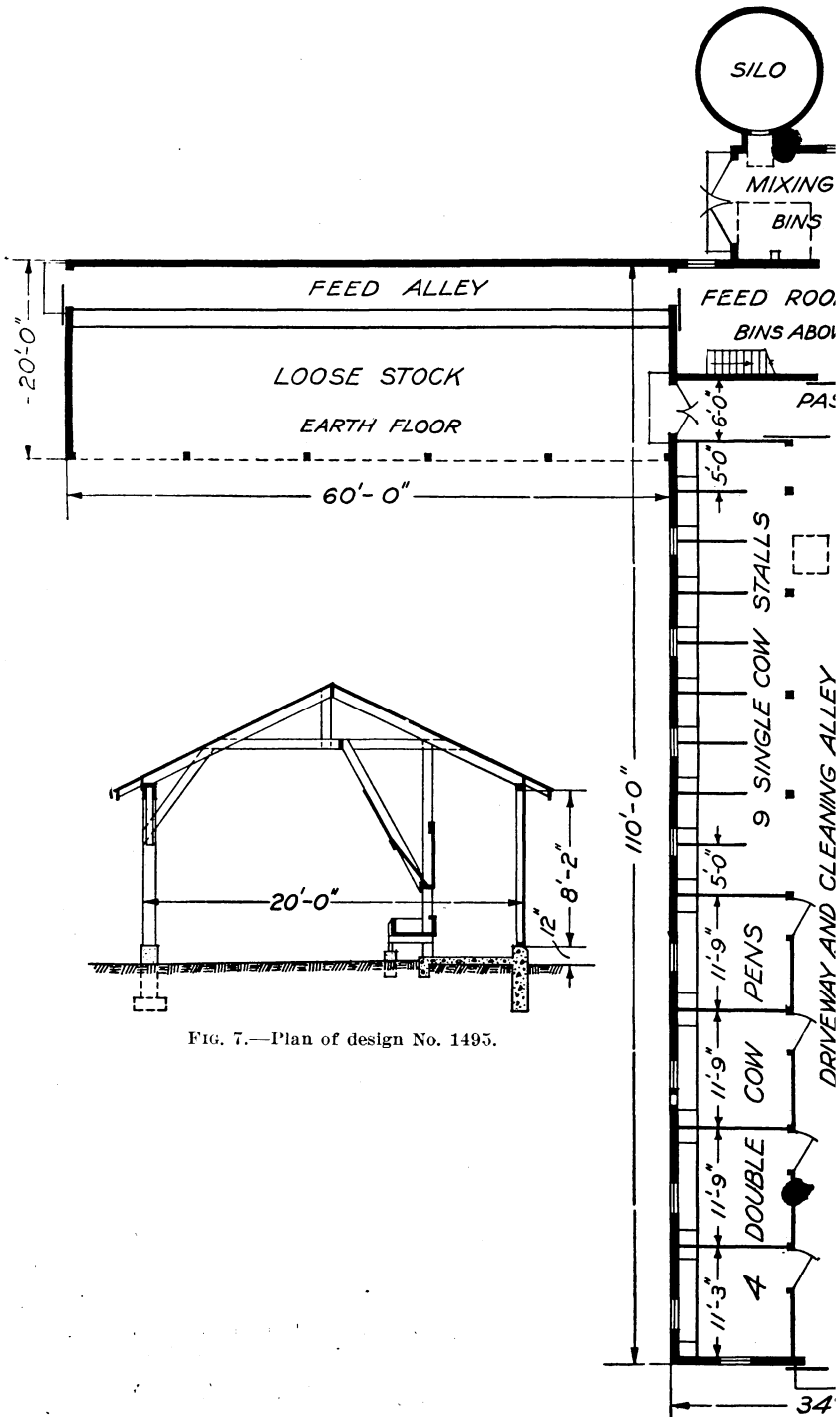


FIG. 7.—Plan of design No. 1495.

FIG. 8.—Section through building.

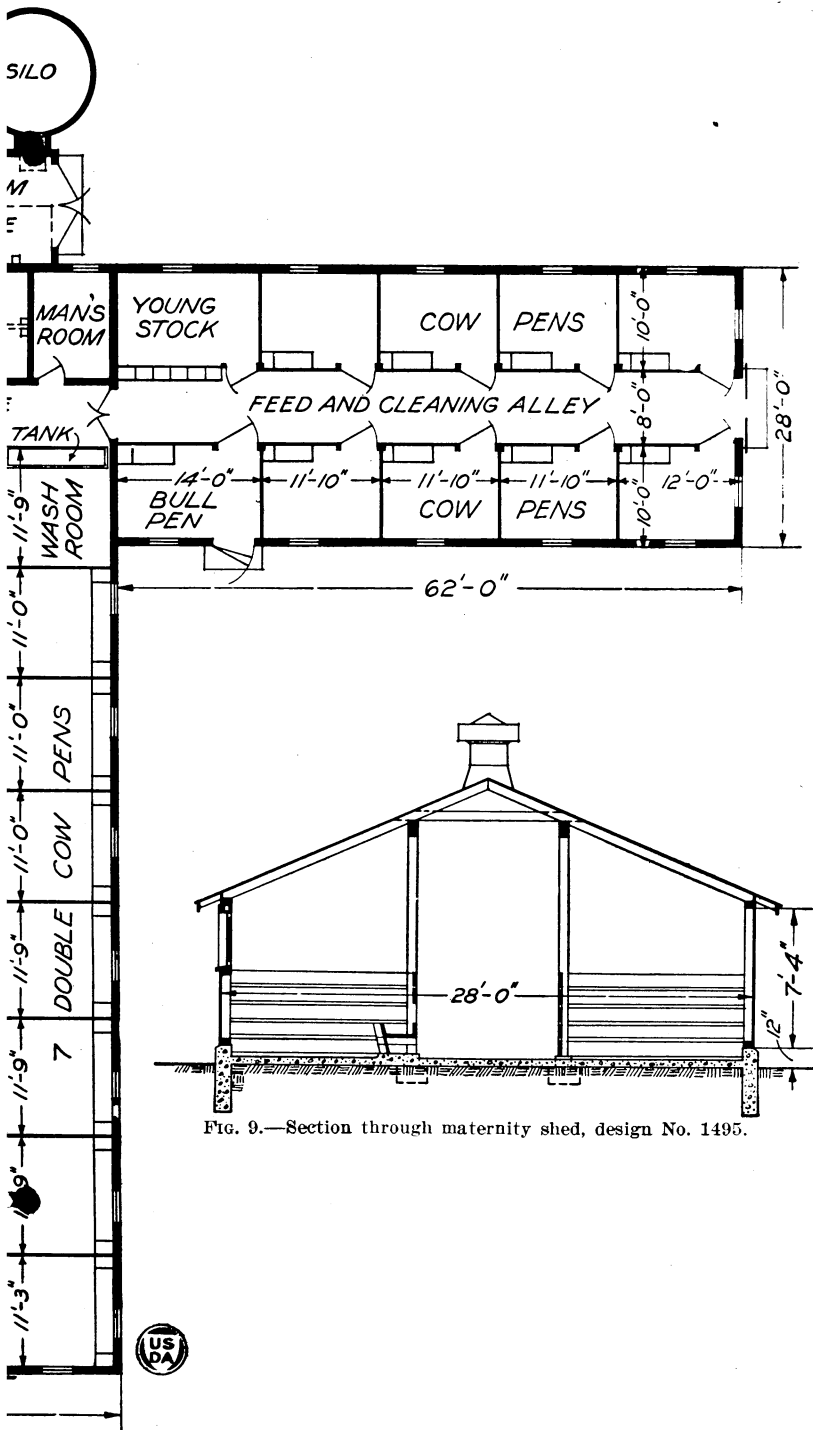


Fig. 9.—Section through maternity shed, design No. 1495.



the air is sometimes removed through a flue or duct the entrance to which is at the ceiling, but in cold sections of the country the opening in the flue should be near the floor. A door opening into the foul-air flue near the ceiling should be provided and should be used in ventilating the barn during warm weather. A cow-barn outtake flue 30 feet or more in height should provide about 30 square inches of cross-section flue area for each cow within the space affected by the flue. From one to three flues are used, depending upon the size and

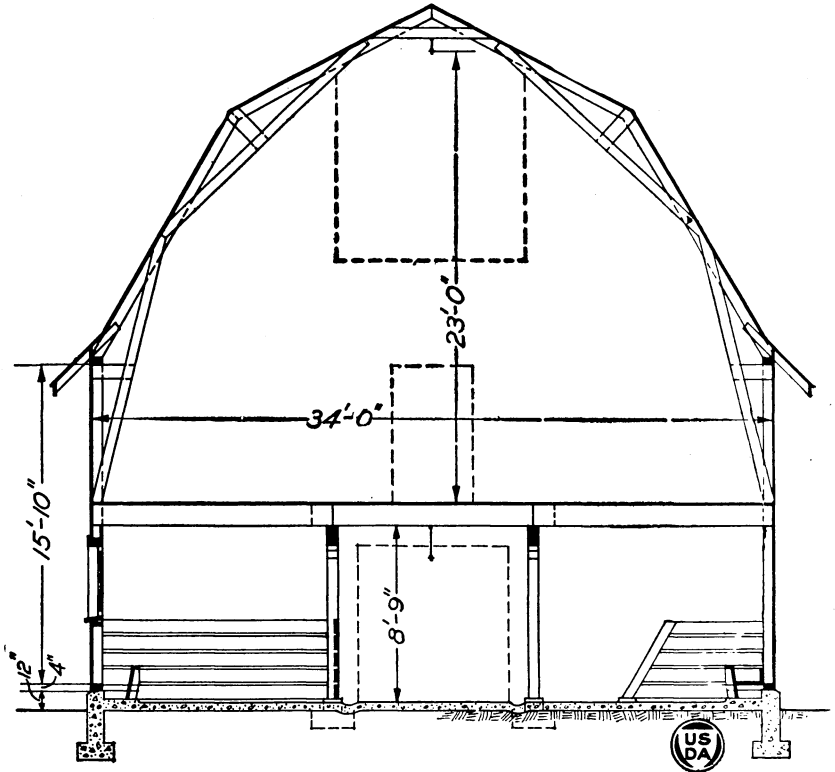


FIG. 10.—Section through main barn, design No. 1495.

arrangement of the barn. Thus each of three flues in a barn housing 30 head should have an area of 300 square inches.

The proportionate area of intake flues is usually somewhat less. It depends largely upon the openness of the structure. In mild climates the intake ducts are sometimes omitted and sufficient ventilation obtained by constructing the windows so that they drop in at the top as much as 10 inches. Intake ducts are desirable in the colder sections, as they afford better regulation of the ventilation system. The openings of intake ducts are usually made 6 by 12 or 8 by 14 inches, and the flues should be 5 feet or more in length. They should be located on both sides of the barn and placed 10 to 20 feet apart, so that the incoming air will be distributed fairly uniformly.

In the South, ventilation of barns is comparatively simple. It is only necessary to construct the building so as to secure an abundance of ventilation throughout the year and to afford protection from the north winds in the winter. Obviously, the barns in this section may be of cheaper construction. Ventilation of the more tightly built barns of the North should be carefully considered. In designing the ventilation system for any barn, it is necessary to study the arrangement of the floor plan and also take into consideration the local conditions.

CONSTRUCTION OF THE BARN.

A full discussion of all the details of barn construction within the limits of this bulletin is not feasible. The plans illustrated in the following pages have been prepared for the purpose of assisting farmers in erecting suitable structures. They are intended to meet, in a general way, conditions found in most representative beef-

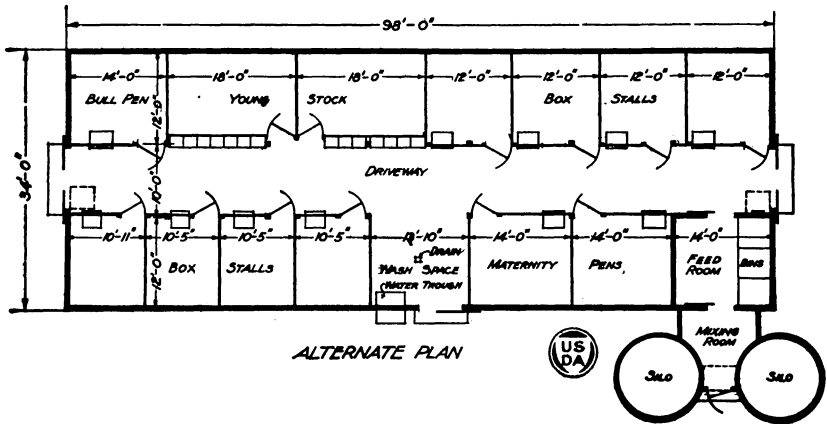


FIG. 11.—Alternate floor plan, design No. 1495.

producing sections and are suggested rather than definite solutions of the barn problem. They may be modified with respect to dimensions, arrangements, and details of construction. Complete working drawings and bills of material for the barns shown herein may be had by those who contemplate building upon application to the Division of Agricultural Engineering, Bureau of Public Roads, United States Department of Agriculture, Washington, D. C. In requesting plans, reference should be made to the design number. The plans showing alternate arrangements are intended to suggest modifications which may be made in the original designs and which may better meet the requirements in some instances. Complete working drawings of the alternate schemes are not available.

BARN DESIGNS.

GENERAL-PURPOSE BARN.

General-purpose barns provide shelter for the stock carried on many farms of moderate size, together with sufficient space for storage of feed. The concentration of the stock in one structure

saves time in caring for them. Design No. 612 (Fig. 1) provides, in addition to cow and horse stalls, pens for about 65 sheep (see Fig. 2). An alternate plan (Fig. 3) is arranged for handling about one carload of loose beef cattle. The barn, arranged as in the alternate plan, is suitable for diversified farming where conditions make some shelter for the beef cattle desirable and where this part of the farm business is not of sufficient importance to warrant separate buildings. The capacity of the mow is approximately 58 tons, of the bins 300 bushels each, and of the crib 300 bushels of ear corn. As the hay rests on the ground in the center of the building, a mow floor of heavy construction is not required. The low mow reduces the height to which hay must be hoisted with the hayfork or sling

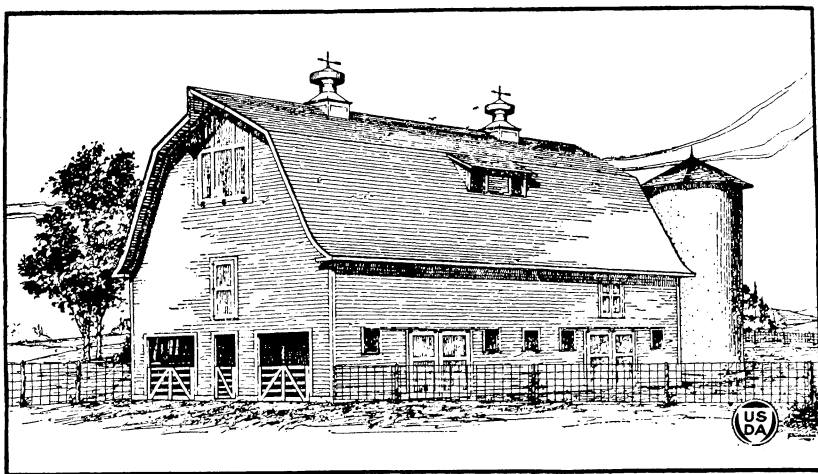


FIG. 12.—Design No. 1175, cattle-feeding barn (closed type), suitable for northern conditions.

and saves several feet of climbing when hay is to be thrown down for feeding. This barn is very popular in sections where home-sawed lumber is available.

CATTLE-FEEDING BARN.

While cattle-feeding barns are not a necessary equipment in the fattening of cattle, yet many feeders prefer to do all their feeding under shelter. This practice is quite common in Indiana, Illinois, Wisconsin, Minnesota, and the Dakotas. Under this system all the roughage needed for the feeding period, and a considerable part of the grain and concentrates, are stored in the barn. This favors a saving of labor and time in feeding and also a saving of feed. Feed stored in the open is seriously affected by the weather. The closer the feed is stored to the feed troughs the less will be the loss of feed in handling. Feed should always be stored under cover, and with this in view it is well to consider the advisability of building a barn or feeding shed having capacity not only for the feed but for the feeding operation as well. Unquestionably feeding barns have a greater use in the colder climate where winter storms are more severe.

Designs Nos. 1175 and 1185 (Figs. 12 and 14) are of the same general construction, except that the former is of the closed type and more suitable for feeding in localities where the climate is severe. In milder climates such as are found in the Central and Southern States the open type is equally as satisfactory.

The closed type of feeding barn is suitable for fattening about two carloads of cattle. Stock can enter and leave the barn freely, and by the use of sliding doors they may be given ample protection during stormy weather. The feeding is done from a central alley, using a silage truck or overhead feed carrier running from the silos through the feed room (Fig. 13). In the shed connecting the silos with the barn provision is made for the storage of concentrates and mill feeds. An outside door between the silos makes it feasible to haul silage by wagon to troughs in the open lot. The number and size of silos depend upon the quantity of silage to be fed and the length of the feeding period. Hay mangers and chutes are arranged along the outside walls. In this position the chutes occupy less

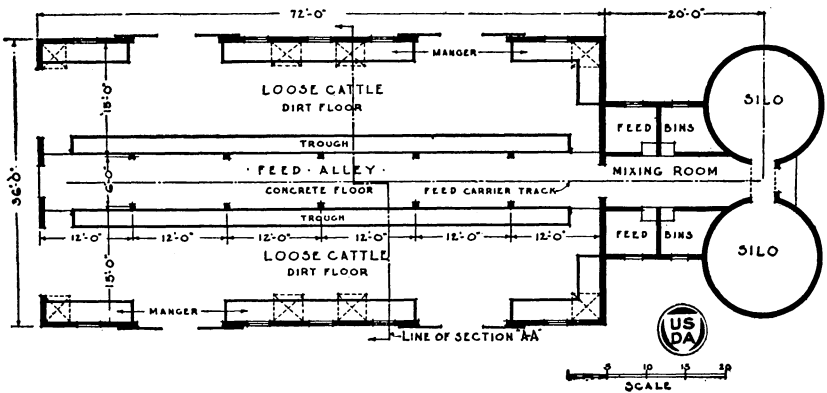


FIG. 13.—Floor plan of design No. 1175.

valuable mow space and do not interfere with mowing away the hay. The mow has a capacity of about 100 tons of loose hay.

Hay mangers of the type shown permit the use of windows in the side walls, making the interior lighter and affording better ventilation. However, there is the disadvantage that when windows are used with racks such as shown in Figures 13 and 16, part of the light is cut off and the glass is frequently broken.

The small doors over the large side openings are for convenience in throwing out hay or bedding for use outside of the barn. The dormer windows in the roof add a little to the expense, but offer an appreciable advantage which is often overlooked, as they provide light in the center of the mow. As most of the cattle feeding is done during the winter months, when the days are short, the extra light is very desirable. The dormers also add to the appearance of the barn, and during the haying season, if opened, make the mow a much more comfortable place for work.

The arrangement of barn in design No. 1185 (Fig. 15) is practically the same as that of design No. 1175 (Fig. 13), except that

the sides are left open, as it is intended for use in mild climates. The framing of the barn is designed for the use of vertical boarding. The same framing may be used in design No. 1175, but vertical boarding is less desirable in cold climates, as it does not make so warm a barn.

An alternate plan (Fig. 16) is constructed so as to permit feeding by the use of a team and wagon. Combination hay mangers and feed troughs may be placed along the outside wall of design No. 1175, thus nearly doubling the feeding capacity of the barn. The feed could be shoveled from a wagon to the troughs on each side.

CATTLE SHEDS.

Buildings are important factors in the operating expense of fattening cattle. It is only proper that cattle should be charged for the equipment they use. Interest, depreciation, and upkeep charges on that portion of the equipment used by the cattle should be charged

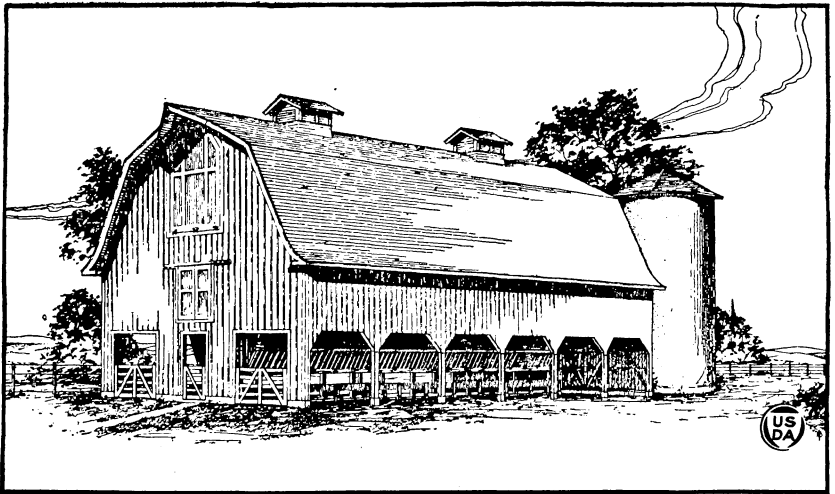


FIG. 14.—Design No. 1185, cattle-feeding barn (open type), suitable for southern conditions.

to them. Therefore, unusually expensive buildings and equipment devoted exclusively to fattening cattle might mean the difference between loss and profit on a bunch of steers.

It is not necessary to have extra good barns for steer feeding alone. In many cattle-feeding sections, a shed having an open side or end is all that is necessary for shelter. If cattle are kept dry and have protection from the winds and storms by having access to a shed they will do very well, other factors being equal. It is advisable to have all feed under cover. A very desirable shed is one having space for hay and straw, for both feed and bedding, in the center or on one side, and permitting the cattle to eat these roughages under cover and have a place to lie down in cold weather.

A cattle shed intended to provide shelter for cattle fed in open lots is shown in design No. 763 (Figs. 4 and 5). The silage, grain, and hay must be stored in other buildings. Feed troughs and racks may,

if desired, be placed within the shed as indicated in Figure 5. The shed may be either L-shaped or straight and of any desired length. In some locations the L shape may be preferred, as it forms a better windbreak for the feed lot.

BARN FOR BREEDING HERD.

The average requirements of the breeder of beef cattle are provided for in design No. 1495 (Fig. 6). The main building contains double cow pens, stalls for nurse cows, and a wash room, feed room, and herdsman's room (Fig. 8), centrally located. Mangers are placed against the outer walls. However, this may be modified as shown in alternate plan, Figure 11.

Two silos are placed at one end and are connected to the main building by a covered driveway with feed bins above. The floor of the driveway is of concrete and is suitable for mixing feed. The

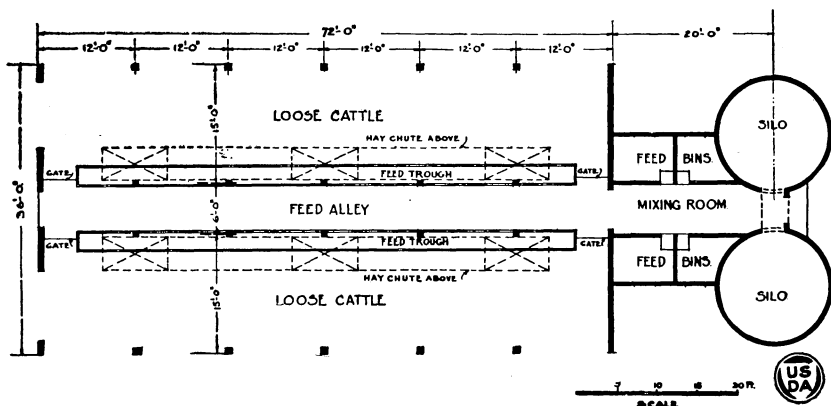


FIG. 15.—Floor plan of design No. 1185.

feed room on the ground floor is intended for the storage of sacked feed.

The mow of this barn has a capacity of approximately 110 tons of hay. Two feed bins with chutes to the lower floor are shown at the end of the mow nearest to the silos. These may easily be omitted if not desired.

Attached to the barn on the left side is a feeding shed for loose stock, and on the right a one-story shed containing a bull pen and calving pens. The T-shaped arrangement of the group affords ample protection from cold winds. The central location of the feed storage and mixing room makes feeding very convenient. Either shed (Figs. 7 and 9) may be made two stories high, with a gambrel roof, if additional space for bedding storage is required. In very cold climates a mow over the right wing, containing box stalls or pens, may be desirable because of the additional warmth it provides.

If overhead feed and litter carriers are employed, it is not necessary to drive through the barn, but it may be made possible by placing the silos farther apart and extending the driveway between them.

Drainage of the main barn and of the right wing is accomplished by means of shallow concrete gutters leading to bell traps. This system requires a minimum amount of under-floor piping. Catch basins should be provided outside the building on each drain line to intercept solid matter likely to cause stoppage in the pipes and to facilitate cleaning the drains.

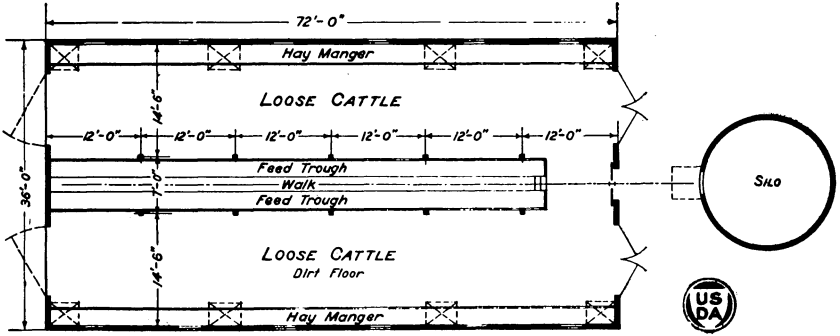


FIG. 16.—Alternate floor plan for designs Nos. 1175 and 1185.

The alternate plan shown in Figure 11 is very similar to the main barn design, No. 1495, with the wings on each side omitted. This barn usually meets the requirements of the smaller breeder or beginner. Wings may be connected to this main barn as the herd increases in size. The silos are placed on one side of the barn, making it possible to have a driveway through the barn sufficiently wide to permit the passage of wagons or manure spreaders.

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