This book is a gift from Arthur M. Carmody who received a MS degree in Animal Husbandry from this University in 1923. He was a well-known farmer and breeder of purebred Shorthorn cattle at Mount Hope, Wisconsin.

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DRIVEWAY AND CARRIAGE HOUSE ON THE ELMENDORF FARM OF J. B. HAGGIN OF KENTUCKY.
(Cement Fence Posts on the Left.)

FARM BUILDINGS

NEW AND ENLARGED
EDITION.

A COMPILATION OF
PLANS FOR GENERAL FARM BARNS, CATTLE BARNS,
DAIRY BARNS, HORSE BARNS, SHEEP FOLDS,
SWINE PENS, POULTRY HOUSES, SILOS,
FEEDING RACKS, FARM GATES,
SHEDS, PORTABLE FENCES,
CONCRETE CONSTRUCTION,
HANDY DEVICES, ETC.

CHICAGO:
THE BREEDER'S GAZETTE.
1911.

PUBLISHERS' NOTE.

THIS is not a book of proposed plans for farm buildings, but for the most part is a presentation of actual construction by practical men. It is in the main a compilation of the best plans contributed to THE BREEDER'S GAZETTE by the farmers and stockmen of the United States in recent years. Many different types are illustrated. Different farms, different latitudes and different methods of management demand an infinite variation in the style, dimensions and detail of American farm buildings.

In barn building as in the planning of the farm home, nearly every individual has his own peculiar ideas and tastes. It is rarely that one is entirely satisfied with what a neighbor has done in such matters. At the same time it is clear that many general propositions and many matters of detail possessing real value to a prospective builder may be gleaned from a study of what successful farmers in different parts of the country have already carried out.

In the belief that many helpful hints will be found in these pages and to fill a persistent demand for information upon the subject treated the publishers present this new and enlarged edition of "Farm Buildings" with full confidence that it will meet with general appreciation.

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FARM BUILDINGS.

LOCATION AND GENERAL ARRANGEMENT.

The planning and construction of farm buildings should be done with regard to the surrounding outside features as much as to the interior arrangement and convenience of the rooms. It is a common error to see little forethought taken in the placing of the buildings, in their relation to one another or to the surrounding conditions; the total disregard of a fine outlook that might have been had from the windows that are most frequented; many errors in the proper way to approach the house from the highway, and many times the utter absence of any attempt at ornamentation in the way of tree planting—nothing save bare sides and sharp angles of buildings open to all winds, storms and sun heat, or the opposite extreme, burying the house in a dense shade of loneliness.

Now this should not be so. When the advantages and increased value of the property as a whole are considered it is at once apparent. Any one can distinguish between a nice farm, a place where it would be a pleasure to live, and on the other hand one that is bare and uninviting. The cost is a matter of forethought on the part of the individual at the beginning in the planning of the work, and the actual material to be used in beautifying the grounds almost always can be had for the gathering. One may easily find the time to do the work when once he has tasted of the pleasures there are in surroundings that are made attractive with trees and plants arranged to make a landscape that is ever improving and changing in scence.

When a beginning is made toward embellishment of the home surroundings then there is a new birth given, the feeling of attachment that reflects back into pleasant and longing recollections of the happy lives passed there, and the far-reaching influence of cheerful home surroundings on the character and future life of the growing generation toward the good and high of ideal life is above any estimation, besides being a source of interest and everlasting joy and pleasure alike to the owner and to all who enter here.

Farming is not all corn. There are many fine farms that are only such from the fact that there is a quiet natural parklike effect resting over the home place, and if favored with a fertile soil and kind climate how much more blest we could be if we would bring about us more of the natural beauties so abundant everywhere. This need not detract an instant from the economical operation of the farm, but if practically planned should add many fold thereto.

We can assume that the residence and other buildings are already placed, or that building is to be done at some future time. With respect to the all-important question of choosing the house site, the custom in the city seems to be the law without recourse in the country, in that the house must stand facing square, with the best rooms toward the public road. If a better exposure or a fine scene lies in another direction, reverse the order regardless of the highway. Again, houses are dropped in a hollow, carried to the top of a bare hill, or placed too near dusty roads or stables, making things more disagreeable than convenience would compensate. The house should not be put on a poor or waste piece of ground just to gain a little extra tillable land.

Personal preferences should of course be taken into consideration, but as a rule many desirable locations are ignored. Among the specific directions to apply in selecting the home site are good sanitary conditions. These demand air and quick drainage of water. All this is secured on a dryish soil, slightly elevated if possible and fairly open to admit a free circulation of air. Any protection against prevailing north and west winds in the winter season, such as hills, trees or any other natural objects in the track of regular storms, should be made use of, but cool and refreshing winds should not be hindered in their direction during the heated season.

The distance from the highway is hardly a matter of importance. If the best place is 400′ from the road it should be chosen over another less desirable, though 200′ nearer. Besides this an entrance approach of reasonable length, if properly laid out among a grove of trees, will add much to the dignity and bearing of the place. The relation of the house and barn should be such that they do not appear as a part of each other, and in driving to the house one is not led first through yards and past gaping barn doors. The barn should occupy a position so that the prevailing winds will carry the stable odors in a direction away from the house, and not toward it, as is often the case. The exact position and arrangement of the out-buildings and enclosures will be according to their use, and order there is a quiet dignity and homelike restfulness that is in pleasing harmony with every rural landscape. The rooms should be few and large. The veranda is right if one step up from the ground and at least 10′ wide, and a porte-cochere or carriage porch should be a part of

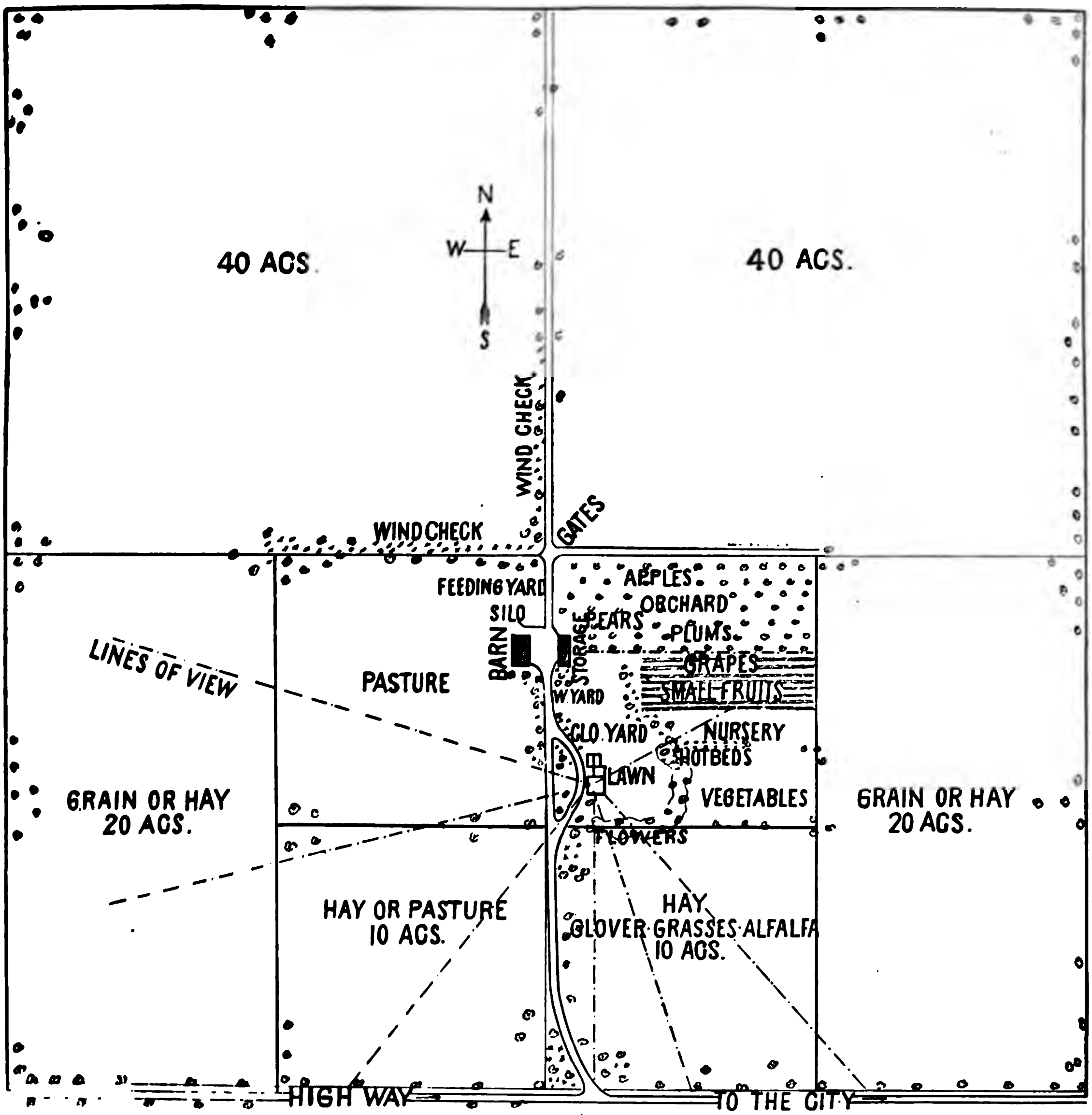


FIG. 1. PLAN FOR LAYING OUT A 160-ACRE FARM AND FARM HOME.

to be convenient should be few and compact, and not scattered over a whole area. Pens, sheds and stacks should not be conspicuous in a general front view.

In country houses broad simple design is much to be preferred. All about a house of this every country house, as it surely is a comfort when rainy or windy to drive up to the door under a roof. Especially is the excessive use of all "gingerbread" mill work in gable ornaments, railings, brackets and the like to be discouraged, as such detail soon falls into decay and is a constant item of repairing, and the greater part of it is vulgar and meaningless. Likewise the use of many discordant colors in outside painting is not in keeping with surroundings; a modest neutral shade that blends with the fields and trees is the correct one. Red is a good and cheap color for barns, and possibly for houses, also, but it should be shaded down and the glare and ash taken off.

Features of the natural landscape should receive great consideration, as it is these that give character to the farmstead. A grove of noble trees on a slight eminence would at once suggest the future home site. In the choice of views here is a suggestion as to the points of interest: first would come the immediate surroundings made beautiful with lawn, trees and shrubs, and farther out the adjacent fields of growing crops or pasturing animals are constantly in mind. The neighboring farm houses, the travel on the highway, or a speeding railroad train are all of everyday attraction. The landscape that is characteristic of the particular country, a broad far prairie scene that holds hands with the horizon beyond; hills or woodlands bounding the view with their picturesque sky-line, a river or winding stream with wooded shores and spanning bridge or a lake of broad expanse and quiet surface—all these are everlasting scenes of delight and inspiration.

Now, as a practical demonstration of how a farm can be developed in a complete and intelligent manner, reference to the accompanying example shown by the plan will serve to clinch the essential points mentioned. The plan represents a general scheme for the layout of a 160-acre prairie farm. There are no trees on the tract of any importance; the surface is slightly rolling with no prominent elevations anywhere—in all a typical grain and stock-farm where corn, oats, some wheat, hay and pasturage are almost all sold in the finished products of beef and pork. It is believed that this scheme comes very near

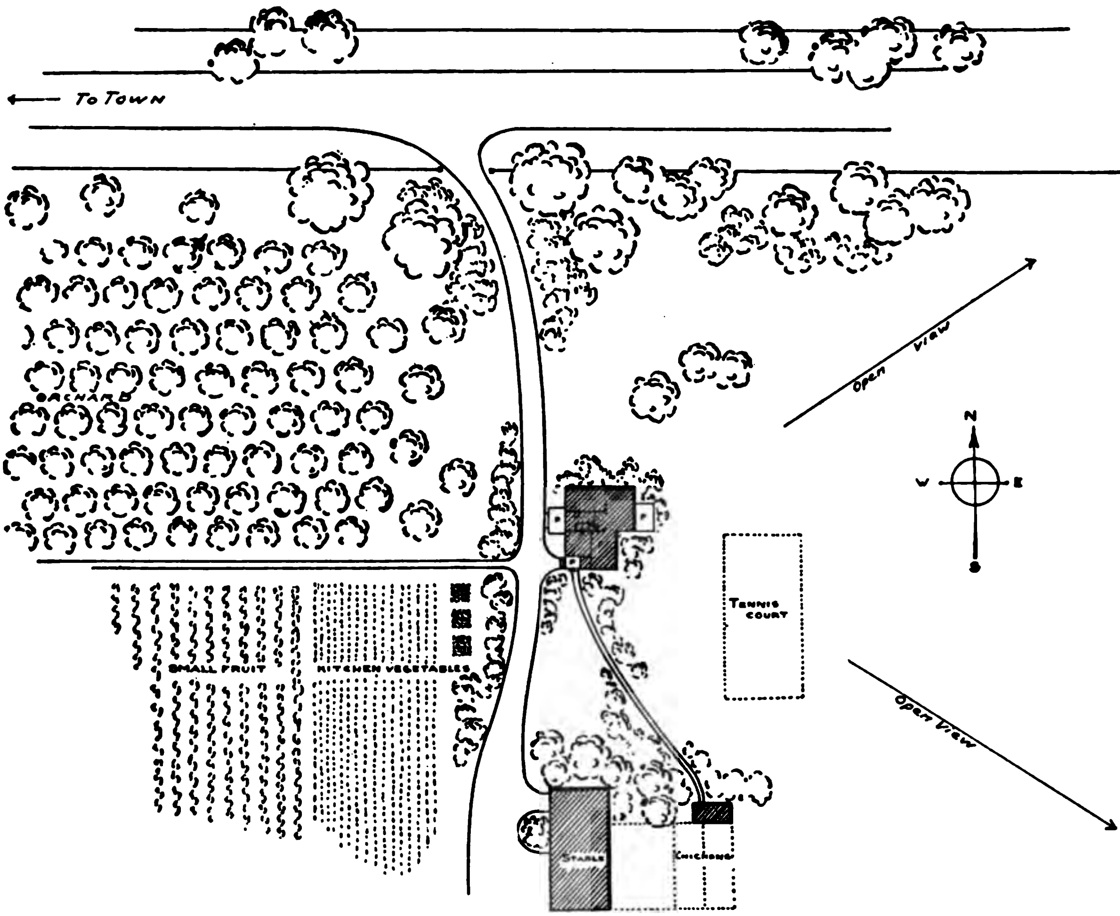


FIG. 2. SUGGESTED ARRANGEMENT OF A FARM HOUSE, BUILDINGS AND GROUNDS FOR A NORTH FRONT.

an economical use of all the land, combined with a beautification of the home surroundings, a parklike entrance and approach drive, a commanding position for the house and the farm buildings centrally located and accessible from all parts of the premises. (See *Figs. 1, 2* and *3.*)

The house is placed in a ten-acre piece, which may be properly called the home plot. Here are collected all the buildings (except the barn and feeding lot), orchard, vegetable and fruit garden, shaded lawn, flowers and all that goes into daily life. This plan leaves no waste ground; everything is compactly arranged, and yet in such a manner as to allow the extension of any particular part without interfering with another.

The residence is about 700′ from the highway and stands in the southwest corner of the home plot, the ground sloping off gently to the south. All the main rooms have a south and east exposure. It is approached from the public highway on a curve which is in the direction of the most traffic (the city in this case). This is a much better way than entering at right angles and adds greatly to the appearance of the entrance and does not allow a direct view up the drive from the road. The drive slants over until within about 20′ of the fence; it then parallels the fence in a straight line to the barn. A short distance from the house a branch road leads over on a gradual curve to the carriage porch, passing underneath it; the curve then continues and joins the main road to the barn. By placing the house about 70′ or so from the main drive the clatter and noise of teaming are to a large degree shut away from contact with the rooms and a nice lawn that comes up to the house on that side.

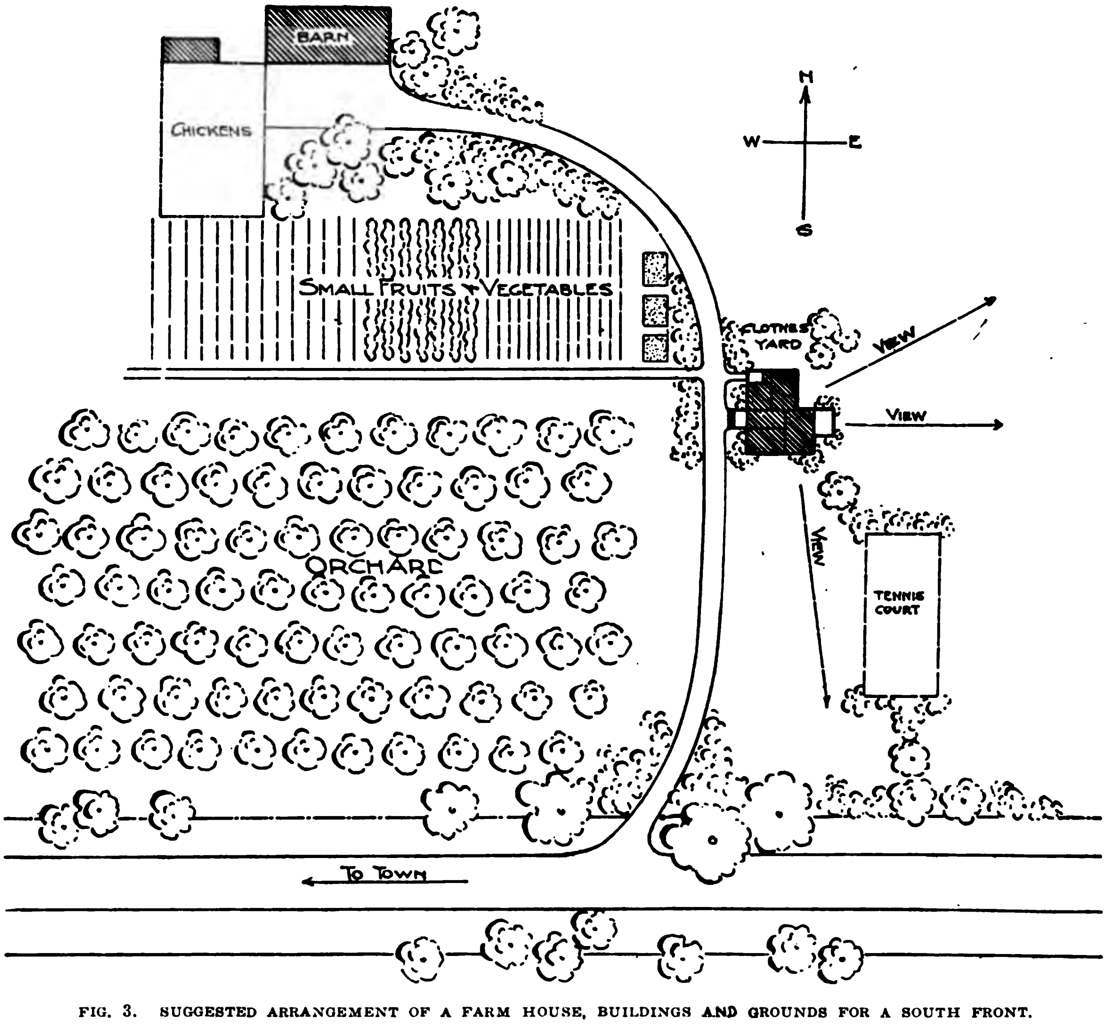


FIG. 3. SUGGESTED ARRANGEMENT OF A FARM HOUSE, BUILDINGS AND GROUNDS FOR A SOUTH FRONT.

This entrance road is ten feet wide, the branch nine feet, graded with gravel from a nearby pit and smoothly surfaced off with a crown just sufficient to turn the water. The barn is 250′ from the house and is set 40′ into the ten-acre pasture to the west, with a silo on the north side convenient alike to the barn and feeding lot. Another building is put up 80′ directly east for general storage purposes of machinery, wagons, supplies and repair shop. The space between the barn and the storage house should be drained and bedded with gravel to serve as a general movement yard and entrance for both buildings—a place to set up the shredding outfit, grinding, unloading and the like. Water is piped into this yard and to the house from the tank and well just back of the storage house. A poultry shed is at the north of this building.

A good big orchard contains about 125 trees, including apples, pears, plums and cherries, which will give plenty of fruit for home use and much to sell. If a fence is run along the lower side of the orchard then the pigs can be turned in any time to consume the fallen fruit, although the trees will be cared for the same as a crop of corn. One acre is given to small fruits. The grapes are put next the orchard because they are more permanent than the raspberries and blackberries, which can be moved back and forth into the nursery ground when they get old and worn out in one place; currants and gooseberries are also planted. The strip for nursery purposes does good service in growing trees and bushes to set out in the future. A row of hot-beds and frames is useful in many ways; it is protected along the north with evergreen trees. The vegetable garden of one and one-quarter acres will give abundance of good things and all that is left over the pigs will take as dessert. The strawberry patch is moved about the garden every year or two. Asparagus and rhubarb are along the fence.

A lawn space bounds the house on all sides, varying in width from 150′ to 200′. It is not necessary, however, to keep it closely mown. In the rear the grass covers the clothes-drying space; further back are the beehives and a place for the woodpile. The grounds about the house are planted with trees for shade and beauty; a place for children to play and climb, and a source of recreation and ease for the older members of the family. As to the kinds used for this purpose, in making the groundwork or foundation of the scene use such native trees as are found growing in the immediate locality; elms, maples, lindens and ash are in greater abundance. All these trees are reasonably quick in growth, bear transplanting well and will therefore prove a success from the start. Hawthornes, wild cherries, plums, and crabapples, juneberry, dogwood and redbud are planted in the places to thicken up and mass with the other trees; occasionally they appear in detached groups or specimens by themselves. They will lend variety and charm to the surroundings in the springtime with their white, pink and red flowers, and in the autumn many of them close the growing season with a contrast of scarlet fruits and golden-hued foliage.

Along the entrance road the work is done in a like manner. Evergreen trees—pines and spruce—are planted in clumps; at the left-hand side of the entrance is one group, farther up on the other side is another. On the west and northwest sides of the house are thick groups to lessen the prominence of the barn, to check cold winds and vary the effect with the deciduous trees. Trees are placed along those sides of the barn seen from the highway; they will soften the blank barn side and give a proper setting to the building as a whole. The gable and tower appearing among the tree tops will mark a distinctly rural scene. To protect the buildings and feeding lots somewhat against the direct force of cold northwest winds groups of Norway spruce are planted in alternate groups with deciduous trees, as shown in the plan, north of the barn and act as a wind check.

The entrance gate should be set in at least 30′ from the fence line, thus leaving an open space of 60′ to 70′ on each side of the drive, as shown in the plan. This space is planted with trees, and if an elm is planted on each side of the gate a beautiful arching effect will be had over the formal entrance to the place.

A tree to appear in all its natural beauty should spread its branches out and down to the ground on all sides. Never trim all the branches off and expose a bare stem, nor hack off the ends of branches and make a stubby, broom-shaped thing. If a good set of roots is dug with the tree no pruning is required. Pruning of ornamental trees is properly a thinning out in the center of minor twigs and branches. Let the tree develop into its own natural form. Cutting can never accomplish this.

Shrubs should be massed in a border along the entrance drive next to the fence, to add variety with their foliage and flowers at different times. An irregular massing of shrubbery forms a boundary belt along the east and south sides of the house. The lawn extends out on those sides to this border. Along the edges next the grass is the place for hardy flowers, native perennials and any other favorites that are desired; here they will be in charming contrast with the lawn and bushes. The kinds of shrubs used are wild native species found growing in the neighborhood, such as dogwoods (the red-branched and others), sumach, elderberry, wild rose, Indian currant, snowballs, spiræa, lilacs, mock-orange and honeysuckle. Japan quince and forsythia are nice in places where they are seen from the windows, because of their early blossoms. So are those early-flowering trees, such as juneberry, wild goose plum, Judas tree and dogwood. Such early spring flower scenes of color are delightful to children or invalids who are confined to the house until weather becomes milder. Vines ramble all over the porch columns and up the fireplace chimney on the west side of the living room.

The views from the house are indicated by the converging lines. (*Fig.* 1.) Three different scenes are open from the living room: We have the veranda along the south and east sides of this room. To the west the sight is across open fields to the lowering sunset. Different openings through the trees give glimpses of the life on the highway. Out of the dining room the picture is one of sunlight and shadow over the open lawn, under the trees to the color of flowers. The kitchen and rear porch are shaded in the summer; a walk connects them with the drive; storage room is ample; the office is handy to the drive, and an outlook to the west; the carriage porch and entrance hall face west.

In conclusion, we may say that the farm home stands as the central feature, with the barns in a subordinate position. They are then brought into harmonious relation with each other through the artistic planting of native trees. Orchard and gardens are grouped as nearby accessories and the grounds about the house are further enriched with shrubs and flowers. The drive and walks allow convenient and easy access to all places and lead in a natural manner to the highway. Along the highway and in groups about the boundaries and cross fences trees are planted according to introduction and outline.

THE MODERN BARN.

Have you any definite idea of what sort of a barn you want? Have you carefully considered first your means, then your needs, then the needs of years to come? Is it your idea to build a small, cheap barn that will hold a few tons of hay, the grain, a few cows, the working horses, a colt or two, the farm machinery, the chickens and ducks? If that is your idea think whether it is economy to shelter farming tools on the barn-floor, which means that they are endlessly in the way and that they have a shed costing ten times what one would cost designed especially for such a purpose. No farmer can afford to build a barn with such a small storage capacity for forage that he will be compelled to fill it in summer and then re-fill it again and again during the winter and spring, drawing hay from the stacks, damaged in quality and at double the expense of putting it directly where it is to be used.

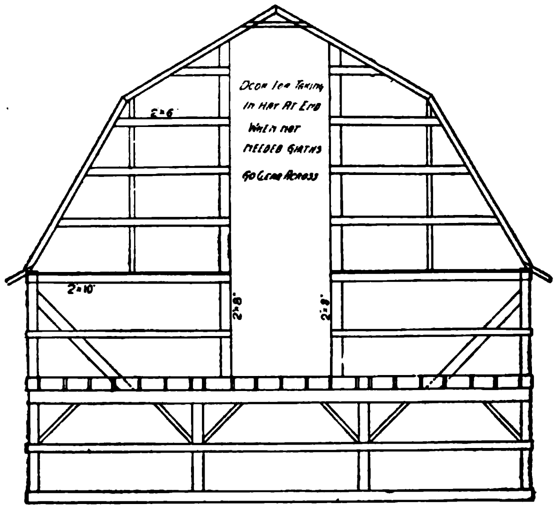


FIG. 4. WING'S JOIST FRAME FOR BARNS.

Is it not cheaper to make shingles shelter a depth of 20′ or 25′ of hay than a depth of 5′ to 15′? Consider whether it is real economy to combine into one barn all the shelter and storage room needed on the farm. There is fire to be considered and convenience in handling stock. Do you wish the colts or cows to run in the yard with the pregnant ewes? Do you wish to mix breeding sows and small lambs?

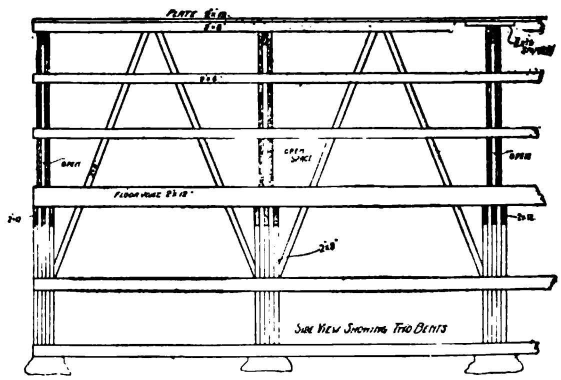


FIG. 5. WING'S JOIST FRAME FOR BARNS.

The barn must fit the farm and the needs of the farmer. It is folly to insist that any one type of building is of universal suitability. There is this thought to consider when building a barn: building is one of the great events that come far apart. After a new barn is built it is not likely that one can afford to add to it or build another for many years. Build, then, of sufficient size and capacity to allow for a reasonable growth and expansion of not merely the farm crops but the farm animals. Especially provide ample room for the storage of forage. Sheds may be cheaply constructed to surround the barn and these sheds will shelter the stock, and may be added at any time, but the storage room of the mow is a fixed quantity when the rafters are put on.

Notwithstanding the fact that barns must always vary in shape, size and arrangement, it is true that they will have certain things in common if they are modern and up to date.

Beginning at the foundation the modern barn has no sills under it. The basement posts rest directly upon stones, which are bedded well in the ground and should reach below the frost line. Sills near the ground are not merely unnecessary but a nuisance from every standpoint. They decay, harbor rats and obstruct. The modern barn has an earthern floor, preferably hard clay, or cement where necessary. The latter is cheaper than the wooden floor and has several points of advantage. It conserves warmth, no cold drafts come under it, does not shelter rats, manures do not leach through it and it does not decay. Yet where sheep are to be sheltered or calves or cattle run loose no other floor is needed than the natural earth well bedded. Even horses prefer to stand on the ground and many of the most successful horsemen insist that their horses shall have earth floor in their stalls.

The modern barn has a basement or lower story beneath its entire area used for sheltering farm animals. The reason for this is that it is in the line of economy. Moreover, it is a great convenience to be able to drive through to clean out manure or for other purposes. There is also a free circulation of air through the basement when the windows are opened on opposite sides, there being no wall or mow of hay to oppose the air currents. Modern hay-lifting machinery makes it as easy to lift the hay above the basement as to drop it on the ground level.

In designating this lower story a basement it is not meant that it should be under ground. Where the ground is inclined and level positions are not easy to be had, the old-fashioned bank barn may be considered, yet in adopting this type it should be constantly borne in mind that stone walls are apt to be productive of disease germs, especially of tuberculosis, which thrive in a dark and poorly ventilated barn basement. However, the advantages of a bank barn may be had without sacrificing light or ventilation. Let the earth be heaped against the wall not more than 4′ or 5′ and above this provide numerous windows, all arranged to open wide. The ventilation of the basement must be carefully thought out according to climatic conditions and the kind of stock to be sheltered. This is a point against sheltering all sorts of animals together. Ventilation that is desirable for the sheep barn may be very undesirable for dairy cows.

The lighting of the basement is an important matter. Sunshine is a great purifier and destroyer of microbes and germs. It adds to the comfort of calves, lambs, and pigs as it comes through the generous south windows during cold winter days. Glass is fortunately almost as cheap as siding. It will pay for itself many times over if used to let the sun in the barn basement. This also is true of the poultry-house. It is a commentary on the ignorance of a man that so often the farm animals will go almost anywhere rather than into the quarters he has provided for them. If the barn is built right and managed right the animals will need to be shut away from it rather than driven into it.

An important consideration is that the barn shall store an abundance of provender that may be easily and cheaply put in it. To this end the building must have depth of hay mow without cross-ties through the middle to obstruct the free working of the hay-carrier and fork or the use of slings. For the ordinary barn of about 40′ length the height from the level of the mow floor to eaves should be 20′, and the best width is between 30′ and 50′. The chief consideration is carrying the hay back from the center to the sides when filling the mow. The track on which the carrier runs should be directly in the center of the roof, and the hay dropping below it will not easily be carried back more than 25′, and on the whole a width of 40′ or 45′ is preferable.

The roof should be what is termed a half-pitch; that is, the rafters inclined at an angle of 45 degrees, or the curb roof of two angles. The roofing material should be slate, good shingles or galvanized iron. Painted iron roofing is not very satisfactory. Tin is used considerably on flat roofs and makes a good job if kept in repair and well painted.

Almost all manufacturers make carriers that hold the load and run it in at any desired height just to clear the floor or the level of the hay in the mow or up to the peak of the roof, according to the needs of the occasion. The use of such a carrier effects economy in time and power and results in making better hay, for there is less mow-burning when hay is not dropped from too great a height.

It should be borne in mind that most barns are too small, too low, too inconvenient in arrangement and too uncomfortable for the animals, while some are too large (this is rare) and too ornate and expensive.

The day of the barn sill has gone. Instead the posts are set directly on stone or piers of concrete made of cement. Between the post and the pier it is well to lay a block 2" thick, which will effectually prevent the absorption of moisture by the bottom of the post. Should this block decay it is readily replaced.

Posts should not come clear down to the floor level; the stones or piers should rise 12" to 16" to throw the post above the moisture or manure which may accumulate in cattle or sheep barns. Box-stalls in horse stables may also be permitted to accumulate manure, being kept well littered, and the result is better dryness and no heating of the well-tramped manure, besides the total saving of all liquids.

Concrete blocks to set posts on are cheap and satisfactory. They are made right in place. Excavate to solid ground—usually 18" will suffice—a hole 24" square. Make wooden moulds shaped like truncated pyramids 8" square at the top, and 18" at bottom or larger, depending on the size and weight of the building. These moulds may hinge together and fasten with bolts that may be loosened so that they may be easily removed from the blocks. It should be leveled so that the top comes to the right place, then filled with concrete in which may well be imbedded a great many cobble stones. A 3/4" bolt projected upwards 4" from center of block and post set down on it is useful, if the building is not very heavy, to keep wagons from butting the posts of the stones. After a few hours of setting the mould may be taken carefully away and another block made. The moulds should be filled full enough to make them of the same level. A surveyor's level at hand when setting the blocks is most convenient and saves much time and trouble.

Hard earth is a very satisfactory floor for sheep barns and cattle barns where animals run loose. Earth is desirable for box-stalls where they are kept littered, as they should be. Cement should be used for dairy cow stalls.

Vertical siding is best. Matched siding is seldom dry enough so that the tongues stay in the grooves. It is better to use plain unmatched barn boards 12" wide, battened with 3" strips after seasoning. In any event put siding on vertically; it is stronger, more durable and cheaper to erect in this way. If you wish to whitewash the building either inside or out use unplaned lumber and the whitewash will adhere better.

Only the best shingles should be used. Cedar is said to be durable, but the cedar shingles commonly sold are very thin. Steep roofs last double the time of flat roofs if of wood. Soaking wooden shingles for a moment in boiling linseed oil adds to their durability. A trifle of red color added to the oil adds to the beauty of the roof. The color should not be of sufficient quantity to more than stain. Dip the shingles in large handfuls to the tips, lay them on a piece of sheet iron and let them drain into the kettle. This is said to make inferior shingles last 40 years. They will not crack badly nor curl when so treated. Painted shingles are not recommended. Shingle nails as now made of steel wire will rust off in 10 years or less. They may be had galvanized and should be so for either shingles or slate.

There is no roofing more durable or more satisfactory than slate. It is heavier than shingles and requires strong rafters. For barns single-lap slate is coming much into favor; it is lighter and much cheaper than double-lap and, save that storms sometimes blow in a very little, it is as good.

Perhaps no form of roofing has caused more disappointment and vexation than metal, which rusts rapidly and requires frequent paintings. Galvanized steel seems durable and when well galvanized it has endured for many years uninjured. Metal roofs are hot in summer.

Rubber, paper, felt and asphalt and other kinds of roofing will serve if given proper attention. Barn roofs are usually neglected.

For eave troughs modern tin rusts through in three seasons. Paint will not prevent rust in a tin eave trough. Galvanized iron is to be preferred. It is well to make eave troughs and spoutings of generous size.

"Let all hinges be larger than seems necessary" is the suggestion of an experienced barn builder. Hinges are cheap; get them strong. Make sliding doors to run on flexible hangers which permit the doors to be raised up at the bottom without twisting the hinges or track.

Stalls for dairy cows should be 3½' wide; for beef cattle 4' wide. Three single horse stalls will go in a 16' tent. Four horses may easily occupy the same space in two double stalls and teams accustomed to standing together will do so without injury. Box-stalls should be of fairly generous size. For cows 7'x8' is permissible as a minimum; for horses 8'x10'. Do not make many box-stalls so small. A good horse stall is 10'x12'. Horses will eat their hay from the ground in a box-stall without waste if not given too much, and many horsemen think it is the best way. Put windows in a stable as high as you can, and put in plenty of them. Make doors 4' wide where you can. Make as many of them to slide as you can. A height of 7' in a cow stable is permissible if a good system of ventilation is provided. Make the horse stable 8' or higher. Make the sheep barn as well ventilated as possible. A width of 12' between centers of posts works well in a sheep barn. Do not try to put under one roof all classes of stock, tools, hens, and hired men. Do not plan immensely wide barns. They seem economical but greater comfort and better results come from narrower barns built partly to surround a paved court, sheltered thus from wind and storm.

WING'S JOIST FRAME.

Joseph E. Wing thus describes the joist frame: I have for many years studied the question of barn frames and designed a good many types. A barn frame should have great strength to uphold weight, resist wind pressure and withstand the pressure of rafters when weighted with snow.

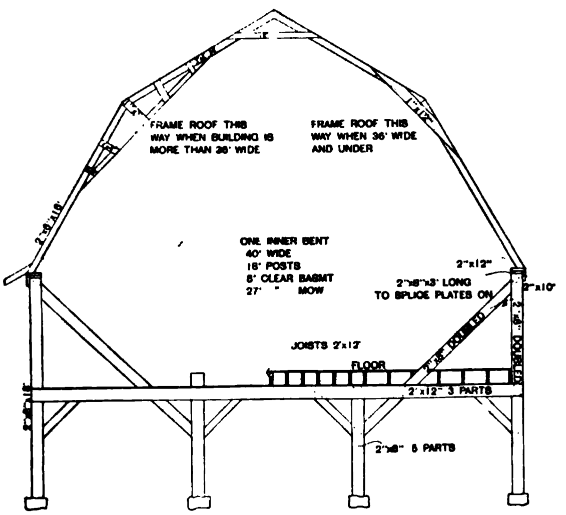


FIG. 6. WING'S JOIST FRAME FOR BARNS.

My progress has been a steady evolution towards the simple frame of two stories or more, with curb roof and purlin posts, in which every stick has a purpose and is so placed that it exerts its utmost power in the line of its greatest strength. The frame is an adaptation, and I have not hesitated to adopt other men's ideas. The roof was invented many years ago and used in New York and New England. It has stood the test of 40 years or more in the heavy snows of that region and I have never seen nor heard of one crushing. Built in the form of an arch it supports itself. The side walls need not be extremely high; from 18' to 20' with this roof gives great storage capacity. They are prevented from spreading by the long brace which will withstand ten times the pull that the thrust of rafters may ever put over it. For very wide barns purlin posts should be used, but up to 50' this roof is safe when rightly framed with the supplemental truss beneath the angle, and when so framed there is yet a saving in material and convenience over the old-style roof supported by purlin posts. (See *Figs. 4, 5* and *6.*)

There is no solid timber at all in the frame and few sticks need be of unusual length. There should be full-length posts; apart from these ties, joist-bearers, plates, nail girts and all may be spliced wherever convenience indicates and by always splicing a piece 2' long behind the splice, and spiking well, the whole is made as though of one piece. But one difficulty may confront the builder: the building of hay chutes. It is not desirable to have permanent hay chutes, for with the mow unobstructed by cross-ties hay is taken in by sling carriers that grip the rope and hold the draft at any height, thus swinging it in as soon as it clears the level of the hay in the mow or the mow floor, and hay chutes are very often needed in the middle of the barn. To make this come right have the hay chutes made in sections about 6' in height, building them 3½' or 4' square, and in this manner build two panels of solid boarding, like doors, say 3½'x6', and hinge together at the edges so that they collapse and lie flat. Provide hooks on one edge and staples on the other. Take two of these pairs and opening them hook together and set over the opening in the floor and we have a section of 6' of the hay chute. Fill the mow that high or a little higher and set up another section, and so on till the mow is filled. When taking out hay these sections are folded up and hung on pegs in the side of the mow until needed again next season. This hay chute costs no more and is as easy to build as any. A light ladder may be fastened to one side of each section for entrance to the mow.

A great many of these frames have been erected, some in very windy and some in snowy locations, since the plan was first presented in The Breeder's Gazette, and not one has given trouble to erect or in use, so far as I have learned. Siding on this barn is better put on vertically.

If matched siding is desired it works as well vertically as horizontally. The building may, however, be studded and siding put on horizontally.

In building the joist frame barn the following directions may be of value:

Get one carpenter to superintend the job; three or four men can find employment—and the more men the shorter the job. Pile up joists six or eight high and square, mark and cut off with a small crosscut saw; pile each sort out by itself so you can get hold of it quickly and surely. Never make splices without breaking joints and use a block 2′ long at the splice. Spike together well at splices and everywhere. Use spikes 6″ long and drive in aplenty; they are cheap. Put bents together on the ground—though you may finish spiking together after raising, as spikes should be driven from each side. Raise the bents and brace up temporarily until you have two standing, then put on box plate, plumb very carefully and put in long side braces and one or two pieces of nail girts. That will make the frame very rigid. You can now continue to raise the bents one at a time and continue putting on plates and braces as fast as they are raised.

It will take four men two days to frame a barn 40′x60′, and if convenient they should have four others to help raise, which will take another day. After the frame is up as far as the square, complete that part and put on the siding before erecting the rafters. A scaffold at the level of the plates is convenient, though some have erected the rafters without it. If you wish to change the proportions of timber used, do so, but make it heavier rather than lighter. A saving of $10 in material might make you many times that much trouble. The frame as it is saves a great amount of timber. Frame together the rafters and most thoroughly nail them together before raising. Discard any weak or uncertain sticks. Use good inch boards 5′ long. A trifle of expense here gives you a rigid roof. Tie together the rafters with 1″x4″ sheeting across all the angles before raising. Leave this sheeting on until you must have it for laying on the roof. Put two nails in sheeting instead of one at each intersection of rafter. Raise the first set of rafters at the gable and very carefully stay them and spike the bases to the plates. Begin raising rafters in the morning so you can get them all safe before night. Select good 2″x8″ long stuff; run diagonal braces under the rafters from the corners of the building clear to the center of the roof, two spikes at each intersecting rafter. This will make the roof very rigid. Get these braces up as soon as three sets of rafters are raised. If hay is to be taken in at the end, throw out two sets of diverging rafters to hold the end of the track and shelter the hay door. Their feet may be spiked against the outer long rafters and their points thrown out, each pair 2′.

Brace the gable well. Hay doors should be 8′ to 12′ wide. They may be double and their upper ends fold down to admit of swinging under the roof. Turn these doors away from direction of wind. Vertical siding is strongest and best for this frame. Roof projection should be 2′ at gables and generous at eaves. It is best added at eaves by spiking on sides of rafters short pieces of 2″x4″, giving the same slope as the top part of the roof. Shingle this clear up. Do not attempt to bend the shingles. Use galvanized shingle nails. Do not leave out any braces. Put 2″ blocks on stones under ends of posts. When they decay they can be replaced and no injury to posts results.

BARN ROOFS.

What advantages, if any, are there in hip over plain barn roofs?

Answering this question a carpenter says:

Fig. 7 is a drawing made to scale of 3/32 of an inch, or in other words 3/32 of an inch equal 1′ and is designed to show cross sections of three

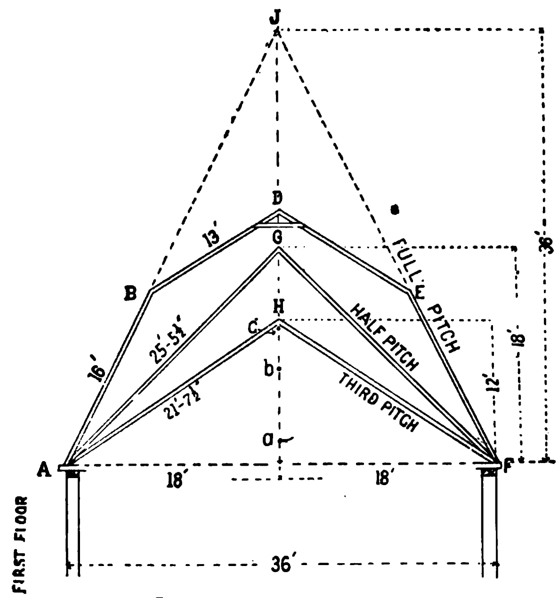


FIG. 7. THE PITCH OF BARN ROOFS.

sets of rafters having different pitches. The pitch of a rafter is determined by rise as compared to the span. In *Fig. 7* the span is 36′. The rafters *A H* and *F H* have a rise of 12′; and since 12′ is one-third of 36′ the rafters *A H* and *F H* are said to have one-third pitch. This pitch has been quite extensively used in the past, but is not so popular now. Improved hay machinery demands a higher roof for best results.

The rafters *A G* and *F G* with a rise of 18′, since 18′ is one-half of 36′, are said to be one-half pitch. The rise, 18′, equals half the span 36′. This roof is growing in favor where a plain roof is used. This pitch is used extensively on houses and makes a very nice appearance. Besides, shingles will last longer laid upon a steep roof than those laid upon a low or flat roof. *A, B, D, E* and *F* show the outline of a hip roof, the lower rafters of which are full pitch. They rise at an angle of about 63°. In full pitch, the rise doubles the run—that is, the rise is 2″ to 1″ run. By extending the rafters *A B* and *F E* to *J* by means of the dotted lines *B J* and *E J,* we have the outline of a full pitch roof, in which instance the rise would be 36′, the width of the span—the rise being equal to the span, hence the term full pitch.

The Gothic coincides with this pitch. In barn architecture full pitch roofs are not desirable except when used in connection with the hip or curb roof. In such roofs, the lower rafters can profitably be employed at full pitch, and by their use the greatest possible storage is secured in the roof. In *Fig. 7* the lower rafters *A B* and *F E* are carried along the full pitch line for a distance of 6′, thereby just using 16′ lengths. They have a run of 7′ 2″ and rise of 14′ 4″. The upper rafters *B D* and *E D* have one-third pitch—that is, the rise at *D* is one-third the distance of the span at the hip at *B* and *E* and is measured from a horizontal line through the points *B* and *E*.

In the plain gable *A H F* having one-third pitch we have 216 square feet; in the half-pitch gable, 324 square feet and in the hip-roof gable 490 square feet. Hence we have a gain of 108 square feet in the half-pitch which equals 50 per cent, and in the hip-roof gable we have a gain of 274 square feet, equal to 127 per cent over the roof having one-third pitch. The hip roof further shows a gain of 166 square feet, or 51 per cent over the roof having one-half pitch. Their volumes are proportioned. Taking three barns of equal lengths, 80′ for instance, and with 36′ widths and pitches as shown in *Fig. 7* the relative volumes of the three roofs above the plates would be as follows: One-third pitch roof 17,280 cubic feet; half-pitch roof, 25,920 and the hip roof 39,200 cubic feet. Upon a basis of 512 cubic feet per ton, the capacity in tons is 33.7, 50.5 and 70.6 respectively. Hence, the one having half-pitch roof has capacity for about 17 tons and the hip roof about 37 tons more than the one-third pitch roof.

Viewing the subject from another standpoint it requires about 10′ of the uppermost space for working modern hay tools. Hence, with modern hay tools hay could be deposited in the roof having one-third pitch at a height indicated by the arrow at *a* minor (See *Fig. 7*), which is only 2′ above the height of the plate. In the roof having half-pitch hay could be deposited at a point as indicated at *c* minor, which is 8′ above the plate, and in the hip roof hay could be raised to a height indicated at *c* minor, which is 11½′ above the plate. Hence, there is a net gain of 9½′ in height at which hay could be raised with tools in favor of the hip roof over a roof having only one-third pitch. Thus in the hip roof, there is a zone or belt having a height of 9½′ and an average width of 28′ and running the entire length of the barn, all of which could be filled with hay by means of hay tools, and all of which space is above the point at which hay could be lifted with the tools in a roof having one-third pitch. The volume of this belt is 22,040 cubic feet—equal to 43 tons, which is a very considerable mow in itself.

In approximating the cost of farm barns we regard 2¾ cents per cubic foot to the plate as about right. Of course the cost varies somewhat with the localities. Upon this basis, the extra volume secured by the hip roof over that of a one-third pitch would be worth $606.10. Hence, from the standpoint of dollars the hip roof as per *Fig. 7* is worth $606.10 more than the one-third pitch. But if we add to this the value of the convenience and satisfaction in the use of a self-supporting and open-center roof over that of one obstructed with timbers of various dimensions, then the problem is not so easy of solution, as the value of the convenience and satisfaction in the use of a properly constructed self-supporting and open-center roof is inestimable.

A MINNESOTA FARM BARN.

The barn built by W. H. Dunwoody on his farm in Minnesota is 120′ long, 90′ wide, 48′ high, and cost complete $20,000. The basement floor is cemented throughout, and on it there is a poultry house 10′x25′, with a glass front to south, nesting boxes, with inclines, roosts and runway to outside yard. There also is a storage room 12′x20′ in the west end of the basement, together with an old pump room and wash room 10′x25′; west stairway to main floor; three box-stalls 12′x17′ for dairy cattle; six stalls

FIG. 8. MINNESOTA FARM BARN (ELEVATION).

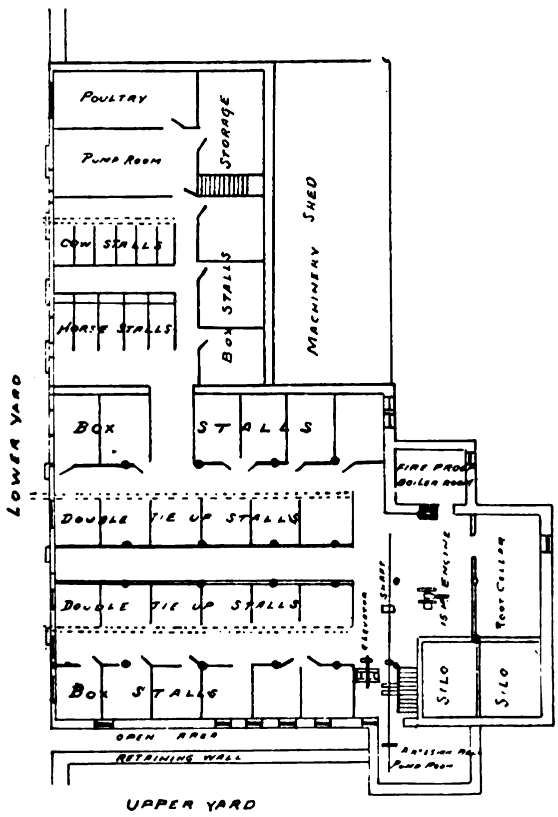


FIG. 9. MINNESOTA FARM BARN (GROUND FLOOR).

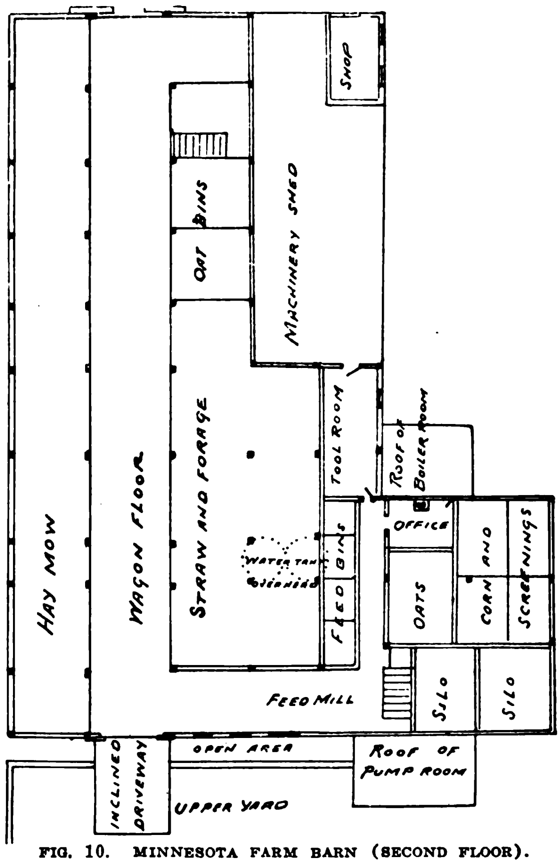


FIG. 10. MINNESOTA FARM BARN (SECOND FLOOR).

for dairy cows; five horse stalls and two box-stalls 8'x12' for horses; two rows of box-stalls 9'x12' (six stalls to the row) with alleys between; 12 double tie-up stalls 5' 8" long, mangers 26", width of stall 8' 9", each stall being equipped with iron enamel water bowl, with drop cover, piped to water supply; drain trenches behind are connected with all stalls, 18" wide by 3½" deep; large ventilating flues from basement to attic of barn. The height of the basement on north side of barn is 4' above outside grade, giving large basement windows for admission of fresh air. Hand extinguishers are provided in the barn and fire hose on reels, connected to attic tanks. The root boiler room is 10'x15', containing a large root cooker; masonry on all sides; steel roof; window for fuel; root cellar 12'x24', adjoining boiler room; two silos about 11'x13'x30', cement plastered; engine room containing 15-horsepower gasoline engine; about 50' of line shaft, with pulleys to grinder, conveyor, elevator, sheller and cutter on floor above, and also connecting pump in pump room, and to circular saw outside; east stairway to main floor; artesian well pump room off engine room. The passageways or alleys between rows of stalls all lead to doors on south side of barn opening into lower cattle yard, which is divided into east and west halves with sheds on farther side; yards to slope south. (See *Fig. 8.*)

The main or first floor is described thus: Machinery shed 18'x60', containing farm machinery, also separate tool room and workshop. Driveway from east to west through barn 120' long; flooring 3" matched plank; 3' on center floor timbers or joists under driveway, size 6"x12"; joists elsewhere same size but 6' on centers; hay and straw bays on south side of driveway (hay carries above the hay distributing floor, above part of the driveway—this floor is provided with trap doors and when bays are full this floor can be filled its full length); grain and feed bins on north side of driveway, connected to conveyor and elevator for handling the grain and feed; feed grinder, cutter, sheller, grain cleaner and elevator arranged next to bins on east end of floor and over engine room; office or men's room adjoining with heater, bed and wash-sink; stairway to second floor in east end. (See *Fig. 9.*)

The second floor is explained as follows: Men's room with heater and furnishings; large storage platform adjoining; stairs to top of silos, elevator head and water tanks. In the attic there are two water tanks holding about 350 gallons of water. The scale and scale platform are outside of the barn on the driveway leading to the east end of the barn. (See *Fig. 10.*)

LOVEJOY'S FARM BARN.

The general-purpose barn shown in *Figs. 11, 12, 13* and *14* was built by A. J. Lovejoy and built on his Riverside Farm in Winnebago Co., Ill., in 1903. It is for horses and cattle, together with machinery, wagons, manure spreader, carriages, buggies and sleighs. It also has bins for 5,000 bushels of small grain, mow room for hay, shredded fodder, a large amount of straw and a large tank of water which supplies the barn and adjoining yards. It is 96'x64' and is built in a first-class manner, having a joist frame made of the best grade of hemlock lumber, with Wisconsin white pine siding and 2"x6" studding, on which rosin paper is used and the whole sheathed with best kiln-dried dressed yellow pine, making an interior finish equal to many houses. The foundation is made of concrete, from screened gravel and Portland cement. Every post in the building rests on solid concrete piers set in the ground

FIG. 11. LOVEJOY'S FARM BARN (ELEVATION).

3′, on a 4′ base. The entire floor is of concrete, 8″ thick, on a gravel fill of 15″, and was made with a good finish by an expert builder of concrete sidewalks. The approaches to each door are also concrete and a concrete sidewalk extends

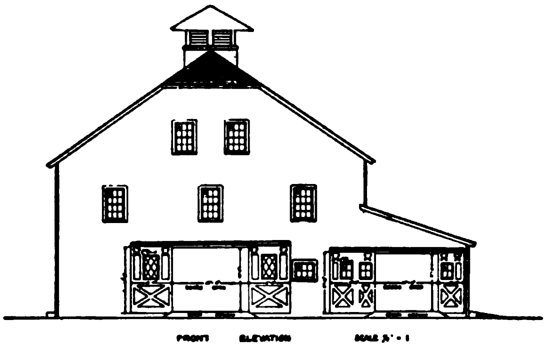


FIG. 12. LOVEJOY'S FARM BARN (FRONT ELEVATION).

along the south side of the building to the door of the engine room. The inside is divided into suitable rooms, as shown in the plan. The engine room is closed so as to exclude dust or dirt from the mill room. A 12-horsepower gasoline engine and swings behind a wagon while standing on scales. This elevator will elevate all kinds of grain to the large bins above. These bins have hopper bottoms with pipes leading to the mill room below, direct to the grinder, fanning mill and for loading wagons. The barn is lighted by acetylene gas furnished from a plant which also lights the residence and farm office.

The barn was made for convenience in handling feed and preparing it for best results. No hogs are kept in the barn, but all feed is prepared in it except the steaming, which is done at the feed house. All wagons are driven in the barn and all hitching and unhitching done in it. The total cost without any of the machinery, engine and the "L," was about \$5,000, which includes painting. The 26′x100′ "L" was joined to the barn for a cattle shed and has arched openings that can be closed by roller doors.

Where the diagram is marked "platform grain dump" a set of scales was put in and an elevator installed to carry grain to the granary upstairs. The six large hopper-bottom grain bins are on the second floor. (*Fig. 14.*) The bay for hay indicated in the illustration, was changed and

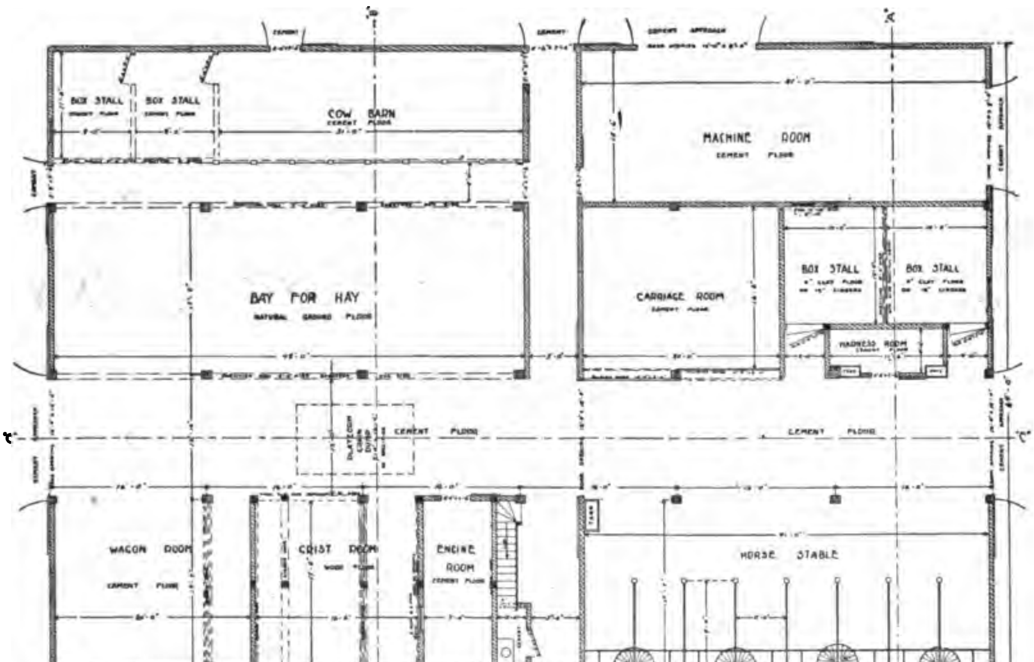


FIG. 13. LOVEJOY'S FARM BARN (GROUND PLAN).

furnishes power enough to run the grinder, feed cutter, sheller, elevator and pump all at the same time. There is a 28′ elevator with a swinging extension that stands at the side of the driveway floored with cement, the same as all the rest of the barn. The elevator does not require a dump, as the hopper swings round behind the wagon and grain is let out into it from the rear end of the wagon. Plank floor is laid in the horse stalls on the cement, as it was thought that horses would be less liable to slip. A drilled well is in the stable with a 100-barrel tank above in the second story. A system of water works from the elevated tank in the barn furnishes a good supply of water in the barn and out in the yards.

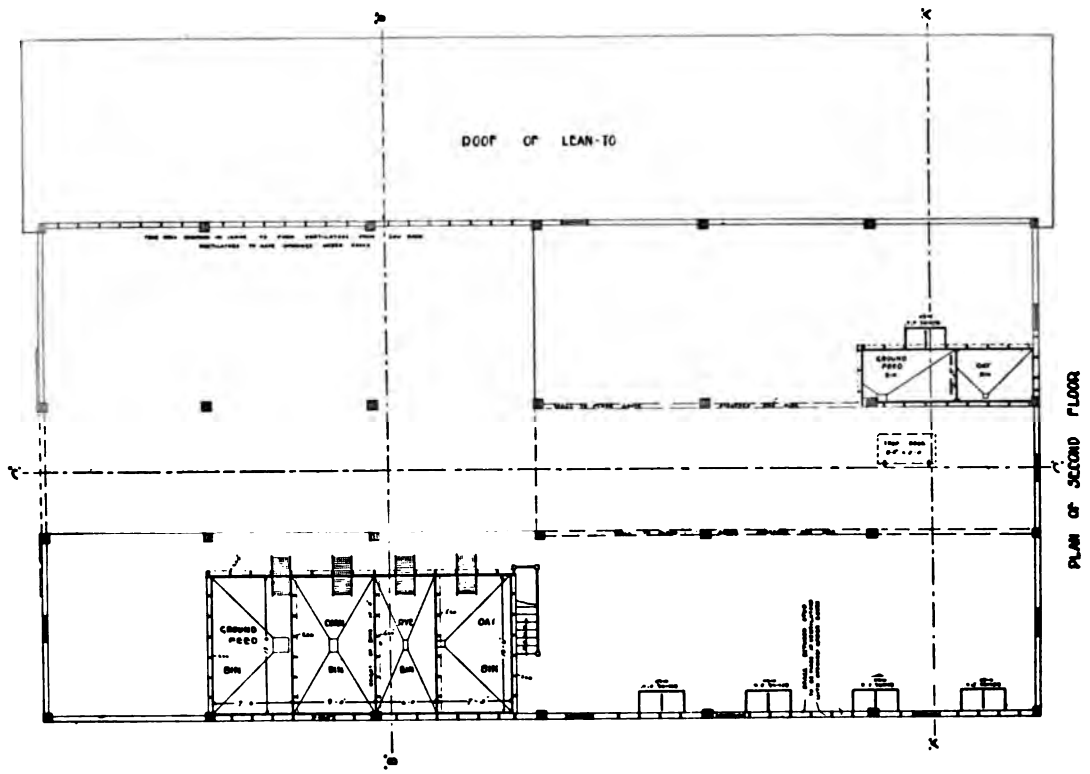


FIG. 14. LOVEJOY'S FARM BARN (SECOND FLOOR).

A better system of ventilation is used than the one shown. All posts in the first story are boxed, giving a finished appearance. The barn is almost frost-proof and is very convenient and a comfort to stock housed in it. The front elevation is shown in *Fig 12*. A photographic view of the barn is presented in *Fig. 11*.

NEW TYPE OF CIRCULAR BARN.

The illustrations (*Figs. 15* and *16*) show a circular barn designed by Architect Benton Steele of Indiana and erected on a farm in that state.

The barn is 102′ in diameter. The system of construction might be termed balloon framing, as no heavy timbers are employed in the barn proper. The system of framing is usually spoken of as the bending system on account of the fact that many of the important features of construction are obtained by bending the timbers into the required shape instead of sawing.

This barn is designed to accommodate all the feed and stock that can be produced on a farm of about 250 acres and yet allow for growth and improvement for years to come. In this, ample allowance is made for storing away implements and machinery and for a battery of feed mills and grinders, together with water tanks and plenty of working space in every department. The floor space shows stalls for cows. The departments marked 1, 2, 3 and 4 (*Fig. 16*) can be used separately or in part, or if need be can be thrown into one continuous department as occasions demand, such as when hauling out manure or in feeding numbers of stock together. The double gates as shown are made and hung in such a manner as to be easily removed, and the walls are provided with a number of sets of "eyes," so that the gates can be hung so as to provide any size space desired. Every department is directly accessible to the outside doors, which is a great convenience in shifting stock from place to place or in case of fire. The stock is all fed the main rations from the one continuous feed alley, the feed being passed through chutes or trap doors in the second floor. When roughage is fed to loose stock it is passed through chutes at the outer sides of the barn next to the wall into racks, which operate on the plan of self-feeders.

The bins or cribs below are filled by gravity from above. Portable corn bins may be used on the second floor when needed. A solid concrete wall is placed under the barn as well as the inner rows where supporting timbers rest, and special

FIG. 15. NEW TYPE OF CIRCULAR BARN (ELEVATION).

precautions were observed so as to exclude rats entirely from ever finding a burrowing place.

The windmill is a power mill with a wheel

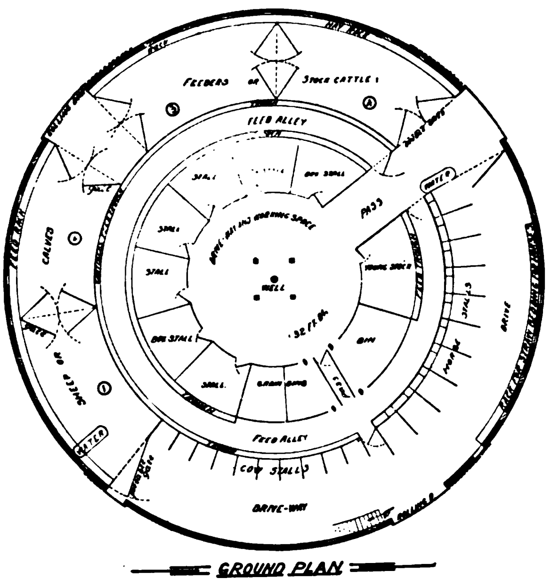


FIG. 15. NEW TYPE OF CIRCULAR BARN (GROUND PLAN).

16′ in diameter, and rests on a crib or tower in the center of the barn. Several flights of stairs are provided which furnish a means of access to the cupola where one can look after the workings of the windmill or get a view of the surrounding country for many miles. The windmill supplies power for running machinery and pumping water, and being placed at such an altitude renders it very sensitive to the slightest breeze.

The second floor is entirely free from obstructions with the exception of the crib and mills, as before mentioned. The roof is entirely self-supporting, no trusses being employed, nothing heavier than 2″x6″ rafters. The mow floor has an estimated hay capacity of 350 to 400 tons. The haying outfit consists of a circular track suspended about midway up the span of the roof and operates an ordinary swivel car or carrier, in other ways much the same as in ordinary rectangular barns with straight-away track.

AN EXPERIMENT STATION BARN.

The Iowa Experiment Station barn at Ames is a very modern affair, roomy and well arranged. It is a brick veneer, three stories high, 50′x100′. The first or ground floor is for stock, the second for grain, implements, carriages and the like, while the third is the hay mow. The silo is of brick, has a 4″ dead-air space in the wall and is 18′ in diameter by 28′ deep, giving a capacity of 70 tons. The root cellar, which is under the driveway, also has a hollow wall. In the horse stalls a 3″ false floor, with wide cracks to allow urine to drain away quickly, is laid over the cement, which is the flooring of the cattle stalls, all passages being brick-paved. Over those parts marked A, which are ceiled up 3′, there is a wire network 24″ high. That in front of the horse stalls is hinged so that all the feeding may be done from the alley. The box-stalls for horses are sided up 5′ with 2″ stuff and iron rods run the rest of the way to the ceiling. (See *Figs. 17, 18* and *19.*)

In the feed-room the hay and straw are brought from the third floor in chutes with doors at the bottom. The grain is also brought down in small chutes with cut-offs, so that all the mixing of feeds may be done on the first floor. The hot-water stove in the herdsman's office heats the bathroom and teamsters' rooms above on the second floor and also the seed-corn room. The 18″ retaining walls on the southwest corner and north side show the difference in the elevation, the ground on the west being higher than that on the east of these walls. On the second floor are the bedrooms and office of at-

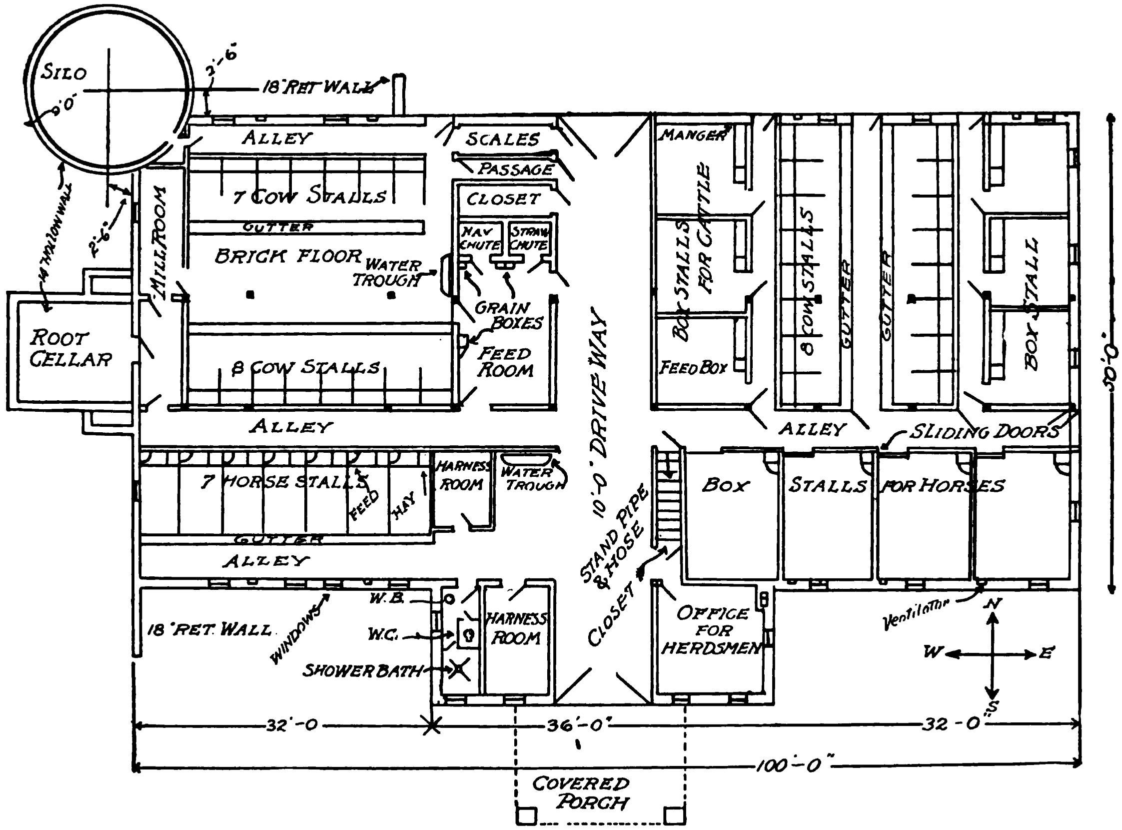


FIG. 17. AN EXPERIMENT STATION BARN (GROUND FLOOR).

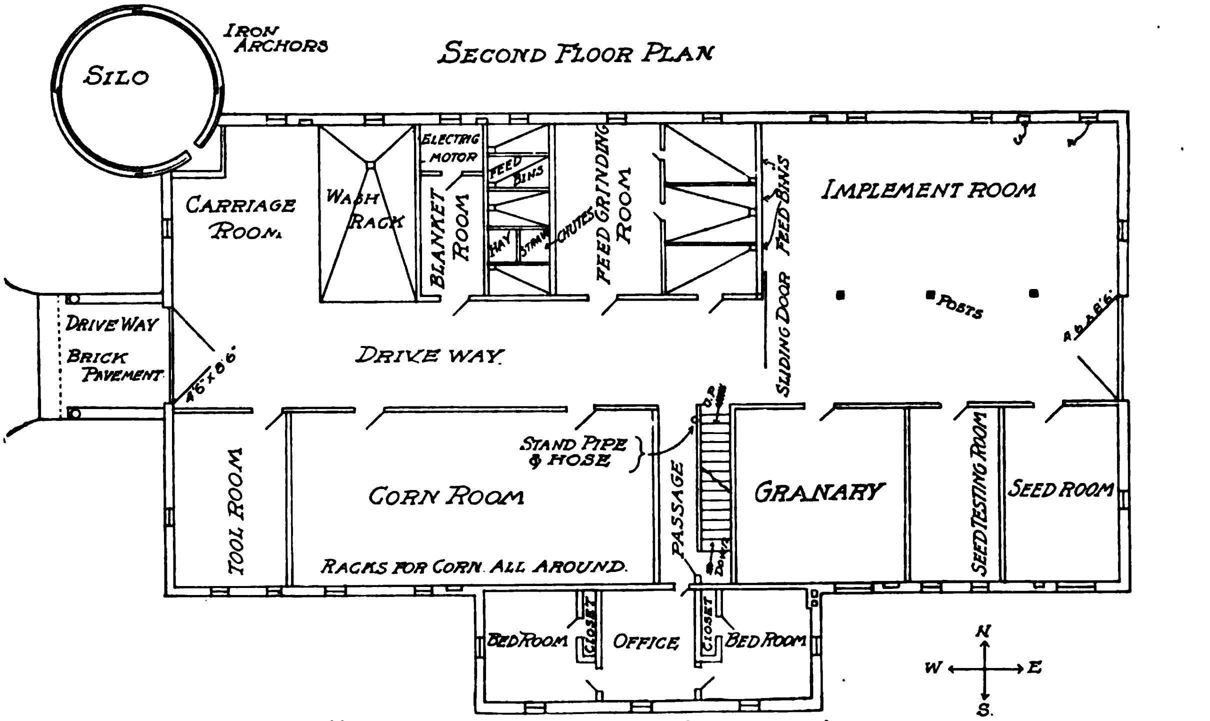


FIG. 18. AN EXPERIMENT STATION BARN (SECOND FLOOR).

FIG. 19. AN EXPERIMENT STATION BARN (ELEVATION).

tendants. In the corn-room there are racks all around so the seed corn can be ricked or corded up in them, giving better ventilation and economizing space.

The driveway is covered and is roughly paved to give horses a foothold in drawing loads over it. A continuous chute from top of silo permits silage to be thrown from either of the three doors to the feeding-floor. The motor-room just off the blanket-room is for a 15-horsepower electric motor. A line shaft from here into the feed grinding room allows for belting to feed cutters and other machinery. All the feed-bins have sloping bottoms to facilitate the passage of grain through the chutes to the mixing-room. Ventilator courses from the ground floor to the outlets on top give ample ventilation. A stand pipe and fire hose on reels afford partial protection from fire within, while larger hydrants outside have been placed near the building.

A STOCK AND HAY BARN.

The illustrations (*Figs. 20, 21* and *22*) are of one of the most commodious and best arranged stock and hay barns in the West. The building in the main stands 132′ east and west by 112′ north and south and the wings are 32′ wide. The details of the basement are very fully shown (*Fig. 22*) and the conveniences of such an arrangement are obvious. In the basement and immediately under the wagon floor there are lo-

FIG. 20. A STOCK AND HAY BARN (FRONT ELEVATION).

FIG. 21. A STOCK AND HAY BARN (REAR ELEVATION).

cated three bins for grain or ground feed and roots. They are filled through trap-doors from above, the sheller, or grinder, or root-cutter, or corn-crusher being placed over the traps and the

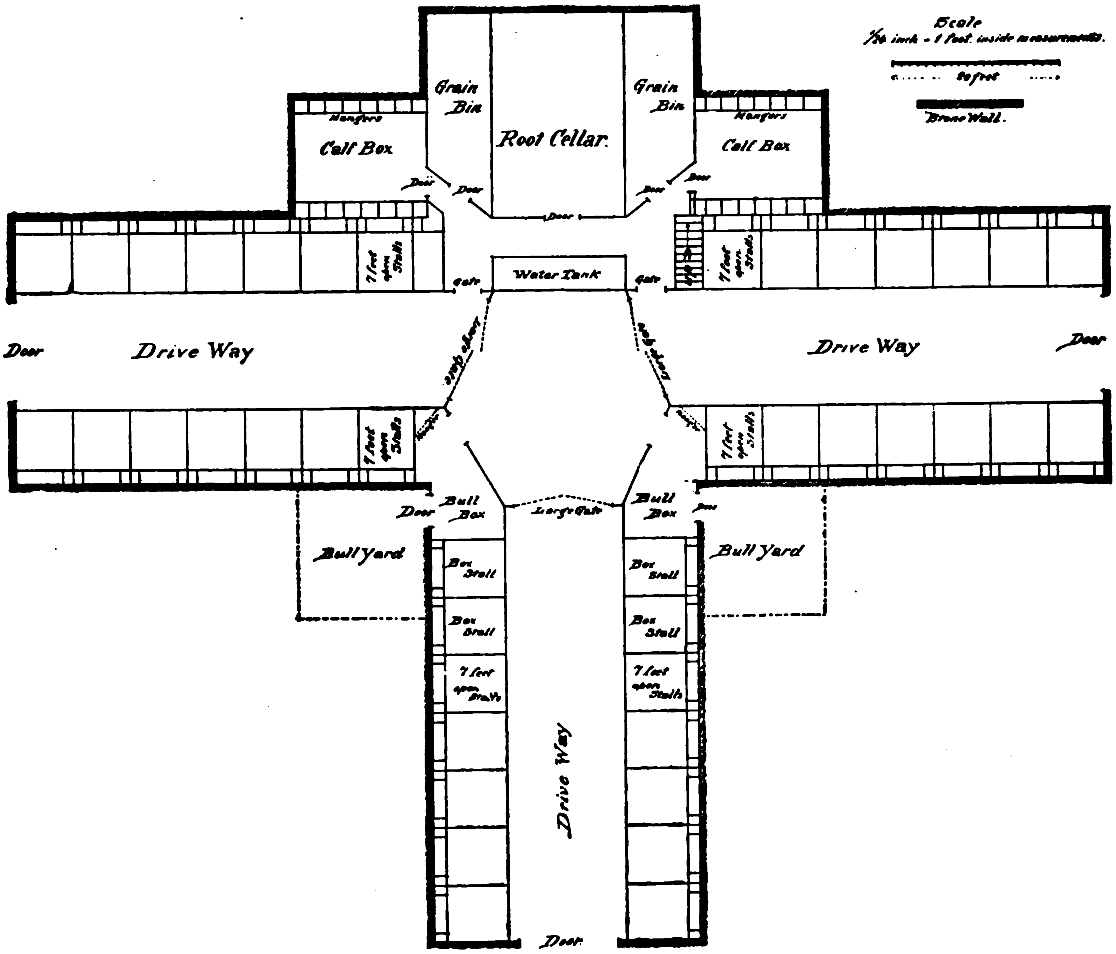


FIG. 22. A STOCK AND HAY BARN (BASEMENT PLAN).

power furnished by the belt from the three-horse tread power shown in the ground plan of second floor. Immediately adjoining the feed-rooms are two calf boxes that will conveniently accommodate about twenty youngsters each, and the rest of the floor is devoted to double stalls 7′ deep, except as otherwise indicated in the diagram. The water tank is in the center of the barn and large gates expedite the handling of the cattle back and forth from the tank to the stalls, or to the yards if they are turned out. There are good-sized box-stalls for the service bulls, with an exercising yard opening out from each, and in the south wing there are four box-stalls for cows calving in cold weather or for any other use desired. The driveways are 12′ wide, so that a team can be driven through the

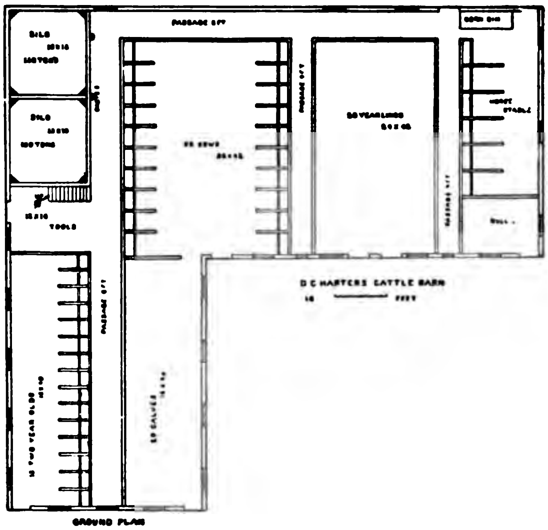


FIG. 23. INDIANA FARM BARN (GROUND FLOOR).

barn from either direction and the manure loaded onto a wagon or spreader and carted to the fields. The basement is surrounded by a stone wall and is very warm, though amply lighted and ventilated by numerous windows and doors. The water is piped underground to the trough from well and windmill outside and is controlled by a float-valve or by a cut-off rod, as desired.

On the second or main floor there are grain bins and corn cribs, 8′x24′ and 14′ high, and office and store-room, each 14′x16′, a space reserved for feed-cutter and for hay-rake and hay-loader and yet additional room in the three mows for 200 tons of hay. The capacity for grain, including both floors, is from 7,000 to 8,000 bushels. The barn will accommodate 125 head of cattle, including from 25 to 30 calves. The building is very substantially constructed and with due regard to general symmetry and effect. As it stands it is a very attractive building, well painted and trimmed and cost about $4,000 when built.

AN INDIANA FARM BARN.

Fig. 23 shows the ground plan of a barn in which cattle and calves may be fed, 20 cows kept (in Van Norman stalls) and "baby beef" produced. It is also provided with stalls for horses. The diagram shows how the ground floor is

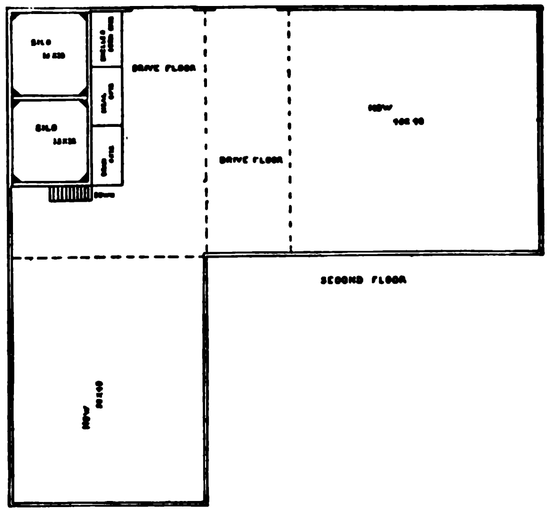


FIG. 24. INDIANA FARM BARN (SECOND FLOOR).

divided. *Fig. 24* shows the arrangement of the second floor. This barn has a cement floor throughout and is conveniently arranged for the uses to which it is put. Two silos are shown in one corner, and the corn silage stored in them is very successfully used in the making of "baby beef."

WHITEHALL FARM BARN.

Figs. 25, 26, 27, 28 and *29* illustrate the elevation, floor and other plans of the beef cattle and horse barn which E. S. Kelly recently built on his Whitehall Farm in Ohio. *Fig. 28* shows the ground floor on which there are stalls for cattle and horses. All the stonework is of good native limestone, laid up in good lime and sand mortar. The retaining walls around the drives have half cement and half lime in the mortar. All the mill stuff and dimension lumber in the basement are of sound native white oak. The 8″x12″ beams in the drives on the outside are also of white oak. All millstuff and timbers above

FIG. 25. WHITEHALL FARM BARN (FRONT ELEVATION).

the basement are first quality long leaf southern pine; 6"x10" middle tie beams are set back 4" from face of posts to allow studding, which is 2"x4", to pass without cutting. The floor of two outside drives is made of 2"x12" oak alternating with 2"x3" oak pieces set on edge, all laid on 8"x12" white oak stringers. The entire first floor is dressed with 1½" dressed and matched yellow pine flooring and the driveways on the first floor have an upper floor of 1" dressed and matched oak. The entire basement is ceiled all around the stalls, passages and alleyways 4' high with 1" dressed and matched yellow pine. The stable doors are built in two parts, upper half 3' and the lower half 4' high.

The roof of the Whitehall barn and ventilators are covered with the best quality of 16" cedar or cypress shingles. The entire barn is framed to secure the greatest strength and permanency of shape with the least weakening of timbers. The windows in the basement are arranged to slide sideways, as directed. The entire outside of the

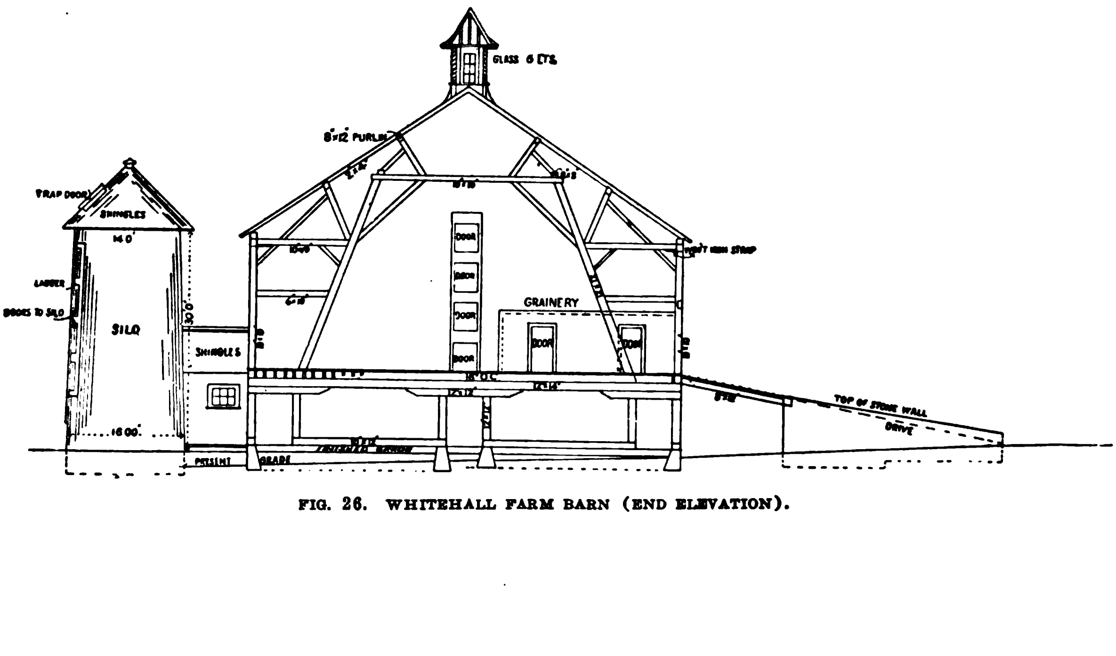


FIG. 26. WHITEHALL FARM BARN (END ELEVATION).

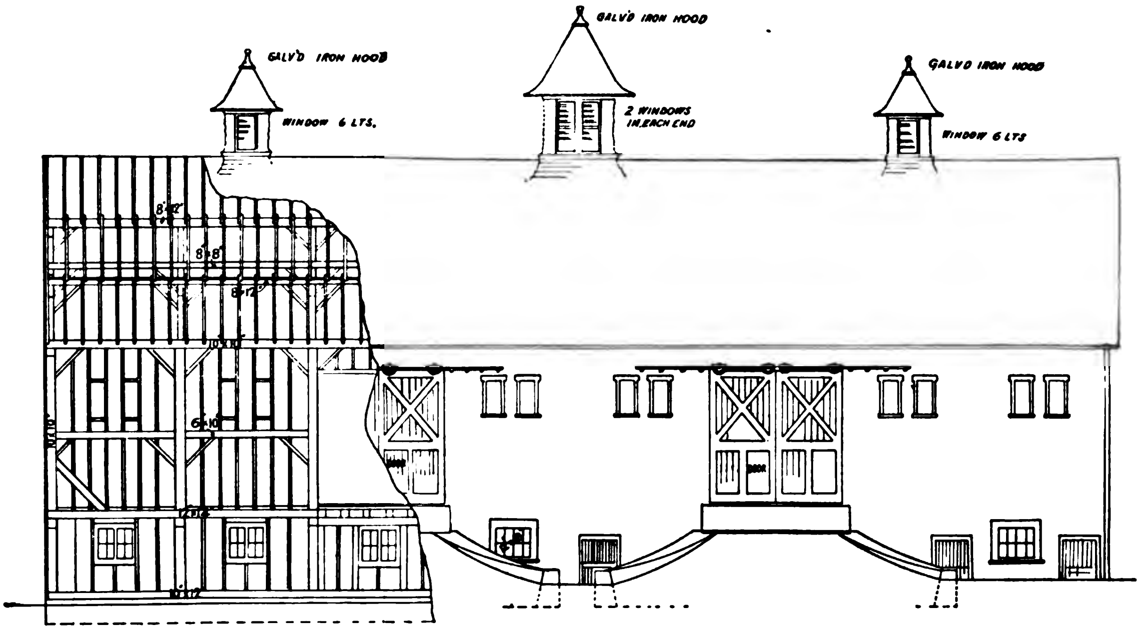


FIG. 27.—WHITEHALL FARM BARN (INTERIOR CONSTRUCTION).

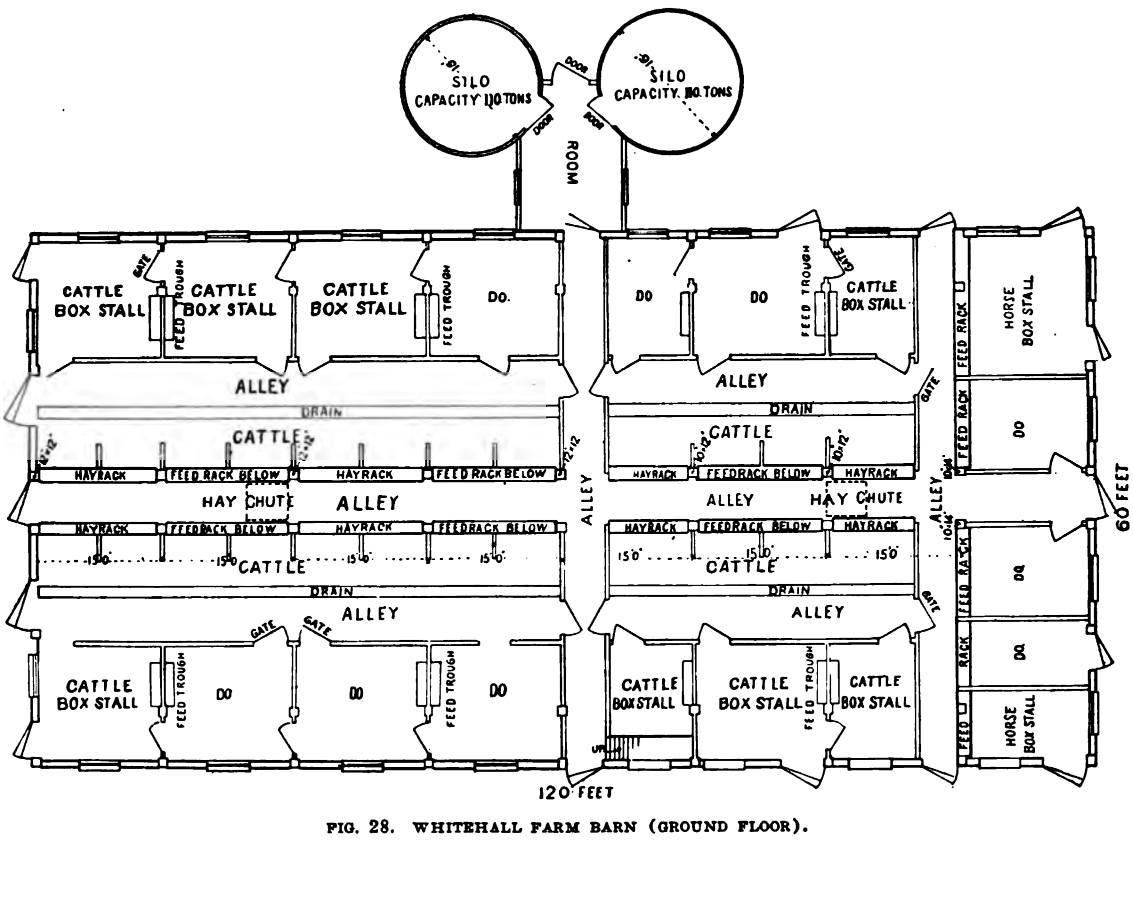


FIG. 28. WHITEHALL FARM BARN (GROUND FLOOR).

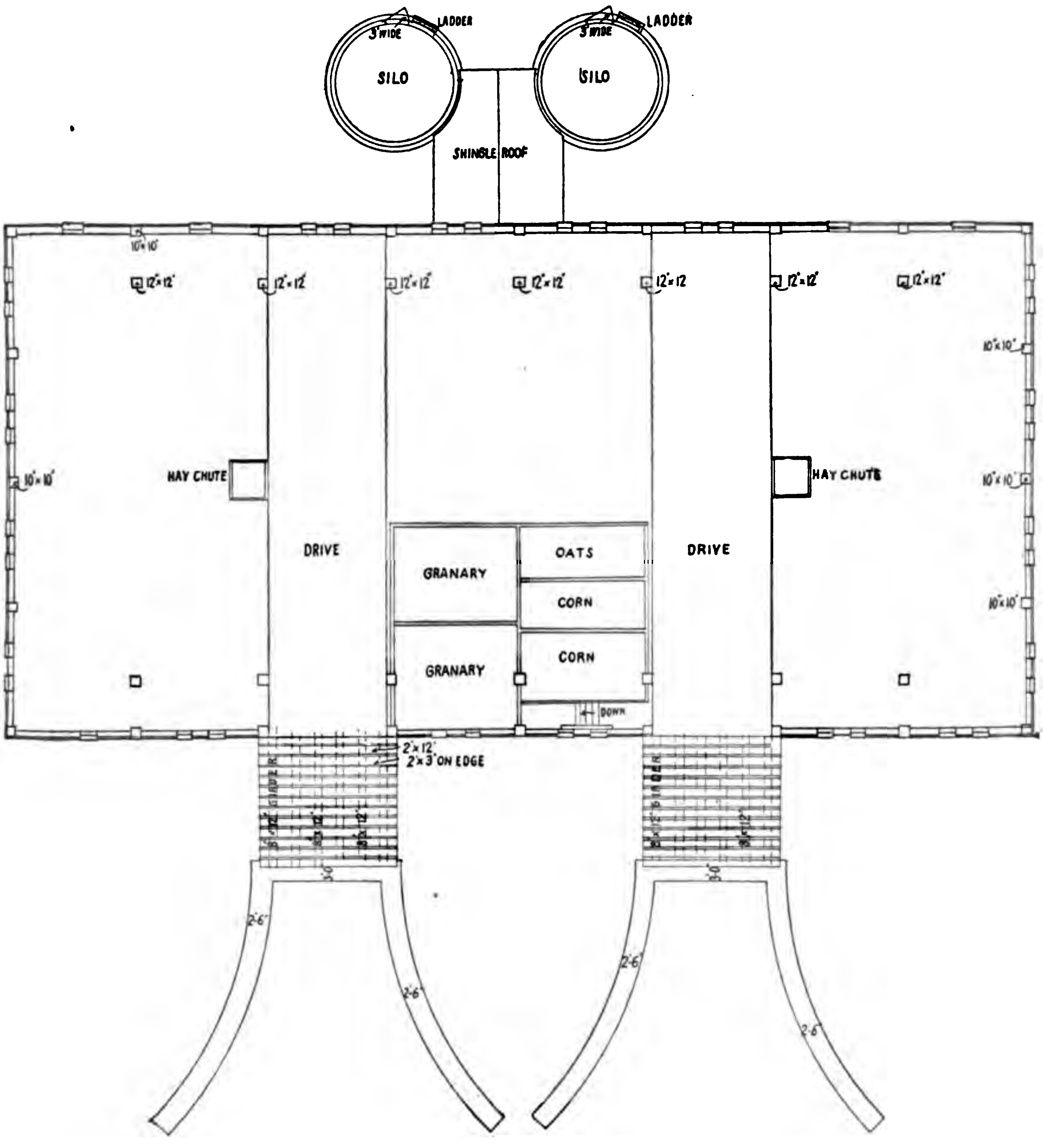


FIG. 29. WHITEHALL FARM BARN (GROUND FLOOR).

barn is covered with 4" drop siding. The cattle floors are made of cement. The barn cost about $7,000.

A WISCONSIN FARM BARN.

J. W. Martin's Wisconsin barn, shown in *Figs. 30, 31* and *32*, has a stone-wall foundation 20" high; the first story 8' is double-boarded with paper between and shiplap floor above. *Fig. 31* shows the arrangement of the interior and *Fig. 32* the plan of construction. The approaches to the main driveway and end doors are paved with cement. Box-stalls occupy the entire first floor of the barn and one stall is cemented for a restless bull.

The cow barn (*Fig. 30*) is 30'x80' with Bidwell stalls and a driveway between the rows of cow stalls on through the middle. This barn would be more convenient if it were 34' wide.

A KENTUCKY FARM BARN.

The general description and plan shown in *Figs. 33, 34* and *35* are of a Kentucky farm barn built a decade ago. It is a bank barn and stands on high ground where natural drainage is good. The size is 62′x74′, and from basement floor to the wind-engine tower the height is 56′, divided into four stories. The basement wall is of limestone, 22″ wide and 8′ high, and the posts in the basement supporting the framework are 20 in number and are made of oak, 12″x12″. The parts of the frame are 10″x10″, 16′ high.

FIG. 30. WISCONSIN FARM BARN (ELEVATION).

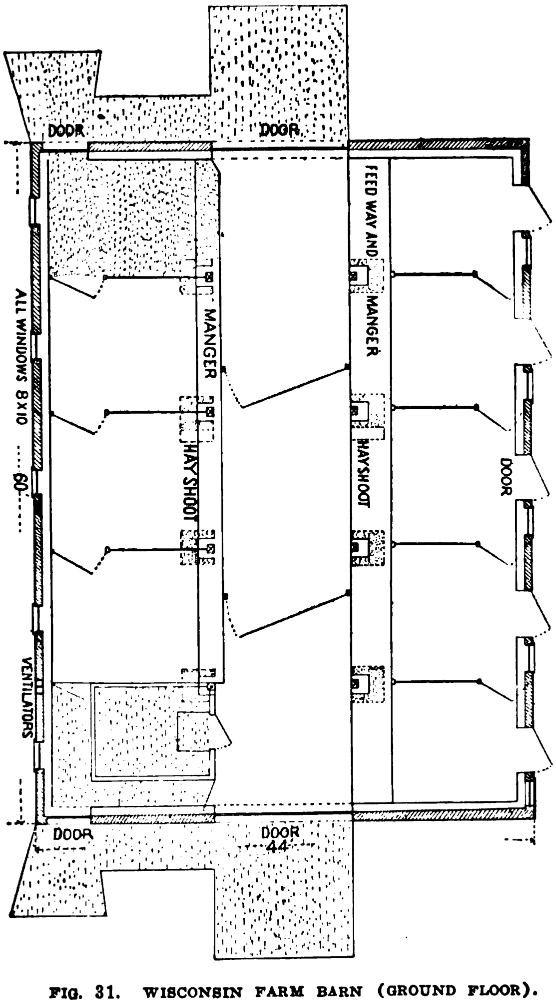


FIG. 31. WISCONSIN FARM BARN (GROUND FLOOR).

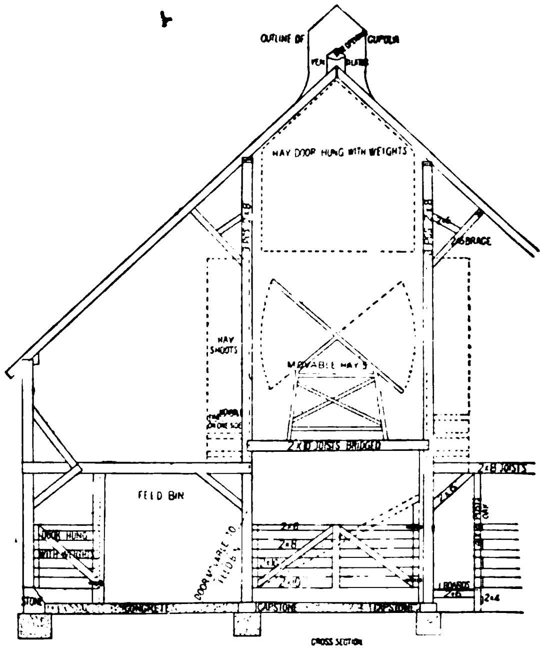


FIG. 32. WISCONSIN FARM BARN (CROSS-SECTION).

The entire framework is of oak, the shingles of poplar and the siding of northern pine. There were used in the structure 100,000 feet of lumber and 50,000 shingles, and the total cost was about $3,900. The diagrams of basement and main floor (*Figs. 34* and *35*) are quite complete

FIG. 33. KENTUCKY FARM BARN (ELEVATION).

and need but little explanation. There are two feed aisles, with a cross aisle and 40 box-stalls for grown animals, and the cross or calf aisle will accommodate 50 calves. The feed descends through a chute from the third story and two cars await to carry it down the aisles, along which it is distributed to the stalls. The columns in the second story, which extend upward and also form the third story, are 36 in number and 10"x10" in size. The floor of this story is double, with pitched felt between, which protects the animals below from those above. The floor is inclined each way from the center sufficiently to cause proper drainage. The entrance to this story is through double doors, 14' high (*Fig. 33*), via an elevated macadamized drive extending outwardly from each. Scales are placed at one door, so that the grain is weighed by the wagonload as it is taken from the barn. The wagon passes along the aisle and out at the opposite door. A gigantic hay-lift reaches down from above, takes up a load of hay and puts it in any desired part of the third and fourth stories or hay loft, which loft has a capacity of 500 bales. The second story has 14 calving stalls, as shown in the diagram, which are so arranged that they can readily be converted in case of necessity into four stalls each, making room for 56 cows. In the center or main aisle, 12' wide, there is room for 50 calves.

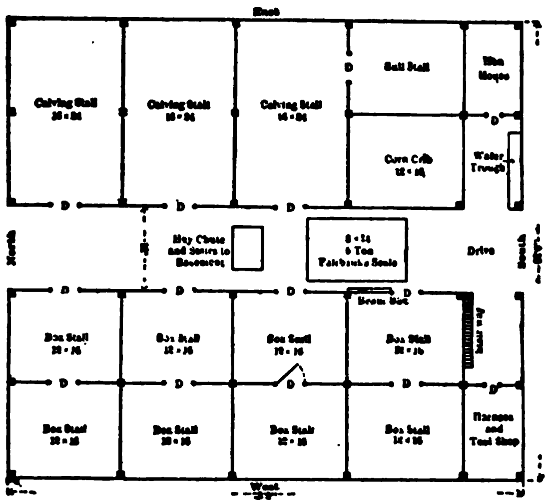


FIG. 34. KENTUCKY FARM BARN (FLOOR PLAN).

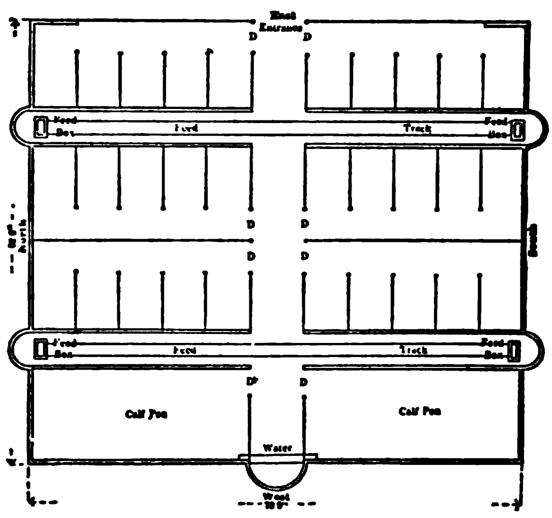


FIG. 35. KENTUCKY FARM BARN (BASEMENT).

This gives the barn a capacity of 196 animals, all sizes. There also is an office on the second floor. Just outside the building a cistern which holds 500 barrels furnishes the water for the entire building through a system of pipes. The third story contains the bran bin, corn boxes and cut-feed room, also the large cutting-box, the corn sheller and the pumping machinery, which are driven by wind power. So complete is the arrangement in every particular that one good man can easily feed, water and care for the stock and keep the barn in order.

AN OHIO FARM BARN.

The Ohio farm barn shown in *Fig. 38* is 42'x84', 24' to square, with curb roof and purlin posts. The rafters are 20' and 12', cut so each covers one-fourth the width of the building; all frame is of plank sided with drop siding, put on up and down. The barn is built on a stone foundation and is covered with slate, single lap on steep deck and double lap on upper deck. The hay door is 8' wide from the mow floor to the comb; hood 4' wide on each side. The lower story is 8' in the clear, mow 14' to square, 30' to purlin plates. The plank frame is a great improvement, certainly in cheapness and strength.

A BANK BARN.

In many locations bank barns may be cheaply constructed. The plan submitted is for a bank barn that will hold 25 tons of hay, have room in the basement for eight horses and about 20 head of cattle, with room above for about 1,000 bushels of corn and 800 bushels of small grain. In addition space is allotted on this floor for implements, wagon and buggy.

The basement plan is merely meant to be suggestive. Cattle may be turned loose, as sheep would be. The feed alleys should be formed by the mangers, these to be movable so that they can be taken out for cleaning. *Fig 36* (first floor) shows a driveway, two corncribs and an oats and wheat bin. These could be decked over and hay put above except the part under the driveway directly under the comb of the roof. Hay is to be thrown down in chutes about 3½′ square, reaching to the feed alleys, and a hole

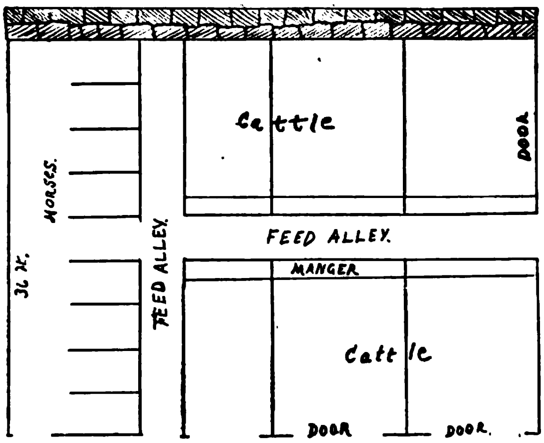


FIG. 36. A BANK BARN (GROUND FLOOR).

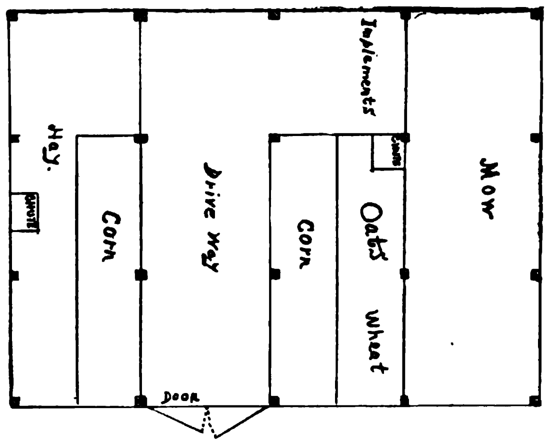


FIG. 37. A BANK BARN (FIRST FLOOR).

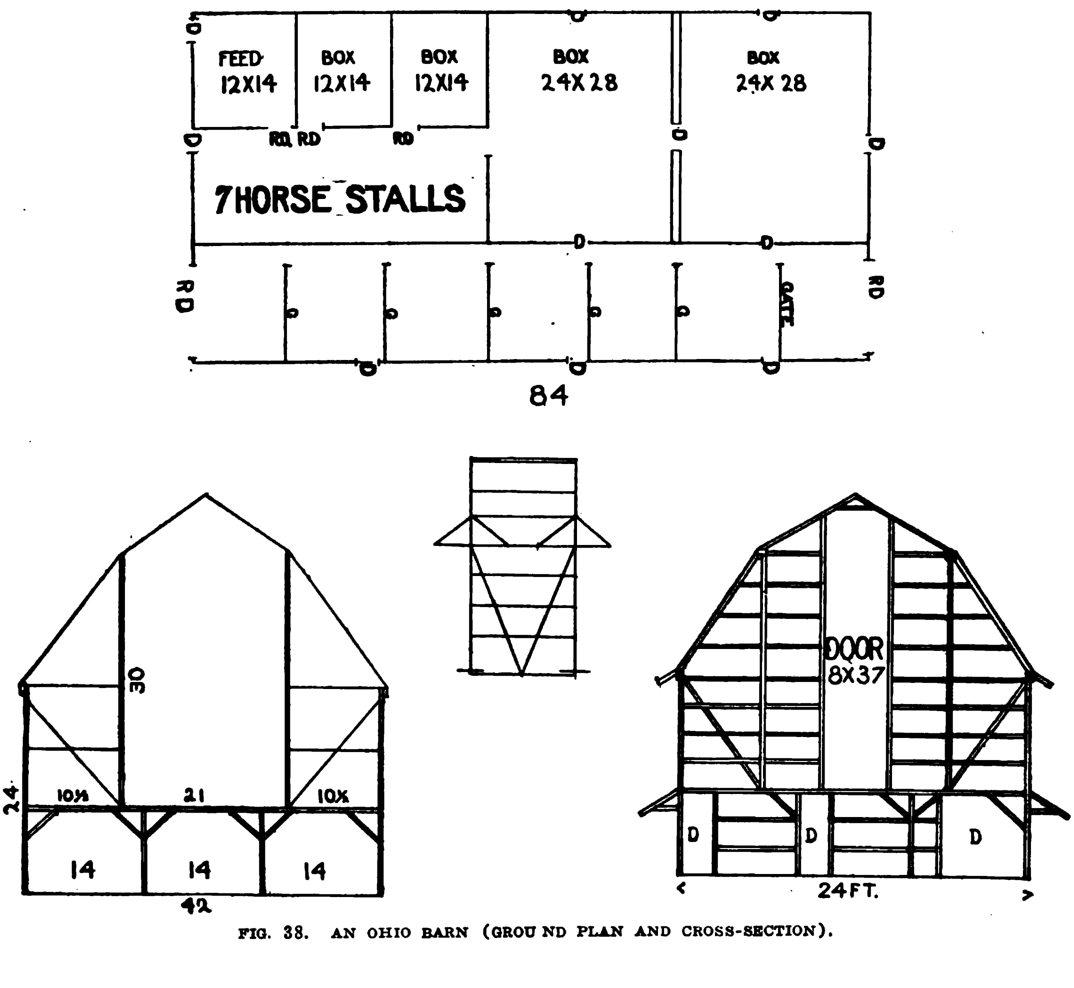


FIG. 38. AN OHIO BARN (GROUND PLAN AND CROSS-SECTION).

may be left open in the driveway covered by a trap-door. If this barn were built of joist frame and most of the framing stuff secured on the farm, and if the farmer himself were at all dexterous in the use of a saw and hammer, the cost may be within $450. The size of the ground plan is 36'x48'. (*Fig. 37.*)

A BASEMENT BARN.

The barn and carriage house shown in *Figs. 39, 40* and *41*, will accommodate three horses and three cows. The second story is used for hay and is 24'x30', with a height of about 10'. The basement is 8' in the clear, 24'x30', has two windows on the north and two on the south, hinged at the top and when opened swing upward and are caught by a wooden latch. On the east there is a window 2'x3', lighting the feed-room between the horses and cows. The wall is range-work stone on three sides and the east side is framed and weather-boarded. The entire floor is paved with cement and tile-drained under the walls, so the basement is dry, well lighted, cool in summer and warm in winter. The ventilation is complete by opening windows on three sides in warm weather and the transom over the entrance at head of stairway. In the winter warm air passes up a ventilating shaft to the ventilator on top of the roof. The granary is set up from the floor one foot and out from walls a foot, so it is dry and rat-proof. It and the

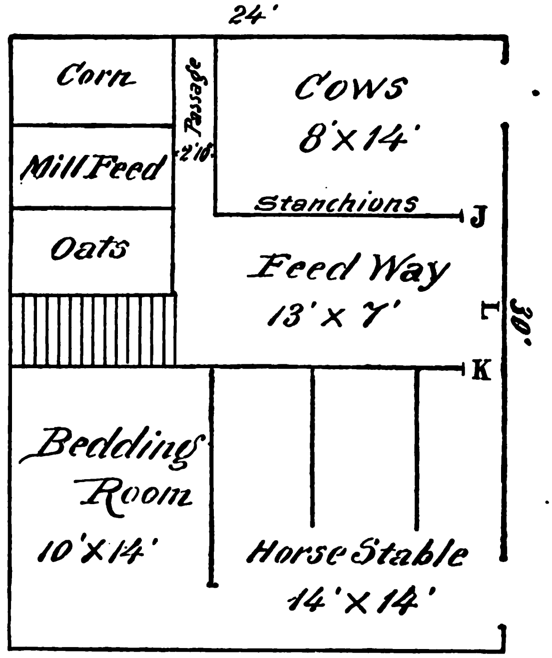


FIG 40. A BASEMENT BARN (GROUND FLOOR).

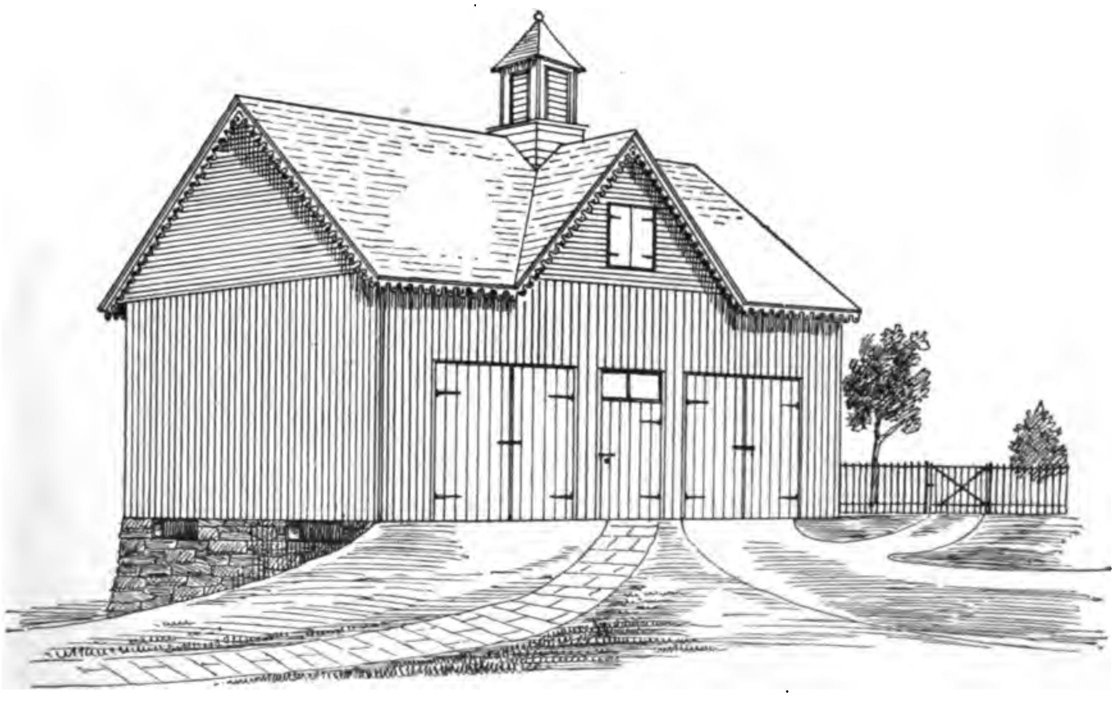


FIG. 39. A BASEMENT BARN (ELEVATION).

bedding-room occupy the back part of the basement, leaving the front part nearest the light and sunshine for the horse and cow stalls. The horse stalls are 4′ 6″x12′. The partitions of 1″ oak are set into the posts, so there are no nails or bolts to injure horses.

The hay-racks are perpendicular, with rounds 3′ long set 4″ apart. The back of the racks is

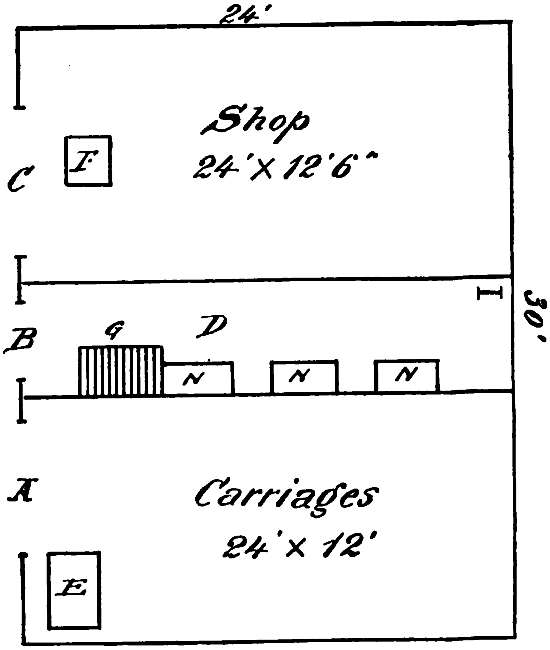


FIG. 41. A BASEMENT BARN (MAIN FLOOR).

boarded tight, sloping, leaving a space of 6″ for hay at the bottom and 18″ at the top, being filled from the trap-doors in the hallway on first floor. The stall on the east side is 1′ wider than the other two to make more room for passing from the feedway into the stable. The bedding-room opens into the stable behind the horses and is filled from the trap-door at the right of carriage entrance on first floor. The granary is divided for corn, oats and mill-feed with a drop door at the bottom of each, so feed is removed and the doors always closed to keep out rats.

The cow stable is fitted with stanchions and a drop 6″ deep and 4′ 6″ back. The litter from horse stalls is pressed into the drop to absorb the moisture from cows, and in front of the cow stable stands a low-down manure truck, which is removed to the meadows or fields when filled. At the head of the feed-room is a water faucet connecting with a cistern on the bank, to which the water from the roof is piped. There is also a trough of spring water in the barn lot.

The front elevation is shown in *Fig. 39.* The double doors to the right open into the carriage-room. The double doors on the left open into the shop, which is fitted up with bench, vise, tool chest, and so on, and lighted by two windows opposite the doors. The central door enters the hall to the hay-mow and the stairway into the basement. Into it hay falls from the mow at the far end and is put into the racks through trap-doors that fall back against the partition. In warm weather these trap-doors are kept open. In cold weather they are closed down.

The plan of first floor, as well as that of the basement, is drawn to a scale of 1/8″ to the foot. (See *Figs. 40* and *41.*)

A—double doors 8′x8′ 9″ to carriage-room; *B*—single door 6′x3′ 3″ and transom 3′ 3″ by 14″; *C*—double door 7′x8′ to shop; *D*—hallway 5′ 6″ by 24′; *E*—trap-door for bedding below; *F*—trap-door for feed to granary below; *G*—stairway to basement; *I*—ladder to hay-mow; *J*—entrance to cow stable; *K*—entrance to horse stable; *L*—water faucet; *N*—trap-doors to hay-racks below.

The building is covered with best pine shingles, weather-boarded with dressed lumber, battened and painted. The 6″x6″ corner posts are 14′ long. The floors to shop and carriage-room are 1¼″ sycamore and the floor to the hay-mow is tongued and grooved pine flooring with no knot-holes.

A KENTUCKY STOCK BARN.

The drawings (*Figs. 42* and *43*) are of a Kentucky stock barn 20′ wide, surrounding a

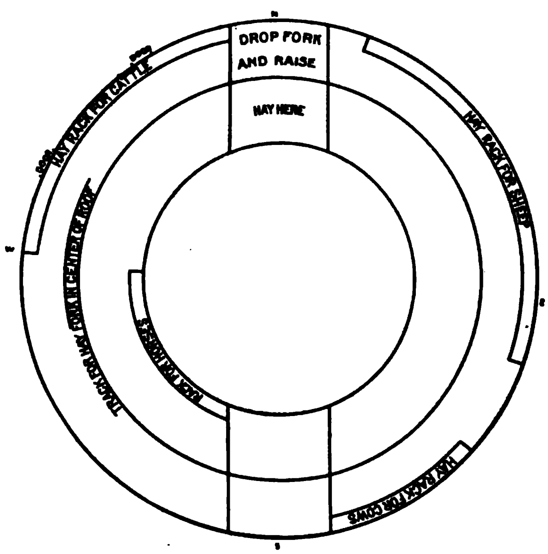


FIG. 42. A KENTUCKY STOCK BARN (MAIN FLOOR).

feed-lot 100′ in diameter. The feed-shed with trough and rack next to wall has the south side open to the feed-lot. The barn has a sheep department, hay rack next to the outside wall and small stalls for ewes and young lambs. It is also

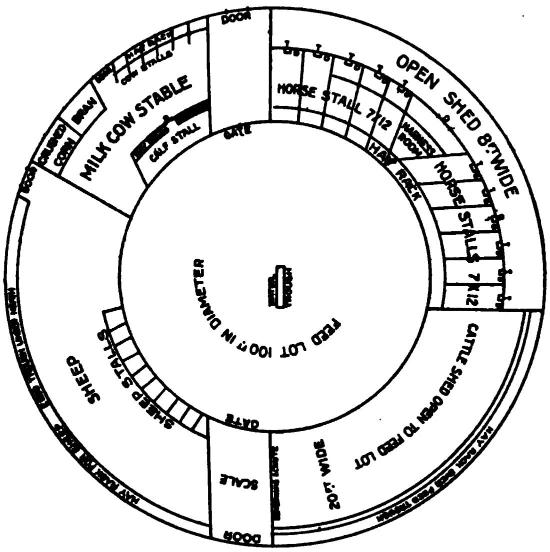


FIG. 43. A KENTUCKY STOCK BARN (HAY MOW).

provided with stalls for milch cows and calves, boxes for bran and crushed corn and box-stalls for horses. There is an 8′ unboxed passage outside and a loft over all except the scales and gateway, which are open for hoisting hay with fork on an endless track. In this loft there is room to store shredded corn and different kinds of hay. A crib should be made separate and rat-proof.

PLAN FOR SMALL BARN.

Fig. 45 shows a barn with four double horse stalls, one box-stall and room for 30 cows and 20 other cattle. It is seldom satisfactory to combine a horse and cow barn, as the latter can be more economically built by making it only 30′ wide, but this does not suit so well for the horse stalls. If one could dispense with the driveway it would be better to cut off as much as needed for the horse stable and place the stalls across

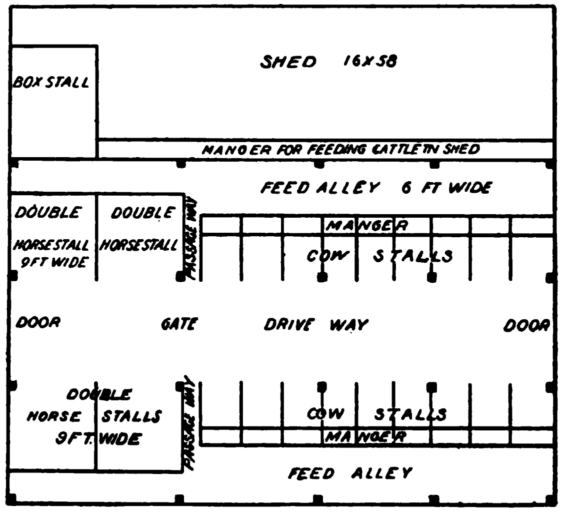


FIG. 45. PLAN FOR A SMALL BARN (GROUND FLOOR.)

the building with an entry from the outside to each double stall. The oats bin should be placed overhead, so that oats can be drawn down through a spout near the horse stalls. This barn with high curb roof will hold about 60 tons of hay.

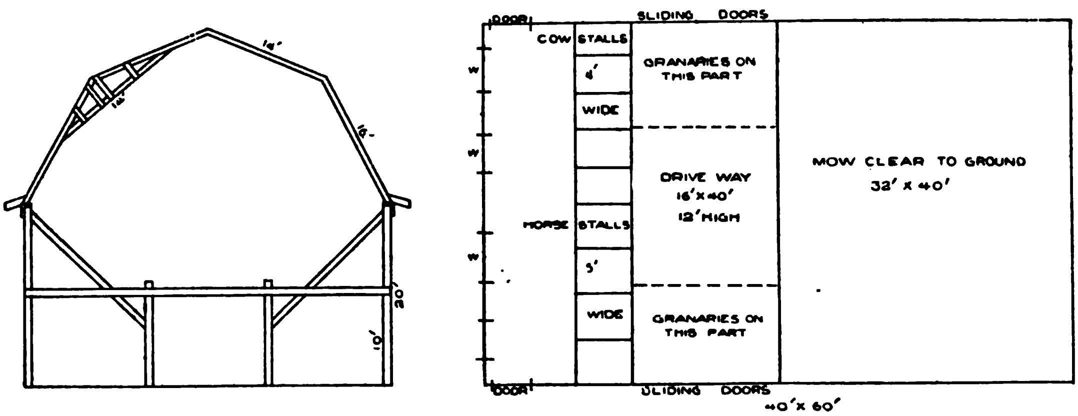


FIG. 44. BARN FOR A SMALL FARM (GROUND PLAN AND CROSS-SECTION).

GOOD TYPE OF FARM BARN.

The plan illustrated in *Fig. 46* shows a cattle barn which is 96'x48'. It is a pole barn with posts 20' high, and a corncrib 80'x12' runs through the center of the barn; the lower boards of the crib are hinged and feed boxes built on a level with the crib bottom so as to make practically a self-feeder, especially when feeding shelled corn. Hay racks on the sides are 80' long. Hay is put in at the ends of the barn. Sliding doors, controlled by weights, are used at the ends of the mow. They are closed when the hay is in the mow. There are doors alongside of the hay mow. When filling the mow a space of 4' between the hay and the sides of the barn may be left so that hay may be thrown into the racks when feeding. The south end is open; the north end has doors which are closed in bad weather. This barn will easily accommodate 100 cattle.

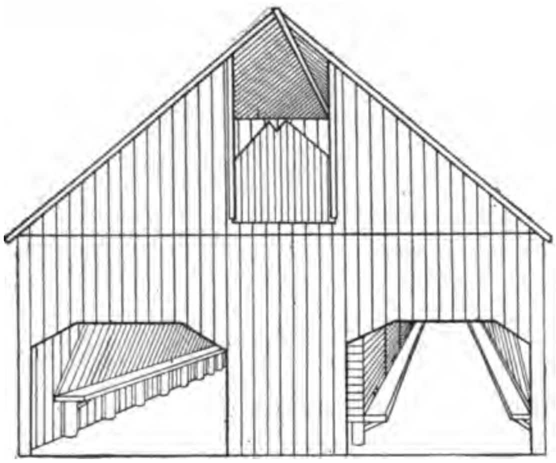


FIG. 46. GOOD TYPE OF FARM BARN (END ELEVATION).

BARN FOR SMALL FARM.

A transverse driveway in a barn is rather a waste of space, as it usually shelters only the farm wagon, yet it is often desired and in this plan (*Fig. 44*) it is made to do duty as a feed alley. There are stalls for four horses and five cows and a large mow reaching to the ground and granaries over the drive on each side, where they are readily filled by hoisting the grain with a hay-carrier rope. Where roofs are 40' wide or more there should be the truss method of framing rafters, using 2"x4" braces beneath the angle, fastened by short pieces of 1"x4". This truss must be on both sides of the roof; it is shown on one side only in the diagram.

A UNIVERSITY CATTLE BARN.

The cattle barn at Purdue University is in reality a dairy barn, as the beef cattle wing has not been erected. The plan calls for two wings placed at right angles and a covered yard on the south. (See *Figs. 47*, *48* and *49.*) The structure is two stories high with a curb roof. The dairy wing sets north and south and is 86' long and 38' wide. The first floor of this wing contains an office, water closet, milk room, feed room, scales, cow stable, calf pens and box-stalls. The second story is for the storage of grain and rough feeds.

In the northwest corner an office is provided for the herdsman, where the breeding records of the herd are kept. The milk room which has no direct entrance into the cow stable is equipped with milk scales, separator, wash sinks, steam, drain boards for drying utensils, and utensils rack. The floor is concrete with a bell-trap drain in the center.

The cow stable is 40'x38' and accommodates 20 milking cows. (*Fig. 49.*) It is separated from the calf pens and box-stalls by a sliding door. The floor and wainscoting, as high as the window sills, are concrete. The remainder of the walls and ceiling is finished in hard pine and oiled. A patent iron stall is used in connection with a platform six inches above the general floor level on which the cows stand. (*Fig. 48.*) Back of them in addition to the drop there is a shallow gutter 14" in width, which slopes from either end to the center where there is a bell-trap drain located. The floor from the gutter back to the wall is finished roughly and slopes slightly toward the gutter so that the water readily drains off into it. There is no joint where the wainscoting and wall meet; the concrete is continuous and the angle is finished with a curved trowel. The mangers are of concrete and rounded at the bottom so that they are easily kept clean.

The King system is used for ventilating the barn. The windows hinge at the bottom and open into the barn at the top. The south end of the barn contains three large box-stalls and a large calf pen with two movable partitions on pulleys and weights. The feed bins are at the north end of the cow stable, although entirely shut off from it. The silage is taken into the feedway from the silo outside the barn. The silo is a round stave silo built of Oregon fir, 16' in diameter and 30' high.

The mill room on the northeast corner is equipped with a motor, grinder, sheller, corn splitter and feed cutter. The judging pavilion

FIG. 47. UNIVERSITY CATTLE BARN (ELEVATION).

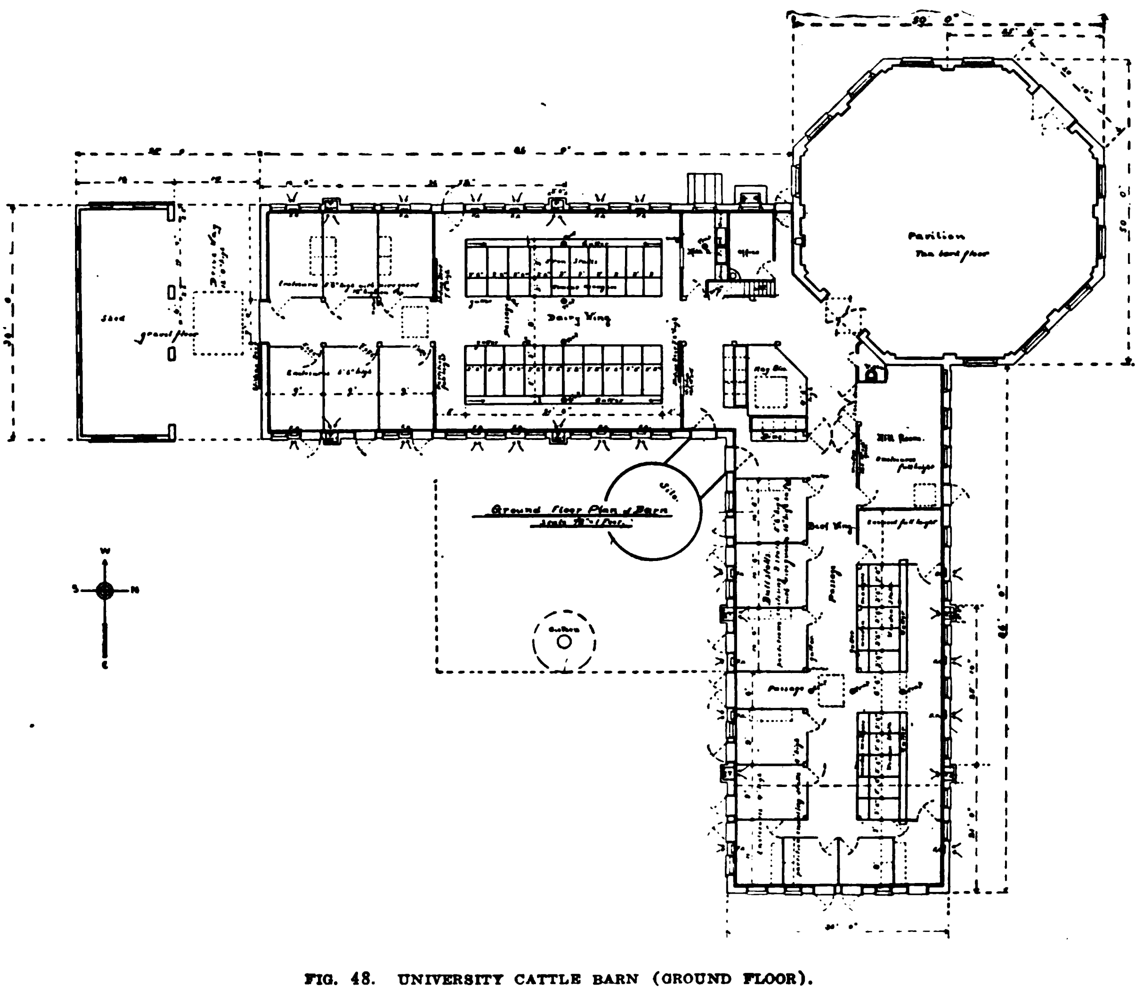


FIG. 48. UNIVERSITY CATTLE BARN (GROUND FLOOR).

FIG. 49. UNIVERSITY CATTLE BARN (INTERIOR SHOWING COW STALLS).

located on the northwest is 50′ in diameter, well lighted, steam-heated and accommodates 100 students. The steam is taken from a small sectional boiler under the milk room and office.

A MICHIGAN BARN.

The barn and yards illustrated in *Figs. 50, 51* and *52* are all connected. The barn proper is cemented on cobble-stones. The yards, whether open or closed, all alleyways and drives, and the floor of silo building are brick. There are seven cement watering troughs that hold 50 barrels each, supplied from a tank 65′ in the clear that holds 550 barrels. The tank is filled by windmills. On top of the barn, *Fig. 51,* there is a windmill which is for grinding purposes and if it is kept running by day when there is any wind and the hopper is kept full, it will supply feed for 300 cattle. This barn was erected recently in Calhoun Co., Mich., by A. Chrystal.

The entry to the barn is from the north end, and when you go into the barn you can see clear through to the silos, although there are two or three doors. The alleyway goes right through from end to end, not wide enough, however, for a wagon. The wagon entries are from the west to east and east to west. You drive over the scales and go right through to one of the open yards on the other side or vice versa and hay is put up on both sides above the stable and above the cow stalls. There is another entry between the silos and the barn, all bricked, to put hay up above the cow stalls.

Every yard is watered. There is water in the barn right at the cow stalls from a hydrant.

When entering the north entrance there is a general carriage house and floor. One can go through another door and come to the stable. Horses are on both sides. Through another door you come to the barn floor. On the east side of the alley you go through the barn from the north and this is where the meal comes from the grinder. On the other side is a granary and feed room. To the east of the alley you come to the mixing floor. East of that is a few cow stalls. On the other side are cow stalls altogether and calf stalls behind them, both east and west of the alleyway. The barn has stalls for 65 cows and 60 calves. On each side of the barn there are four doors so that the cows can go out from the barn on each side, going into four distinct yards. Behind each four cows are

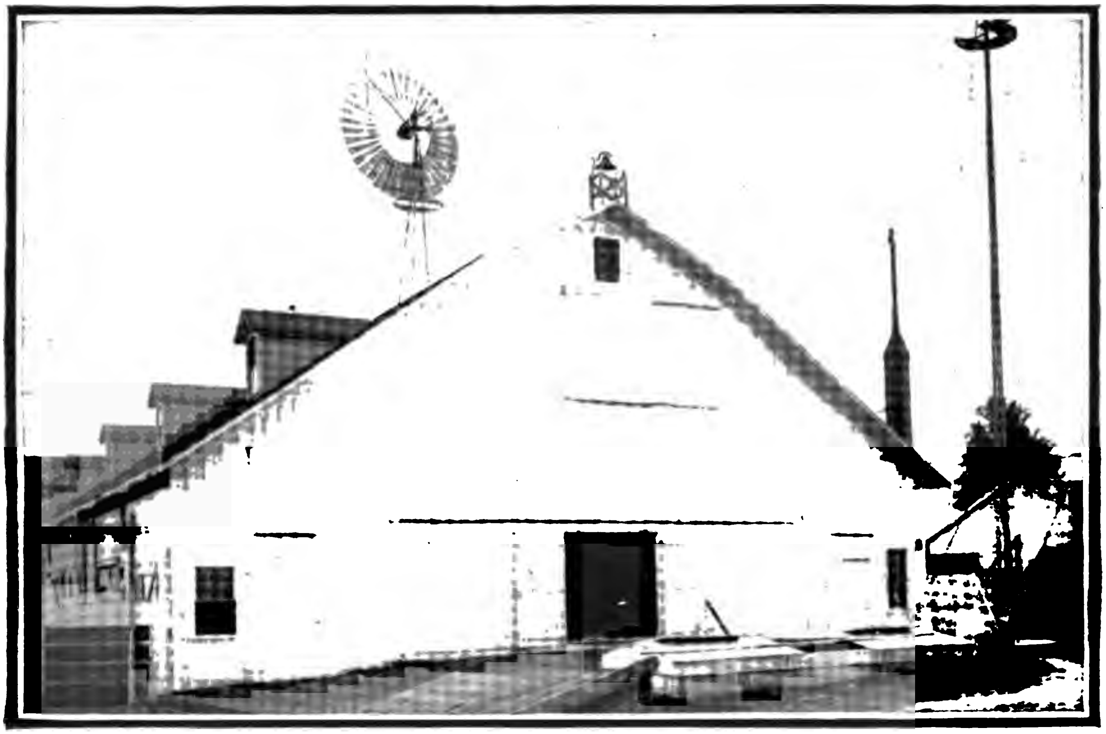


FIG. 50. MICHIGAN BARN (END ELEVATION).

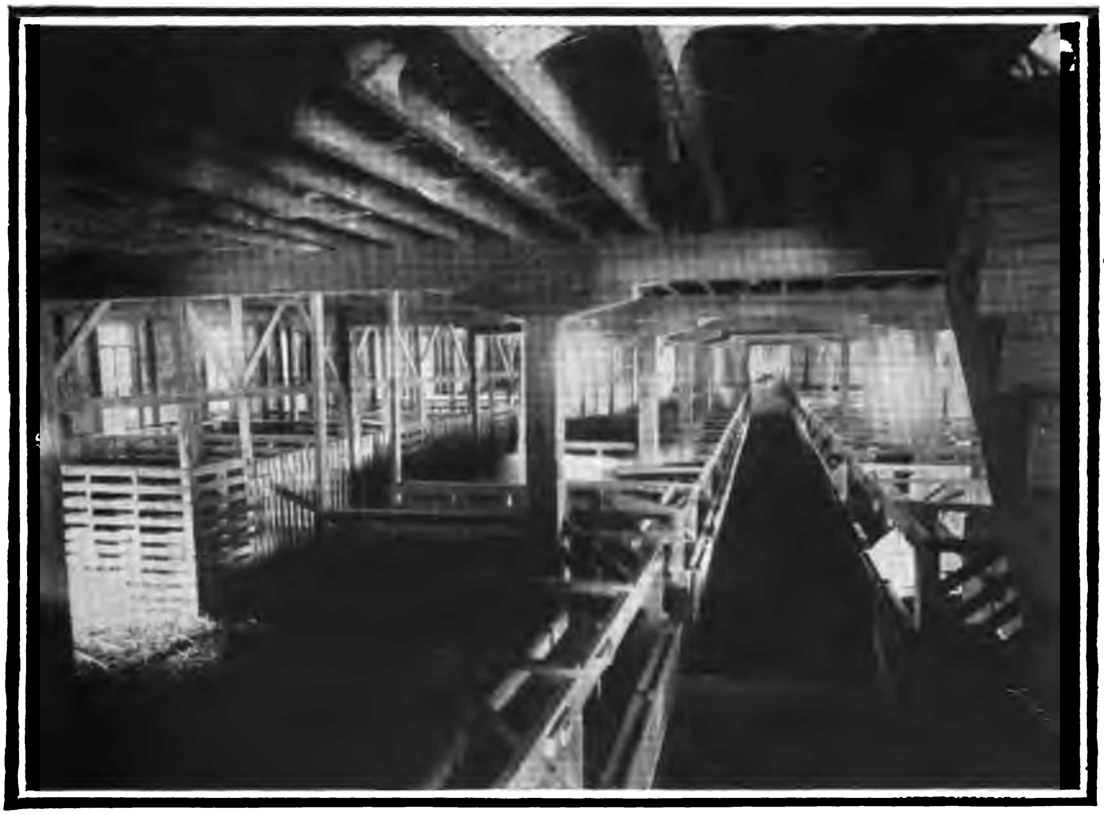


FIG. 51. MICHIGAN BARN (INTERIOR ARRANGEMENT).

two box-stalls containing two calves each. Between the cow stalls and the box-stalls there is an alleyway on both sides. There is a gate which shuts right across the alleyway between every four cows so that four calves are behind their own four dams and cannot run all over the barn. They are easily put back in their own stalls again. As before stated the whole of the barn has a cement floor and outside in all the yards there is a brick floor with regular pavement manholes for taking away the water from the eave troughs or around the barn. There is an entire system of good sewerage.

On the west side, the alleyway that comes over the scales from the west onto the barn floor is covered with a projecting roof half way to the barn. On each side there is a small yard half way to the barn and then an open yard. All these yards on the west side are shedded clear round with a 20′ roof and troughs are under each roof and a hay rack above the troughs. On the southwest there are two open yards, all shedded with a 20′ roof. That makes four yards altogether on the west side.

On the east side there are two yards shedded all around near the barn and farther east are four yards entirely covered. In the southeast yard there are 11 good-sized box-stalls which are used for cows to calve in, or for young calves with their dams. *Fig. 50* shows that the whole barn and yards are all connected. The yards on the west side are 120′ east and west and 190′ north and south. The yards on the other side are 160′ east and west and 190′ north and south. The barn proper is extra.

The first box-stall to the right of entry to the barn floor is the office. It has a cement floor and is all lined with sheet steel and is convenient when a man finds it necessary to stay at night in sitting up with a cow that is going to calve. On each side of the barn floor near the granaries are box-stalls. If an animal is taken sick it is put into the box-stall next the office, there being a door right into the stall from the office, and should a weak calf come it is taken in beside the fire and dried.

FIG. 52. MICHIGAN BARN (SIDE ELEVATION).

A WESTERN ILLINOIS BARN.

The plan and photograph shown in *Figs. 53, 54* and *55* are for a barn built originally for beef cattle. There are ten large double stalls, 15′ 8″ long and nine smaller double stalls. The barn is 64′ long and 53′ 10″ wide. In selecting material for the trusses used in this barn it was found best to use both heavy and light timbers so that one might be bolted and tied into the other without the use of mortise and tendon. Heavy bolts were used in every case except in that of the short braces, which were mortised into the heavy timbers as usual. Each

FIG. 53. WESTERN ILLINOIS BARN (ELEVATION).

…st runs up and acts as a direct support for a purlin. The rafters are notched over the purlins and form the upper part of the truss and for supporting the hay rack. Care was taken to have every section of the truss a perfect piece

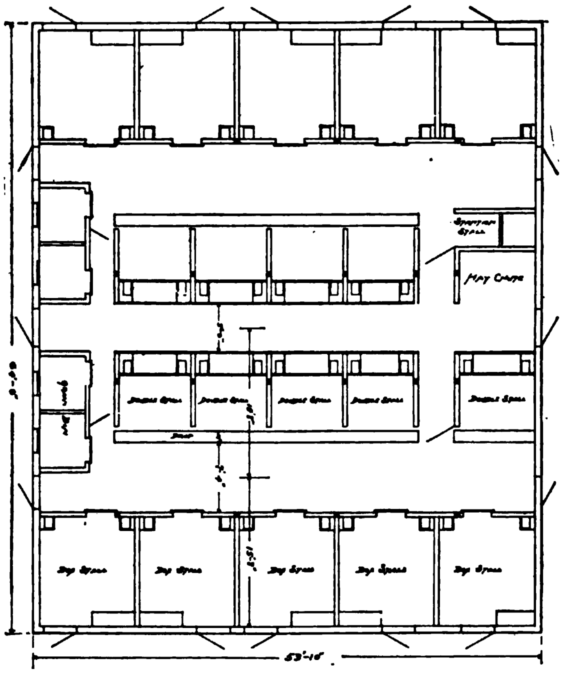


FIG. 54. WESTERN ILLINOIS BARN (GROUND FLOOR).

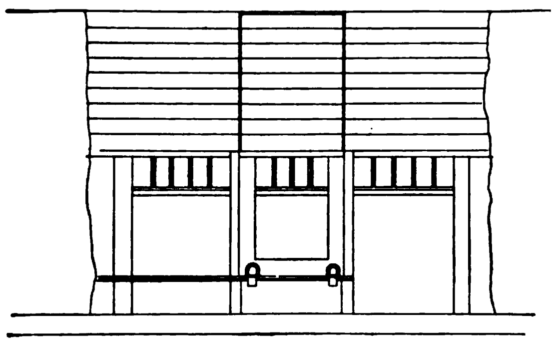


FIG. 55. WESTERN ILLINOIS BARN (DOOR DETAIL).

in itself, so that whether the strain was tension or compression the size of the timber was designed for the special place which it was to fill, thus forming a complete whole and a very stable and substantial frame.

A SMALL STOCK BARN.

Figs. 56, 57 and *58* illustrate a bank barn to hold 12 milking cows and 6 horses.

The wall is 24″ thick and but 5′ high, the posts coming down to that level. This gives opportunity for plenty of light and ventilation in the cow stable, which is very essential. By pen-

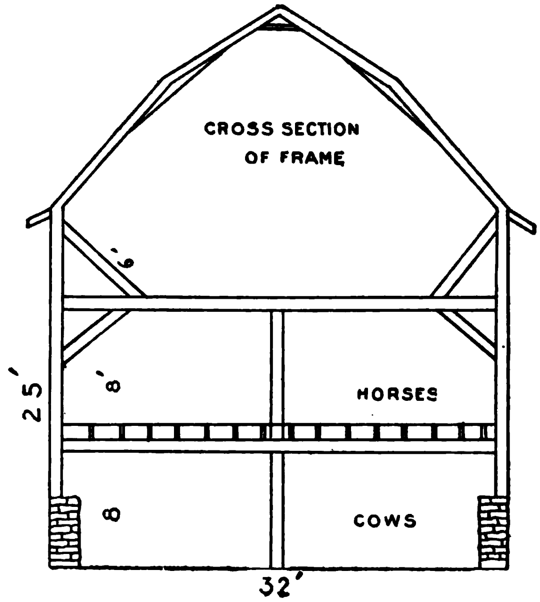


FIG. 56. SMALL STOCK BARN (FRAMEWORK).

ning off the end of the passage between the cows with a gate that may swing back out of the way when it is desired to drive through, a box-stall is secured there, and three such stalls are secured

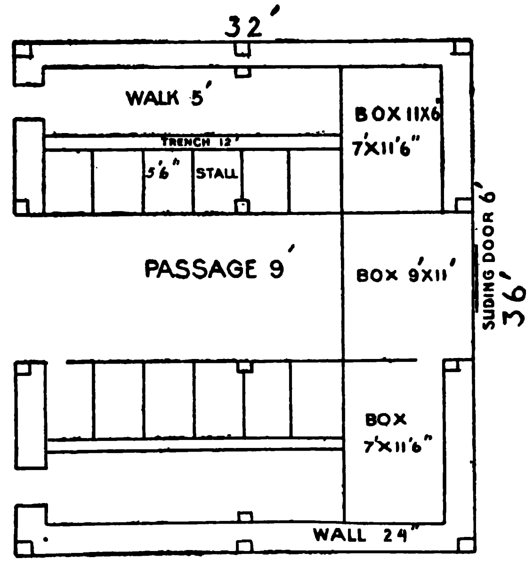


FIG. 57. SMALL STOCK BARN (GROUND FLOOR).

in all. The manure spreader may be driven right through to clean out the stalls, or a manure carrier be used, as occasion may seem best.

The cow stalls are 3′ 6″ wide, which serves well for dairy cows, and from 5′ to 5′ 6″ long for cows of varying length. The trench is 12″ wide and 6″ deep. All the floor should be of concrete. There are bins above in the horse stable where ground feed may be stored for the cows and drawn down by spouts into the feed alleys. (See *Fig. 57.*)

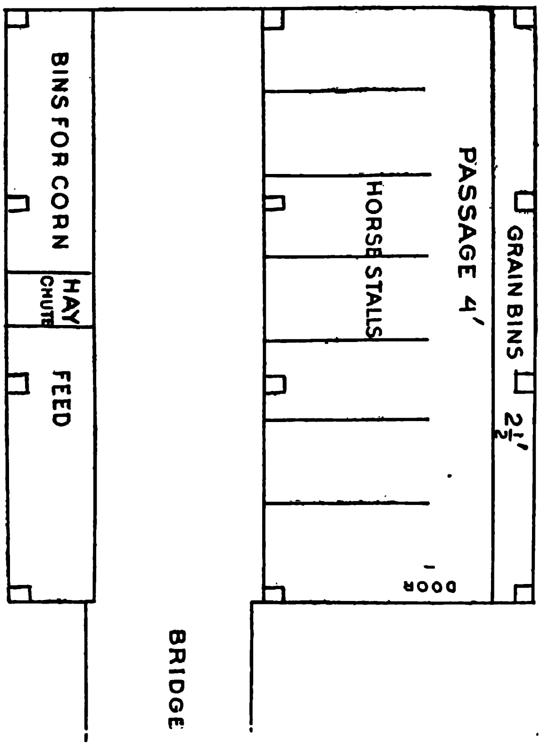


FIG. 58. SMALL STOCK BARN (SECOND FLOOR).

The height of cow stable is 8′ in the clear; of horse stable the same. The horse stable is turned in a different direction from the cow stable, so that a bridge may bring in the horses. One row of stalls is sufficient, and the rest of the space given up to bins and passages. The horse stalls are 5′ wide. (See *Fig. 58.*)

BARN FOR HORSES AND SHEEP.

Figs. 59 and *60* show a design for a barn to accommodate seven working horses in double stalls, two mares in boxes and some sheep. It is joint frame throughout. The size is 32′ x 56′.

Horse stalls are 8′ wide, facing a feed alley 4′ wide, which is pretty narrow, but will serve where room must be economized. The box-stalls are of good size, 10′ x 14′, except that the hay chute is at the bottom, 7′ x 8′ (40″ x 40″ only

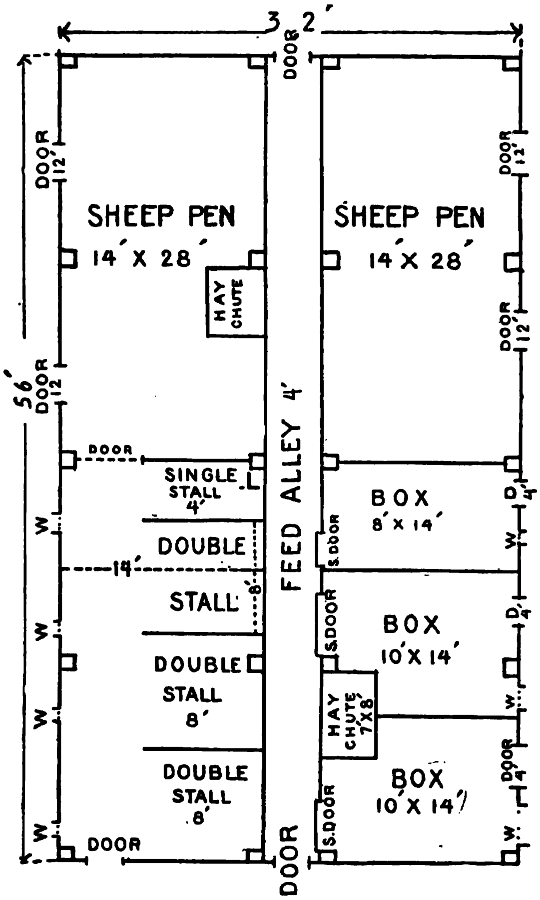


FIG. 59. BARN FOR HORSES AND SHEEP (GROUND FLOOR).

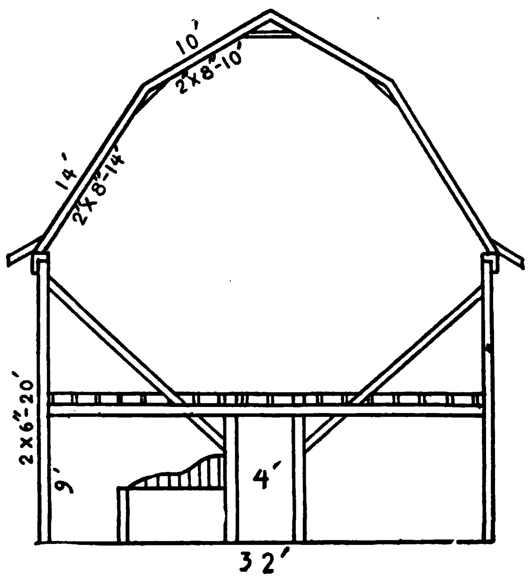


FIG. 60. BARN FOR HORSES AND SHEEP (FRAME).

in upper part), and from this chute hay will be carried to the work horses. There is one single stall.

For the sheep, the feed alley may be taken out and all the pen be thrown together. There would be 784 square feet of floor space with the alley—too little for 100 breeding ewes.

BARN FOR 50 COWS.

There is not a great chance for variation in cow stable construction if the best is aimed at with economy of construction.

Figs. 61 and *62* show a barn with a width of 36'. It gives comfort and better opportunity for cleanliness. Wider is a waste of space.

Much experiment has seemed to recommend that two rows of cows should face each other. In this way the feeder economizes his labor and gets best results, for he sees at a glance how well each cow is taking her feed and if anything goes wrong he quickly knows it. We may adopt the VanNorman cow stall. Between the mangers allow a passage 5' wide and over it a track to convey the feed to the cows from a feed room at one end and from the silo just outside, or wherever may be most convenient to place it.

Three and one-half feet is a good width of stall and that makes the bents of 14' come nicely into play, for then four stalls go in between each set of posts. The manure drop we will make 24" wide and but 6" deep; there is then little danger of the walk becoming soiled beyond the drop, and the shallowness makes it less uncomfortable if a cow happens to step in it.

Lights should be as high as they can be

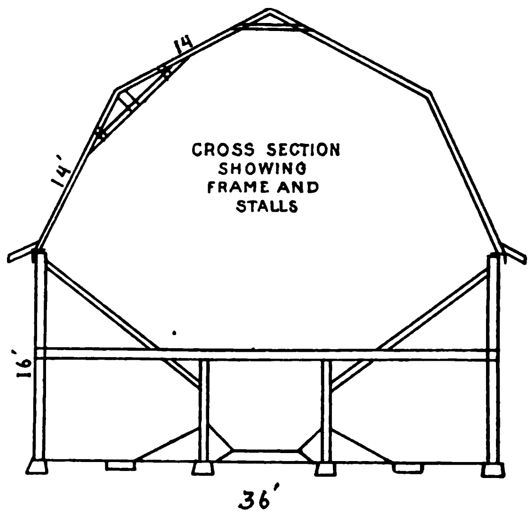


FIG. 62. BARN FOR 50 COWS (CROSS-SECTION).

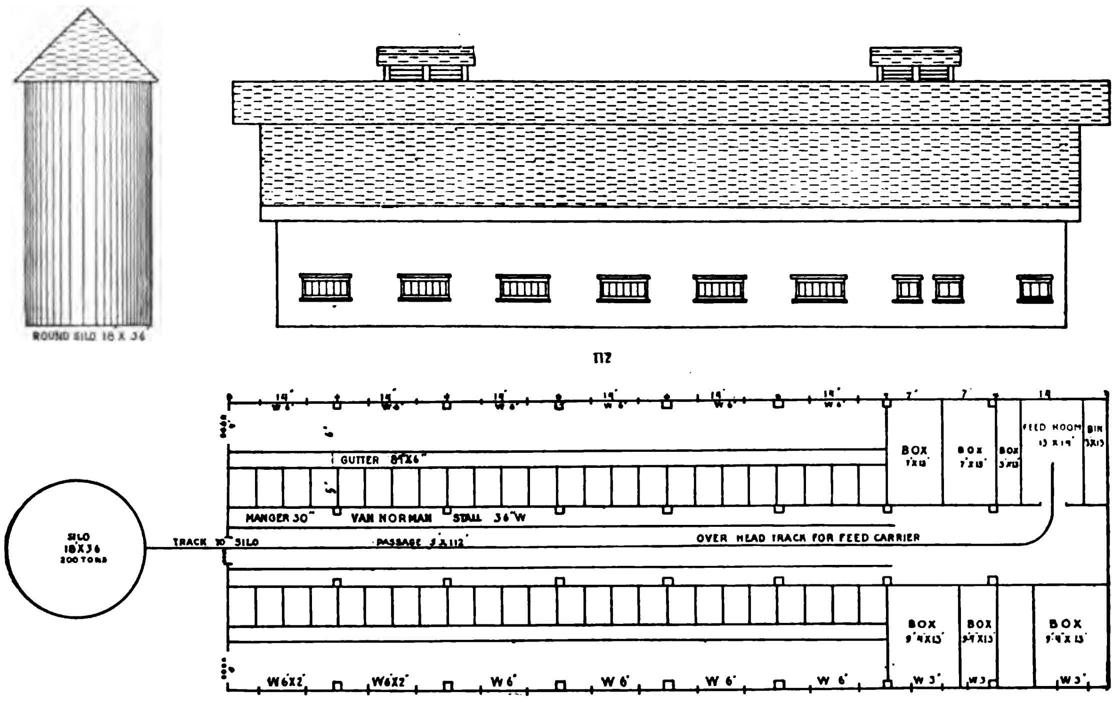


FIG. 61. BARN FOR 50 COWS (SIDE ELEVATION AND GROUND PLAN).

placed, each sash hinged at its lower edge and opening inwardly to permit a current of air to pass over the cow. In this stable we have compromised somewhat by making about half the space window, putting in 6′ of glass in each 14′ space. The glass is 24″ high, so that there is a ray of sunlight of 12 square feet coming in to each 4 cows. A good plan, and not very costly, is to use a greenhouse sash opener that will open or close an entire row of lights at one time by simply turning a wheel at one end. Or each window may have a separate fastening.

Some men have become hysterical over the matter of sanitation and declared that there must be no forage held over the cows at all. They fear that the breath of the cows will contaminate the hay and spread disease. There is little or no basis for this fear. There is not a chance in a million that a cow will by her breath ascending into the hay carry disease to another cow. Moreover, the mow floor should be made so tight that no exhalations of the stable will ascend into it at all. Then the entrances to the hay chutes may have close-fitting doors held shut by weights when not in use. There should be separate airshafts running up between the windows, and reaching to the peak of the roof, where they may discharge through ventilators. These airshafts should be large, much larger than usually advised, and should be made of wood. Iron in a cold climate fills solidly with frost. An airshaft 12″ square inside is none too large for four cows. These airshafts should have openings at the ceiling level that may be closed in cold weather, when they will perhaps take air from the lower end. They will certainly if all else is adjusted.

Now as to the rest of the stable, there must be some box-stalls; we have provided five, which will not always be enough for a herd of 50 cows. There must be the feed room where some grain is stored and all is mixed; there must be bins above the feed room whence spouts convey the grain below; there must be the great loft provided with track and sling carrier, taking in hay at either end, and that is all of the absolute necessities.

In the stable we think there should be three

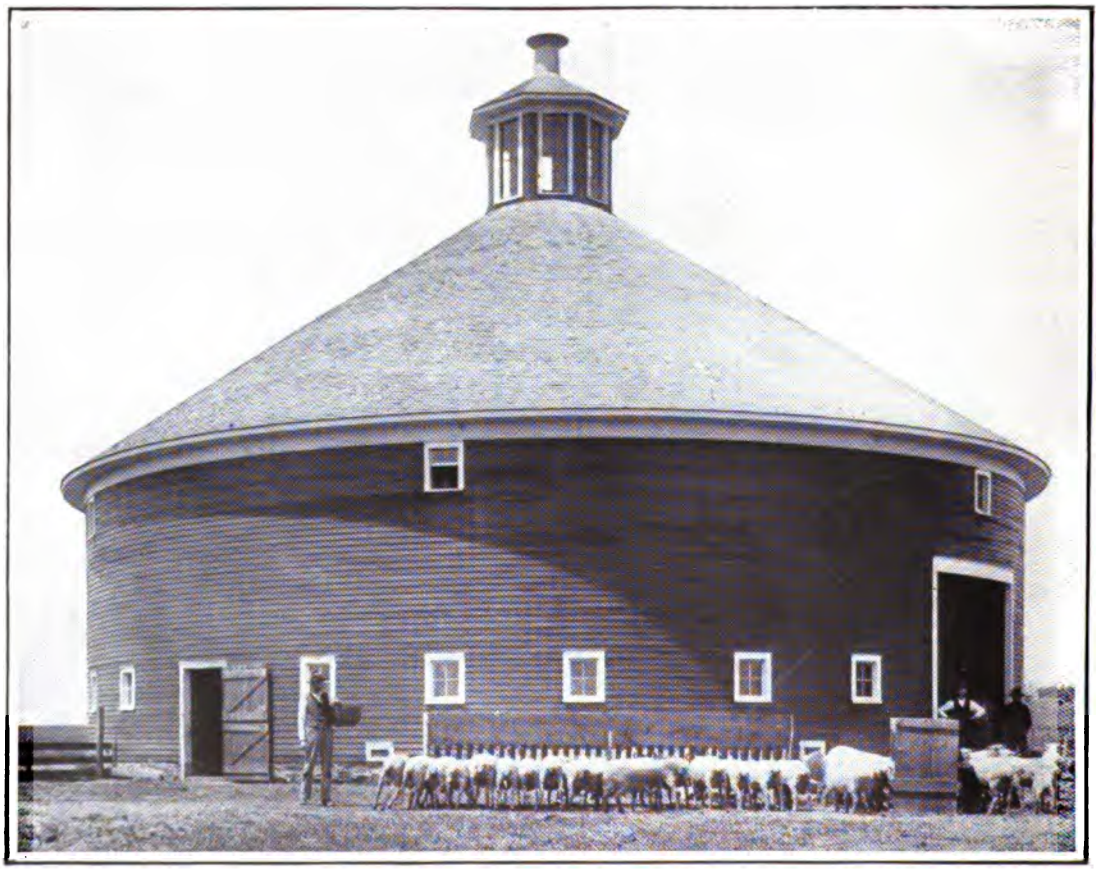


FIG. 63. AN IOWA ROUND BARN (ELEVATED).

tracks—one in the middle for the feed and one behind each row of cows to carry out the manure. The carrier for manure must be of good iron and quite water-tight, easily reversed to clean.

The silo (*Fig. 61*) needs to hold at least 200 tons, unless two are used, and may be built 18'x36', which will just nicely hold that amount. It may be placed where most convenient and is better not to be an integral part of the barn. It must be so placed that the track easily reaches it to carry the silage to the cows.

The floor should be all concrete—alley, feed room and all.

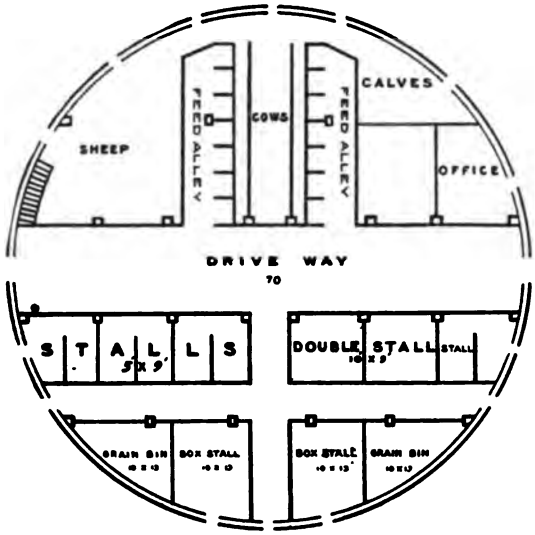


FIG. 64. AN IOWA BARN (GROUND PLAN).

AN IOWA ROUND BARN.

The accompanying photograph (*Fig. 63*) is of a round barn built recently in Iowa. It is 70' diameter with 20' side walls, and is divided rectangularly as shown in *Fig. 64;* the idea being so to arrange the posts that they would be in the partitions and not in the way. There are four parallel cross-beams, or joist bearers, the longest being on the sides of a 12' driveway running clear across the barn. The mow floor is 8' above the foundation walls and the driveway is floored over high enough for a load of hay to be driven in, except a space of 20' in the center where the hay is taken up. After a careful study of the methods of getting hay into such barns the slack rope carrier was adopted.

The roof is entirely self-supporting, there be-

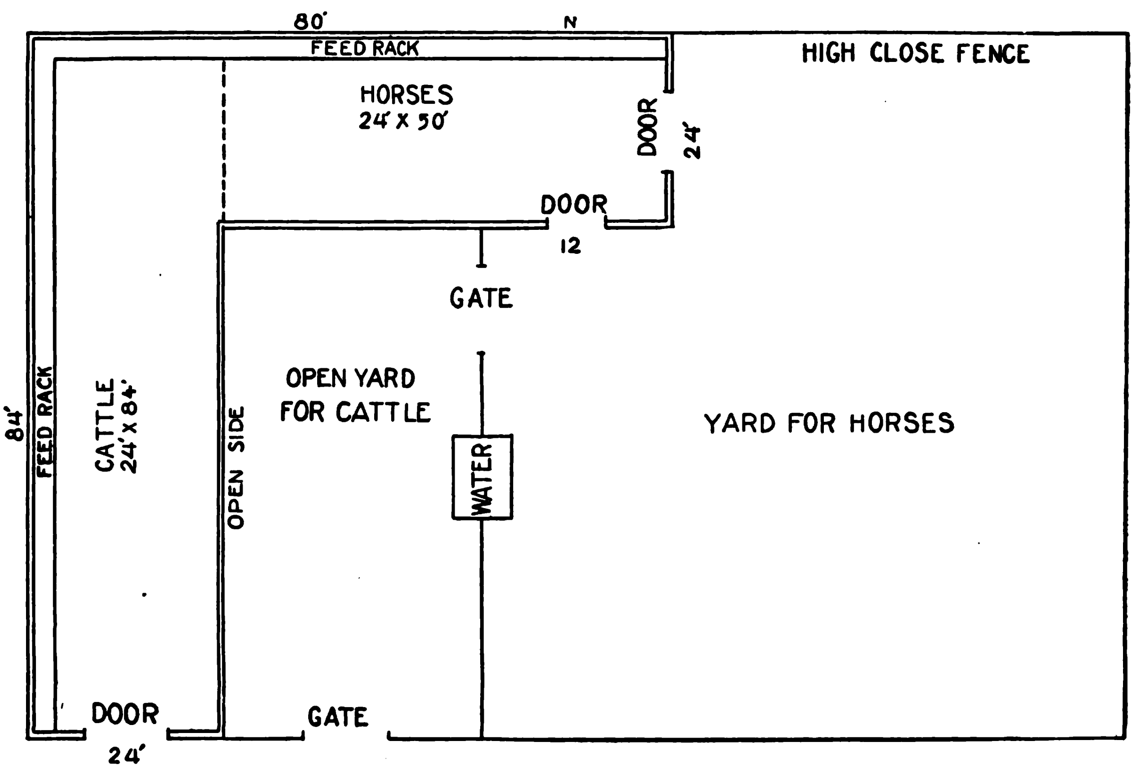


FIG. 65. BARN FOR CATTLE AND HORSES (GROUND PLAN).

ing no posts or obstructions in the mow. The first rafters are 20′, the upper ends resting against a 40′ hoop made of inch boards bent around until six thicknesses are in place; then the upper rafters (18′) start from this hoop and run to another 10′ in diameter, this hoop being made of 2″ lumber which sawed in a circle with four thicknesses, the cupola resting on this. This makes a barn as solid as a rock and is just the thing for a windy country.

BARN FOR CATTLE AND HORSES.

Fig. 65 shows a narrow barn, 24′ wide, with two long wings making a sheltered L, one wing being 84′ long, the other 80′. This can be built in 16′ sections or bents, and of very simple and cheap joist construction, with ample hay-carrying room overhead. We allow 40 square feet for each animal, supposing them to run loose, and if they are dehorned we have ample room for 60 head. The cattle have the most sheltered yard, as they need it most, and the horses a larger yard where they can exercise. The horse yard has an added protection of a high close-built board fence.

One water tank serves both and roof water may fill it much of the year. Make the barn so that you can readily drive through it and put movable feed racks in beside the permanent one along the wall, into which hay may be thrown at any point.

These long narrow-winged barns, sheltering the yard from wind and storm, are by odds the most comfortable, sanitary and practicable stock barns, especially where the desire is to fatten the animals.

HAY BARN WITH SHEDS.

Figs. 66 and *67* represent a hay barn for allowing the hay to rest upon the ground and with sheds on each side.

Erect the sheds first, on each side of the 24′ space in the center, then put up the rafters in the middle. The drawing shows the frame so plainly that any carpenter can or should erect it. The whole is of 2″x8″ stuff except the plates, which are 2″x10″. The purpose of the long brace in the shed, running from near the foot of the short post, is to carry the thrust of the rafters down as near to the ground as possible, seeing that there are no cross ties at all in the barn.

The rafters are all 2″x8″.

Make blocks of concrete for foundation and set in each one a ¾″ iron pin that will project throught a 3″ block about 10″x10″. The ends of the posts will then toe-nail with spikes nicely to this block. There should be an overhang to shelter the door in the end and the track in the

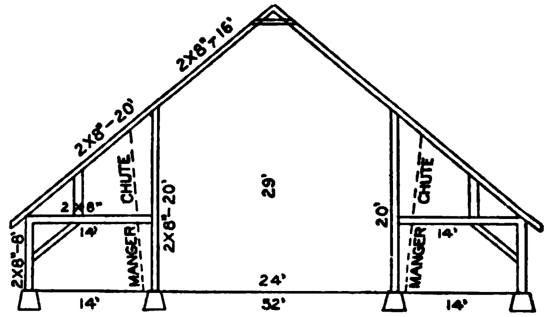


FIG. 66. HAY BARN WITH SHEDS (CROSS-SECTION).

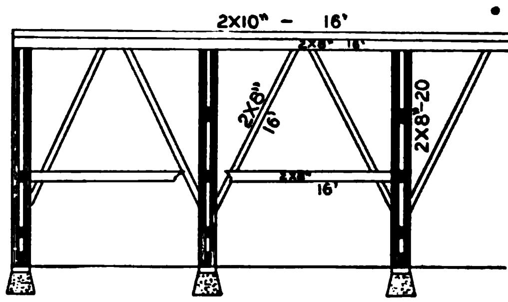


FIG. 67. HAY BARN WITH SHEDS (DETAIL).

peak. Put in a sling carrier of the strongest make. There should be a continuous manger along the side and a long chute above it into which hay may be thrown from the mow.

A DAKOTA PLANK FRAME BARN.

The illustration in *Figs. 68* and *69* is the plan of a South Dakota general-purpose plank frame bank barn 36′x72′ with solid concrete basement. The first story of 8′ is of 12′ studding with 16′ rafters. The first half of the roof covers 10′. The purlin plates and posts are made of three 2″x6″ used as shown in the illustration. A driveway runs lengthwise of the first story, and will be used mainly for horses, a few cows and machinery. The floor plan is shown in the drawing, 14′ being allowed for horses, with 8′ feedway between; water is had at a convenient place. There is a 5′ passageway alongside. Manure is dropped through trap doors into a wagon in the basement driveway and hauled direct to fields. Granaries all have spouts into the basement. Instead of a post in the 24′ square for vehicles a truss is placed up in the mow, which holds nearly 100 tons of hay. The granaries hold about 2,500 bushels of small grain. There are 34 25"x26" single light sash in the first two stories and four six-light sash

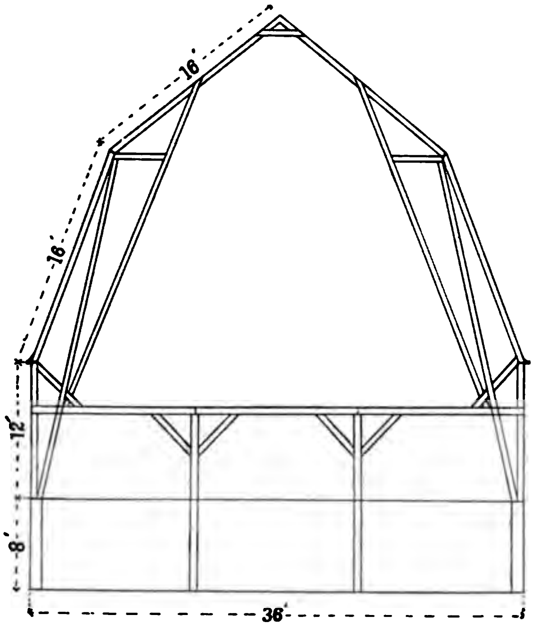


FIG. 68. DAKOTA PLANK FRAME BARN (CROSS-SECTION).

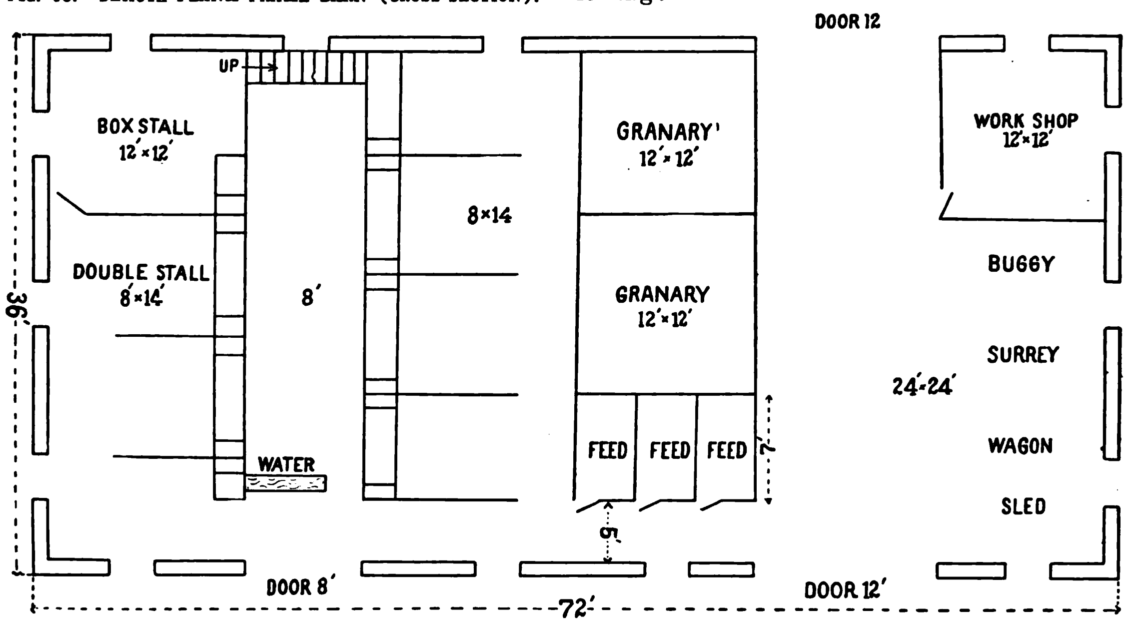


FIG. 69. DAKOTA PLANK FRAME BARN (FLOOR PLAN).

in the gables. The roof stands very rigid in severest winds and will not sag at the comb.

STOCK BARN WITH HAY IN MIDDLE.

The cross-section of the frame shows clearly the manner of building the barn illustrated in *Fig. 70.* The central part is all for hay, 32' wide, 36' deep to peak of roof, without cross ties, and with sheds on either side 13' wide. These sheds may be made wider, though the design is for 16' rafters. If longer stuff is used they may have purlin plates in the middle, upheld by braces from the long posts.

It will be seen that this frame is without cross ties. It must be erected with sheds first put up, and shed rafters on, which will hold the thrust of the roof. Then the inner brace *B* will be very thoroughly fastened at the upper ends to the post, the tie is firmly held at each end, and the foot of the brace anchored solidly to a large concrete footing set in the ground. This will effectually hold the barn from spreading and leave no obstructing cross ties anywhere. The short braces under *B* are merely to hold any weight of hay that might come upon them. Fasten the foot of each post to its concrete base. This barn may be of any length, using 12', 14' or 16' spaces as desired, 14' being a good distance.

STABLE FOR HORSES, HOGS AND COWS.

A reader of THE GAZETTE submitted the following:

"I want a stable for six horses—single stalls, two box-stalls and stalls for two cows. Along the south side I want pens for about eight sows, or what figures out conveniently, with an alleyway in which I can throw hay at one end to put in horse mangers, horses facing this alleyway.

I would possibly put a partition through mow so that over sows I could put straw directly from thresher. I would also like carriage room for one carriage and two buggies and if convenient a bin for oats. I would like a cement or dirt floor and mow room for about 15 tons of hay."

The accompanying sketch (*Fig. 71*) was designed to meet the requirements. Only the ground plan can be given, leaving the structural details to be worked out by the builders. The width of 32' should be suitable, as with plenty of windows on the sides it can be made very light and airy. Posts 16' to the square and stable part 8' to under side of joists will leave a mow capable of holding more than the 15 tons; in fact, posts of 14' would serve all right.

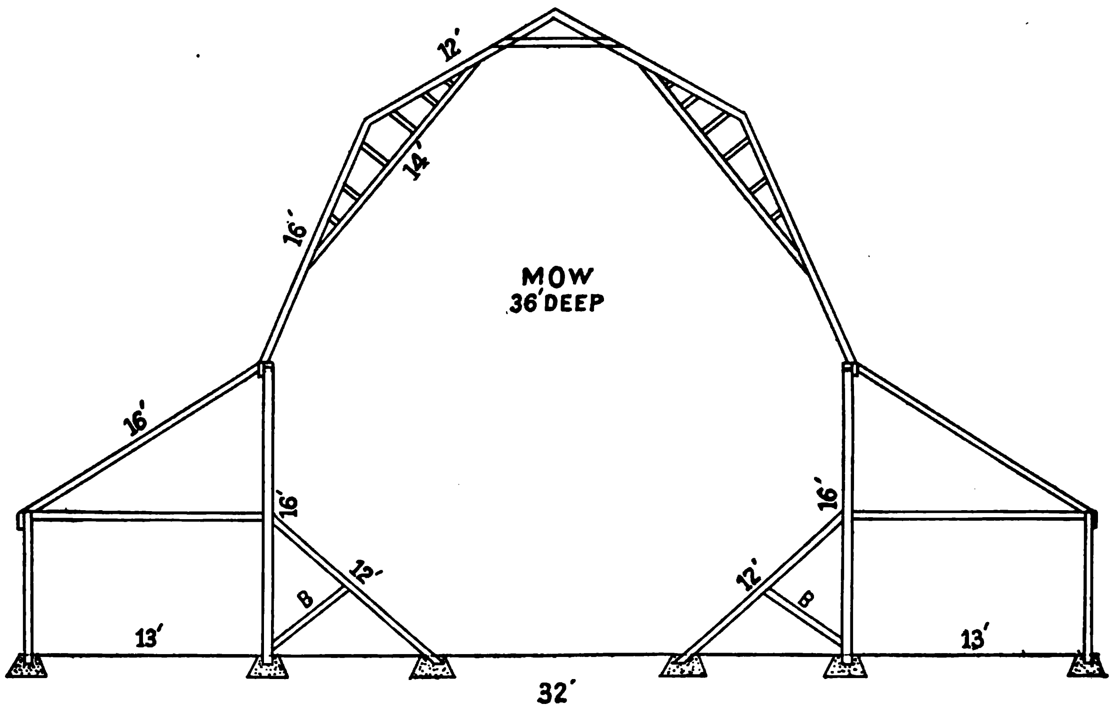


FIG. 70. STOCK BARN WITH HAY IN MIDDLE (CROSS-SECTION).

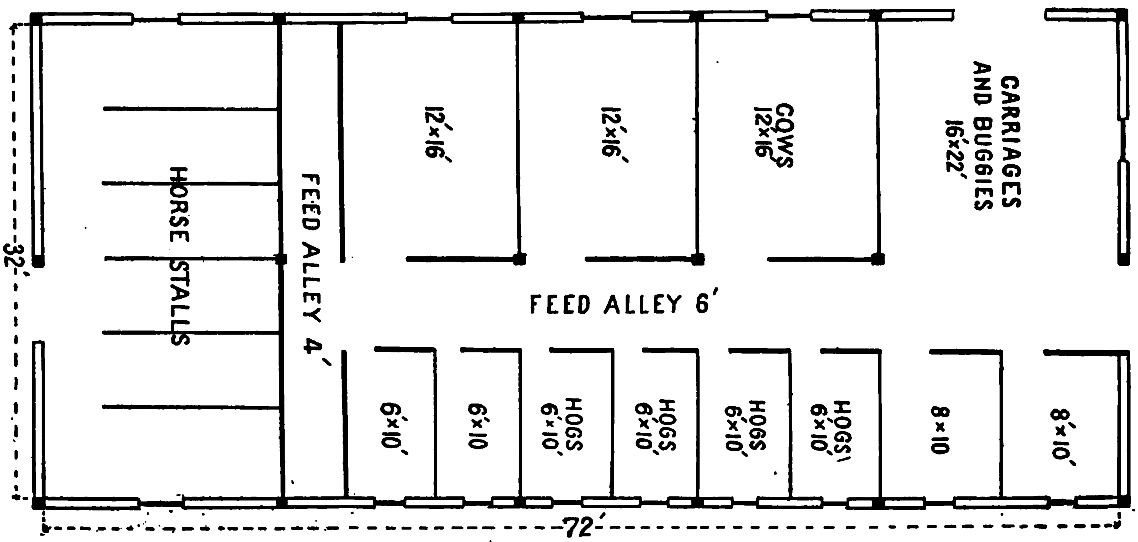


FIG. 71. STABLE FOR HORSES, CATTLE AND SHEEP (GROUND PLAN).

CATTLE BARNS.

The ideal location for the barn should be as nearly as possible in the center of the farm. The dwelling of course should be near. The advantage of having as many pastures and fields directly connecting with the barns is obvious. Time, distance and labor are saved, and oversight at all seasons of the stock made more convenient. The character of the site, however, is of still greater importance, and perhaps there is nothing worse than a low, flat, undrained barnyard and adjacent lots. Strange to say, however, nothing is more common.

If such a location is unavoidable, then it will pay to use all the resources of drainage, tile and stone, till even the longest wet spell loses its terrors and planks and rails no longer are needed as bridges to cross the depths and reach the barn door. Wet, and not cold, is the greatest enemy to thrift and flesh, and the floors of all sheds and pens should be high, dry and well drained. The importance of a sufficient number of well fenced, conveniently arranged lots of sizes from a hundred or so square feet up to an acre or two should not be overlooked. There are never too many. There is an infinite variety of wants met by an infinite variety of circumstances, mental peculiarities and financial conditions, resulting in a corresponding variety of farm buildings.

Good air, good light and dryness are foremost in importance; they go together. One of these qualities lacking, the others are almost sure to be absent. The dark, cavernous recesses of very large barns are seldom ventilated or dry. The heavy foundations imply a basement dark, damp and malodorous. The great roof and floors mean heavy timbers, much skilled labor and expense, and last but not least is the chance that some winter night the structure vanishes by fire. More desirable are two or more smaller buildings, all above ground, on light foundations, light timbers with but little framing and far enough apart for some degree of safety from fire and a chance to save life. There should be doors on every side and ample windows. Nothing is so cheap as sunlight and yet nothing is so scarce in the average barn or stable. Another great advantage of somewhat scattered and smaller buildings is the possibility of dividing up the stock and obtaining direct access from different lots and pastures for different classes of stock. It is not uncommon to see in the middle of the night, in a large barn, 100 cattle aroused and disturbed by one uneasy heifer or lost calf.

Plank flooring is to be avoided if possible. It is unsanitary. Broken stone (8") with here and there a 3" tile running to the outside, with 6" of porous, yellow clay on top, wetted and tamped, hardening like a brick, will always be dry, never slippery, needs only here and there after the winter is over a little fresh clay and affords no harbor for rats. Many breeders prefer cement floors, which are in common use. Have no narrow, contracted passageways in which the larger cattle will crowd and jam together. A favorite arrangement seems to be a narrow feeding alley, two rows of cattle, heads in, and two narrow passageways behind the cattle. This is a misuse of space, more expensive and no more convenient. Far better have one wide space, not less than 10′, which is less than the 3′ in the center, in which the cattle have ample room quietly to walk to their stalls, where they stand heads to the wall. A hand-cart may be used to distribute the feed (before the cattle come in at night) and every animal always has the same stall. A noted cattle breeder is quoted as saying that time and again he has seen 70 head of cows walk into such a stable from three entrances and be tied up by two men and munching their feed in 20 minutes, with neither noise, hurry nor confusion.

Every barn should have a mow sufficient at least to supply its inmates with the winter's hay, bins for bran and prepared feed, but it is the opinion of many farmers that the corncribs should be separate and distinct structures.

In latitudes where the mercury only now and then falls below zero animals suffer more from the barn being too warm and close than from cold. In fact, but for the difficulty of properly apportioning feed, so far as health is concerned, a good, deep shed, say 20′ from front to rear, with a hay-rack and plenty of bedding, is better than a barn; the air is pure; there are no draughts and no over-heating and no chilling. Health and vitality are in direct proportion to pure air, and well bedded is half fed.

No matter how perfect the barn may be nothing can take the place of abundant bedding, and convenience in getting it in and getting it out (in the shape of manure) easily and rapidly is a thing indispensable. As a rule the manure should go direct from the stalls to the pastures and cornfields. As long as small grains will pay the cost of production the straw is a sufficient profit to justify the stockraiser in growing it. Sawdust and even dry leaves are useful if straw is lacking. Water in the barn is not always a success. A large central tank supplying drinking troughs in every lot, filled with covers to be closed at night in the winter, seems to serve every purpose, and it is a rare day when all kinds of stock should not be turned out for a few hours at least. Thirsty cattle coming suddenly out of an overheated barn may be hurt by drinking ice water, but the cold air has the same effect where the barn is warm. Tank heaters are in common use in cold latitudes to take the chill off the water.

In the case of heavy doors nothing but the best of rollers should be used, the track of iron, put up as true and solid as it is possible to have it, and then watch and keep clean the groove in which it runs to the bottom. Box-stalls should be built wherever a roof can be extended along the sides without cutting off the light and air from the main building. A long shed closed in front and divided into box-stalls, on the north side of a lot, is of great utility. One or two extra warm ones should always be provided a little to one side for winter-night calving, sick animals and the like.

Many patent fastenings have been suggested and advertised, but after all nothing in practice has been found more convenient, more speedy or more safe than the old-fashioned German chain cattle tie with about a foot play on a vertical ½″ iron rod under the edge of the manger. The cattle have perfect freedom up and down and can reach to the center of the manger of an 8′ or 9′ double stall. When taken off the cattle the end ring should be hooked over a nail in the side of the stall just above the animal's neck, where it is just in place for use at night.

A KANSAS CATTLE BARN.

The diagram, *Figs. 72* and *73,* as will be seen, fully carries out the idea that an expensive, elaborate barn is not a necessary adjunct to successful cattle breeding in the western states, but that reasonable shelter for the herd from the rigors of winter and some little outlay for the protection of the hay is in keeping with the best principles of economy. This barn was built by W. A. Harris on his farm in Leavenworth Co., Kansas. This unpretentious yet admirably arranged building was built many years ago and has given the best of satisfaction. The materials used in its construction were as follows: 32 telegraph poles, 20′ long; 32 telegraph poles, 25′ long; 6,000′ of boards, 16′ long; 30,000 shingles; 400 battens, 3″x½″, 16′ long; 34 sash, 4 lights, 10″x12″; 4,500′ of

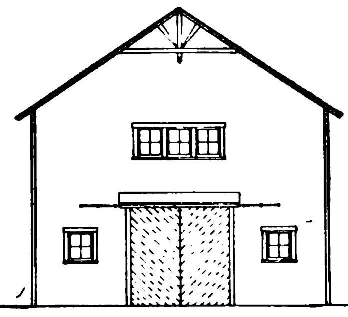


FIG. 72. KANSAS CATTLE BARN (GROUND PLAN).

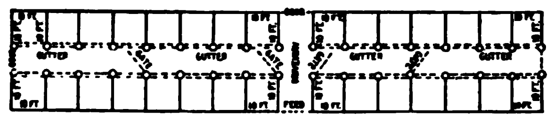


FIG. 73. KANSAS CATTLE BARN (GROUND PLAN).

flooring; 200 joists, 2″x8″, 16′ long; 2,500′ of rough boards; 250 pieces, 2″x4″, 16′ long; 1,400 of masonry in underpinning.

Points in favor of this cattle barn are cheapness, light, ventilation and ample room. The wide alleyway permits the ready and uncrowded passage of cattle, and the same is true of the stalls. Wagons go through and take up the manure, which goes direct to the fields. Bedding is distributed in the same way, and hay from the outside is distributed in this way, holding in reserve that in the mow. The dirt floor is cheap and never slippery. The holes which wear are readily filled by a load or two of dry earth which is at once an absorbent and deodorizer. All the windows open on one side or the other (to the leeward) and obviate "wheezing" or "coughing." It was built by two carpenters and four laborers in 30 days and cost about $1,100. The mow holds nearly 140 tons of hay by filling up after the first has settled.

THE MORGAN COW BARN.

The barn shown in *Figs. 74* and *75* is T-shaped, 412′ across the front and extending back 280′. It was recently built by F. W. Morgan on his Rock Co., Wis., farm. The entire barn covers about three-quarters of an acre. There are two silos in connection with the barn, the

FIG. 74. MORGAN COW BARN (ELEVATION).

forward one being 25′ inside diameter with 18″ walls and 40′ high with 8′ in ground. The other silo is 30′ inside diameter and 40′ high. Both are constructed of grout, a mixture of four parts ordinary gravel, two parts sand and one part Portland cement. These silos have given good satisfaction. The entire floor of the barn is also made of grout. A patent roofing is used in covering both the sides and roof. This is composed of layers of felt, burlap and felt, the three coats being cemented together with asphalt. The sides are battened. The frame is composed of 2″x10″, 6″x6″ and 2″x6″ planks and is of ordinary construction. In the center of the barn is an open space in which is a weighing scale and from which silage can be loaded and carried to feed troughs under cover. The maternity stable has double rows of posts equidistant apart with grooved sides into which portable gates can be placed, thereby forming separate stalls 28′ square for each cow and calf. There are eight bull stalls 16′x25′, each one with separate door into yard.

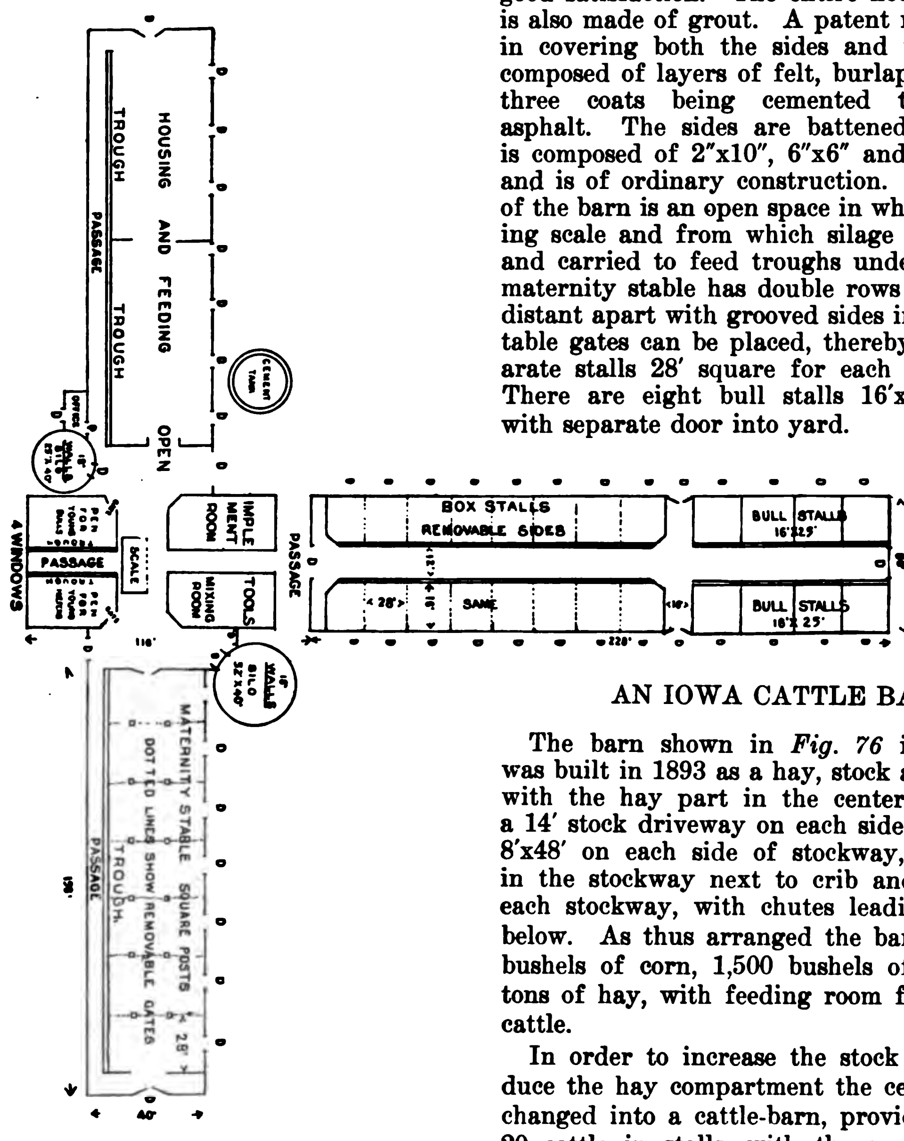


FIG. 75. MORGAN COW BARN (GROUND FLOOR).

AN IOWA CATTLE BARN.

The barn shown in *Fig. 76* is 48′x68′. It was built in 1893 as a hay, stock and feed barn, with the hay part in the center 24′x48′, with a 14′ stock driveway on each side and corncribs 8′x48′ on each side of stockway, with troughs in the stockway next to crib and oat-bin over each stockway, with chutes leading to troughs below. As thus arranged the barn holds 3,000 bushels of corn, 1,500 bushels of oats and 65 tons of hay, with feeding room for 40 head of cattle.

In order to increase the stock room and reduce the hay compartment the center part was changed into a cattle-barn, providing room for 20 cattle in stalls, with the same stock room outside of this as before. A feed-bin 8'x6'x48' was built, with a chute to stalls below. There is room for 60 cattle (20 stalled), 3,000 bushels of ear corn, 1,500 bushels of oats, 1,000 bushels of shelled corn or ground feed and about 40 tons of hay. The frame is white oak poles set in ground every 8' except at cribs, where they are 4' apart, with additional foundations set one stone under each crib.

frame, the girders, posts and some other members being built up.

This makes a much stronger job and saves time in the framing. The rear 45' of the first floor is used as the main mow. The bents which form the frame in this part of the barn are so constructed that no cross-tie beams are required. This arrangement requires less labor and material and makes a stronger construction,

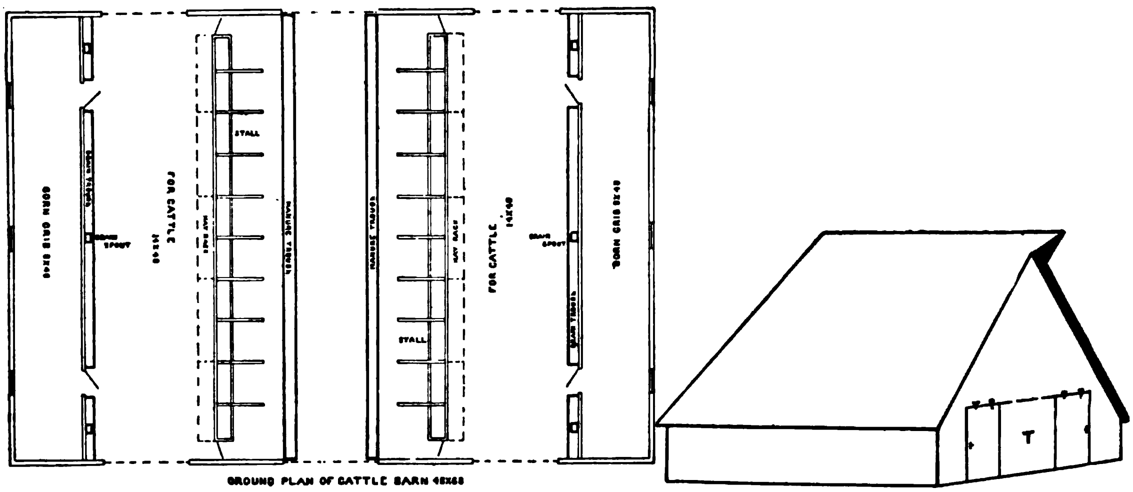


FIG. 76. AN IOWA CATTLE BARN (FLOOR PLAN AND ELEVATION.)

A HAWKEYE CATTLE BARN.

The cattle barn shown in *Figs. 77, 78, 79* and *80* was built for C. S. Barclay, of Muscatine County, Iowa. The capacity of the barn figures as follows: Hay, 240 tons; grain, 9,000 bushels; cattle, 100 head; horses, 10 head. The frame is balloon construction and all of native hardwood, the lumber being sawed on Mr. Barclay's farm. With the exception of the 4"x12" sill there is nothing thicker than 2" in the

besides doing away with the objectionable tie-beams. The frame is all securely bolted together.

A dump elevator and grinding machinery are so installed as to save much labor. (See *Fig. 80.*) The power required to run the machinery is furnished by a 12-horsepower portable gasoline engine. Chutes are so arranged that all kinds of feed are accessible in the feed room without handling. A water supply is also installed.

The floor in the driveway of the basement and also in part of the stalls is of paving brick laid

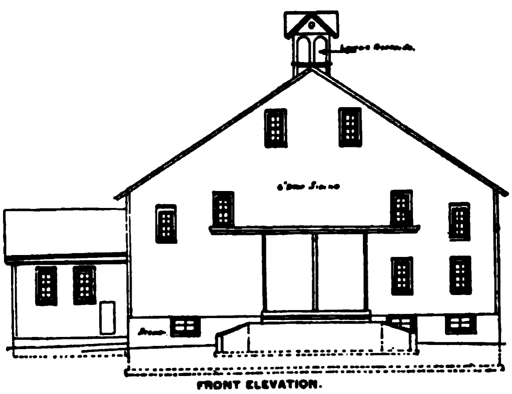


FIG. 77. HAWKEYE CATTLE BARN.

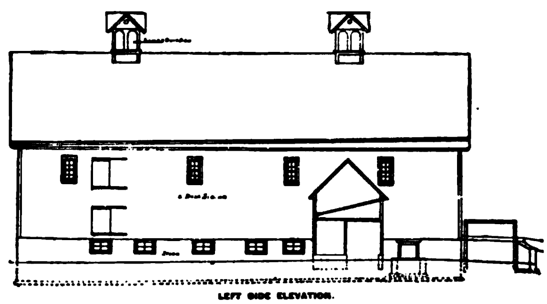
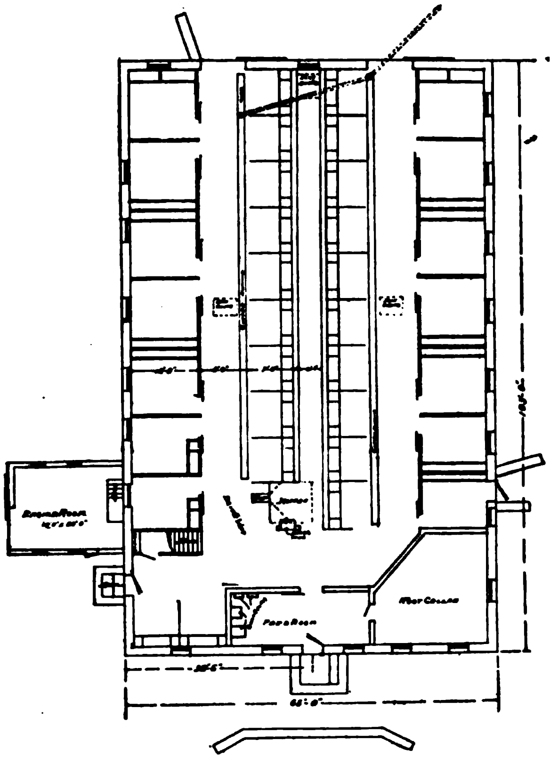
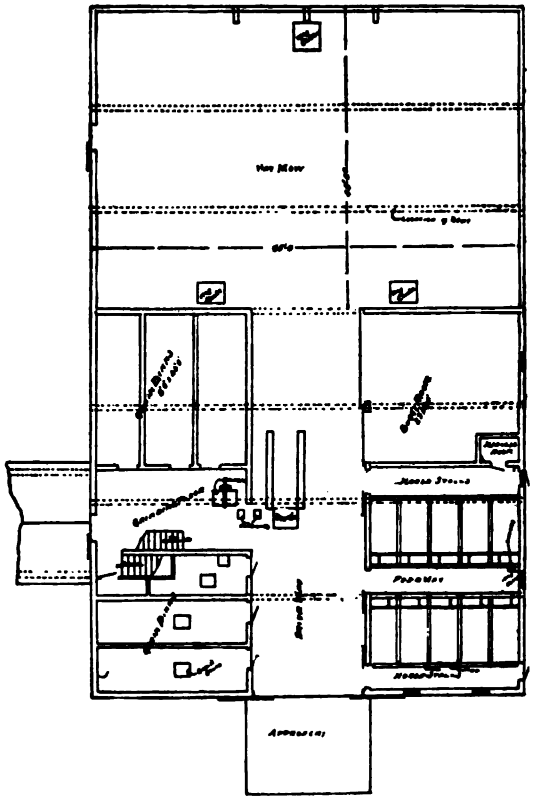


FIG. 78. HAWKEYE CATTLE BARN.



BASEMENT PLAN.

FIG. 79. HAWKEYE CATTLE BARN.



FIRST FLOOR PLAN.

FIG. 80. HAWKEYE CATTLE BARN.

on a bed of sand, the cracks between the bricks being washed full of thin cement. The remainder of the floor in the basement is of concrete. The floor for the horse stable, which is on the first floor, is of concrete.

Behind the stalls the concrete is covered with 2" flooring. The stalls are provided with hardwood gratings, which can be removed for cleaning. The cattle mangers and feed-racks are a new departure. The barn cost about $6,000 when it was built a few years ago.

ANOTHER KANSAS CATTLE BARN.

This barn is built of joist construction, no piece being more than 2" thick. It has ample storage for all the cattle that can get beneath the roof and is so constructed that winds have little effect upon it, the low roof deflecting them harmlessly upward.

The dimensions are 60'x112'. It is so designed, however, that the length may at any time be increased by adding more bents. The principle of construction is clearly shown in *Fig. 81,* an end elevation showing a doorway framed to take in hay from the outside. This feature is not in the barn as built.

This barn has the open-center which admits of hay being unloaded by slings and carriers that do not raise the hay higher than just enough to clear the level of the top of the mow before they swing back.

The interior arrangement as adapted to the feeding of young beef cattle also is shown in *Fig. 81.* The exterior is nicely presented in the diagram.

This barn has been extensively copied. It is unique in that it dispenses with siding except at the ends, and for strength, cheapness and general desirability it has hardly a rival in the class of large barns.

AN INDIANA CATTLE BARN.

One of the largest and best cattle barns in the country is that erected by F. A. Nave, of Fountain County, Ind., for his Fairview Hereford herd. Its construction is clearly shown in the diagrams from the architect's plans. The dimensions are 120' long, 64' wide and 18' to the eaves. It runs east and west and is set into a bank that affords driveways from the level onto the upper floor at the east end and the

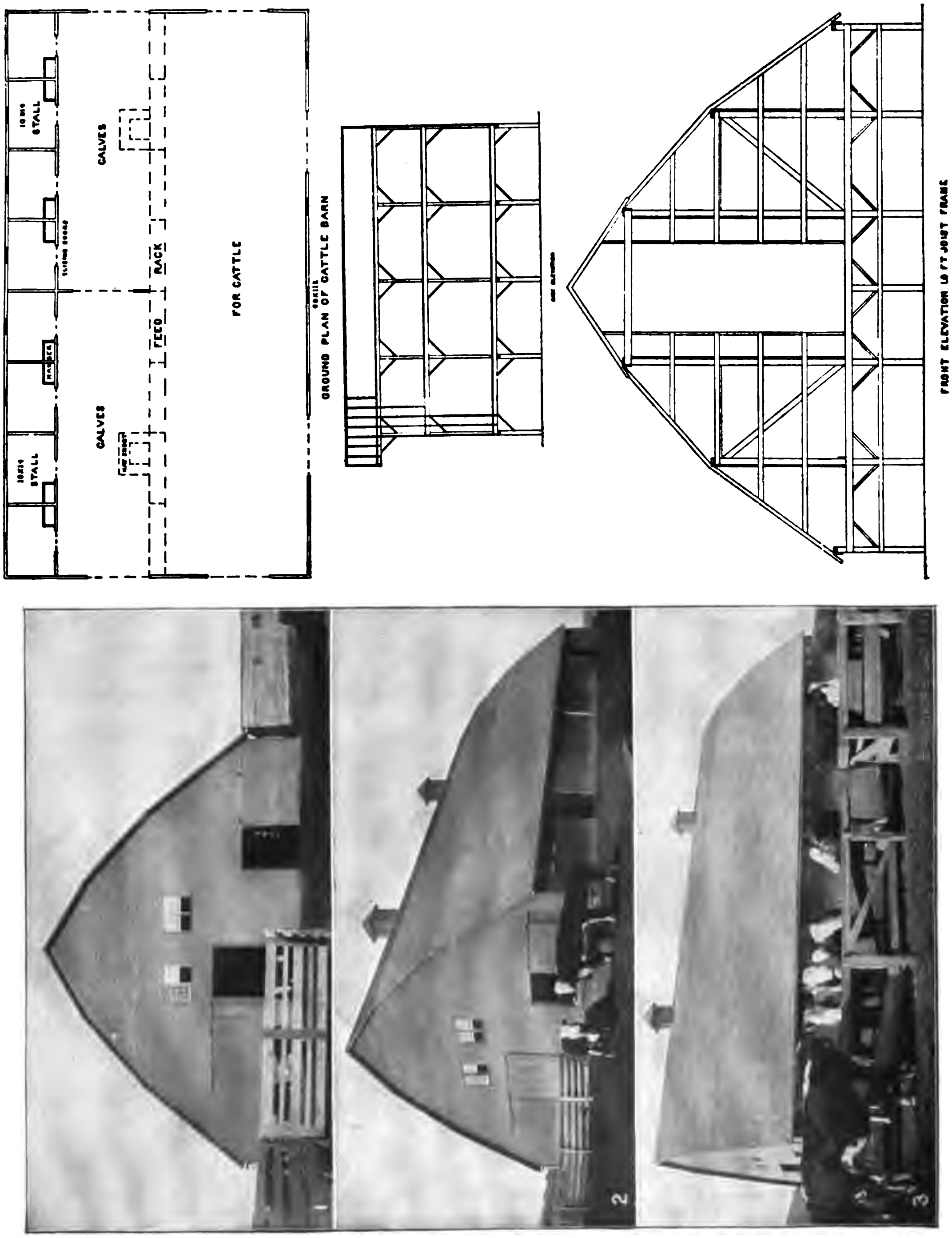


FIG. 81. ANOTHER KANSAS CATTLE BARN (ELEVATION AND FLOOR PLAN).

northwest corner. A heavy stone wall runs along the entire east and north sides, but the ground falls away sufficiently on the north to allow of ample window space. Doors open at frequent intervals on the south side into good-sized and well drained paddocks, and the fall is equally good on the west. *Fig. 82* shows the rear (west) elevation, and also the engine-house and water tank. A large gasoline engine pumps water and runs corn-sheller, grinder, fodder-shredder and hay-cutter on the upper floor. While possibly a little power may be lost in transmission, yet the engine is adequate, and this small loss is more than compensated for by the protection from fire in this detached engine-house. The well is equipped with a 6″ pipe and the supply is fairly inexhaustible. Hot and cold water is on tap in the barn. The entrance to the huge upper floor for hay and corn-fodder is at the corner nearest the engine-house.

The side of the framework is shown in *Fig. 83.* The posts are all set on stone foundations. *Fig. 84* gives an idea of the framing of the barn, showing an end and an inside bent. The ends are strongly framed and a very large inside space is clear. The ground plan is indicated in *Fig. 85,* which shows the arrangement of the stalls. A row of large boxes runs through the

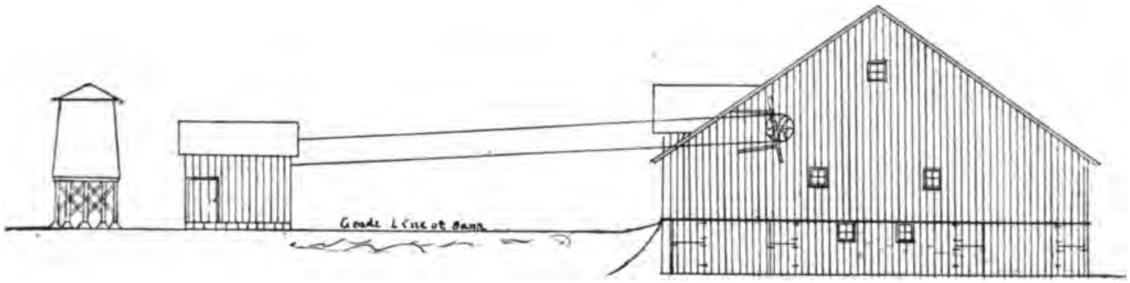


FIG. 82. AN INDIANA CATTLE BARN (REAR ELEVATION).

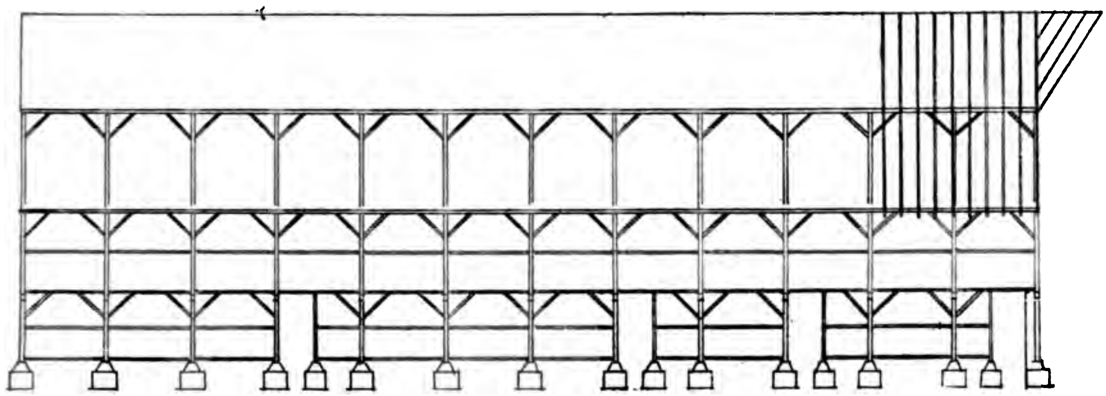


FIG. 83. AN INDIANA CATTLE BARN (FRAMEWORK).

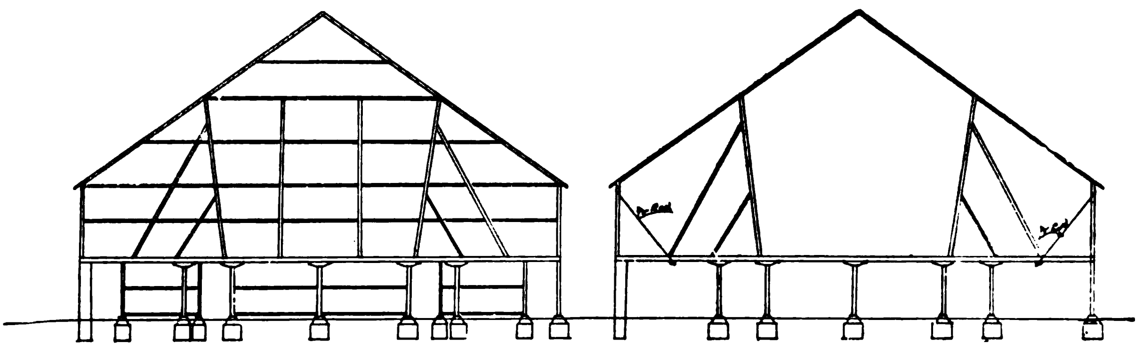


FIG. 84. AN INDIANA CATTLE BARN (CROSS-SECTIONS AND FOUNDATIONS).

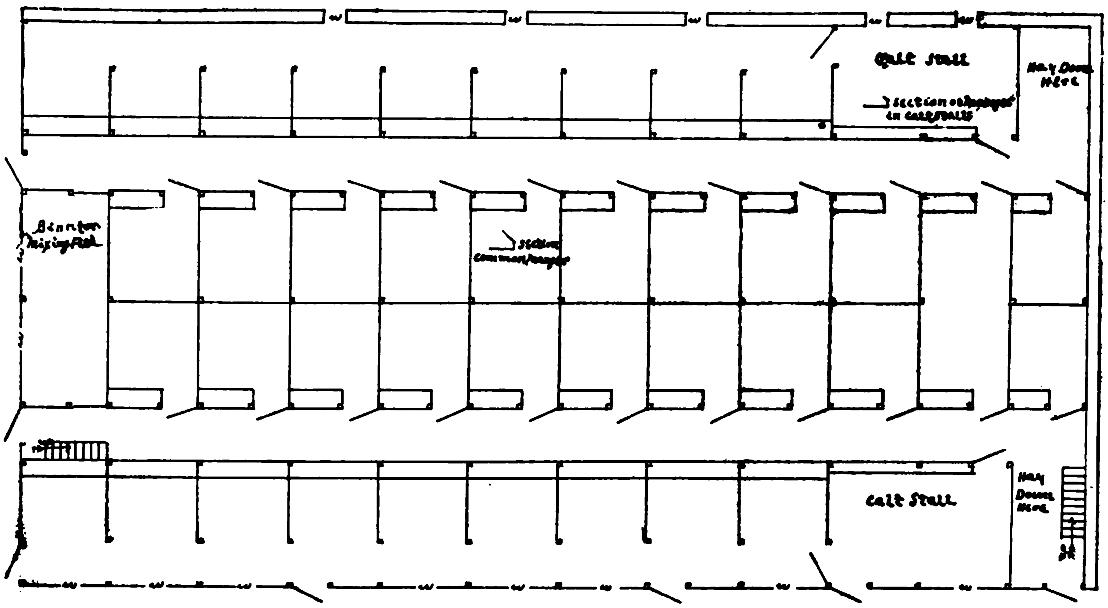


FIG. 85. AN INDIANA CATTLE BARN (GROUND FLOOR).

center and the middle partitions through the entire row are movable, so that two boxes may be thrown into one. On either side the cows with calves may be tied, two to a stall, although each stall will comfortably accommodate three cows. The convenience of the calf pens needs no explanation. This barn is very substantially built but without extravagance. It was designed throughout by Mr. Nave as the most convenient plan that he could figure out for the economical care of a large herd. It will easily accommodate 150 head of cattle, and 200 head may be

FIG. 86. A HOOSIER CATTLE BARN (ELEVATION).

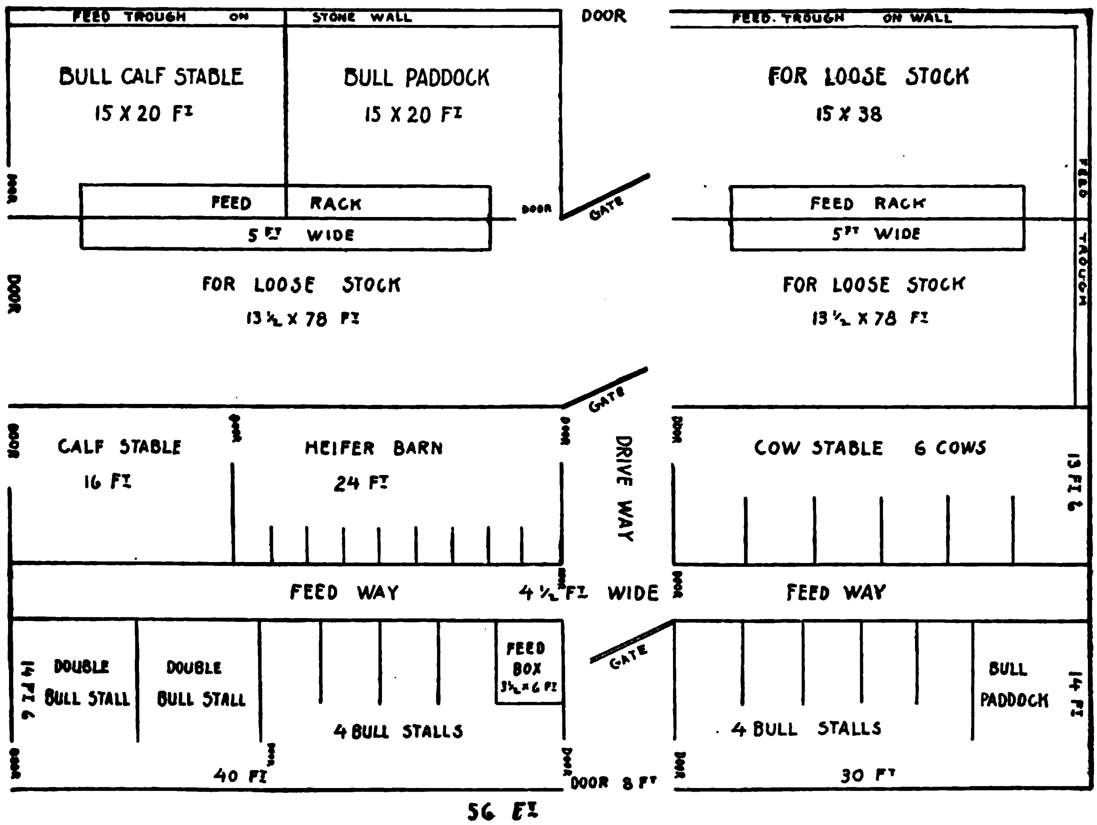


FIG. 87. A HOOSIER CATTLE BARN (BASEMENT PLAN).

comfortably housed without crowding. The second story will hold all the provender and forage needed for a large herd, thus doing away with the necessity of hay barns and fodder stacks. In the west end the mill rooms are located, and the prepared feed drops below to the mixing floor.

A HOOSIER CATTLE BARN.

Figs. 86 and *87* show the ground plan, interior arrangement and elevation of one of the large cattle barns on the farm of J. H. Miller, of Miami County, Ind. The arrangement of this barn is very convenient, and while it is large and roomy it has not cost an extravagant amount of money. The advantage of the arrangement of the different stalls and paddocks will be readily perceived, and it will be noticed that a wide driveway extends through the barn from north to south, so that the stalls can all be conveniently cleaned and the manure hauled away readily without much extra labor.

The feed-bins are on the second floor with chutes to the basement. There is a traveling feed-box of about ten-bushel capacity swung to a steel hay track above the feedway, running the whole length of the barn, 78′. Above the basement is a large hay mow and rooms for feed and machinery. The basement itself is 8′ high, the posts are 12″x12″; joists, 2″x12″; braces, 4″x4″; rafters, 2″x4″ and the barn cost about $2,500.

AN OCTAGONAL CATTLE BARN.

An octagonal barn that will accommodate about 50 head of cattle is shown in *Figs. 88* and *89*.

The octagonal form has always seemed open to the objection of being hard to fill with hay and more difficult to arrange in the interior. However, it may be that the great amount of space secured at the cost of a much less amount than in the square form more than balances the objection. This octagonal barn of 25′ on a side has in it about 800 square feet more space than the same amount of wall in a square form. That is equal to gaining a barn 20′x40′. However, the main objection, that of filling the barn, remains to be attacked. This may largely be overcome by erecting a gable on one of the sides of the roof and running a track in from that height which may be carried across to within 20′ of the opposite side, and that will serve very well to distribute the hay.

The walls should be made 24′ high, the basement 8′ to 10′, the roof will rise 20′ and the little turret in the peak will be about 48′ above the foundation. The roof is self-supporting, the

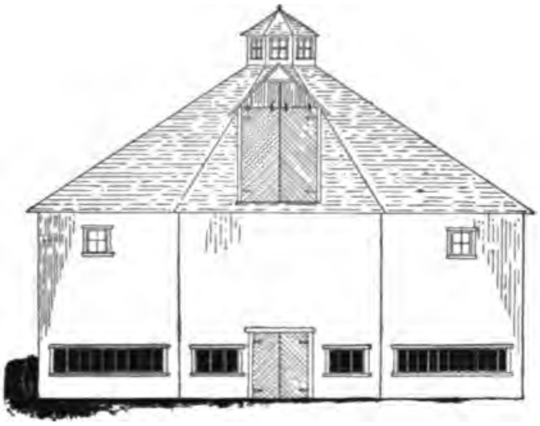


FIG. 88. AN OCTAGONAL CATTLE BARN (ELEVATION).

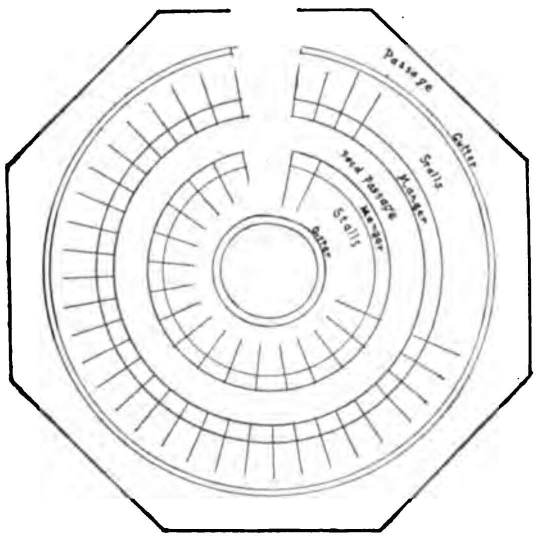


FIG. 89. AN OCTAGONAL CATTLE BARN (GROUND PLAN).

plates being bolted together at the corners and held by a band of iron 4′ long bent to fit and solidly bolted so that the corners can never spread. The plates are of 2″x12″, two parts. All parts are of joist construction.

The basement plan shows stalls for approximately 60 cattle; the larger cattle would be in the outer circle, the smaller ones in the inner row. One feeding alley serves for the two rows and a circular track brings in grain or silage and another circular track and conveyor takes away the manure. Above the passage and just within the outer door there will be chutes from above, down which will come hay, bran and other feed, the granaries being located there and filled from the same door that takes in hay. There would be other hay chutes leading down to the floor.

Abundant light and air are let in to the basement by a practically continuous window 3′ high and 3′ above the ground. The sashes of this window hinge at the bottom edge and incline inward, each one being opened all at one motion

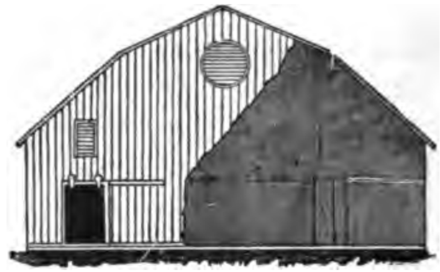


FIG. 90. A CORNBELT BARN (END SECTION).

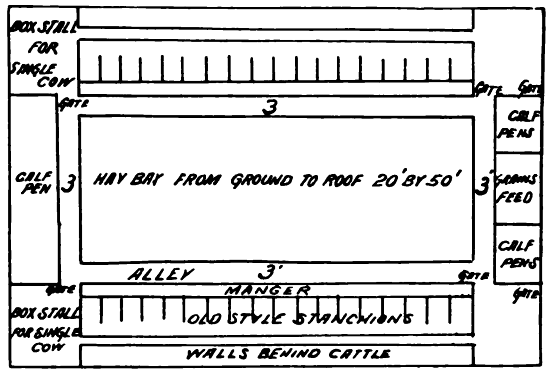


FIG. 91. A CORNBELT BARN (GROUND PLAN).

or closed by a motion, the mechanism being the familiar contrivance employed in greenhouse construction. The outer walk is 4′ wide at its narrowest point. Perhaps 3′ would be better, as it would give more room between the cattle, and with the manure conveyors there is not the need of wide passages that there once was. Cement floor throughout and Van Norman stalls complete the basement construction.

A CORNBELT BARN.

The Illinois cattle barn illustrated in *Figs. 90* and *91* has an immense storage capacity afforded for hay and straw, and in view of the vast quantity of forage of that description wasted annually from lack of protection from the inclement weather the question arises as to whether or not more attention should be given to that subject in the construction of barns.

The plan indicates a barn 50′ x 70′, with cattle stalls and a 3′ alley on each side, central space and entire area above the stalls being devoted to the mowing of hay and straw. The "end section" (*Fig. 90*) is intended to show this arrangement.

There are doors at the rear end of the barn the same as in front, and over the main doors in the rear are two smaller doors wide enough to admit the straw-carrier of a threshing machine, so that when threshing the machine dumps the straw into the loft of the barn over the stack on either or both sides by moving the machine. There is also a large door 10′x9′ for taking hay from the load by the horse hay forks on a track running the entire length of the comb of the barn, hauled up by horse at the other end of the barn.

Material of the following description is used: Sills, 6″x8″; joists, 2″x8″; corner posts, 6″x6″; other posts, 4″x6″; braces, 4″x4″; girts, 2″x4″; plates, 4″x6″; rafters, 2″x4″; sheeting, second fencing; shingles, 18″, best; siding, 12′ stock boards; flooring, 2″x8″.

MODERN TYPE OF CATTLE BARN.

A sanitary, comfortable and commodious barn recently built by H. H. Trimble, Davis County, Ia. It has 84 single stalls and 10 box-stalls or breeding pens. There are bins for grain and storage for 350 tons of forage above. Silos may be conveniently added, one at the end of each wing, where the feed-carrier will convey the silage down the central alley between the rows of cattle.

The barn is 30′ wide and forms three sides of an open court (*Fig. 92*), which is 66′x78′, designed to be paved with vitrified brick or concreted, having a water tank in center, thus forming a convenient sheltered yard where cattle may exercise any day in severe weather. *Fig. 93* shows the ground floor. The specifications provide this barn with manure-carriers behind the cattle, feed carriers with track in front of them and numerous windows to admit light and air. The windows are hinged at the lower edge and open inwardly with greenhouse construction, so that a turn of a wheel opens a row of them. Sectional hay chutes extend down into the feed alleys. The barn has cement floors and Van Norman stalls. This barn has proved very satisfactory to the proprietor, who says that "we believe we have saved $1,000 of its cost in one season in grain and hay and in preventing loss of flesh in the animals."

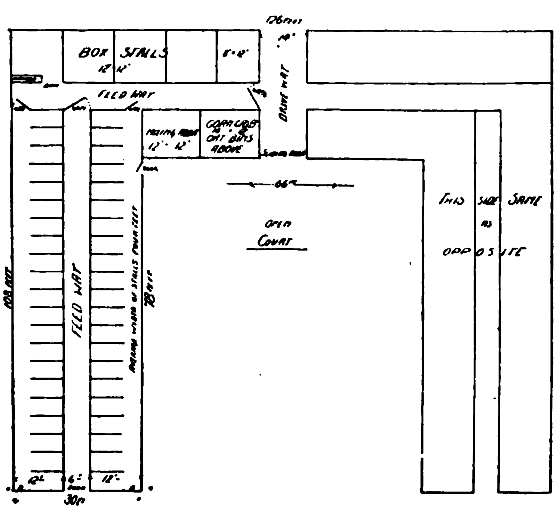


FIG. 93. MODERN TYPE OF CATTLE BARN (GROUND PLAN).

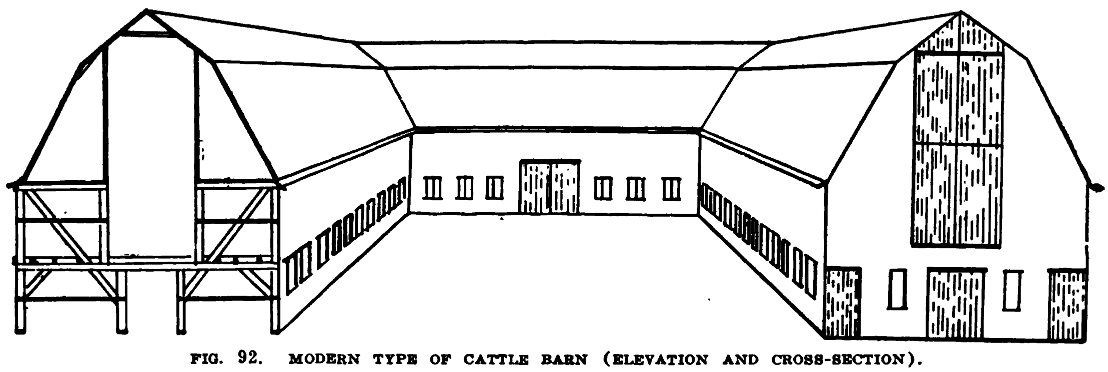


FIG. 92. MODERN TYPE OF CATTLE BARN (ELEVATION AND CROSS-SECTION).

A BARN FOR BREEDING CATTLE.

The cattle barn on the Willow Lawn farm of E. Reynolds & Son, of Whiteside County, Ill., is 56′x124′. It is 22′ to the eaves and 48′

FIG. 94. BARN FOR BREEDING CATTLE (ELEVATION).

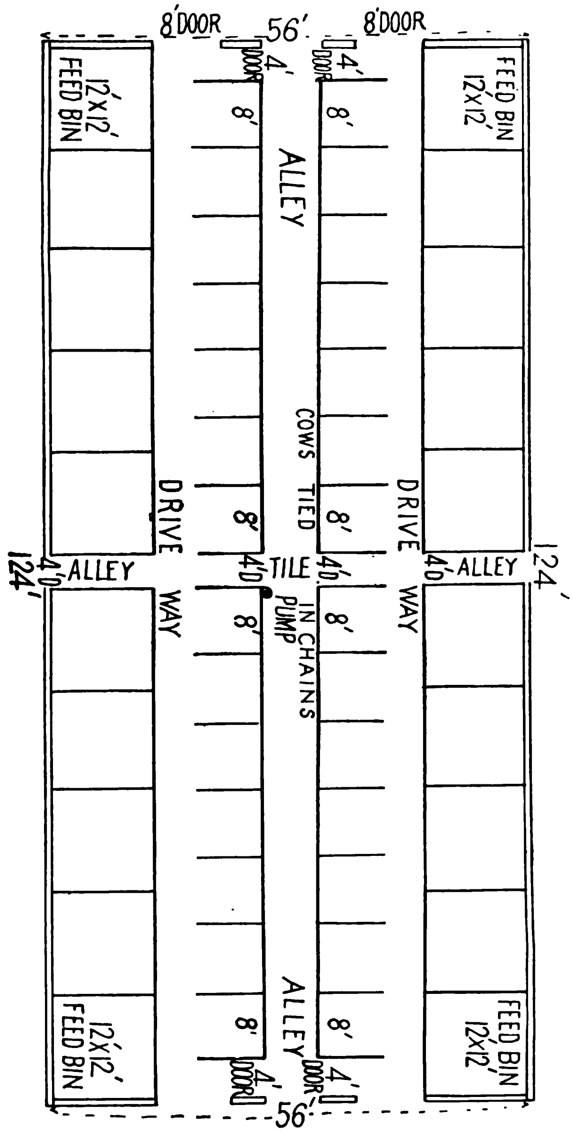


FIG. 95. BARN FOR BREEDING CATTLE (GROUND PLAN).

to the peak, giving ample pitch to the roof. This barn will hold about 300 tons of hay and there is a place directly over the meal bin for two carloads of bran or feed. One floor of the barn is cement, having a slope of 5″ from where the cows are chained in the box-stalls. The stalls also slope 2″ from outside the barn to the drain behind the cows. The drain slopes gradually from both ends toward the center, where there is a till to receive the liquid. There are six large ventilators running from the bottom of the barn up to the cupolas. There are 24 windows below and several opening into the loft. (See *Figs. 94* and *95.*) The barn cost about $4,000 a few years ago.

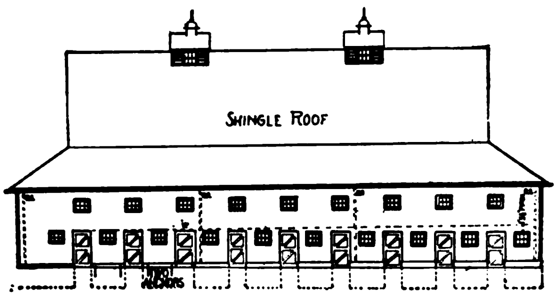


FIG. 96. ILLINOIS CATTLE BARN (SIDE ELEVATION).

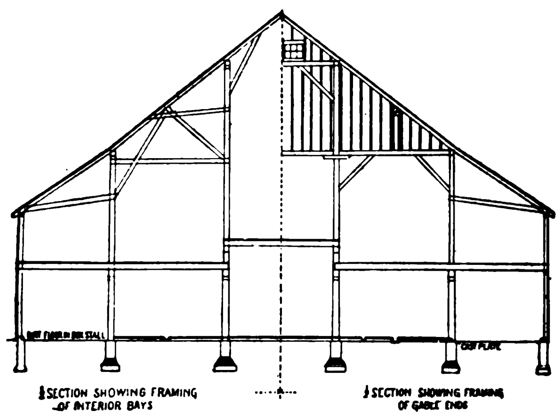


FIG. 97. ILLINOIS CATTLE BARN (END SECTION).

ILLINOIS CATTLE BARN.

Hon. Frank O. Lowden's large cattle barn on his farm in Ogle Co., Ill., is one of the most complete and conveniently arranged buildings to be found. There is a perfect system of waterworks and sewerage in the barns and yards and there are water troughs in every yard that drain directly into the sewer, so that when not in use they can be drained, thereby obviating the danger of freezing and insuring water of even temperature at all times.

The dimensions of this barn are 71′ 8″x121′ 10″. The diagrams shown in *Figs. 96, 97* and *98* present a clear idea of its arrangement.

Feed is conveyed by trolley cars on either side of the main floor and in front of the cattle stalls. The capacity of the hay loft is 260 tons. The hay is taken up in the center of the barn and

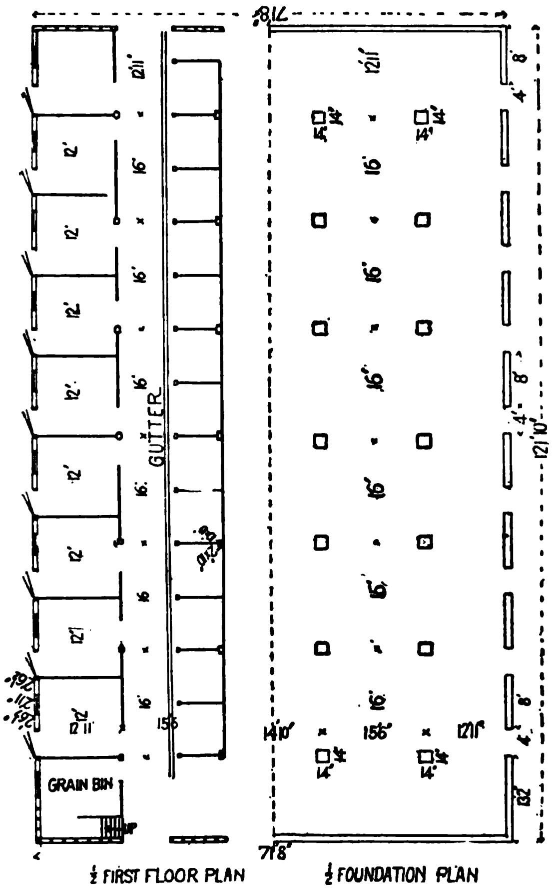


FIG. 98. ILLINOIS CATTLE BARN (GROUND PLAN).

conveyed by reversible carriers to either end of the barn and is thrown down in center of main floor to feed cattle in the stalls. The racks in the box-stalls are filled directly from the loft through trap doors in the floor which may be closed when not in use. Alleys behind the stalls are wide enough so that a manure spreader for receiving the manure may be driven through and taken directly to the fields.

AN OPEN-CENTER CATTLE BARN.

The cattle barn shown herewith is 50′ x 105′ with a basement 10′ high and second floor posts 16′. *Fig. 99* illustrates plainly the method of framing. It will be seen that this is an open-center barn. With large barns of this type there must be unloaded a great deal of hay and there is nothing that compares with the sling for unloading hay, and the use of the sling calls for an open-center barn with no ties across the mow floor. Two purlin plates support the roof. The roof is half pitch. This frame is built of solid timber, but 2″ joists may be used. In this case a few hundred dollars in expense may be saved and perhaps a stronger and better frame secured.

Fig. 101 shows the basement floor. The feed passage is 4′ wide with the mangers taken off;

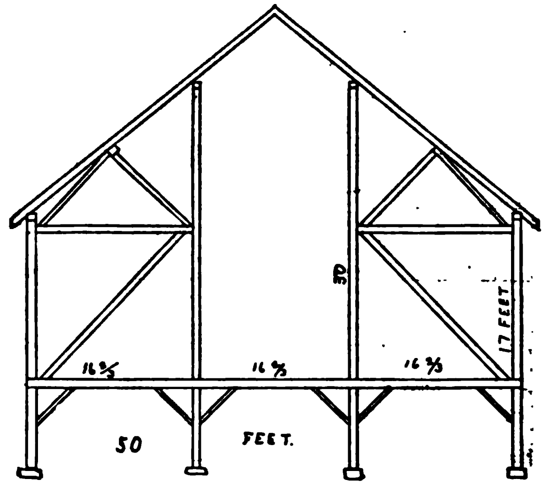


FIG. 99. OPEN-CENTER CATTLE BARN (FRAMEWORK).

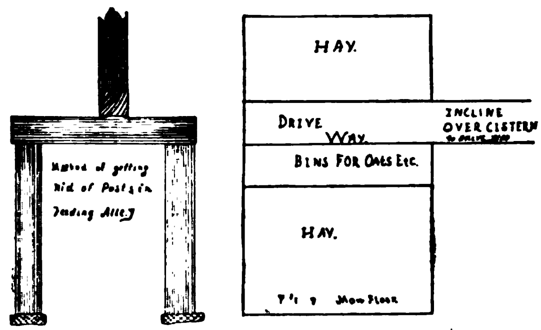


FIG. 100. OPEN-CENTER CATTLE BARN (DETAIL).

hay is thrown directly into the feed passage down chutes reaching from the mow above and coming down the purlin posts. There is room between the rows of stalls for the driving in of the wagons to clean out the trenches, although there is not room to drive in between the cows when they are in their stalls. The stalls may be put further apart than they are if it is not thought best to turn the cattle into the yard while the stable is being cleaned. The stalls are 3½′ apart, thus getting 14 animals in a row. The whole barn may be divided in this way, or part of it may be made into pens in which polled or dehorned cattle may run loose. Very thorough ventilation should be provided in so large a barn where so many animals are confined. The hay chutes provide quite well to carry off the vitiated air, but provision should be made for a fresh in-flow. The bents are spaced 15′ apart because that distance fits the stalls. If the lum-

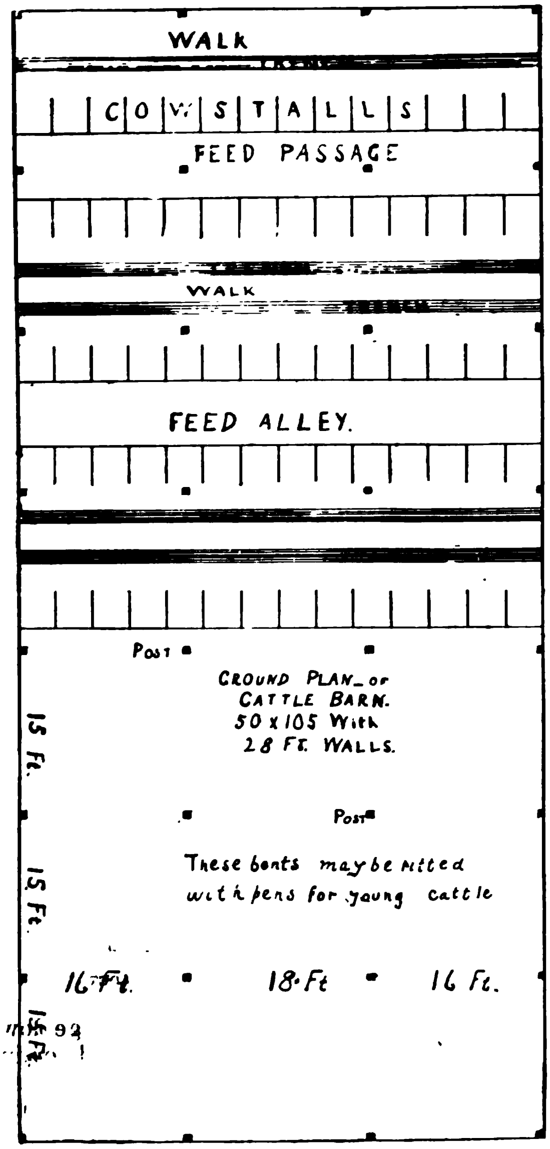


FIG. 101. OPEN-CENTER CATTLE BARN (GROUND FLOOR).

ber must be bought it would be better to use 16′ spaces, making a wider feed alley, as odd lengths are not kept in stock. This would make the length of the barn 112′. *Fig. 101* shows the floor. The incline of the driveway is built over a cistern which receives its supply of water from the roof. The oats and ground feed may be spouted from the bins to two feed alleys. Distribution of the ground feed may be made by means of the small cart pushed by hand from which may be measured the ration that each animal is to receive. *Fig. 100* also illustrates the method of keeping the joists from being in the way of the feed alleys. The location of the stalls in the basement should be made with accuracy before the building is erected, so that nothing will be in the way when all is done. If built in joist frame this barn can be completed in good shape and fitted with stalls for from $1,000 to $1,500.

A MISSOURI BARN PLAN.

The cattle barn shown in *Fig. 102* was built by James A. Barrett of Missouri. The length is 52′; width, 36′; 9′ and 16′ posts are used. The timbers are 8″ x 8″ and 8″ x 10″. An 8′ x 26′

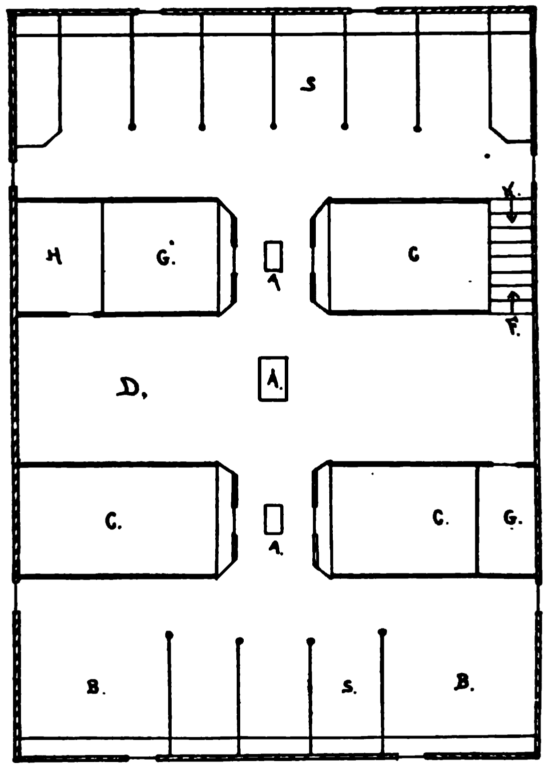


FIG. 102. MISSOURI BARN PLAN.

self-feeder is placed in the basement. The chutes *A* and the octagon ends of the cribs empty into the self-feeder. The barn has a capacity of 25 tons of hay, 1,500 bushels of corn and 500 bushels of oats. Nine single and two box-stalls afford ample stabling quarters. Forty head of cattle find comfortable quarters in the basement. In diagram, *G* represents oat bins; *C* corncribs; *B* the box-stalls (which are 10½′ x 12′); *S* single stalls 5′; *D* a 10′ driveway; *H* harness-room; *K* and *F* stairways to the hay mow and basement respectively. At either end of the row of single stalls shown at the top of *Fig. 102* chutes are placed for throwing hay into the basement. This barn was built at a cost of $1,750.

A CATTLE FEEDING BARN.

A convenient and comparatively cheap barn in which to grow "baby beef" in the cornbelt may be constructed from the general description and plans following:

To get best results among average cattle and in a climate like that of the cornbelt the animals should run loose in a rather small yard,

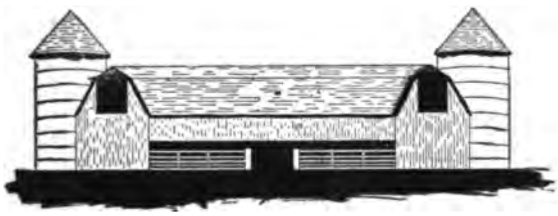


FIG. 103. CATTLE FEEDING BARN (ELEVATION).

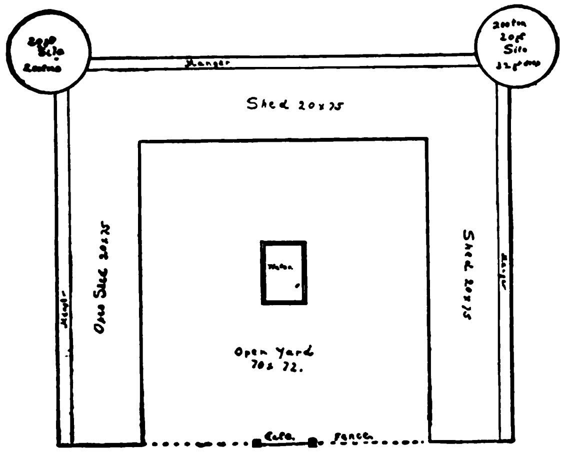


FIG. 104. CATTLE FEEDING BARN (FLOOR PLAN).

with shelter from wind and storm. It is with a view of meeting this requirement that the enclosed yard shown in *Fig. 104* is provided with a shed on three sides, 8′ in the clear and with hay loft above. There is a manger running along the outside of the shed in which may be fed hay or silage. Hay is thrown in this directly from the mow through a slit in the floor and it may be boarded up to make a continuous chute open at the bottom through which the cattle draw their hay. The mow is 7′ to the eaves and over 18′ to the peak, allowing the use of horse forks for filling with hay. While it does not hold a great amount of hay, it will hold an entire rick, and the design is to draw

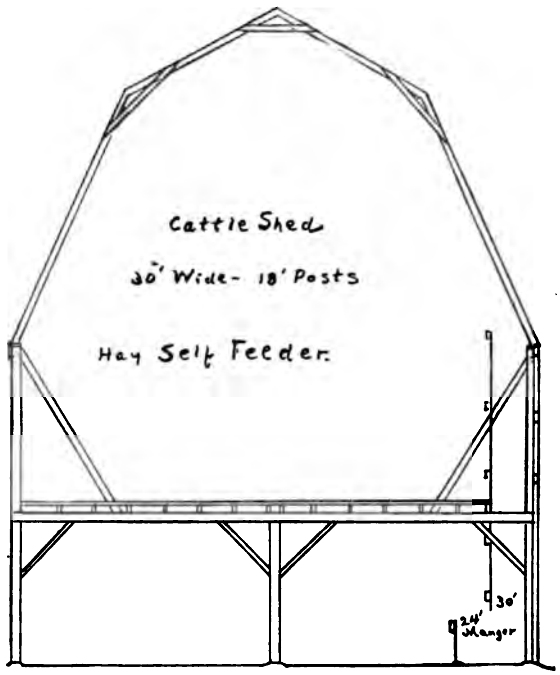


FIG. 105. CATTLE FEEDING BARN (CROSS-SECTION).

during good weather a rick at a time and stow it away in the dry. The sheds and yard are large enough for about 125 head of yearling steers. Two silos are provided having a capacity of more than 200 tons each. The doors for emptying are inside the sheds and there may be an overhead track carrying a large box along the line of the manger, thus making feeding easy and rapid. In the yard (*Fig. 104*) may be provided open boxes for feeding ear corn or shock corn when desired. As this yard is not very large it might be expedient in many cases to cement the entire bottom and save mud and waste of manure. Sufficient corn should be fed on the stalk to bed the yard thoroughly and keep it dry and clean. A cement tank affords water for the cattle. Eave troughs carry away the drip from the eaves. Modern tin generally lasts about four years and good galvanized iron makes a better trough.

Forty acres of corn in a favorable season will a little more than fill the silos. There is silage enough in the two silos to feed 175 calves (yearlings) for six months, provided they are fed at the rate of 25 pounds per head per day. If there is a little silage left over until summer it can be used to advantage in supplementing pastures, which are often short during a part of that season.

The cross section of the frame (*Fig. 105*) shows a building 30′ wide, which is preferable to one of less width. With the hay self-feeder in place with a width of 30′, a height of posts of 18′, with long rafters 16′ and short rafters 10′ enclosing a court 80′ in diameter, the barn will hold nearly 300 tons of hay. The self-feeder is shown in cross-section (*Fig. 105*); the continuous chute is 30″ wide, the manger 24″ out from that, the chute reaching to within 6″ of the top level of the manger. Doors in the chute admit of hay being thrown in from any level. Strong feed-racks 3½′ x 8′ that can be set where convenience dictates and readily removed on occasion are preferred to permanent mangers. The side opposite the hay-feeder and next to the enclosed yard is open except that gates may be hung so that cattle, when putting in silage, for instance, can be shut into the yard.

A BARN FOR FEEDING CATTLE LOOSE.

There is a demand for cheap barns in which to store forage and feed to cattle below running loose. The design submitted (*Figs. 106* and *107*), has several good features. Hay stored above is thrown through chutes into the central

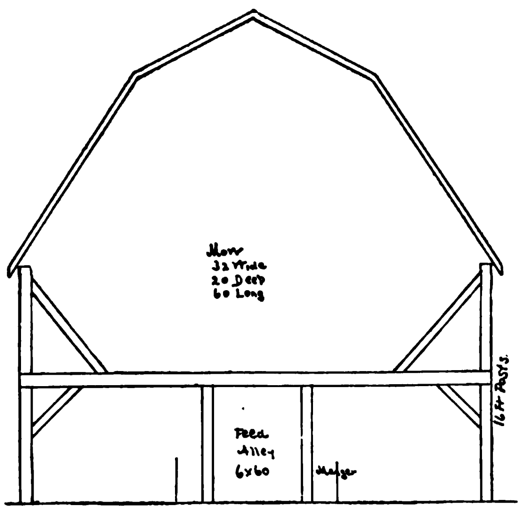


FIG. 106. BARN FOR FEEDING CATTLE LOOSE (ELEVATION).

feeding alley, and thence placed in two long mangers, in which the grain may also be fed. The openings may be at the ends or sides and —ns will be driven through to remove the manure. This building may be of any convenient length, or may enclose three sides of a square open to the south in which cattle will be sheltered. It is all of joist frame construction, without sills or wooden floor. The floor is hard clay, which is as good as anything where cattle run

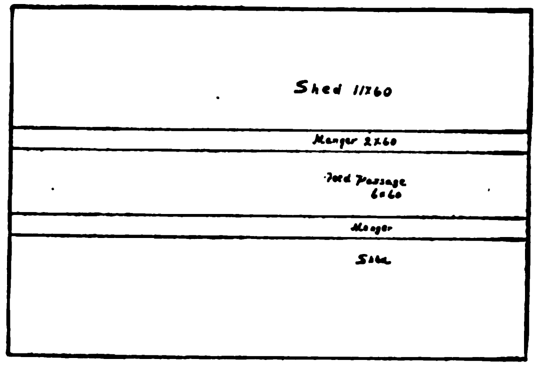


FIG. 107. BARN FOR FEEDING CATTLE LOOSE (FLOOR).

loose. The barn has a hay track in the peak and hay is taken in at one end of the barn.

AN IOWA STEER BARN.

H. J. Hess' barn in Blackhawk Co., Ia., shown in *Figs. 108* and *109*, is 60′x80′ with 14′ outside posts. It was built for feeding steers and will accommodate more than 100 head besides 160 tons of hay. The first floor or basement is one large enclosure with a driveway running through lengthways. This driveway is wide enough to admit a team and manure spreader to pass through the barn.

The mow floor is supported by posts which stand upon cut stone caps 12″ x 14″, and these caps rest upon concrete bases 18″ x 18″ and 24″ deep. In making the concrete bases (see *Fig. 109*) holes were dug a little more than 2′ deep and into each was placed an empty cement barrel having about 12″ of it sawed off and the

FIG. 108. AN IOWA STEER BARN (CONSTRUCTION).

head taken out; the concrete was then tamped thoroughly in these barrels and when it became hard the hoops on the barrels were cut and the staves removed, leaving a round concrete pier on which to lay the stone caps.

The outside wall of the barn was made of stones (boulders) laid in cement. It is 3½′ high, 3′ wide at the base and 2′ wide on top. About 18″ of it is in the ground. From the ground floor to the mow floor is 10′; this gives the cattle plenty of room. The second floor or hay mow will hold about 160 tons of hay, which is fed through six chutes, three on each side of the barn, placed 10′ on each side of the center of the mow, thus making the two rows of chutes 20′ apart. These chutes are cone-shaped, larger at the top than at the bottom, and feed into a

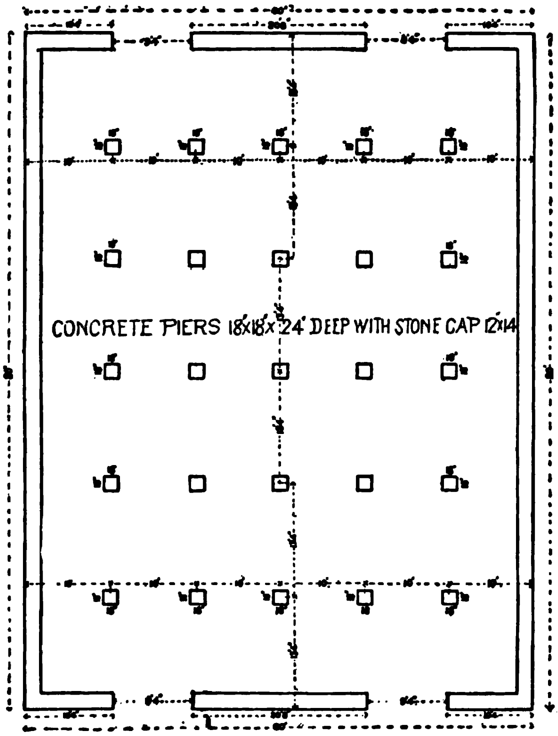


FIG. 109. AN IOWA STEER BARN (BASEMENT).

manger below. They extend to the roof and hay may be pitched into them at any point.

The barn is built of 2″ pine stuff; there is not a solid timber in it. All the posts are continuous from the capstones to the roof, being spliced with heavy spikes. The siding is 8″ dressed and matched. The large hay room or mow was made possible by constructing the hip roof. Hay is taken in by slings. The barn cost $2,000 a few years ago.

BARN FOR BEEF CATTLE.

Thos. Johnson of Ohio built a barn that is described as one of the best in America. The plan is so simple and adaptable that almost any farmer or cattle breeder could imitate it. The general form is of a long and rather narrow barn, with two equal wings enclosing three sides of a court 80′ x 88′. It is so designed that there shall be an open shed across the front of the court, thus completely enclosing the space and effectually shutting off all wind and storm from whatever direction it may come. See *Figs. 110* to *119*.

The thought in designing this barn was, first, at the least cost to provide shelter, warmth and food for the animals. Next, to see that they were amply provided with light and air; then that they should be so stalled as to appear in plain view to visitors in all their comeliness; then that it should be so arranged as to be easy to care for and feed the cattle and to remove the litter; then that there should be ample storage room for all the forage and straw that the cattle would need. In working out these ideas the architect called to his aid all the experience that he had gathered during a number of years spent in examining good barns and in designing them himself. The task is not altogether an easy one when one is determined to create the best type, nor is there room for very great variation; the best will pretty sharply limit the designer to certain forms and principles.

First, then, as to form. This barn is meant to provide shelter for about 100 pure-bred cattle, many of them receiving individual attention. It might have had a compact form, with double the width that it now has, and the first cost of construction would have been less, but so designed the ventilation and the lighting could not have been so good. Built in narrow form it encloses the great sunny open court and this will be of great service in caring for cattle and in keeping them in health and vigor. Thus the narrow form was plainly prescribed.

As many of the cattle would be breeding cows with their calves it was essential that the stalls be so arranged that the calves would be close to their mothers and that they should be readily turned to their mothers to be suckled and as readily put back to their own open stalls. Moreover, the calf stalls should be sunny and clean and comfortable. Along the north side of the main barn was put a row of cow stalls, each one double, taking two cows tied with chains, and right behind them a row of calf stalls, or stalls that could be used for either calves or for

FIG. 110. BARN FOR BEEF CATTLE (NORTHEAST ELEVATION).

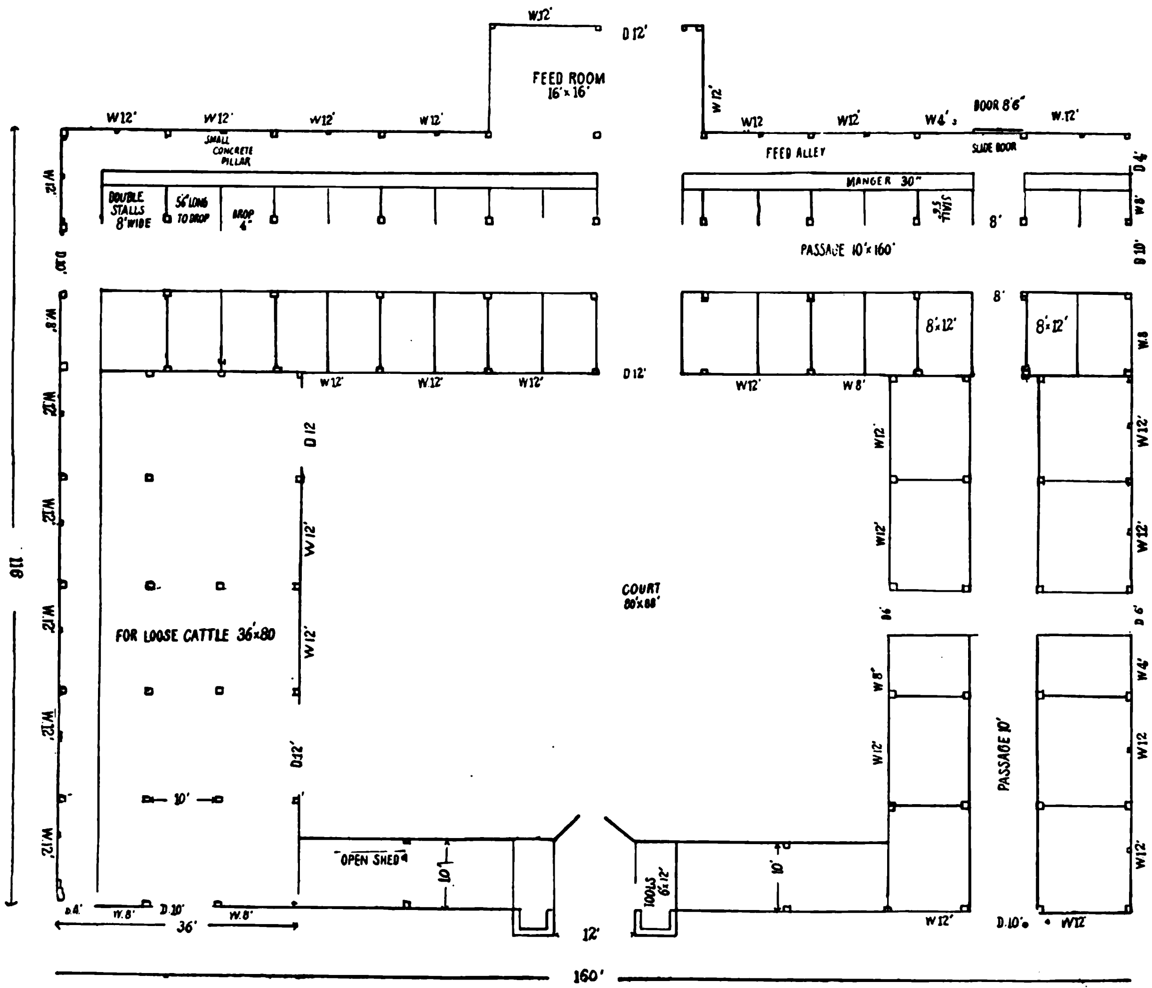


FIG. 111. BARN FOR BEEF CATTLE (GROUND PLAN).

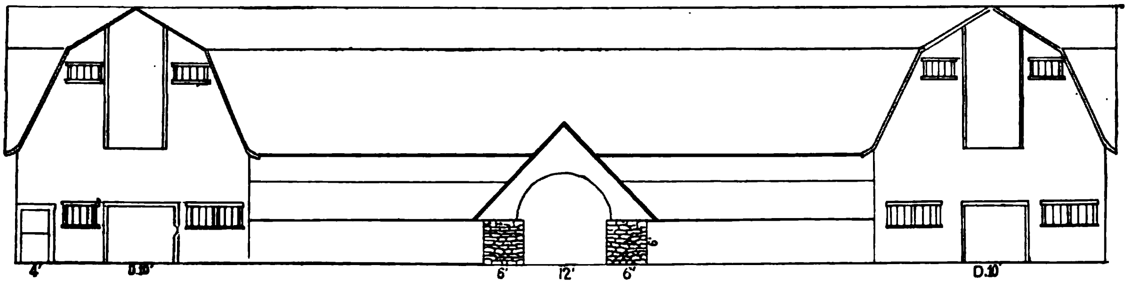


FIG. 112. BARN FOR BEEF CATTLE (FRONT ELEVATION).

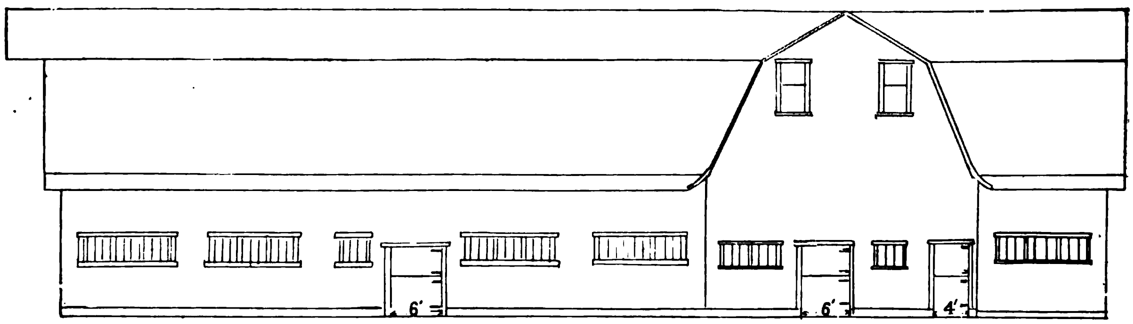
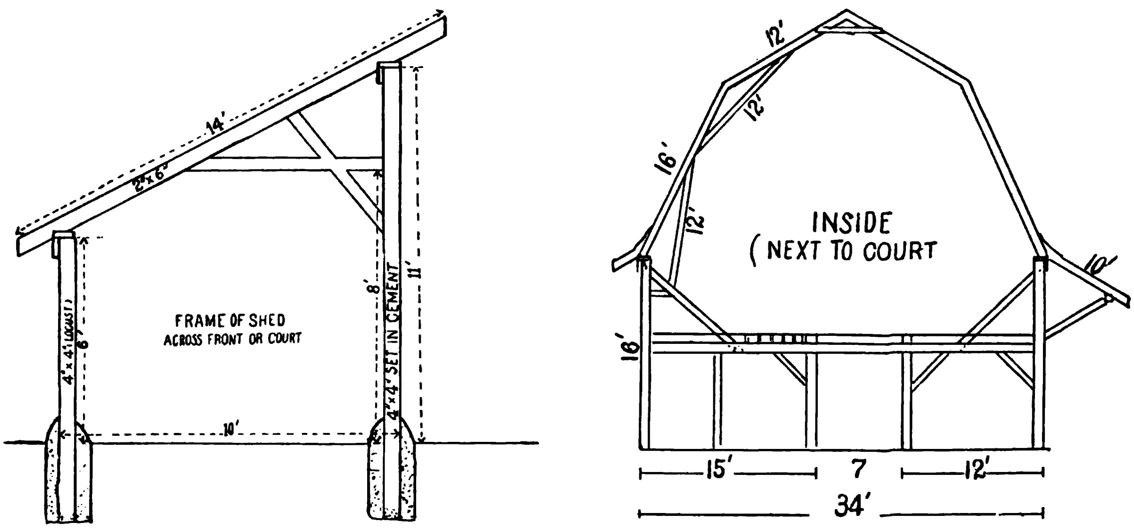


FIG. 113. BARN FOR BEEF CATTLE (SECTION THROUGH REAR).

hospital stalls or for nurseries with mothers and calves.

In any beef cattle herd there will be a number of dry cows and heifers that are better off not to be tied up at all, and these could be well cared for to run loose and have only shelter from the weather and a morsel of alfalfa or clover, with perhaps a ration of silage or a bite of bran. Therefore one wing was designed to be for the use of loose cattle, fed together in open mangers. And as there would be bulls and other animals needing strong, tight stalls it was designed that one wing should be given over to these stalls. As all that goes into a barn must come out it was designed that carts or manure spreaders might be delivered through the barn from end to end and transversely, while overhead feed carrier tracks would carry large boxes of feed along in front of the calves and along the rows of box-stalls. Hay would



FIGS. 114 AND 115. BARN FOR BEEF CATTLE (FRAMEWORK AND SHED FRAME).

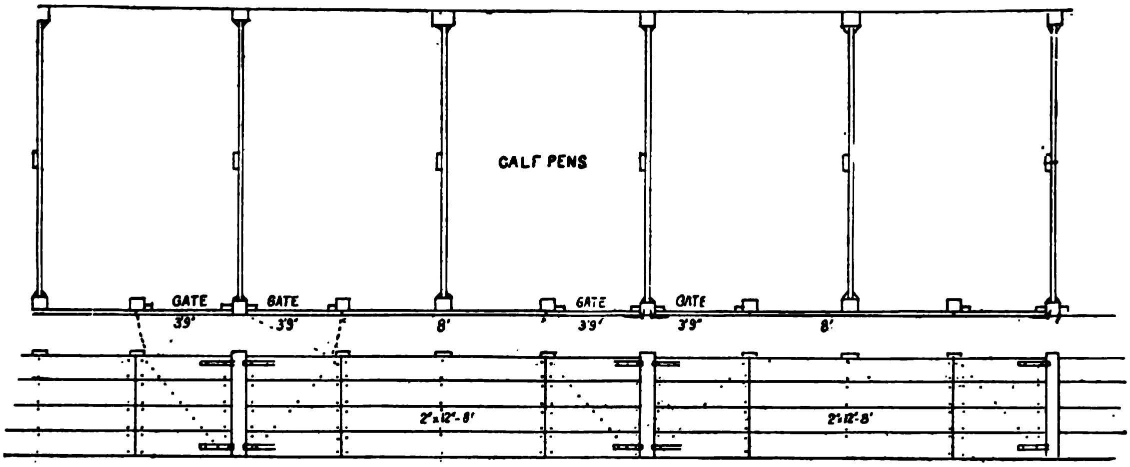


FIG. 116. BARN FOR BEEF CATTLE (CALF PENS).

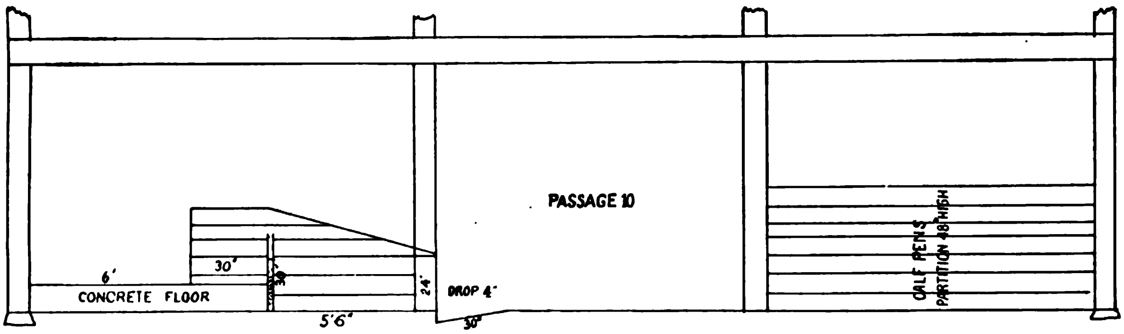


FIG. 117. BARN FOR BEEF CATTLE (STALLS).

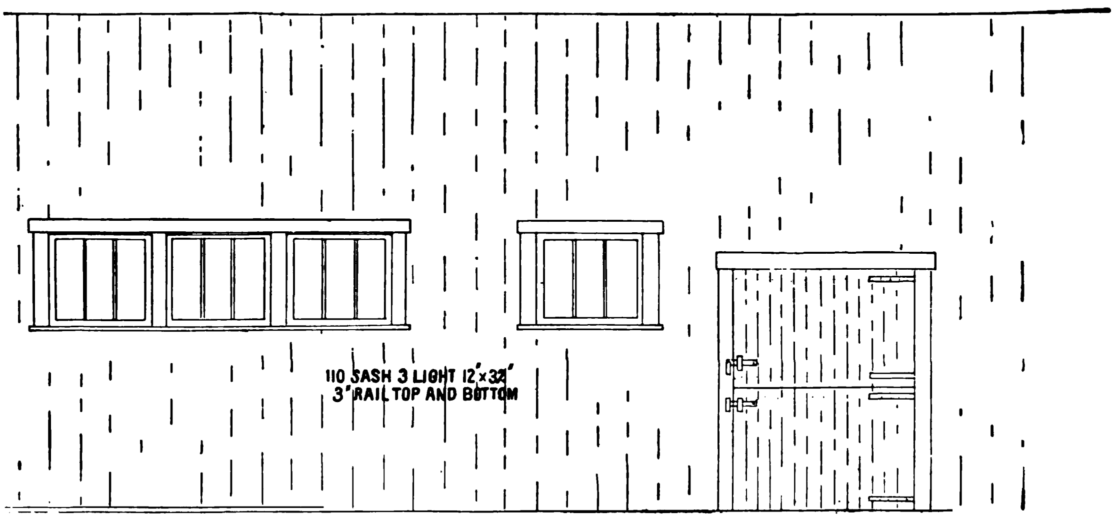


FIG. 118. BARN FOR BEEF CATTLE (SASH WORK).

be conveniently put in from the middle of the barn, going each way and from each wing, entering at the ends. All would be floored with concrete, including the court.

Thus the plan was worked out—a main barn 160′ long, with two wings each 116′, a width of 36′ and posts of 18′; a lower story 8′ in clear, 9′ to floor joists, stalls 8′ wide, each holding two cows (which gives fine room) and box-stalls 8′ x 12′ for calves and single matrons with larger stalls for bulls. The carpenter lessened the height of the barn by 2′ and thus without any material saving in expense greatly lessened about the building. They are as high up as possible, out of the way of cattle. They are glazed with 12″ x 32″ glass, three to each sash, are hinged at the bottom and open inwardly; when the building is complete these windows will be controlled by greenhouse sash openers so that an entire row may be opened slightly, or wide as may be needed. Ventilation is by means of these windows and up through chutes passing through the mow above while ample ventilators carry away the vapors. It was not thought best in this barn, designed for beef cattle well fleshed and thus cold-resistant, to at-

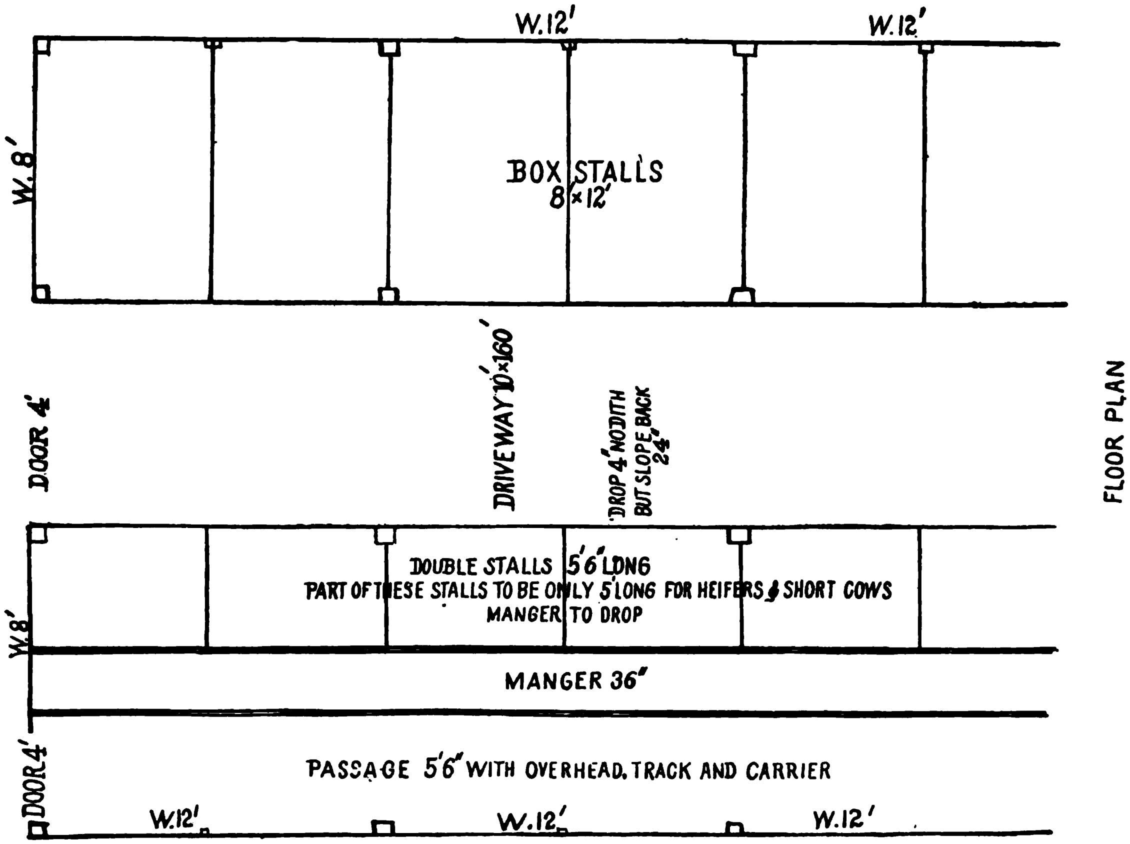


FIG. 119. BARN FOR BEEF CATTLE (INTERIOR ARRANGEMENT).

its carrying capacity of hay and straw, and should any other barn for similar purpose be constructed the proportions as originally planned for Mr. Johnson should be preserved. The barn is admirable; take one wing of it or any section, and if a breeder cannot afford to own it in its entirety he can copy 48′, 64′, 80′ or 96′ of its length with confidence in its proportions.

Calling attention to some essential features, the windows form almost a continuous band tempt to keep the temperature high, and it was believed that an abundance of fresh air, even though comparatively cold, would better conduce to the health of the cattle. Thus also the outer court was planned so that every matron should spend part of her time therein each day unless the weather proved unusually severe.

The problem of stalls is one that received much thought; many measurements of good-sized cows were taken before a decision was reached. Finally a length of 5′ from front of

FIG. 120. WISCONSIN CATTLE BARN (ELEVATION).

manger to drop was decided on, with part of the stalls 5′ 6″ long to drop. The drop in the design is but 4″ and from it the floor slopes upward to the level of the stall in a distance of 30″. Of course this slope must be rough enough to prevent the slipping of animals stepping thereon, but it effectually prevents the spread of urine over the walk and at the same time makes cleaning very easy. The front of the manger may be 30″ high, to be built of 2″ oak plank and to this front the cows are attached. They need not reach down 30″ to eat, since the floor of the manger is raised 12″ and this floor extends level across the feed alley which is 6′ wide, and thus the feeder may feed the cows on the level of the alleyway, and as there is no back to the mangers there can be no accumulation of refuse gather, and after each feeding all may be swept out readily. Cows pull their food toward them, rather than push it away, and therefore a back to a manger is not necessary. The partitions between the stalls

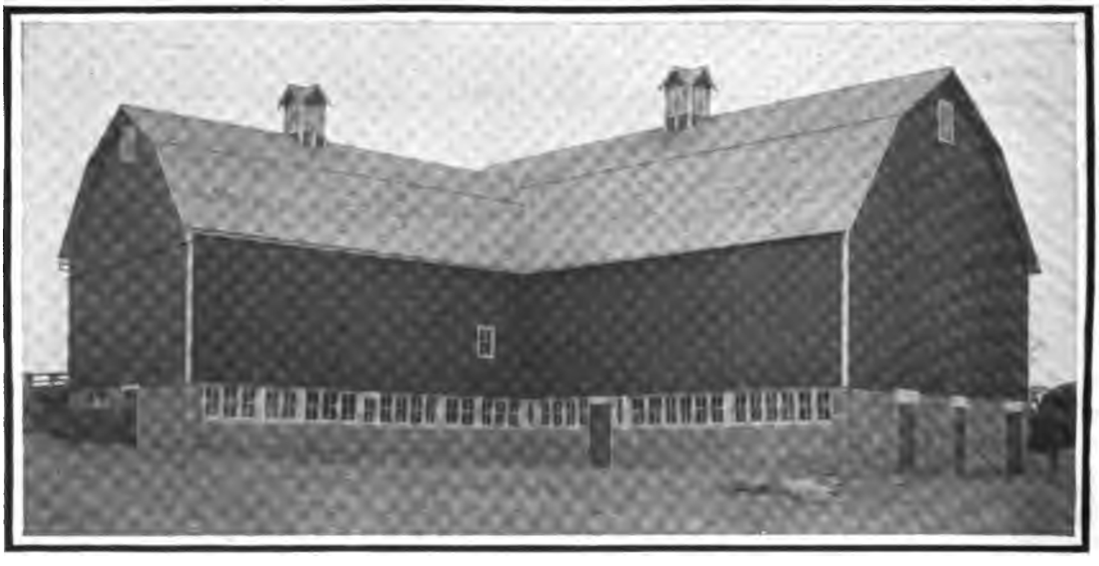


FIG. 121. WISCONSIN CATTLE BARN (SIDE ELEVATION).

extend, however, 30″ in to the space in front of the tying board and thus separate the feed that is given one cow from what is given another. It is believed that this simple manger is more satisfactory for this class of cows than any other yet devised, and its form is such that it hides the animals comparatively little. With wild or obstreperous cows a front board may be placed at the top of the ends of division planks, so that they will not try to jump across their mangers.

An overhead track in front of the cows carries a large feed carrier. The feed room is in a central place and all the bins for grain are in the second story of this, the grinder also, and below are bins for mixing feed. It will be observed that a driveway goes across the line of stalls near one end; it is designed that swinging partitions here will readily convert this into mangers, since only occasionally will the manure cart need to pass this way.

A large water tank in the courtyard affords a means of watering the animals and a large elevated tank at the rear holds a supply, part of which may be received from the capacious roof. Nothing has been added to this barn for show; it is purely a business barn, and yet it looks exceedingly well.

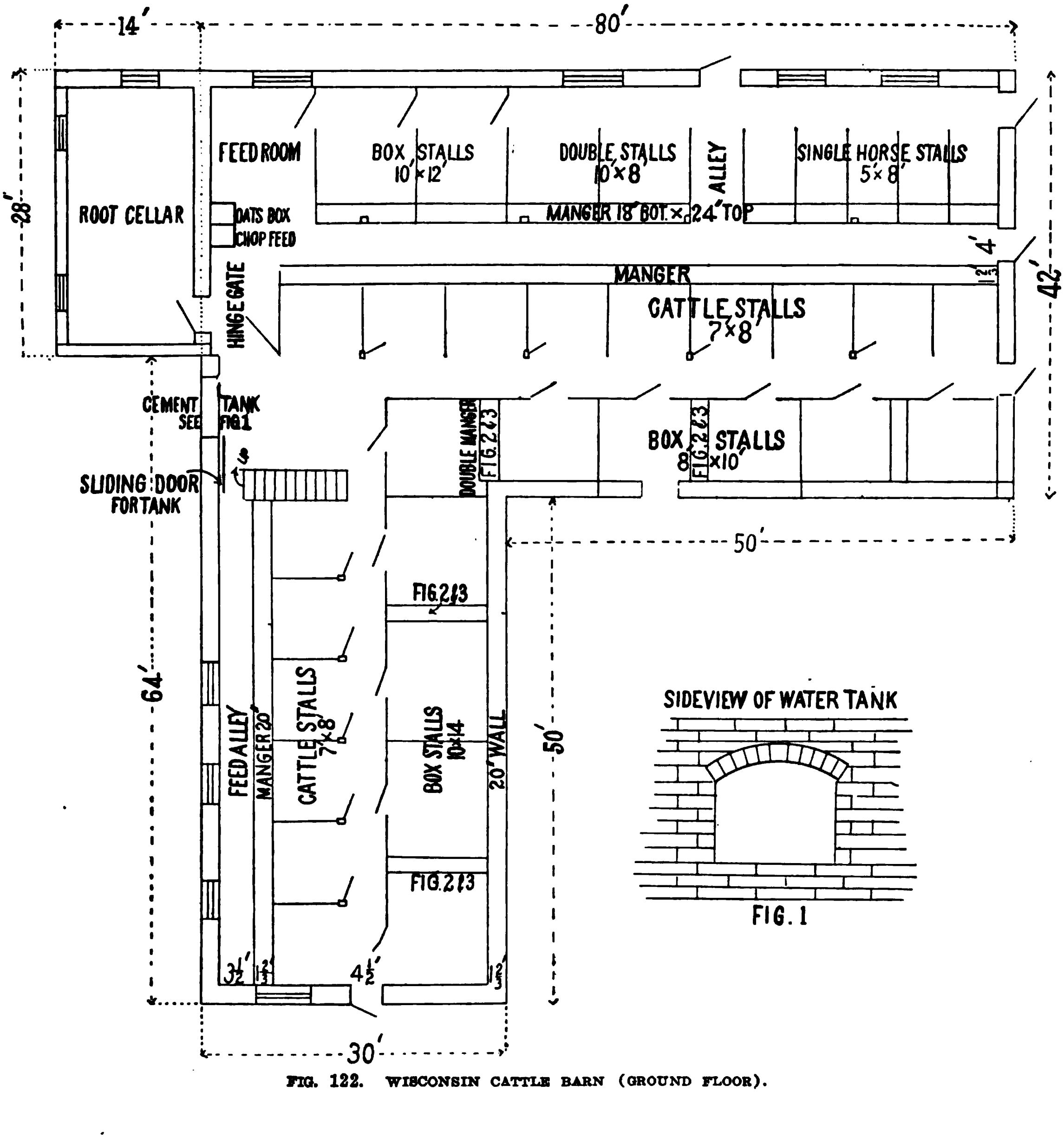


FIG. 122. WISCONSIN CATTLE BARN (GROUND FLOOR).

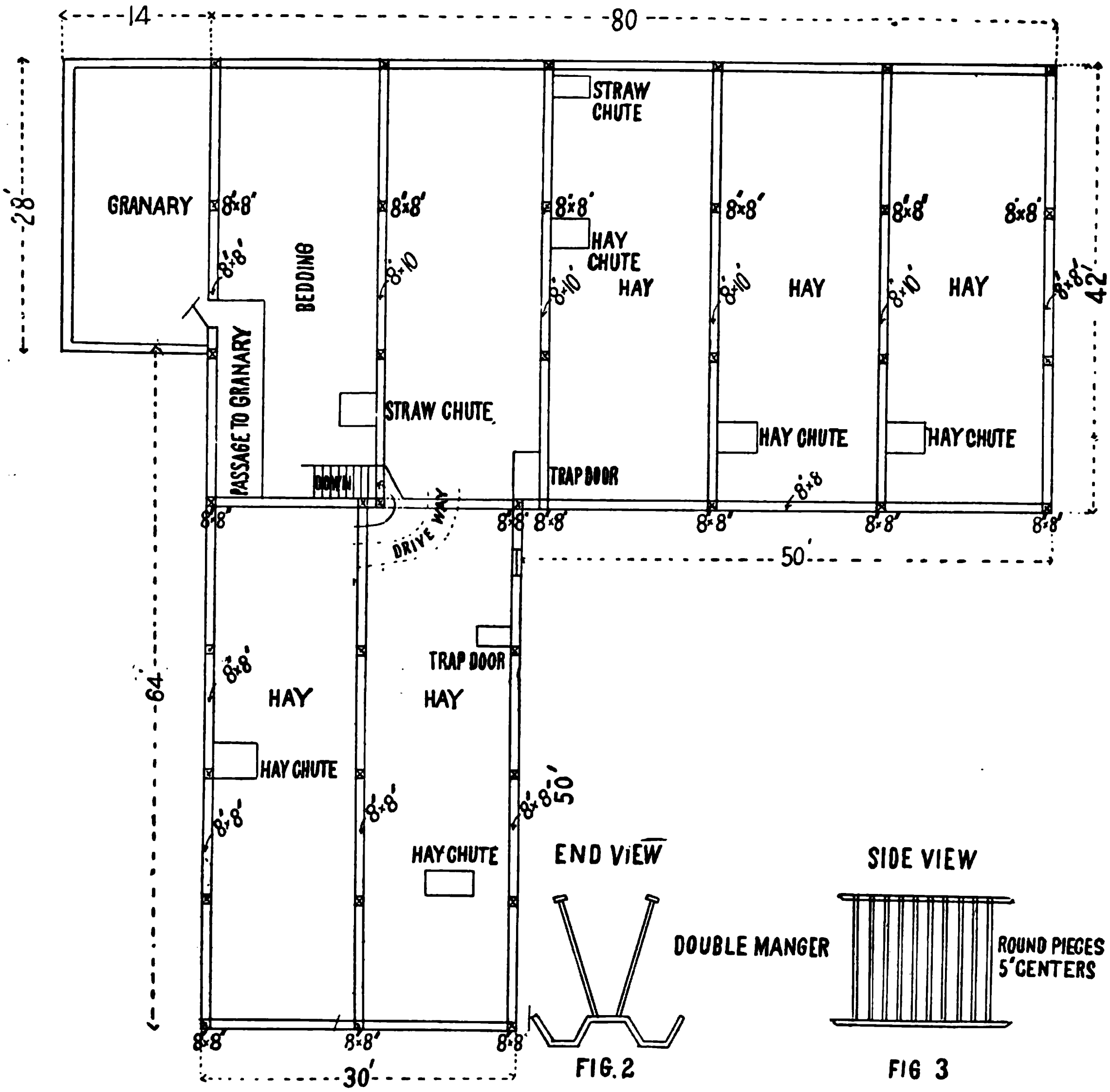


FIG. 123. WISCONSIN CATTLE BARN (SECOND FLOOR).

A WISCONSIN CATTLE BARN.

Figs. 120, 121, 122 and *123* show an L-shaped cattle barn which serves the purpose of a general farm barn. Small *Figs. 2* and *3* give an idea of the double manger used in the box-stalls shown in *Fig. 122.* The total length of the barn is 92′ and width 94′, including the 14′ x 28′ root cellar. One of the main features of this barn is the ample space provided for hay storage (see *Fig. 123*). The total cost, not including board of workmen and expense of getting out rock, was as follows: Hardware, \$145.88; lumber, \$1,956; mason work, lime and cement, \$429.10; tin work and spout, \$59.13; lime and cement for cistern, \$27.35; carpenter work, \$550.50.

A CATTLE BARN IN INDIANA.

The barn illustrated in *Figs. 124, 125, 126* and *127*, is 108′ long by 60′ wide with a silo 16′ in diameter and in height 24′ above ground and $8\frac{1}{2}'$ in the bank, the portion under ground being cement and that above wood. The water is pumped from a flowing well shown in a corner of the fence, *Fig. 126*, into the tank in the feed room, *Fig. 126*, and from there into the tank at north end of the barn, *Fig. 126.* The whole foundation is built of

FIG. 124. A CATTLE BARN IN INDIANA (ELEVATION).

cement and extends 2′ above the ground. The feed troughs rest on the cement wall, *Fig. 125,* and total about 35′ of trough and rack, which will accommodate 100 head of cattle at one time. *Fig. 126* shows the horse stalls and grain bins on the second floor, also the truss rods under the third floor.

A BARN FOR 125 CATTLE.

The problem of accommodating 125 head of cattle is a simple one (see *Fig. 128*). They should have approximately 40 square feet of floor space when running loose. That makes a need for around 5,000 square feet of floor room.

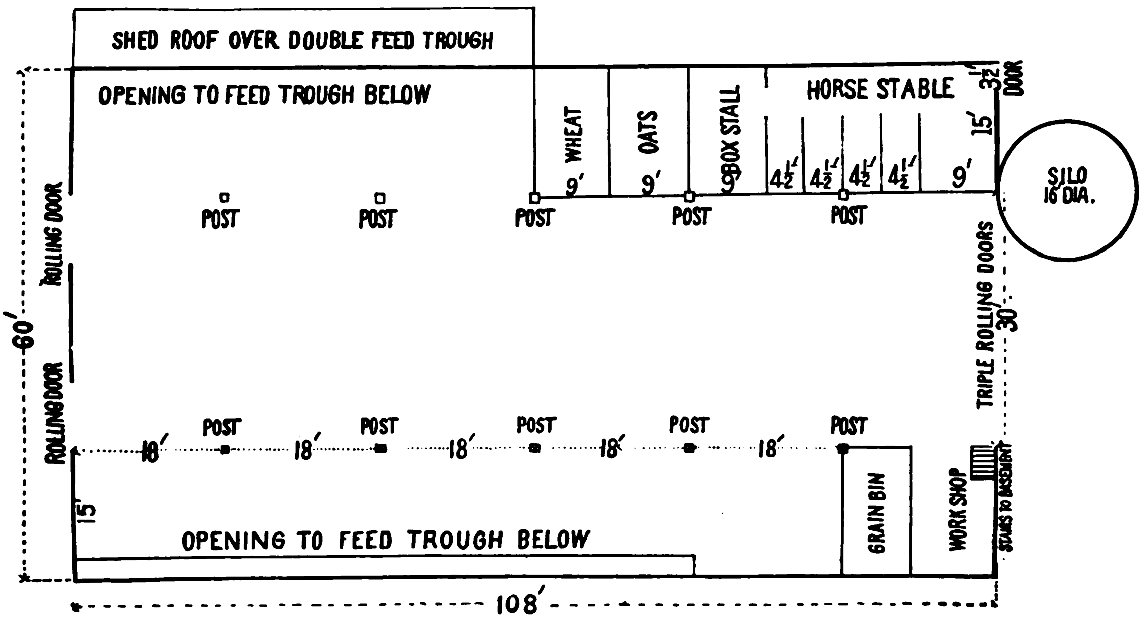


FIG. 125. A CATTLE BARN IN INDIANA (BASEMENT PLAN).

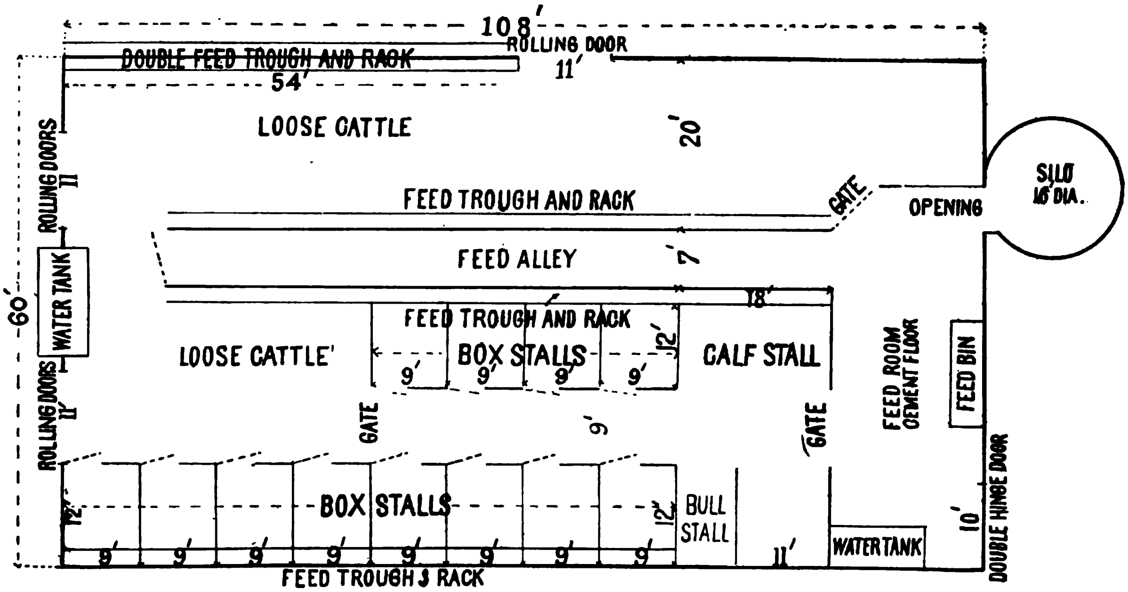


FIG. 126. A CATTLE BARN IN INDIANA (FIRST FLOOR PLAN).

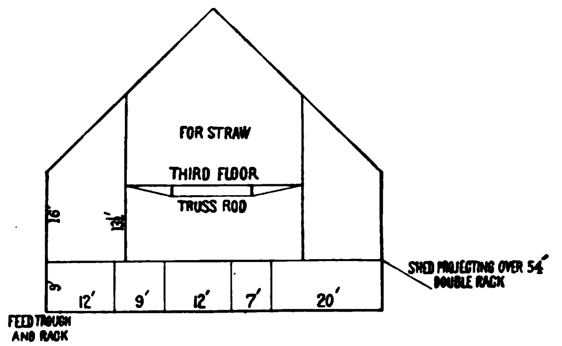


FIG. 127. A CATTLE BARN IN INDIANA (CROSS-SECTION).

There might be built then approximately a barn 24′ x 216′ (which would be the plan here outlined if it were in a straight line), or a barn 40′ x 125′ or 30′ x 160′ or 32′ x 156′ or 32′ x 168′ (allowing for 12 bents, each 14′). Each animal must be given room to eat and no corners in which one can be crowded. All things considered a width of no more than 24′ or 32′ will give the best satisfaction in use. It is wise to place the corncribs apart from the barn for various reasons—rats for one, ventilation for another. The corn can then be kept in a rat-proof crib and carried to the barn either in a horse cart or wagon or in carriers made expressly for this service running on overhead tracks. If this arrangement is desired the cribs or else the grinder must be on opposite sides so that the tracks will not cross the roadway. There is no objection to putting a gasoline engine in a proper room in the barn since the fuel may be at a long distance, carried in a small pipe. No fires are known to originate from this method.

The advantage of the L arrangement is the shelter afforded from the wind, but it is not adaptable to all sites and must depend upon the nature of the ground. It may easily be better to place the whole length in a straight line, or it may curve regularly in a semi-circle if the ground fits that construction, by making the inner side of each bent shorter than the outer side. Hay would be put in from the driveway and from the ends, though there can readily be built another transverse driveway for hay unloading and that would really be better. Crushed corn will be distributed in the basement by means of a carrier made for the purpose passing each trough and manger.

The framing is very simple and cheap. The basement will be above ground unless perhaps where the driveway is, and all the one side will be open to the yard except where closed by the mangers. These communicate with chutes reaching to the top of the mow so that every manger may be filled without going into the basement at all. Corn can not be satisfactorily fed from above. This narrow barn is very economical of construction, seeing that the timbers are small and the stress is slight. The joist frame and self-supporting roof will be used throughout and very common rough boards will serve for floor of mow. Bear in mind that the L shape is not an essential part of the plan, that the semi-circular or straight arrangement is just as simple.

AN INDIANA STOCK BARN.

Fig. 129 shows the plan of the barn built for a Decatur Co., Ind., breeder. All the walls of the foundation are concrete and are in the

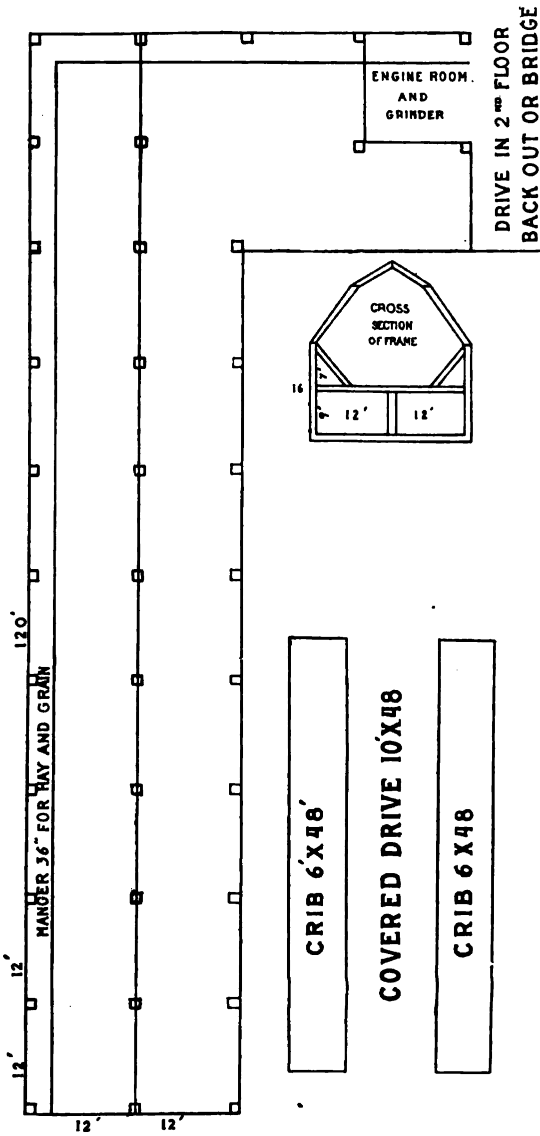
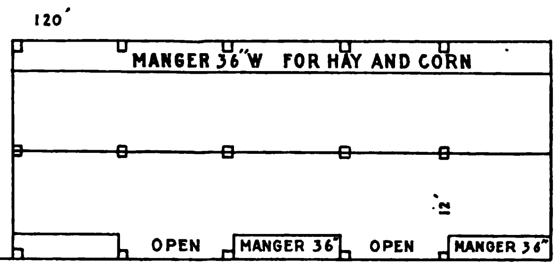


FIG. 128. BARN FOR 125 CATTLE.

ground to the depth of about 2', making it a very undesirable place for rats. The outside walls have a slope of 1" to the foot and are at 8" wide at the top. The cross walls under the stall partitions are 6" at the top and are built about straight. The mangers and feed room floors are concrete also, the mangers being 28".

The sills are made of 2" x 8" piece stuff laid double and the joists broken. The studding for the sides are 16' long set 2' on centers. They have a shoulder cut in the top end to admit of a 2" x 4" being spiked to them. The foot of the rafter is cut to correspond with the studding,



only it is a reverse cut. The mow joists are 2" x 10" in the side mows and 2" x 12" over

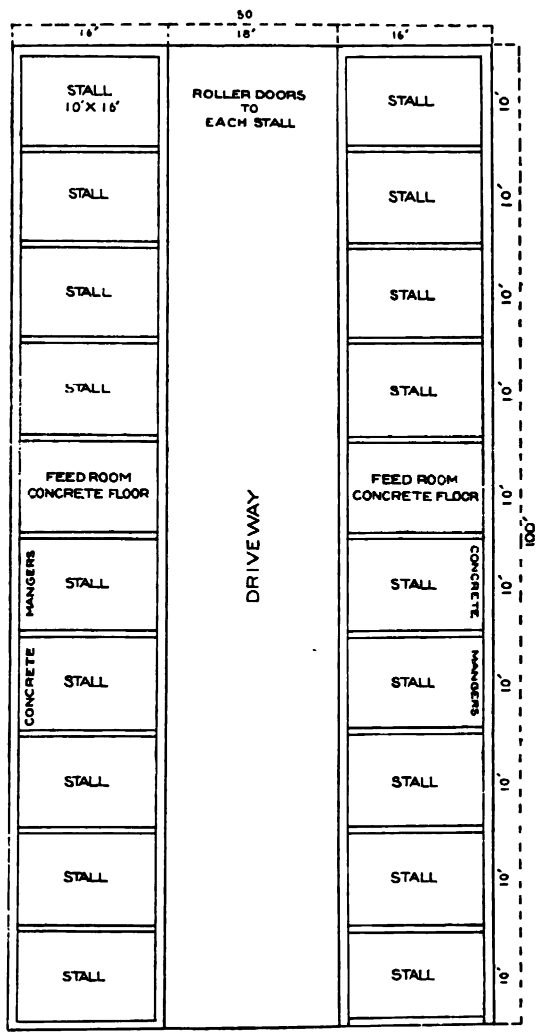


FIG. 129. AN INDIANA STOCK BARN (GROUND FLOOR).

FIG. 130. AN INDIANA STOCK BARN (SIDE ELEVATION).

the driveway. The hatchway for taking up the hay is located in the center of the barn. There are trap doors between the hatchway and each end also. As the hay is fed out these can be opened to save carrying the feed so far.

The section shown in *Fig. 131* is comprised of the following pieces of timber: side studding

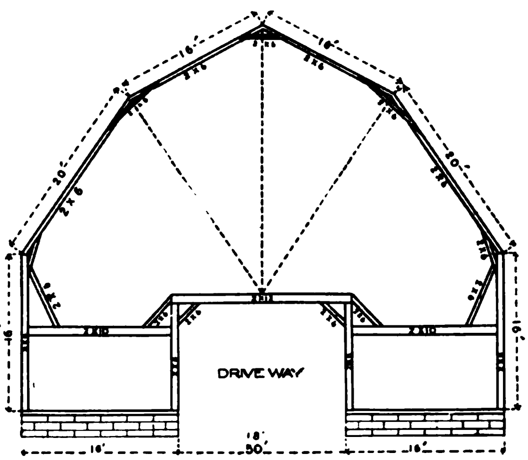


FIG. 131. AN INDIANA STOCK BARN (CROSS-SECTION).

2" x 8", 16' long; rafters 2" x 6", first span 20' long and the top span 16' long; braces 2" x 6", 10' long. There are about 45,000 feet of hard wood in the building and 10,000 feet of dressed yellow pine, also 65,000 shingles to cover.

The roof has three double dormer windows on each side and a cupola on top with double windows on each side. The combs of the dormer windows are on a level with the break in the main roof.

The outside weather boarding is yellow pine drop siding and the inside finish is shiplap put on diagonally. The doors are all roller doors. The whole cost of the barn was $2,800 when originally built.

NORTH DAKOTA COLLEGE BARN.

The main part of this cattle barn stands north and south, and is 135' long and 37' wide. It holds two rows of stock facing the center, with a 5' feed passage through the middle. The feed passage connects with the silo, which allows the silage to be thrown into a small truck and drawn through the passageway between the mangers as it is fed to the stock. (See *Fig. 132.*)

On the east is a projection 10' long by 32' wide, containing an office, a stair and a milk room. On the west is a large wing 50' long by 37' wide, with two rows of box-stalls of different sizes, stairs, watering troughs, and closet. The building has 16' studding throughout.

The stalls are of the Bidwell pattern, and are of different sizes, ranging from 3' to 3' 4" in width, and they are 5' and 6' in length. The manger is 3' wide and 8" high, and is movable. It has a fence like a partition in the middle, which prevents the animal walking forward through it. This stall can be adjusted to suit the size of the animal. The gutters are 16" wide and 6" deep at the back, with 1" slope from front to back. The box-stalls are of different sizes.

The second floor has feed bins, attendant's room and hay mows. The hay is taken in by means of hay forks to all parts of the barn.

The floors of the office and milk rooms are double, with building paper between. These

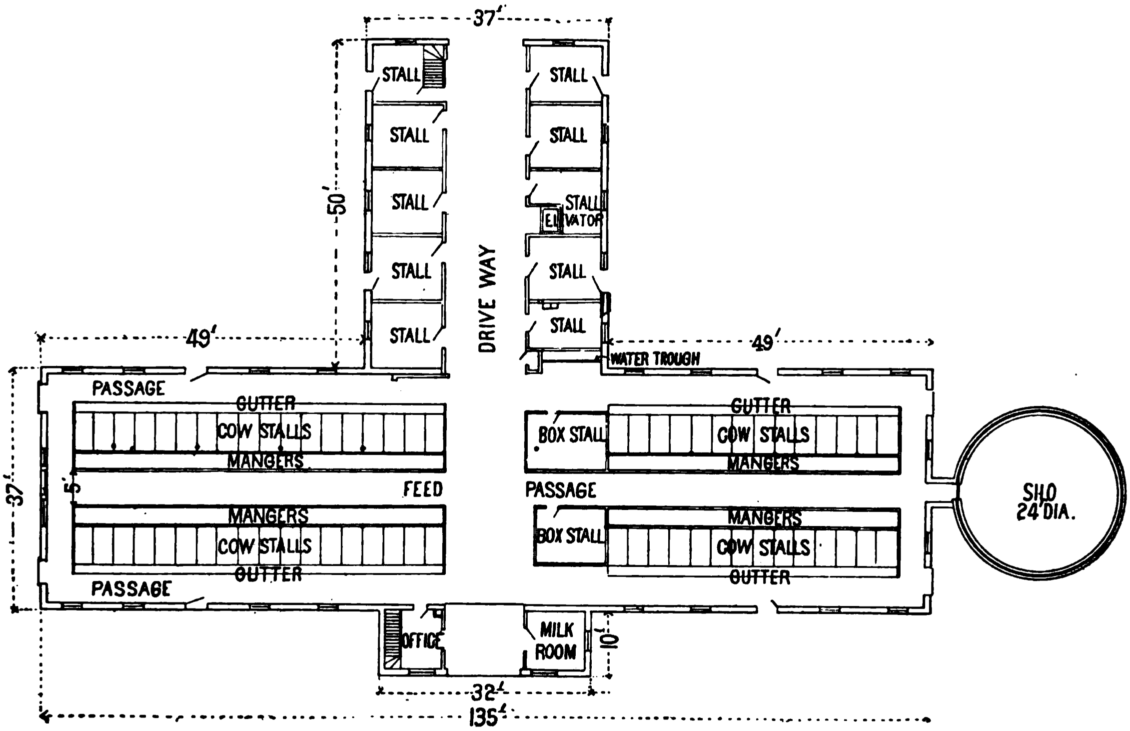


FIG. 132. NORTH DAKOTA COLLEGE BARN (FLOOR PLAN).

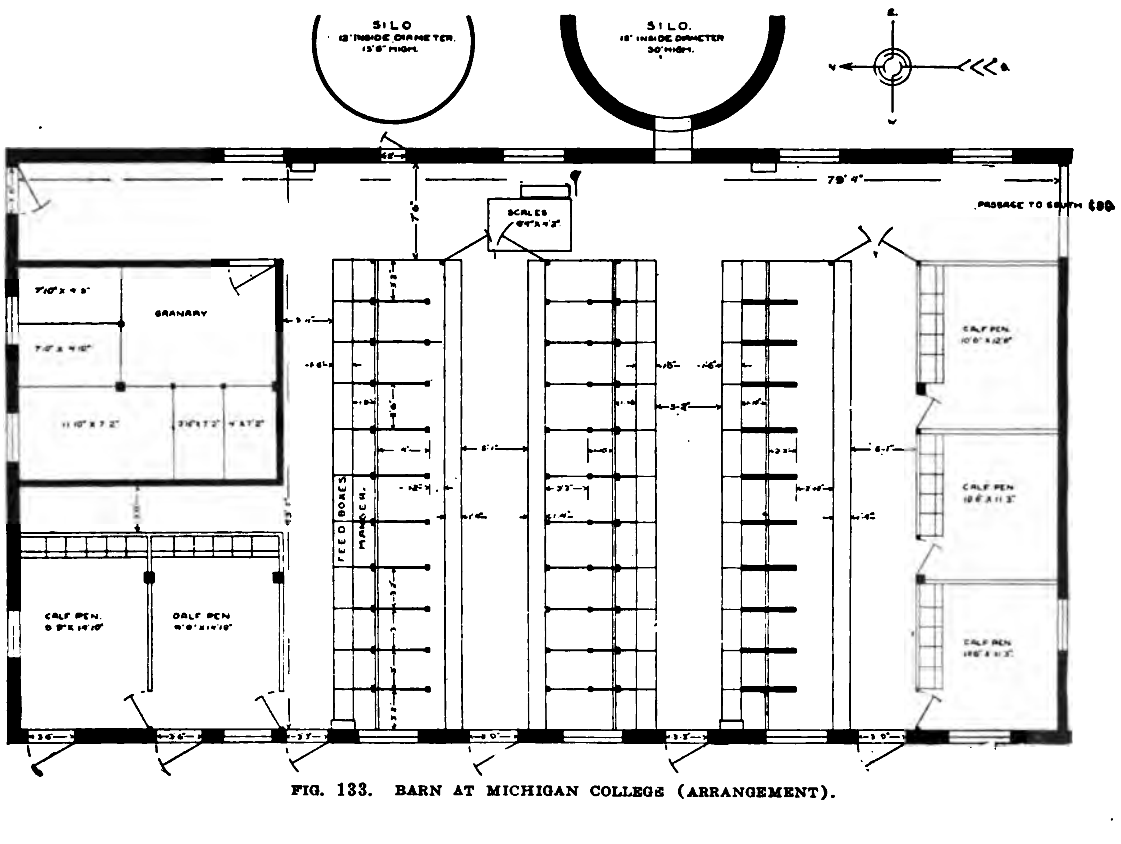


FIG. 133. BARN AT MICHIGAN COLLEGE (ARRANGEMENT).

rooms are ceiled with western fir ceiling. The remainder of the first floor is laid with sized 2" x 10" plank. The planks constituting the stall floors are laid with western fir throughout.

The silo is round in form and is 24' in diameter, inside measurement. The wall is made of brick, 28' high and 20" thick, with a dead air space in the center of it. The floor and wall are cemented with the best grade of cement. A dormer window in the silo serves as an intake for green corn or other material with which the pit is filled. A second dormer window on the opposite side of the roof furnishes light.

MICHIGAN COLLEGE BARN.

Fig. 133 represents the grade beef herd barn in use at the Michigan Agricultural College. This is a remodeled structure, the building having originally been used for a grain barn. The outer dimensions of the foundation are 45' x 80'. The barn will accommodate 33 head of mature cattle and from 18 to 20 head of calves and yearlings. The first row of 11 stalls from the south end is filled with swinging stanchions and short partitions to permit calves to suckle with ease. The second row of stalls is fitted for the handling of milch cows; these stalls are separated by gates and the cow is kept in place by a chain fastened across behind. The remaining or third row is fitted with heavy solid plank partitions, for handling feeder steers. In front of each row of mangers there is a feed box for each animal, designed to hold about a week's rations of concentrates; while this is necessary in experimental work, it would not be needed by the farmer. The five calf pens are fitted with stanchions which are used to secure calves and young animals at feeding time only. Chutes are so arranged that hay is dropped from above into the feed alleys and straw behind the stalls at the most convenient points. The manure gutters are 6" deep from the stall side and 4" on the opposite side; they are 16" wide. The manure is conveyed by car running on a cable to a concrete manure shed, about 60' from the barn. The amount and placing of lights have proved to be about ideal.

BARN FOR PURE-BRED CATTLE.

Figs. 134 and *135* represent the pure-bred dairy and beef barn now in use at the Michigan Agricultural College. This entire structure was originally designed for a dairy barn, and the north part was fitted solely with box-stalls which have been removed and fitted to handle the pedigree beef herd, thus putting all pure-bred cattle under the same roof. The two parts are to be entirely separated on the ground floor. The main building on the north end, 43' x 70', now furnishes stall room for at least 16 head of mature cows and from 24 to 36 head of young stuff, depending on size; the young dairy stock

FIG. 134. BARN FOR PURE-BRED CATTLE (ELEVATION).

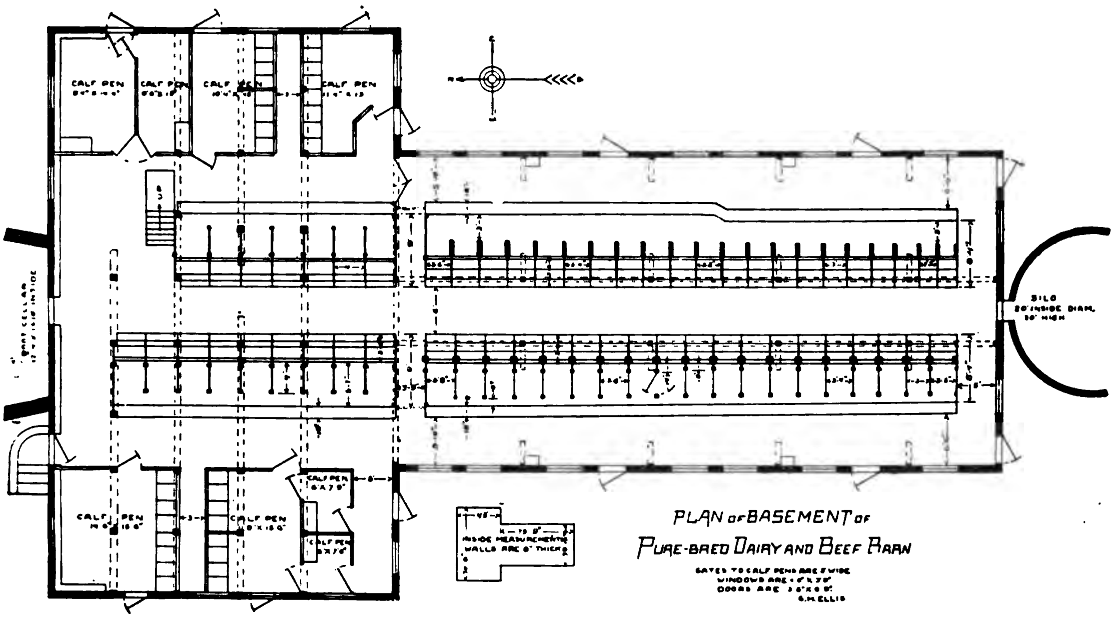


FIG. 135. BARN FOR PURE-BRED CATTLE (BASEMENT).

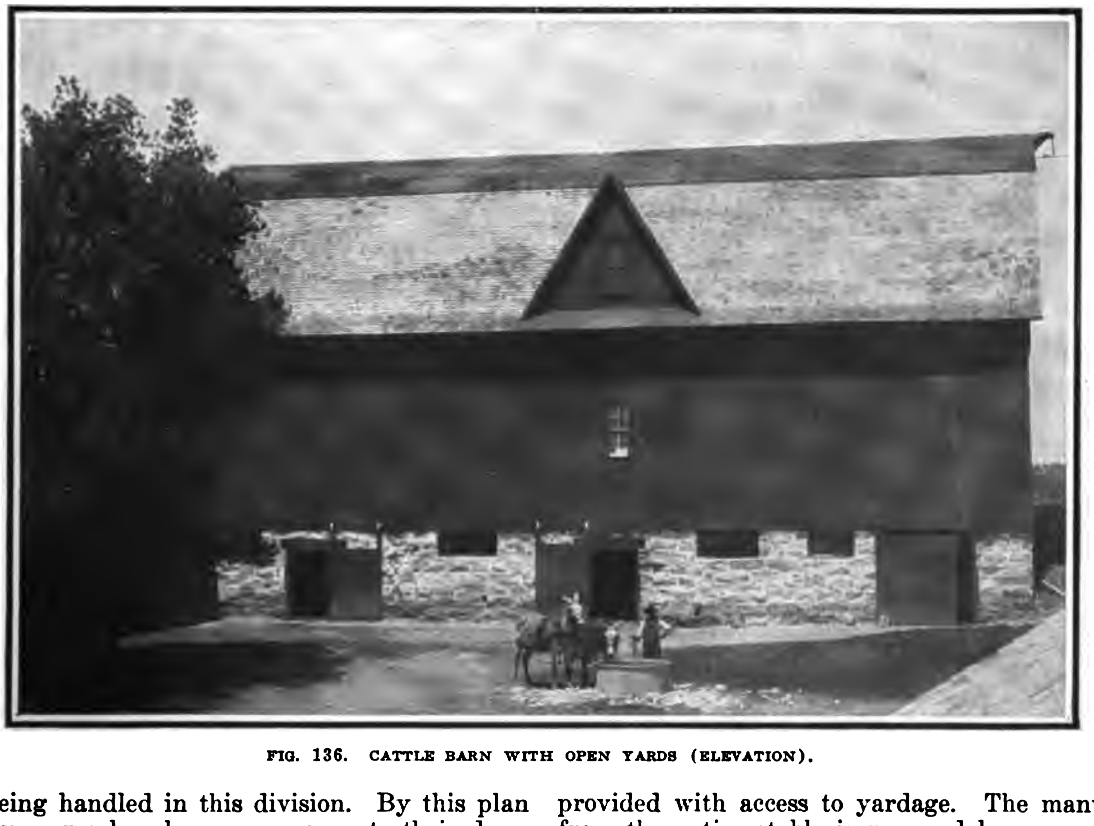


FIG. 136. CATTLE BARN WITH OPEN YARDS (ELEVATION).

is being handled in this division. By this plan the young calves have easy access to their dams to nurse. The apartments marked calf pens are fitted with adjustable stanchions to handle any age from calves to yearlings. All calf pens are provided with access to yardage. The manure from the entire stable is removed by cars running the entire length of both alleys and connecting with a shed located just south of the silo, this shed now being connected with barn.

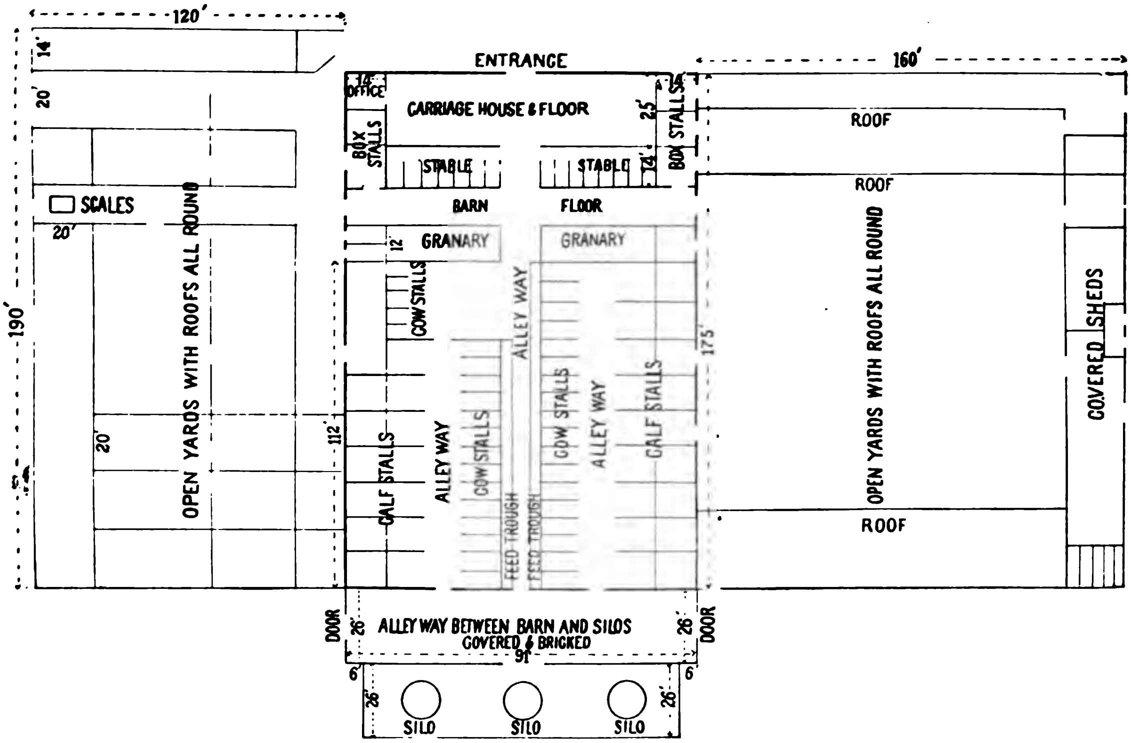


FIG 137. CATTLE BARN WITH OPEN YARDS (FLOOR PLAN).

Feed cars are used to convey silage, hay and roots. The south part or annex, accommodates 40 dairy cows and heifers of various sizes.

CATTLE BARN WITH OPEN YARDS.

Fig. 137 shows a plan for a barn 175' long and 91' wide, at the south end of which are three silos separated from the barn proper by a covered alleyway 26' wide. On both sides of this barn are enclosed open yards with roofs all the way round. The larger of the two yards is 176' x 160' and the smaller one 190' x 120'. There are about 36 cow stalls and 15 calf stalls, besides accommodations for about 20 horses. This barn has a stone foundation and is built on

FIG. 138. A CATTLE FEEDING BARN (ELEVATION).

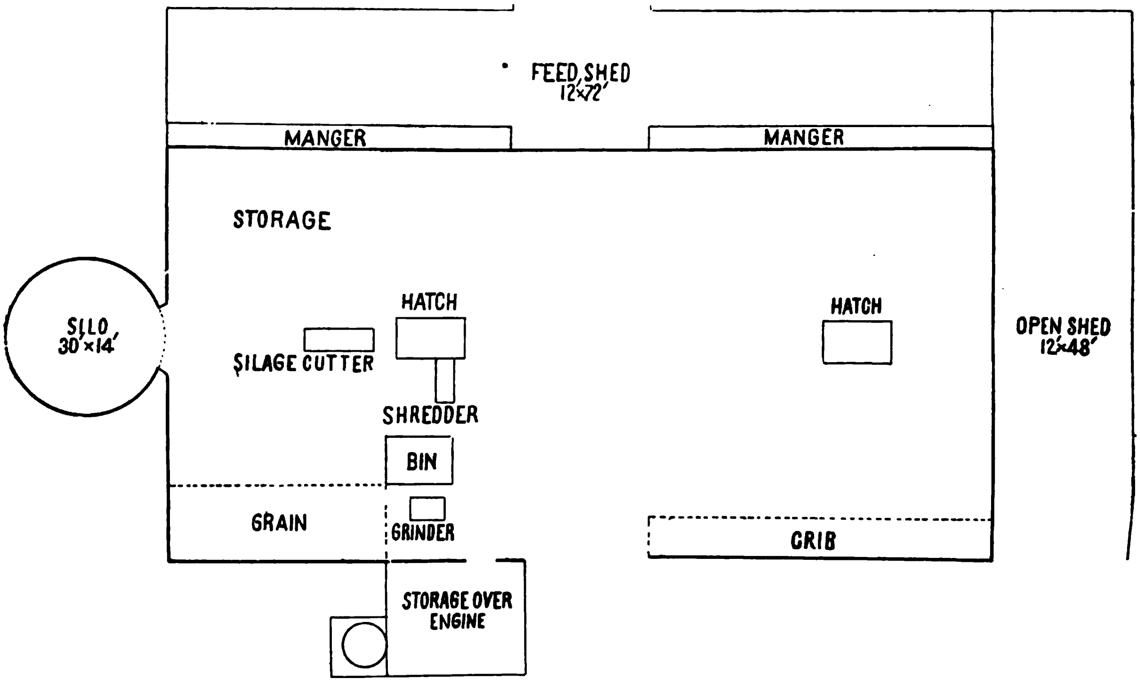


FIG. 139. A CATTLE FEEDING BARN (FIRST FLOOR).

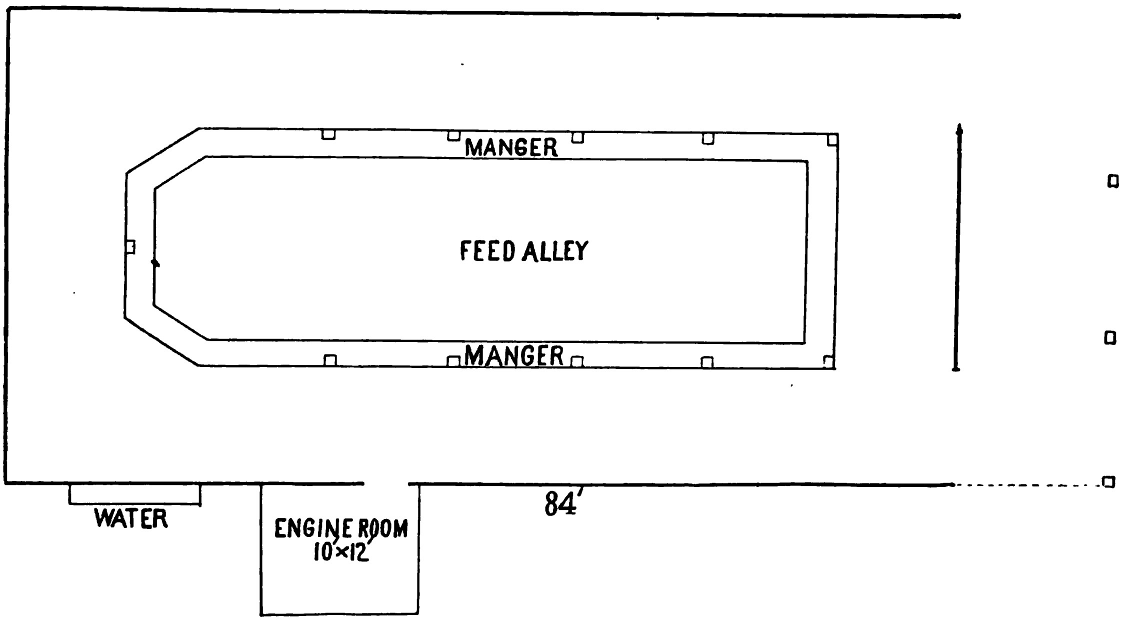


FIG. 140. A CATTLE FEEDING BARN (BASEMENT PLAN).

the joist frame construction plan. (See *Fig. 136.*)

A BARN FOR FEEDING CATTLE.

Illustrations and plans shown in *Figs. 138, 139* and *140* represent a good feeding barn constructed with three objects in view: First, the winter feeding of young cattle; second, the use of the entire corn crop; third, the saving of all manure.

The entire basement floor is cement, as is the feedway and one side of manger, the latter being raised about 10" above the floor proper. (*Fig.*

140.) The space around the wall will easily accommodate 60 weanling calves. A manure spreader can be driven entirely around the space. The basement walls are of limestone construction 8′ high, insuring light and ventilation. A large arch in the wall accommodates a water tank supplied by a storage tank above ground. An engine room adjoins the basement and is equipped with a 12 H. P. gasoline engine. A small cistern just outside the wall furnishes never-freezing water for cooling the engine. A line shaft driven by this engine operates machinery on the floor above. Pulleys can be shifted on shaft and positions of machinery changed. (See *Fig. 140.*)

The superstructure is a modified type of plank frame construction. The posts are 14′ in length. All the frame is of hardwood; the siding of No. 1 common Arkansas pine, with shingles of Washington cedar. A lean-to shed at the east end of the barn protects the entrances to the basement and provides exercise and shelter for cattle. The silo is at the west end of the building; is of 100 tons capacity, constructed of 24′ hard pine staves, set on brick well laid in cement mortar, and excavated about 6′ deep. The bays at the eastern end and the space above the machinery accommodate a large quantity of shredded fodder or hay.

The special features of this barn are the arrangements for taking care of the corn crop. All grinding, shredding and filling of silo is done under cover and all feeding indoors. A 12′ cemented floor shed is located on the north side of building (see *Fig. 138*). The mangers are 2′ above the floor, but level with main floor of barn. The entire cost of building as constructed, including cost of silo and machinery, was $3,500.

A BREEDING CATTLE BARN.

A western breeder asking for a design for a barn for beef cattle specifies that there shall be space for 20 young bulls, 20 heifers, 20 cows and as many calves, with stalls for 20 cattle and 5 bulls, besides some box-stalls and four double horse stalls.

The general scheme shown in *Fig. 141* is of a very long narrow barn of very simple construction, enclosing three sides of an open court, and thus shutting off winds and making an admirable place for cattle to be out of doors and to sun themselves in winter time. In this barn most of the cattle will run loose, having access also to small yards. They will be fed in a common manger from a feeding alley, and everything may be fed without getting in among them, if this is desired. The building is 22′ wide, with 18′ posts, a basement 8′ in the clear, through which one may drive to remove manure. The floors are of hard clay except where the stalls come, and there are chutes through which hay can be thrown into the feed alley and straw chutes into the sheds. There should be sections of the mow left unfilled when hay is put in, and these sections blown full of straw at thresh-

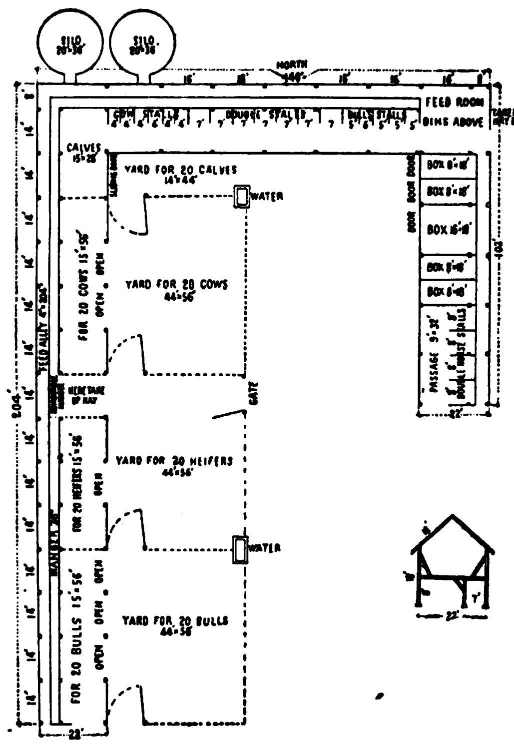


FIG. 141. A BREEDING CATTLE BARN (ARRANGEMENT).

ing time. The mow is calculated to hold ample hay and straw for caring for all the animals that should be beneath it, and with little additional room. Provide for little glass in the left wing, since the sides of the sheds next the court would be nearly all open to the air at all times (strong sliding doors might be provided, if they would be left open), but where the stalls come much provision should be made for light and ventilation by giving almost a continuous row of windows on the south side, hinging on the bottom and opening inwardly. Ventilation will be through the hay chutes and out through ventilators in the roof.

Hay will be taken in in four places—a temporary transverse driveway through the left wing, at each end of the central part and at the end of the right wing. The box-stalls may sometimes be subdivided, making a few stalls 8'x9', thus increasing the capacity. Gates will divide them. The plan calls for about 62,000 feet of lumber and the barn should be completed for $2,500 to $3,000.

AN ENGLISH BULL BARN.

Figs. 142 and *143* show a bull barn used by George Taylor in England.

It is finished in a substantial English manner, with concrete floors and wood all creosoted and some of it pitched. Each bull has a snug sleeping apartment, a small open yard where he can take the sun, and a covered place over his manger. Very strong gates boarded tight divide the pens and when these gates are opened and swung half way around they fasten the bulls each one in his own sleeping pen, while a cart

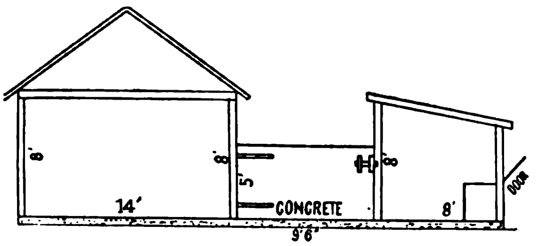


FIG. 142. AN ENGLISH BULL BARN (CROSS-SECTION).

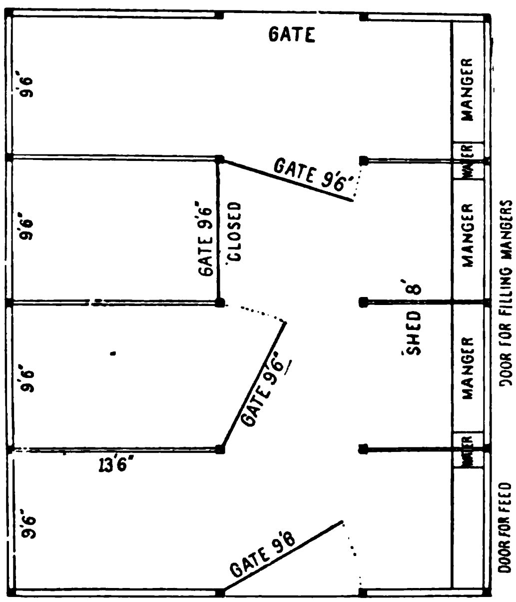


FIG. 143. AN ENGLISH BULL BARN (FLOOR PLAN).

can go through to clean the whole thing out. In feeding one can put the feed into the mangers from outside. Water should be within the stalls, especially in mild and summer weather. The roof over the manger is of galvanized corrugated iron; the other roof is of slate with a capacious eaves-trough.

A CATTLE SALE PAVILION.

Designed for use as a barn in which to hold auction sales of pure-bred beef cattle, this building (see *Fig. 144*) seats 600 people (*Fig. 145*)

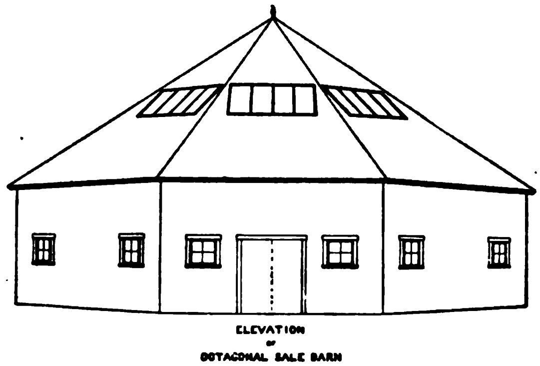


FIG. 144. A CATTLE SALE PAVILION (ELEVATION).

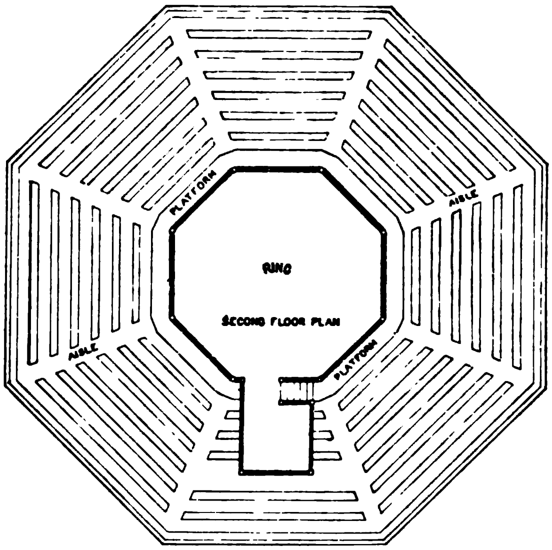


FIG. 145. A CATTLE SALE PAVILION (FIRST FLOOR).

and has stalls for 30 cattle (*146*). As it is not meant regularly to accommodate cattle no provision is made for the storage of hay or grain, which will be received at the barn in small amounts, the hay in bales, and stored temporarily in the passage. The seats are over the cattle stalls and are arranged in a regular incline, giving every visitor a good view of the sale-ring, which is 24' in diameter. The building is 25' long on each side, of octagon shape, and 16' high at the eaves. Light to the sale-ring is afforded by skylights in the roof. The stalls are well lighted by two windows in each side. The building is very economical of material and space and may be built at very moderate expense, or if desired made quite elaborate.

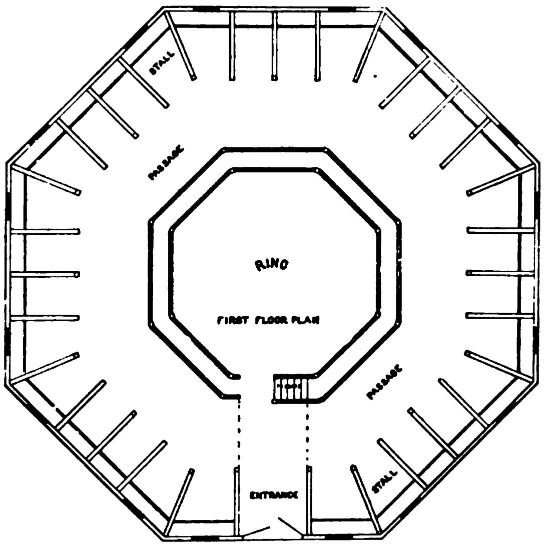


FIG. 146. A CATTLE SALE PAVILION (SECOND FLOOR).

A CATTLE SALE BARN.

The cattle sale barn shown in *Fig. 147* cost about $1,000. It was built by Stow & Ginrich, proprietors of the Clover Wave Hereford Farm in Iowa. This barn is 60' in diameter and 50'

FIG. 147. A CATTLE SALE BARN (ELEVATION).

high. The sills are made of board 1" x 6", green native lumber, six boards thick, placed on edge on the foundation, making a sill 6" x 6". The studding is of pine 2" x 6" and 16' long. The girders are 1" x 4" native lumber bent around the outside of the studding. The boards are double and put on so as to break joints. This makes a 2" x 4" girder. The plates are made of 1" x 6" in the same manner; the rafters are of pine 2" x 6" and 18' long to purlin plate, which is made of 1" x 6" native lumber. The upper rafters are same length, reaching up to the top plate which forms the base of the cupola. The cupola has 2" x 4" studding 6' long and at the top is another plate made of native lumber 1" x 4". The siding is pine 8" board; the sheathing is 1" x 3" native lumber except on cupola, which is 1" x 2", so as to bend more easily. About 35,000 shingles were required to cover it. The doors are hung on rollers and are

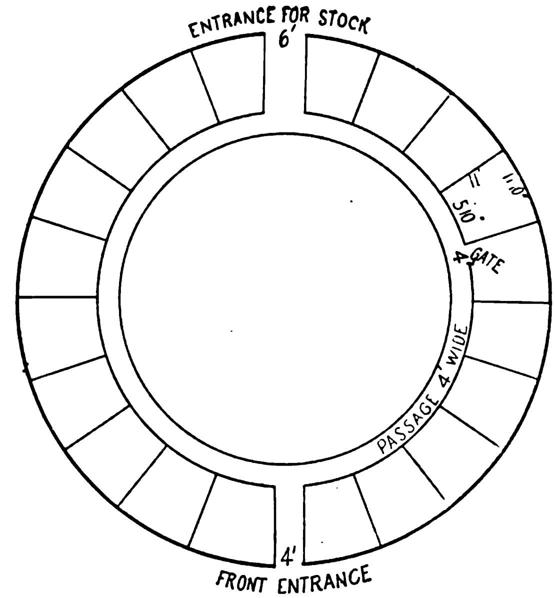


FIG. 148. A CATTLE SALE BARN (FLOOR PLAN).

curved the same as the side of the barn. The roof is cone-shaped and is self-supporting. The hay capacity of the mow is 150 tons and the ground floor will accommodate 32 head of large cattle. In the center of the barn is a sale-ring 30' in diameter and around the side of the building are 20 large stalls.

Fig. 148 shows the arrangement of the ground floor. The entrance for stock is 6' wide and the front entrance 4' wide. The aisle is 4' wide. Gates opening into the stalls are 4' wide and are made to fasten across the aisle when open for convenience in handling stock. There are 12 feed boxes around the circle in the center for that number of large cattle, or quite a number of calves could be put in loose.

A SMALL CATTLE BARN.

Fig. 149 shows a cattle barn and shed adjoining that has been used for five years with satisfactory results in raising and fattening young beef. The main barn is 60'x56' and 22' to the eaves, which gives ample loft room over the sheds in which hay is stored and the center mow blown full of straw. The box and milch cow stalls have plenty of sunlight and are closed but few days in the year. About 25 cows are kept for raising calves; they have the protection of the open shed with mangers in which is fed roughage, usually corn fodder, while their calves get through a creep into the shed of the main barn, where they are fed clover hay, oats, bran and a little chopped corn and oilmeal, which they learn to eat long before they are weaned. Their grain is fed in troughs in an open yard. A large gate between box-stall and shed admits of driving the entire length of the barn, which makes hauling out the manure a simple matter.

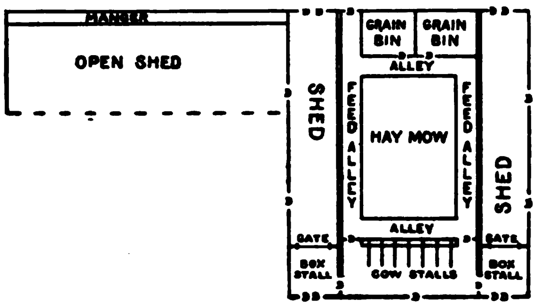


FIG. 149. A SMALL CATTLE BARN (FLOOR PLAN).

HORSE BARNS AND STABLES.

On the farm a general style and principle may be employed in building housing for horses and cattle. Preceding pages in this work may be taken as suggesting horse shelter for many farms, but when it comes to building stables exclusively designed for horses special plans must be followed. The ceaseless activity of the horse, young and old, must be reckoned with from first to last, and this necessitates a solidity of structure in detail which need not be observed in the erection of ordinary farm buildings.

A fairly large barn is desirable on account of the economy of construction involved. Box-stalls must be provided for stallions and for mares and foals. The walls of every box should be made so that they slope inward for the first four feet of their height, being at the ground point one foot inside the perpendicular of the wall. This prevents a horse from being cast or rubbing his tail or bruising his hocks. Doors from each box should open to the outside. This insures a ready egress for the animals in case of fire and an easy way to clean out the boxes day by day. Once the manure is thrown on the outside it may be drawn away and spread on the grasslands or fields at once and its utmost benefit secured to the farm. A gravel or stone road should be laid entirely around a stable with these outside doors. The inside space of a large barn must necessarily contain boxes which cannot open to the outside. These should communicate by large doors with broad alleyways.

Convenient space should always be reserved on the ground floor for a feed-mixing room and hay may be delivered to the manger in each box directly by chutes or to convenient spots in the alleyways. If each box is equipped with a chute a great waste of hay is almost certain, as the tendency will be to save time and work by filling the chute full and allowing the horse to stand to hay all the time. This is one of the most costly and most unnecessary wastes on the American farm.

Loft room should be very ample. To this end the open form of construction in the roof has been found to be the most satisfactory. Large bins for keeping grain and bran should also be provided as nearly rat-proof as possible and connected with the feed room below by spouts. In the comb of the roof in large barns there should be a complete system of tracks for hay forks or slings, admitting of the filling of the loft from each end.

Partitions between box-stalls for the first five or six feet from the ground upward must be very strong and substantial. Above this, iron rods ½" thick or heavy wire netting should be used. Horses love company, and if closely confined but unable to see one another they are likely to get restless and contract the bad habit of pawing. These iron rods should be set top and bottom in oak or other hardwood timber 2" x 4" in size and the edges should always be rounded off with the plane. It seems likely that partitions of concrete will come into great favor. For the mangers iron is preferred by some and wood by others, but when wood is used it must be very hard wood. The constant biting and gnawing to which most wooden mangers are subjected, chiefly by colts, make little impression on hard wood. Some prefer to leave nothing in the box at all on which the horse may fix his teeth. A portable feed box, placed inside the door and removed when the feed is finished, and hay fed on the floor are preferred by many of the best breeders and horsemen of the day, but the feeding of long hay on the floor is wasteful. It is better to provide a manger bound with tin or sheet iron to prevent gnawing. The best flooring for the boxes is a hard clay.

Light and air are essential in all horse barns. Windows should be easily opened and each one should be fitted with a wire screen so that in summer the flies may be kept out. Doors to the outside should be in two parts, the lower half about 5′ high and the upper smaller, its place to be taken in hot weather by strong wire screen netting. This must be protected by a framework of hardwood bars. With windows and doors thus opened and screened the horses will be cool and comfortable as possible in hot weather. Electrically driven fans of course may be installed, but they are not common.

If the design is to build a barn which may be used partially for breeding horses and also for driving horses, a series of standing stalls should be arranged. These may be floored with pine or other planks for two-thirds of their length, allowing the fore feet to rest on a clay floor. A well-built harness room fitted with cases in which the leather goods may be shut up airtight is desired. The ammonia arising from the stables where horses are kept is very destructive both to leather and the varnish on carriages. For this reason the carriage house should be shut off from the section in which the horses are kept. Glass doors should be used in the harness cases in order that the condition of the leather may be readily noted.

Ventilation is one of the essentials in a stable. There must be airshafts from the lower story leading to slatted cupolas on the comb of the roof. If reasonable amount of attention is paid to the location of the windows and doors there need not be any trouble as to the supply of necessary fresh air, but ample shafts to carry off the heated foul air must be provided.

Generally it is well to devote barns to one distinct use or another but very satisfactory composite structures may be built. If there are several stallions, usually the most valuable animals on the farm to be cared for, it is best to give them a stable by themselves, and in such a case, more than in any other, doors should open to the outside. Fire is an ever-present possibility and the horse is the most stupid of all the domestic animals when fire is to be fought. The utmost celerity of action is necessary, and any plan of construction which does not coincide with that is faulty.

The method of watering is rather unimportant so long as the water is pure. Perhaps as good a way as any to water horses is the old-fashioned one of carrying it to them in buckets. A hydrant in the barn or a convenient pump is preferred by many owners to a system of water troughs in the stalls which must be cleansed daily or become foul from the dropping of feed in them. A watering trough of cement, galvanized iron or wood, conveniently placed in the stable yard or inside the stable, is perhaps as economical of time and labor as the individual troughs in each stall, when the trouble of keeping the latter clean is considered. Fresh cool water in the summer and tempered water in the winter add much to the comfort and thrift of the horse. Water fresh from a well or hydrant meets both conditions. When horses are watered from an outside trough in winter a tank heater is necessary to keep it free from ice. In all cases the water should be close at hand.

THE STABLING AT OAKLAWN FARM.

When horses were first kept at Oaklawn 40 years ago the big basement barn was the main structure on the premises made so famous by the late Mark W. Dunham, DuPage Co., Ill. It is still a central figure. Observe this barn in the diagram showing the stabling on this farm. There are three stories in it—the stone basement filled with box-stalls only, the floor or "show barn" on the ground level, also filled with box-stalls, and the loft above for the storage of hay and grain. This barn stretches its length east and west. The barn where the driving horses are kept adjoins it on the west, but that in its width extends some 12′ or more to the southward, which cannot be seen in the diagram. Room is provided in single stalls on the upper ground level for 12 driving horses. Still to the west of this driving barn is the coach house with room for 20 vehicles of all sizes from the barouche to the runabout or single speeding buggy. Above the driving horse barn and the coach house are the lofts where the seedcorn and other similar supplies are stored in winter—a fire being kept in the coach house in cold weather. Below these two divisions are the root cellars, solid stone-walled pits where hundreds of tons of carrots, sugar beets and mangels are stored each fall for the winter consumption of the 600 or more horses, young and old, on the farm.

Observe now the convenience with which the manure is handled from these two barns. The ground level floor contains the 12 drivers and more stallions in boxes in the show barn. The manure is thrust from properly covered apertures in the walls to the ground below on the level of the floor of the basement and is there joined by the manure from the boxes therein. It is all thrown in piles on a stone causeway and removed daily by a teamster whose sole duty it is in and out of season to keep this litter spread out on the grasslands.

Adjoining the root cellars on the lower level and stretching at right angles to the basement come the sheds—one-story structures—running first from the root cellar south, then east and then north to meet the "running shed," a vaulted structure 300' long by 120' wide used for showing stallions to customers in cold or stormy weather. This running shed stretches its length east and west and is advantageously used in summer for the storage of grain and hay, loads of sheaf grain or hay over night, or corn fodder in thrown in piles at the doors each day and removed almost as soon as thrown out. Above all these boxes are lofts for the storage of hay and grain.

Barn No. 5 is used altogether for the housing of colts. It stretches again east and west and along its north side there is an alleyway from which feed may be placed in the mangers. The boxes in this very large stable are spacious and hold from three to ten foals or yearlings, and 100 head may safely be housed in it. Spouts bring oats from large bins in the loft to a feed room in the extreme west end of the building and hay is run down convenient chutes at intervals throughout its length. No. 5 and the running shed terminate about on a line at their easternmost extremities. A court is formed within the two, the west end being encompassed by the row of boxes, and the exercising of horses may be done in this court at any time.

The big barn farthest east is No. 6. It is the largest and best barn in DuPage county that is

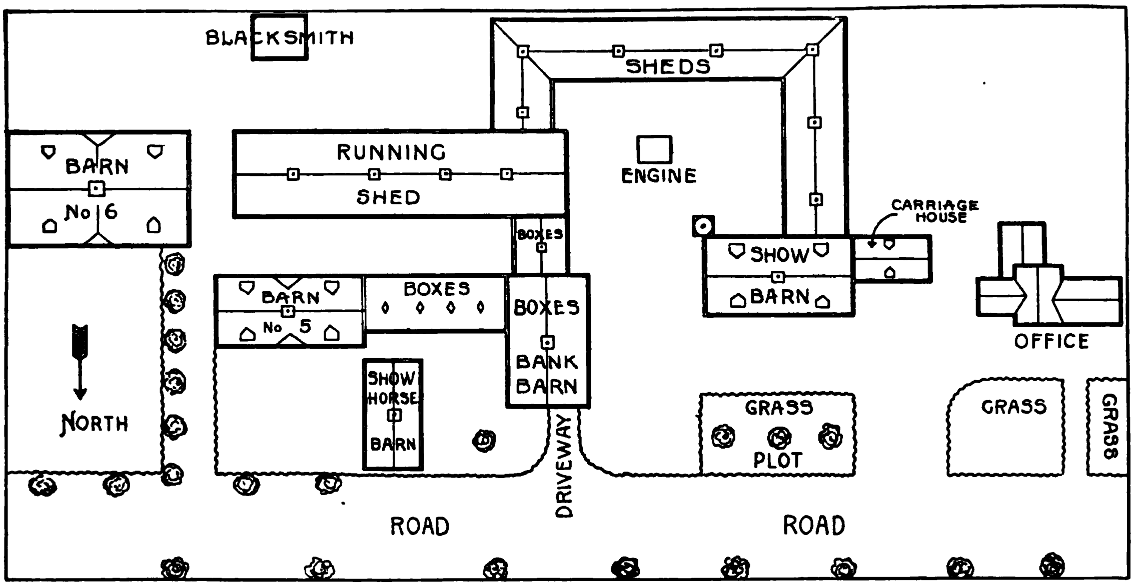


FIG. 150. GENERAL ARRANGEMENT OF STABLES AT OAKLAWN.

the fall, the only requisite being that it shall be free for showing and exercising in the winter selling season.

On the opposite side of this big shed and running northward is a row of box-stalls, terminating in a double-stalled barn near the hedge, as marked in plat, *Fig. 150*. About half-way between the running shed and the terminal barn as here described a row of stallion boxes runs eastward to the west line of Barn No. 5. There are double boxes in this row, the doors facing north and south. The manure from these is devoted exclusively to the keeping of commercial horses. It is 112' long, 62' wide and 54' high from sill to peak of roof, the posts being 28' high. Storage capacity for about 400 tons loose hay is afforded. Main timbers are 10" x 12" and 32' long. In it on the ground floor there are box-stalls only with accommodations for something like 28 stallions. All but a very few of the stalls open to the outside and the few in the center have access to the outside by broad alleyways. The manure here is thrown to the outside where hard gravel roads have been made and, as in all other barns, is removed each day or twice a day as the case may be, to be spread at once on the land most requiring it. The enormous crops of hay grown and fed at Oaklawn and the excellence of the grain crops on this farm prove the efficacy of this method of utilizing the vast quantities of horse manure which must be handled each season. In addition, after the fertilizing elements have had due opportunity to be dissolved and sink into the earth, the unrotted straw is carefully raked up again when dry and carted back to the barns, where it is stacked and made to do duty as bedding once more.

In the second story of No. 6 is a vast amount of hay and grain storage, that portion of the barn having been built with an open center with a view of affording the utmost room for this purpose. Large storage of oats and bran is also provided, the necessary bags of these products being swung to their place by means of an ingenious system of ropes and pulleys which enables the work to be easily and quickly done by horse power. Similarly the hay floor is filled from the wagons by means of slings, harpoons and grip forks, the tracks being laid in the apex of the roof with the object of filling the loft from either or both ends, as the case may be, and at the same time from both if desired. It may be said that this barn was built from plans approved beforehand by the insurance companies with which the risk was placed.

Directly south of about the middle of the running shed and well down the hill is the blacksmith shop, safely removed from both that shed and the single story sheds which run north and south to meet it at its westernmost end. In the middle of the quadrangle formed by the root cellars, the single story sheds and the basement barn stands the engine which pumps the water for the entire farm, boils feed, grinds grain, shreds fodder, saws wood and the like.

In each barn there are several hydrants. The well which is driven in the center of the quadrangle described grants an abundance of the purest water, which is pumped by the engine to a reservoir back of Oaklawn House on the highest part of the farm. From there the water is distributed to every barn and field by means of pipes sunk 6' to 8' in the ground. The supply is never-failing, but is reinforced by a multiplicity of windmills and wells in the pastures somewhat remote from the main engine. Another well, fitted with a powerful windmill, is placed at the southeast corner of the show barn, as shown in the drawing, *Fig. 15*[illegible], to aid in maintaining a full supply in times of drouth. In addition to supplying the stable and fields with water the engine and main well are also made to supply Oaklawn House and other smaller dwellings on the farm.

Such is the Oaklawn plant. Its convenience for the purpose for which it is used is beyond criticism. The small barn, where the show and breeding horses are kept for the most part, is situated by itself and about half way from the double-stalled barn to No. 5. It extends north and south nearly to the main road and is in itself a model for its uses. It has limited hay storage above the boxes and plenty of room for grain, while the appliances for mixing feed on the main floor are thoroughly modern.

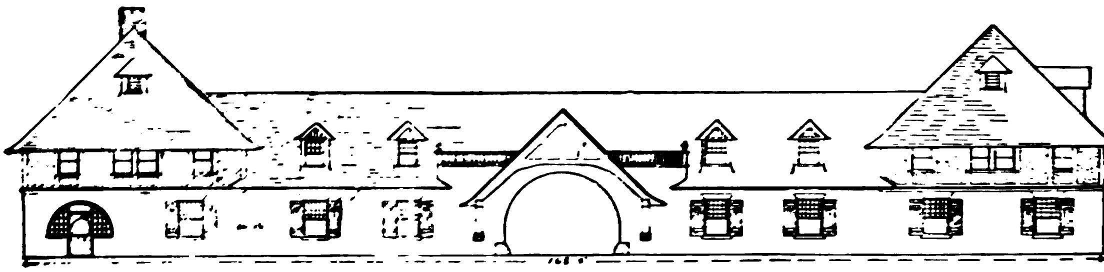


FIG. 151. BARN FOR LIGHT HORSES (FRONT ELEVATION).

The same may be said of all the other barns. The object has been in arranging the entire plant to make the steps taken by the grooms the fewest possible under the circumstances. The hay may be dropped just where wanted and the grain spouted to its place for mixing. The walls of the box-stalls are all fitted with small sliding doors opening into the mangers so that the grooms need not enter the boxes when feeding the horses and most of the boxes are also fitted with water troughs into which a supply of water may be turned at will or in which one may be retained permanently by means of ball and float valves. The buildings are all painted a dark rich red, the trimmings being white. The mares and foals are kept on other parts of the farm which cannot be seen in the engraving to which this refers.

BARN FOR LIGHT HORSES.

A very complete and convenient horse barn was built several years ago in Venango Co., Pennsylvania, for the stabling of light horses. The diagrams (*Figs. 151* and *152*) afford a capital idea of the front elevation and the ground plan of the structure, which is very handsome in its architecture, economical in its construction and admirable in its arrangement.

The dimensions and capacity appear in figures on the diagrams. The grooms have very comfortable steam-heated quarters in the second story, over the harness and wash rooms, and there is ample reserve room over the left wing of the front of the barn. A feature not shown in the diagram is the half-story over the entire circle of boxes, which affords storage for a large quantity of hay that can be mowed away and pitched out at various convenient points. Most of the eastern light horse breeding establishments are equipped either with stables in which boxes are arranged around a big covered area or else with large riding or training schools, in both of which large and costly roofs are needed. Provision has been made in this case for such a training school without the expense of the roof by allowing the roof of the boxes to project over the inner circular court about 12′, thus affording a covered track under shelter the entire distance around without a single post. The drainpipes from the eaves are hinged, so that they may be hooked up to the inner side of the roof out of the way, thus giving an arena 119′ in diameter, with 12′ under cover all around the outer circle. The inner circle on the diagram is an imaginary line, designed to show the distance that the roof projects over the court. The

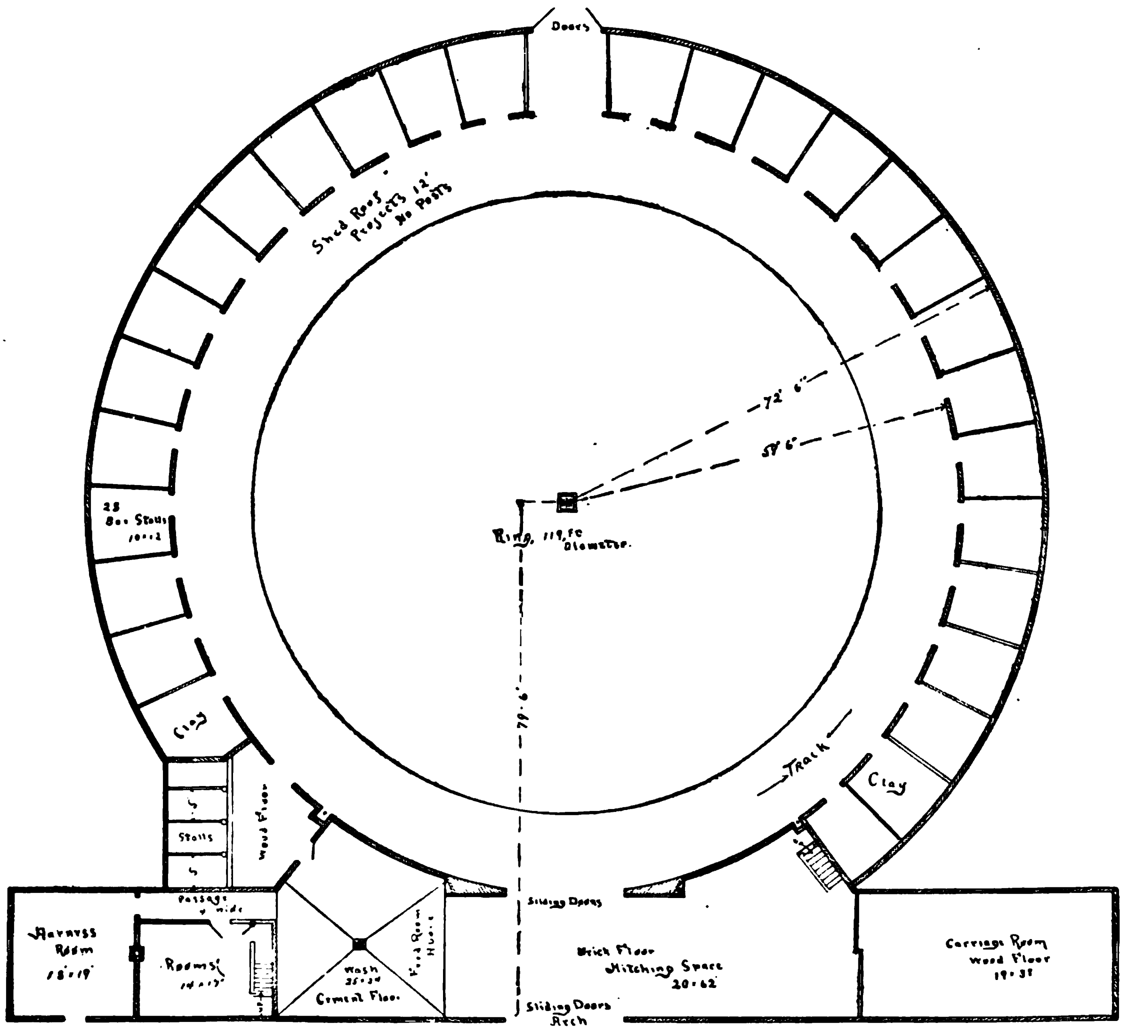


FIG. 152. BARN FOR LIGHT HORSES (GROUND PLAN).

entire court is laid in rolled cinders and has a slight fall toward the center for drainage. All doors opening into it may be tightly closed, thus affording as fine a training and exercising arena as could be desired in clear weather, while it must be a very stormy day that will interfere with work on the 12' track under shelter. Twenty-eight box-stalls, each 10'x12', give luxurious quarters to the horses.

FIG. 153. COACH AND STALLION BARN (INTERIOR).

A COACH AND STALLION BARN.

J. B. Haggin's combination coach and stallion barn at Elmendorf Farm in Kentucky is in keeping with the substantial buildings at that great breeding establishment. It is constructed of stone and brick, the upper part of the building being of the latter material, while over all is a tile roof, making the structure as nearly fireproof as it is possible to make such a building. (See *Fig. 153.*)

Mr. Haggin had in mind the great value of his stallions when he ordered the barn built. As a stallion barn it is a fairly large structure, the main barn having two wings, one on each side. In both the main structure and the wings are box-stalls for the coach horses and valuable stallions which form the nucleus of his Thoroughbred stud. The partitions between the box-stalls and the main barn are of brick (*Fig. 153*) so that no ordinary fire would be able to do any great amount of damage to the animals contained therein. On one side of the main barn are open stalls for the coach horses. In addition to the doors to the box-stalls from the interior are small windows and on the exterior of the stalls are windows placed well up. They afford plenty of light while not allowing the stallions a view of what is going on outside.

In the center of the stallion barn are large ventilators, while the wings are ventilated with circular ventilators made of galvanized iron. In the upper barn is room for the feed, hay and grain.

As a model of fireproof construction the Haggin coach and stallion barn is considered about the best around Lexington, Ky.

A MONTANA HORSE BARN.

The dimensions of this barn, shown in *Fig. 154,* are 36'x84'; posts are 12' apart; two horses are put in a stall; the stalls are 12' wide, facing the sides of the barn. There are several advantages in this arrangement: horses are easily put in and taken out, easily groomed, and harness may be hung on hooks suspended by pulleys right behind them and drawn up out of the way. Besides with such wide stalls it is easy to put feed in their mangers even when the horses are in place. The transverse driveway is to be used only when hay is put in; at other times it is closed with swinging partitions and made into two box-stalls, which are very useful in any stable. This stable may be equipped with an overhead track and carrier for taking out the manure. In the mow floor there should be bins for oats or corn, to be spouted down beside the

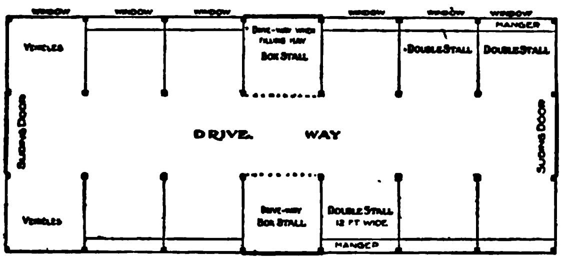


FIG. 154. A MONTANA H RSE BARN (GROUND PLAN).

posts, and filled by a horse-hoist from the central driveway. The frame is all joist, with a self-supporting curb roof.

A MODERN STALLION BARN.

Plans for an admirable barn (*Fig. 155*) for stallions recently built in northern Illinois follow:

The main barn has 18' studding. The lower story is 9' high, covered outside with drop-siding, galvanized iron, molded gutters, red cedar shingles, lined throughout—the lower 4½' with 2" x 12" dressed lumber, above 4½' with matched fencing. Partitions between stalls are 7' high, the lower 4½' of 2" x 10" oak, above 2½' of 2" x 12" hemlock. Alley partitions are 6' high of 2" x 12" hemlock; wall studding 2" x 6"; floor joists 2" x 12"; rafters 2" x 8"; supporting timbers 4" x 6" and 6" x 6". Stall doors are of 1" x 6" matched fencing and double. The wing is one story high, 36' x 110'; it has a row of box-stalls opening into the exercising room. The latter is lighted by windows 3' high, set on upper end of rafters over box-stalls and under the upper end of rafters over exercising room, giving perfect light and ventilation. An office and car-

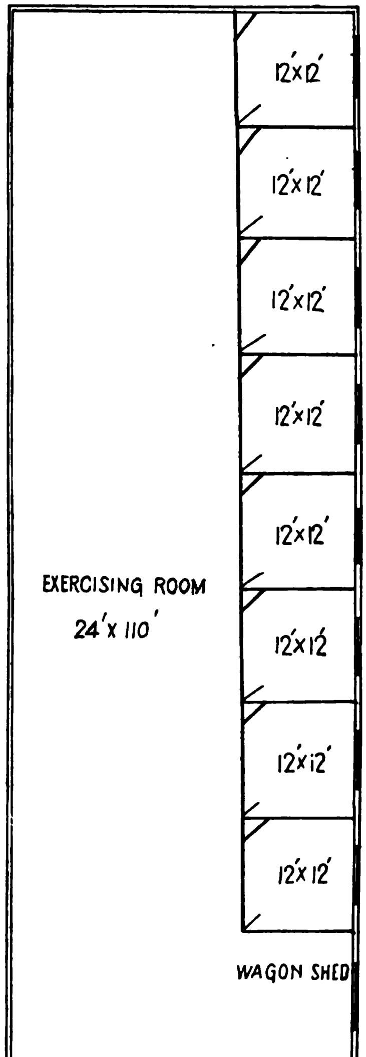
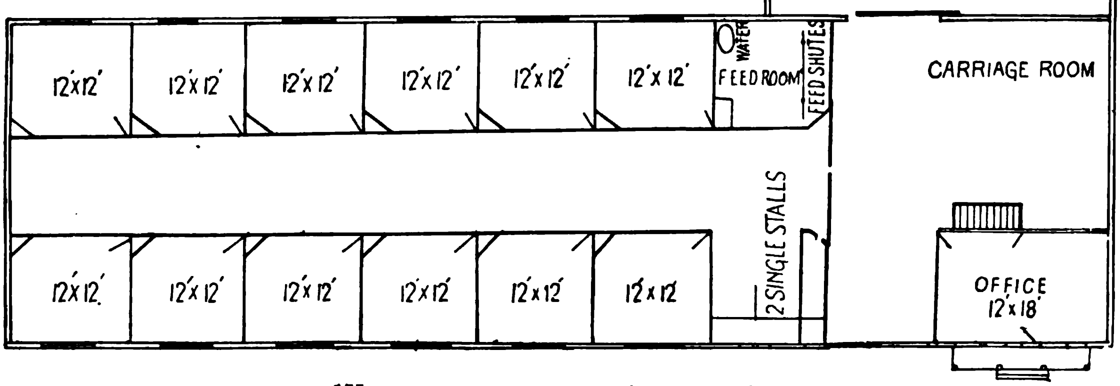
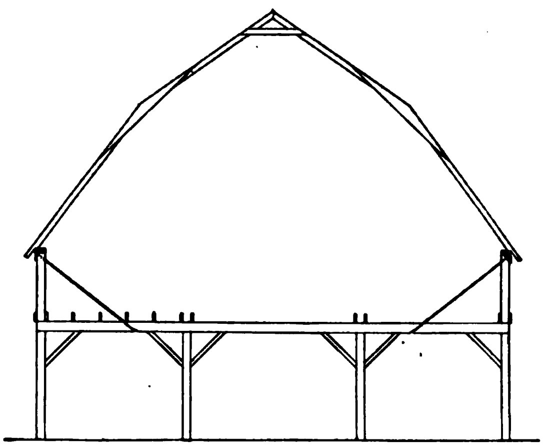



FIG. 155. MODERN STALLION BARN (FLOOR PLAN).

riage room are in main building; men's sleeping room over the office. The stable was built at a cost of about $2,600.

A HORSE BARN WITHOUT CROSS TIES.

A horse barn that possesses many excellent features, among them being the minimum of cost for accommodations secured, economy of space, convenience and healthfulness for the occupants, is built either with joist or solid-timber frame (*Fig. 156*), without cross ties or even purlin plates. The roof is self-supporting, each rafter being so spliced to the one above as to make it virtually one piece and the half of an arch. This arrangement gives ample strength to the roof.



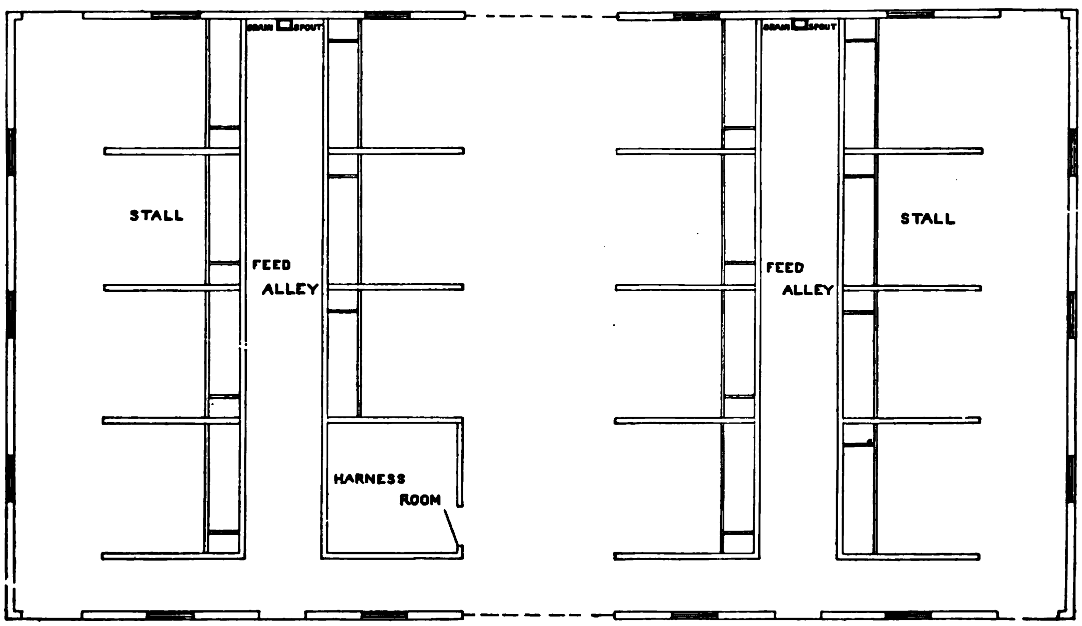
END ELEVATION OF FRAME

FIG. 156. HORSE BARN WITHOUT CROSS-TIES.

In lieu of cross ties there are ¾″ iron rods running from the plates at the posts to the joist-bearers below. These keep the sides from spreading. The rafters are 2″ x 6″ and join at the ends by butting together. Below the rafters there is a triangular piece of oak about 2′ long cut to fit in the angle. This is firmly nailed. On each side of the joist there is now added a board of some tough wood, 1″ x 12″, which also is nailed firmly in place. At the peak there is the collar beam 1″ x 6″, which adds materially to the rigidity of the frame. The hay rack is put on this collar-beam. No floor is used nor sills, the posts resting directly on stone.

The floor is of hard earth. The stalls are double, two horses being put in each. Grain (in bins in the second story) is spouted down to each alleyway and hay chutes reach into the feeding alleys. These chutes should reach up through the mow nearly to the roof, should be 3½′ square and open on one side. These chutes form very efficient ventilators. There is an alleyway (*Fig. 157*) that gives access to the central passage where horses are harnessed or hitched to the vehicles. There should be a window to the harness room, omitted in the drawing, opposite the one in the alley.

Ladders through the hay chutes give access



GROUND PLAN 40X70

FIG. 157. HORSE BARN WITHOUT CROSS-TIES (ARRANGEMENT OF FLOOR).

to the mow. Hay is taken in at either end through doors arranged so as to allow the use of slings and the taking in of draughts at any desired height, these doors reaching from the peak down to the floor of the mow. This barn could be easily converted into a cattle barn by putting in cattle stalls where the horse stalls are arranged.

A BARN FOR 14 HORSES.

The plan shown in *Fig. 158* is for a barn 36′ x 60′. It will accommodate 14 horses. By increasing the length 12′ it will accommodate 18 head. It has two feed rooms, a safe and convenient place for harness, two box-stalls and 12 open stalls.

The barn may be sided with 16′ stock boards with battens or with shiplap. By making the eaves higher than 16′ there will be more room

The feed rooms are situated on each side of the driveway and are each divided into two compartments and an entry so as to allow a variety of feed to be kept and to be easy of access.

The barn should be lighted with 10 windows on each side, two to each box-stall, two to each feed room and one in front of each single stall. Common barn sash should be used, having six 8″ x 10″ panes to each sash, a single sash to each window, with the longest way of the sash up and down. They should be put in on top of the girt, about 4′ from the bottom of the sill and should be arranged to open by sliding to one side.

Feed rooms should be sided with hard pine flooring with the smooth side next to the stalls and driveway. Instead of a harness room hooks can be put up along the sides of the feed rooms next to the driveway, which will be found to answer as well as a regular harness room and more convenient, as it will be more accessible.

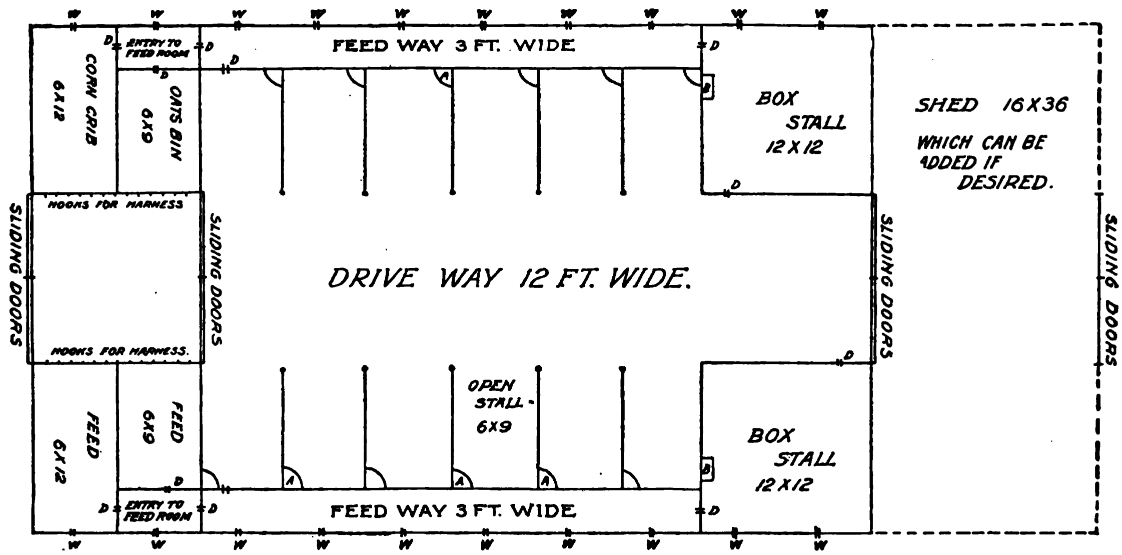


FIG. 158. BARN FOR 14 HORSES (FLOOR ARRANGEMENT).

for hay, but a barn of the dimensions given will contain all the hay required, as it will hold about 40 tons.

Instead of chutes or the regular mangers to feed hay there is a feedway 3′ wide, with perpendicular sides 3′ high from the floor of the stalls, and it is floored on a level with the top of the sill. A feedway like this is better than mangers or chutes, as it allows a man to pass along the entire length of the barn in front of the horses when feeding; there is absolutely no waste of hay, as the horses stand with their heads over the hay while eating and do not pull it out and drop it under their feet, and the chaff is not constantly falling down in their eyes, as when a manger is used that feeds from above.

The box-stalls should be sided perpendicularly, inside and out, from floor to ceiling, with hard pine flooring, except the front, which can be sided up 4′ high and left open, unless a stallion is to be kept, in which case the front may be finished up to the ceiling with ½″ rods set about 4″ apart in the top of the partition, or the regular box-stall wire work may be used. No manger should be used in the box-stalls, the hay being fed on the floor. None will be wasted unless more is fed than the animal should have.

The floor of the hay mow should be not less than 9′ from the floor of the barn, though 10′ or even 12′ would be better for sanitary reasons. The mow should be floored solid, except over the feedways, which should be left open to throw

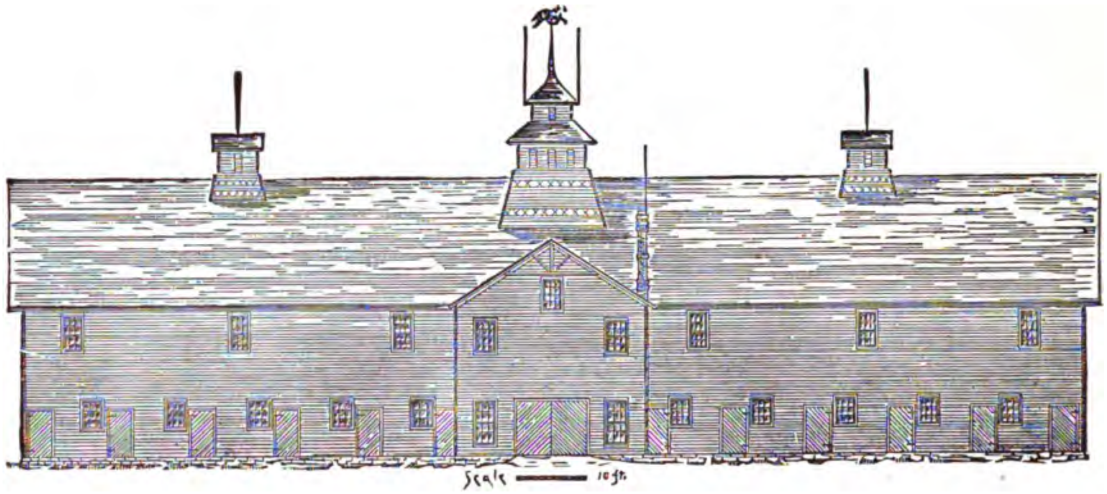


FIG. 159. NEBRASKA HORSE BARN (ELEVATION).

feed down. The roof should have from one-third to one-half pitch, and should be self-supporting so as to do away with all cross ties in the mow. The driveway can be floored with 2″ plank and clay floors used in the stalls, but that and many other minor details must be governed by the individual taste and requirements of the builder. This barn was originally built for about $1,000.

A NEBRASKA HORSE BARN.

It will be seen from the accompanying diagram of the ground plan (*Fig. 160*) that the interior arrangements of this substantially built stallion barn in the main consist of a wide driveway 24′ x 152′, with a row of boxes on either side. This driveway affords a place in which to exercise the horses every day in the year, being of such dimensions that they may be taken on a gallop if desired from one end to the other—and all horsemen understand the value of such a place when the inclemency of the weather prevents outdoor exercise.

Another special feature is the construction of the boxes. The partitions between the boxes and abutting on the hall consist of a solid 4″ wall of pine, made of 2″ x 4″ pieces laid like brick, one on top another, with a cap-piece of oak 5′ up. Above this for 3½′ more there is a grating of gas pipe ⅞″ in size, outside measure, and 4″

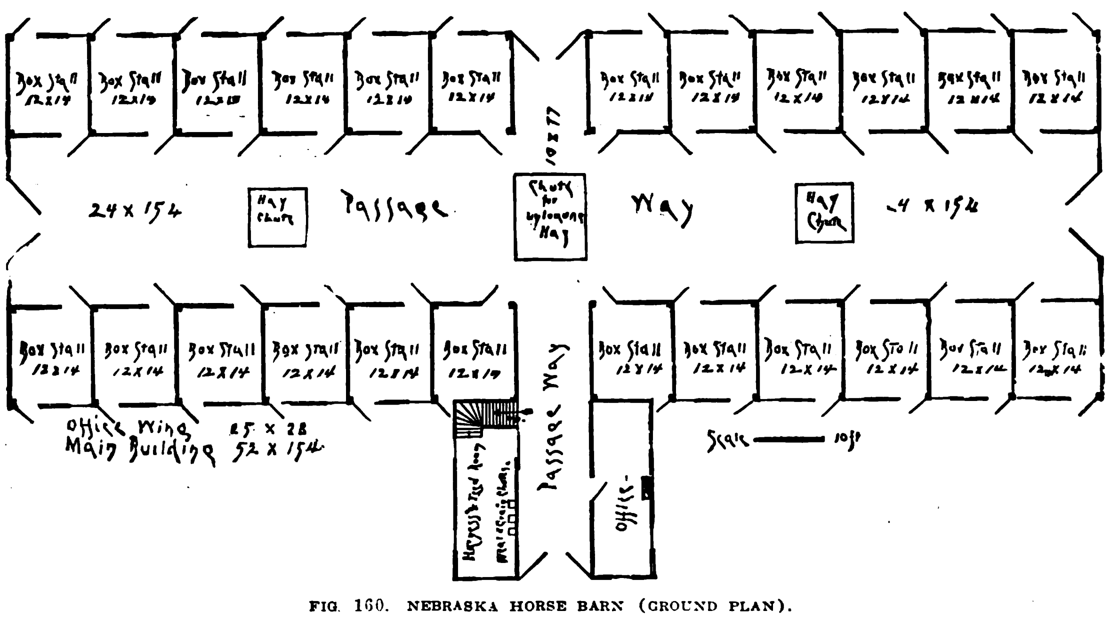


FIG. 160. NEBRASKA HORSE BARN (GROUND PLAN).

apart. To provide means of speedy egress in case of fire there is an outside door to every stall.

The foundation consists of a solid 18" wall 18" deep; piers and interior posts are 18" x 18" and 3' deep. The frame is a mortise and tenon; hall. Sides 5½" patent siding; rafters 2" x 8", 2' apart, with 2" x 8" ridge pole; shingle roof, with eaves projecting 24". Stall windows have nine lights and slide to one side. The hall and office windows have 12 lights, each 10" x 12", and

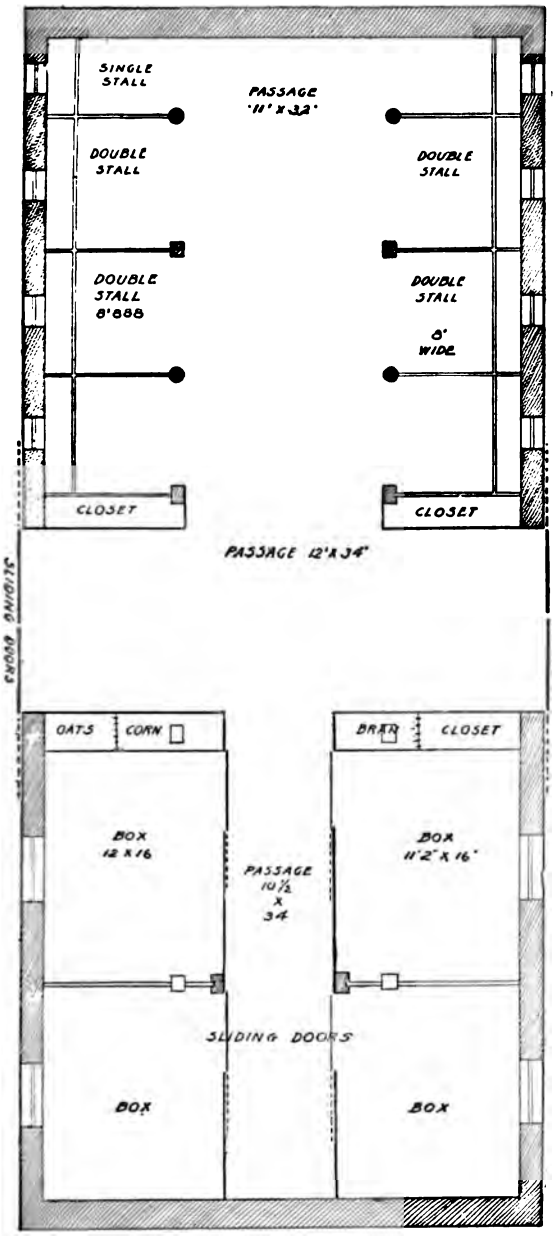


FIG. 161. THREE-STORY FARM AND HORSE BARN.

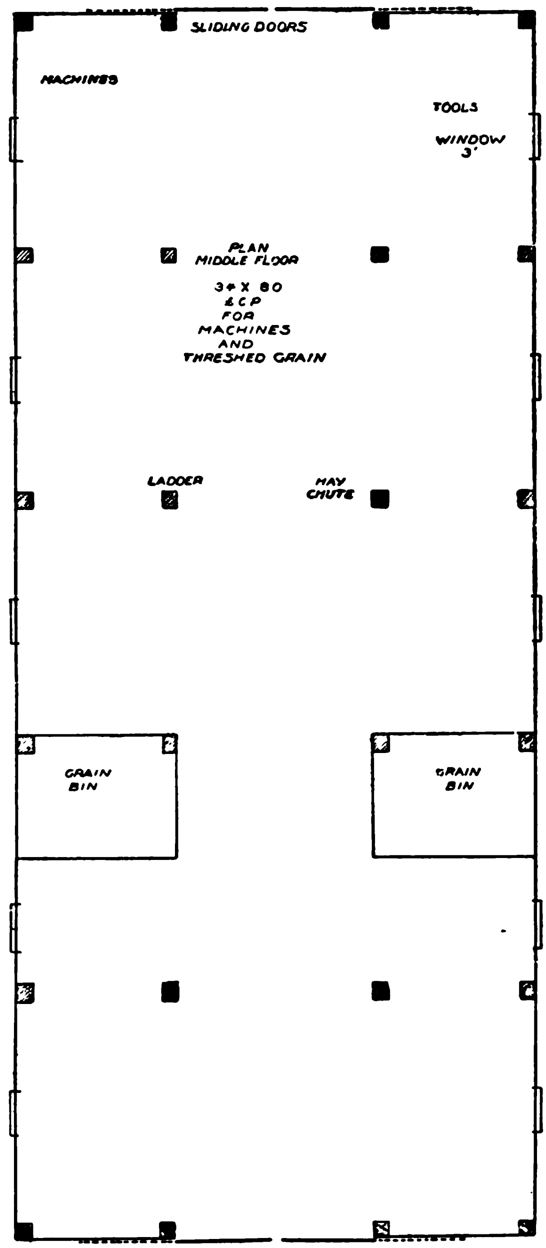


FIG. 162. THREE-STORY FARM AND HORSE BARN.

8" x 8" stuff for posts, sills and cross-beams; posts 22' high. The first floor is of earth and the second floor over boxes is matched flooring, and over hall common boards. The joists are 2" x 10"; 16" apart over stalls, 12" apart over second floor windows have 12 lights, each 10" x 14". The inside doors are of three thicknesses of ¾" matched flooring. There is a cellar 9' deep under feed room for carrots. The sides and ceiling of office room are matched ceiling of pine and in the second floor rooms laths and plaster. The large ventilator is 10′ x 10′ and handsomely proportioned.

Several years ago the cost of this barn was probably between $8,000 and $9,000. *Fig. 159* shows the elevation.

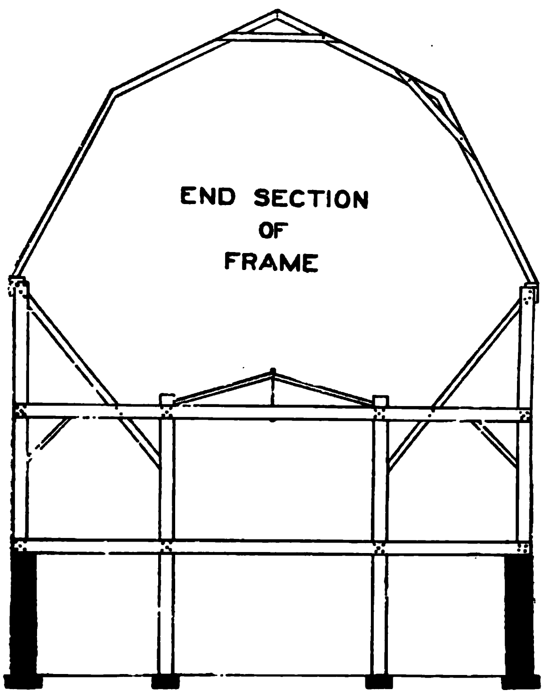


FIG. 163. THREE-STORY FARM AND HORSE BARN.

THREE-STORY FARM AND HORSE BARN.

The three-story farm and horse barn shown in *Figs. 161, 162* and *163* is 34′ wide and 80′ long, with six double stalls, two single and four large box-stalls. Through the basement (*Fig. 161*) is a cross driveway. Grain is spouted down into small bins at one side of the passage and closets on the other side will be found convenient for harness and stable furniture.

As this three-storied barn is narrow it was needful to restrain the height as much as is safe to avoid wrong proportion, so each story was built 8′ in the clear. With the self-supporting roof ample room for hay storage is secured. Hay is taken in from outside, though empty wagons may be driven through the second story. To make the drive high enough to take in loads of hay would be a useless extravagance. Hay doors may be put in each end. To take out braces and yet make the center span of joist bearers strong enough can be done by the wooden truss shown which makes the span unbreakable.

AN IOWA STALLION BARN.

The brick stallion barn shown in *Fig. 166* was built by Champlin Bros. in Clinton Co., Ia., at a cost of $16,100. This barn is built of solid brick and is 140′ x 75′. The front elevation shows two stories high; the rear is three stories. (See *Fig. 165.*) The first and second floors are

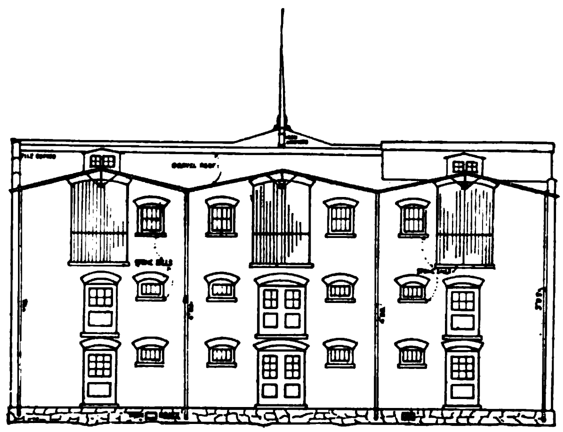


FIG. 165. AN IOWA STALLION BARN.

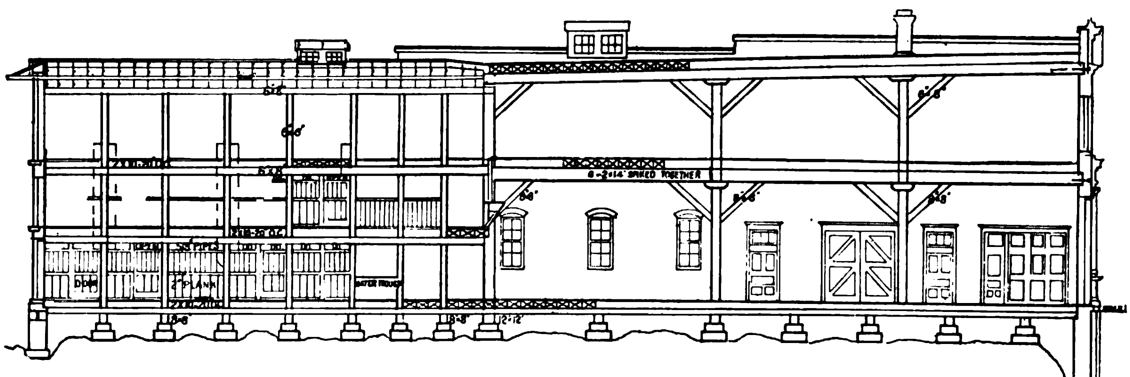


FIG. 164. AN IOWA STALLION BARN (LONGITUDINAL SECTION).

FIG. 166. AN IOWA STALLION BARN (FRONT ELEVATION).

for horses and the third floor is for hay mow and grain bins. It has a capacity for 100 horses, there being 40 box-stalls and 60 single stalls. The blacksmith shop, heated harness room, wash room, robe room, offices and large space for showing horses are on the first floor (*Fig. 166*), and a large carriage room is on the second floor. The barn is equipped with an electric motor, which cost $1,000, to run elevator, grind feed, pump water and unload hay and oats.

BARN FOR 40 HORSES.

This barn for about 40 horses (see *Figs. 167* and *168*) was erected on a large Kansas farm and has many excellent features. There are stalls for 42 horses and three box-stalls, abundant hay room, harness room and room for stableman. The latter room may be made into a box-stall if preferred. The diagrams show the interior arrangement and exterior appearance of the barn.

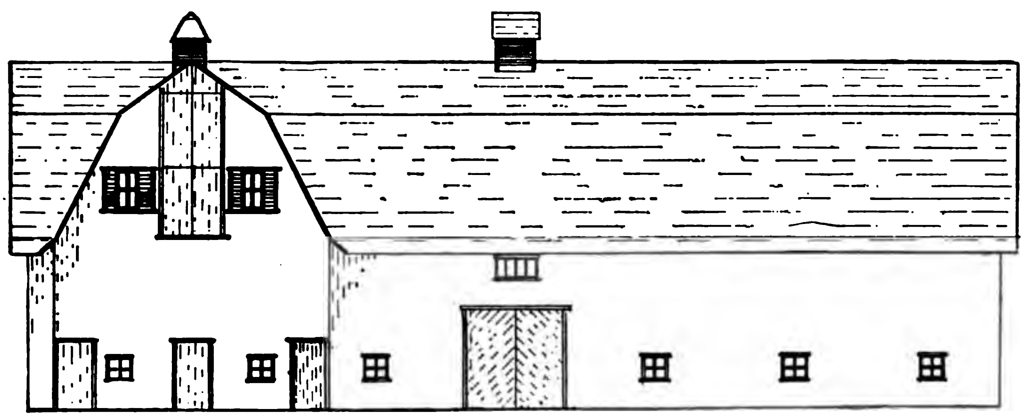


FIG. 167. BARN FOR 40 HORSES (SIDE ELEVATION).

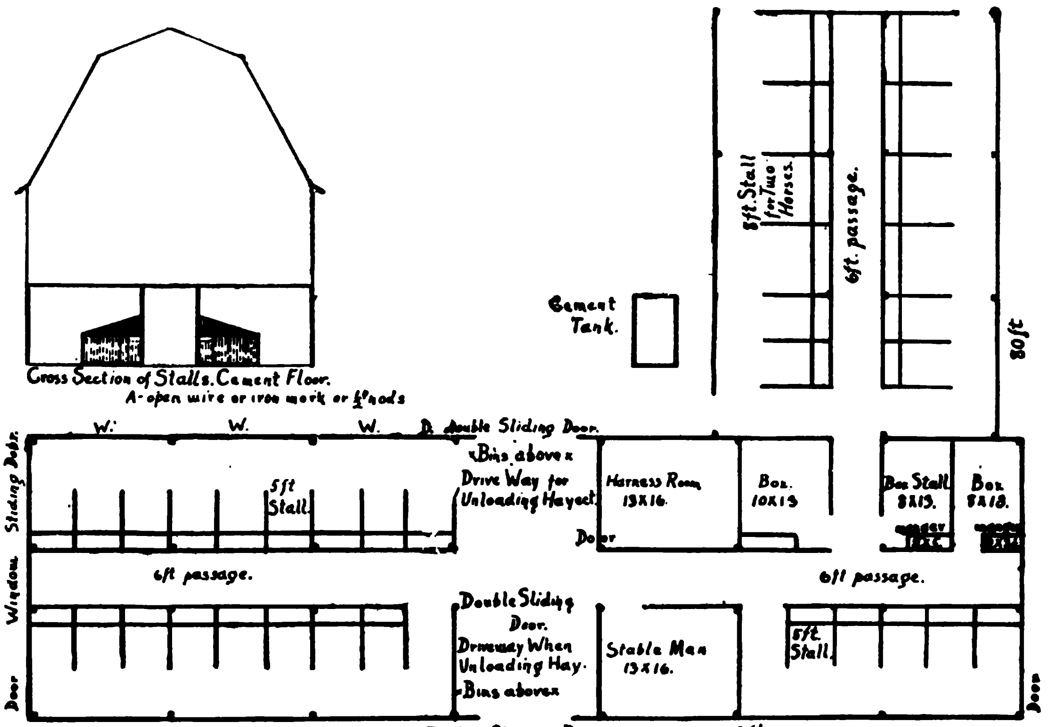


FIG. 168. BARN FOR 40 HORSES (CROSS-SECTION AND FLOOR).

BANK STABLE FOR HORSES.

This building is 36′ wide and 52′ long, there being two bents of 16′ each and for convenience in placing posts two bents of 10′ width at the

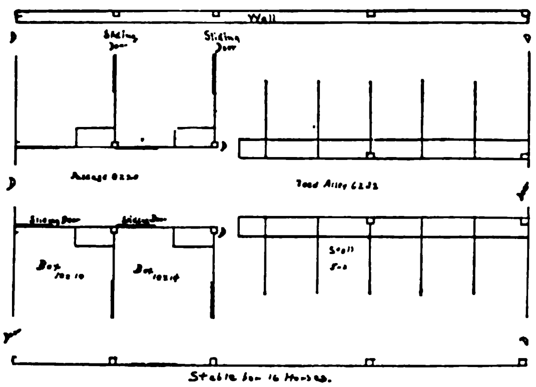


FIG. 169. BANK STABLE FOR HORSES (FLOOR).

box-stalls. It has a feed alley 6′ wide and a wider passage between the box-stalls. Bins may be above this wider passage with spouts down. Abundant light and air may be provided, as the wall sets back to allow a row of windows on each side. Ventilation also through the hay chutes will help keep the horses in health. The stalls

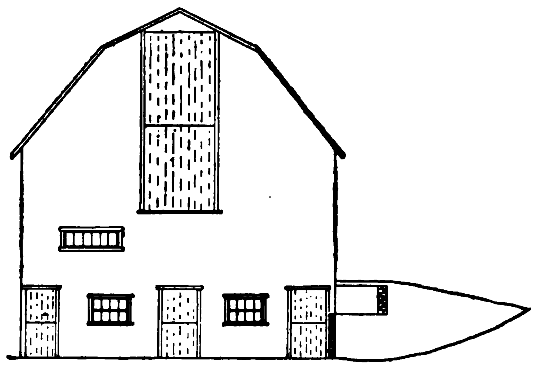


FIG. 170. BANK STABLE FOR HORSES (ELEVATION).

are 5′ 4″ wide, three to a bent. (See *Figs. 169* and *170.*)

McMILLAN'S HORSE BARN.

A convenient barn for draft horses built by H. G. McMillan on his farm in northwestern Iowa is shown in *Figs. 171* and *172*. The dimensions are 56′x76′. The engraving (*Fig. 171*) shows the north end of the barn. On the right extending from the southwest corner of the barn to the west is a shingled roof shed 24′ x 48′. On the left extending east from the northeast corner of the barn is another shed 32′ x 80′. Both of

FIG. 171. M'MILLAN'S HORSE BARN (ELEVATION).

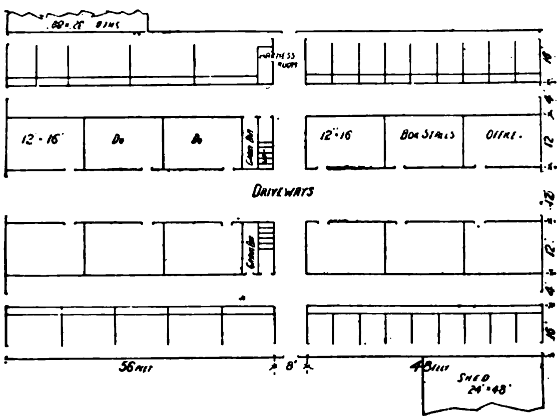


FIG. 172. M'MILLAN'S HORSE BARN (PLAN).

these sheds open to the south. There is a driveway running north and south and crosswise east to west. The drop roof on both sides gives excellent light in the upper part of the barn, and may also make the structure stronger. The barn has a capacity for 175 to 200 tons of hay.

A BARN FOR SPEED HORSES.

What is considered one of the best barns in Kentucky from a sanitary and practical standpoint is that of L. V. Harkness at the Walnut Hall farm at Donerail, near Lexington, Ky. It is an impressive structure on account of its size and on close examination all practical horsemen are taken with it, mainly because of its practical merit.

The building itself is 400′ long by 70′ wide. (See *Fig. 173.*) It is located on a knoll not far from the track on which the Walnut Hall youngsters are developed for speed and not far from the homestead where Mr. Harkness makes his home when in Kentucky. The situation is superb, as it insures the best of drainage, an absolute necessity where the stall floors are composed of dirt.

In the center of the stable from one end to the other is a large runway, large enough so that in stormy weather it is possible to exercise the horses indoors. (*Fig. 174.*) This really has all

FIG. 173. BARN FOR SPEED HORSES (ELEVATION).

FIG. 174. BARN FOR SPEED HORSES (INTERIOR).

the merits of a covered track—all that is needed indeed for a barn in that section of the country. Exactly in the center of the stable is a section for road carts and sulkies and here also are doors opening from the stable capable of allowing a man in a vehicle to drive out. In this section are cement floors for the washing of the vehicles.

On either side of the driveway which extends the whole length of the barn, are the box-stalls. These are commodious, with doors facing on the interior driveway and also doors facing on the exterior, while above are small windows. These exterior doors are constructed so that in case of fire the attendants will be able to liberate all of the horses without going into the building. Once out the horses can roam as they please and be captured at will.

Above the large box-stalls is limited space for the daily feed of the horses. Evidently the owner's idea in constructing the building was to afford plenty of space for air, and in this respect the barn is an admirable pattern. That the idea is all that was intended is best evidenced from the fact that few horses have ever had any sickness in the stables.

The entire barn is of frame construction and while not elaborate in regard to finish is certainly practical and has every convenience for everyday use.

AN ILLINOIS STALLION BARN.

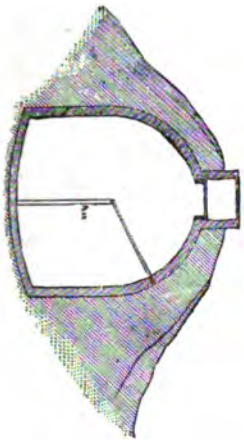
This stallion barn built a few years ago in Illinois is regarded by many as a model of convenience, although there is nothing very pretentious in its architecture; neither is it an expensive building.

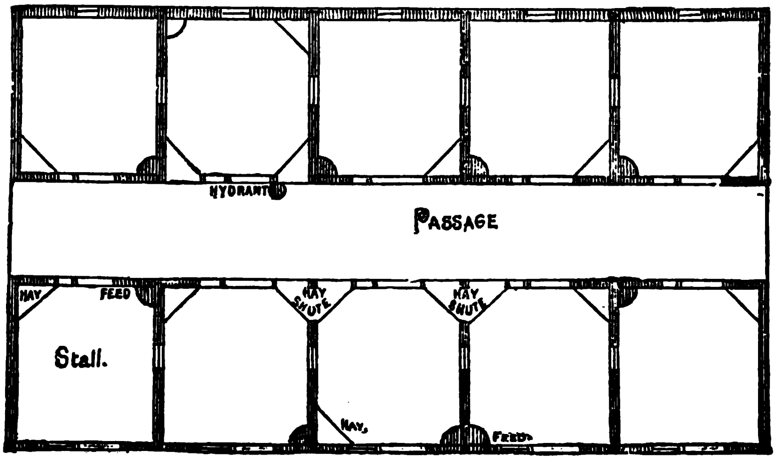
Fig. 175 represents the south elevation of barn and shed connected with it. Basement with box-stalls and the plan of the yards and distribution of water also are shown in the drawing. (*Fig. 175.*) The barn (40′ x 70′) is located on the south and near the top of a gentle ridge running east and west. It is constructed partly on the side-hill or basement plan, the north wall being only full height of basement, and this wall is all above ground except 3′, which gives room for large windows. All other foundation walls are on a level and extend but a few inches above the ground floors, which are of earth in the boxes as well as in the driveway of basement. Foundation walls and framework of basement correspond with the main framework of the building. The framework, consisting of five 14′ bents, gives the space of 28′ x 40′ on each side of the driveway on the second floor. This driveway is reached from the north side of the building. A stone wall 20′ long and parallel with the building, 14′ distant, gives foundation for a driveway. Against this earth is graded, forming an easy approach to the second floor.

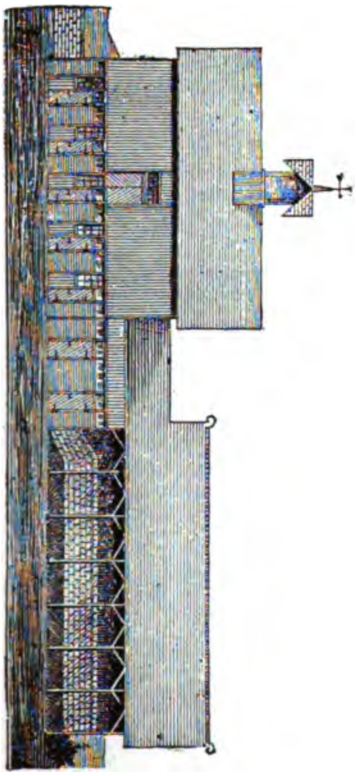
The reservoir or cistern is located on the highest ground obtainable, and this not being as high as desired a portion of the arch is built above the natural level and heavily banked with earth. It is bricked up from the bottom with an 8″ brick wall laid in cement and the mortar well flushed against the earth bank and finished with a heavy coating of cement on the inside of brickwork. The pipes should be laid at the same time the cistern is built. The diagram shows the manner of constructing the arch. A post is firmly set in the center of the cistern to a height at which the arch is designed to begin. A hinged rod is attached to the top of this post, which is swung round by the workman as his work proceeds and enables him to form a perfect arch.

Inch-and-a-quarter gas pipe is laid from cistern to hydrant in barn basement and also to yards and pastures as desired.

The diagram representing stock waterer (included in diagram) shows two barrels set side by side, connected by a short piece of gas pipe, *D*. The water enters the barrel, *A*, from the bottom, *E*, to a height controlled by a float connected by a copper wire to a hinged valve. This







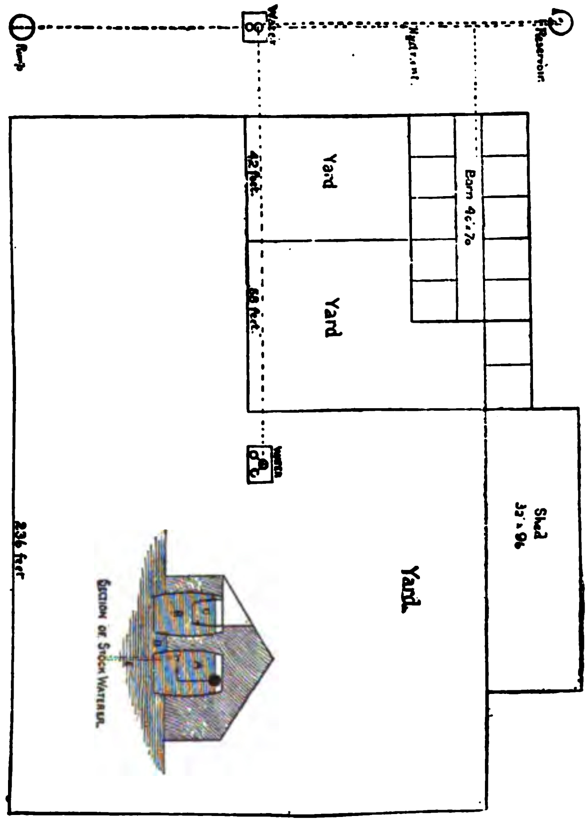


FIG. 175. AN ILLINOIS STALLION BARN (ARRANGEMENT AND ELEVATION).

allows the water to stand in the barrel to just such a height as desired. As the barrels, *A* and *B*, are filled to the same height any water taken from the drinking tub, *C*, is quickly replaced. For a drinking tub one-half of a beer keg set in the end of a kerosene barrel may be used.

CONVENIENT COLT STABLES.

The colt stable illustrated and described herewith is one of a series built by the late M. W. Dunham at Oaklawn, the noted Illinois horse-breeding establishment. He regarded these stables as of especial value with reference to the development of young horses.

The buildings are situated in line east and west, about 40 rods from building to building. The strip of land used is 60 rods wide. This gives a pasture 20x30 rods for each field and each affording abundant pasture for two animals the year round. (See *Fig. 176.*) Of course in the winter a certain amount of hay is necessary. Each stable contains stall room for eight animals, with the partitions put in (*Figs. 178* and *179*), so that four animals are in the fields and four in the stable alternately. In the summer time the doors are left open and are provided with a canvas fastened at the top, fitting the doorway closely. This excludes the light and protects the animals when in the stable from the flies. In the angle of each stall, stalls combining to form the center of the stable, is a hydrant to which is attached a float valve (see *Fig. 178*) which controls the supply of water, except in the intense cold weather in the winter when the float valve is removed and the tub filled with water from the hydrant as required.

The grain is also fed from the center, directly over the water tub. The feed bin is about 6′ square and of sufficient height to hold about 200 bushels of oats. The bottom of the bin tapers to the center at an angle of about 60° and is closed by a circle of sheet-iron with eight holes of sufficient diameter to hold two quarts of oats, and projects to within 2″ of the bottom of the feed trough. Another sheet-iron plate, fastened

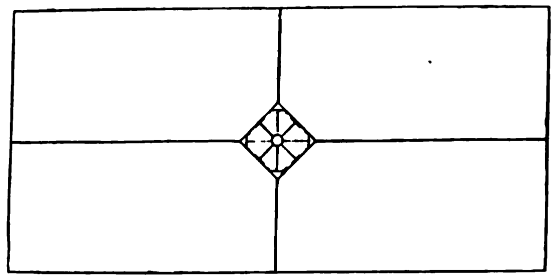


FIG. 177. CONVENIENT COLT STABLE (ARRANGEMENT).

in the center, with holes corresponding to the pipes, is placed flat upon its top surface, to which is riveted a lever. The slot in which this lever works is long enough to allow the opening and closing of the holes in the lower plate by the movement of the lever. By this device the movement of the lever permits the filling of the pipes with oats and the reversal shuts off the supply, giving each animal two quarts, or any quantity the pipes are made to hold—the grain filling the pipes and is eaten from the bottom. This method of feeding has the advantage of rapidity, uniform quantity, prevents waste and secures slow feeding, consequently better mastication. The fences enclosing the pastures are 7′

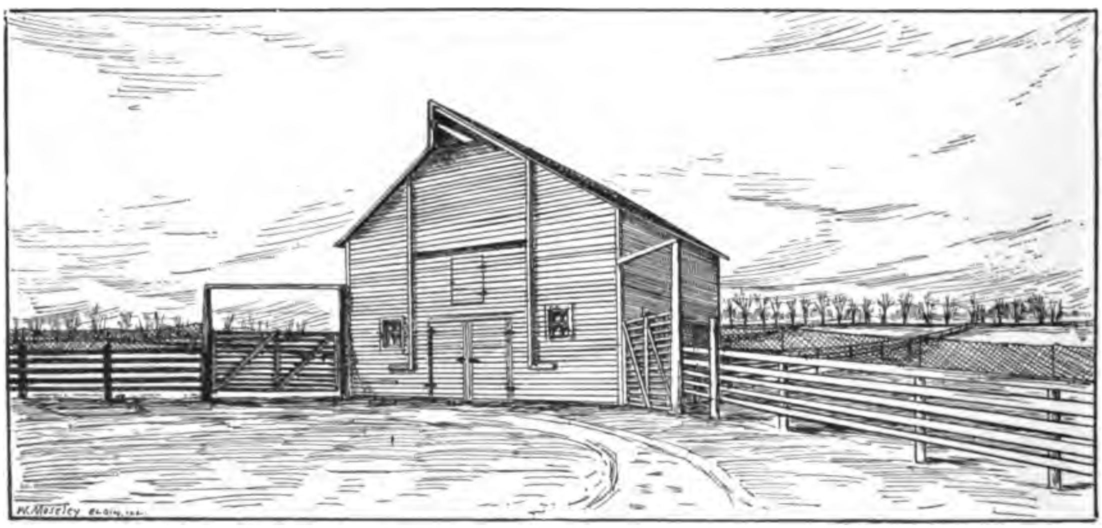


FIG. 176. CONVENIENT COLT STABLE (ELEVATION).

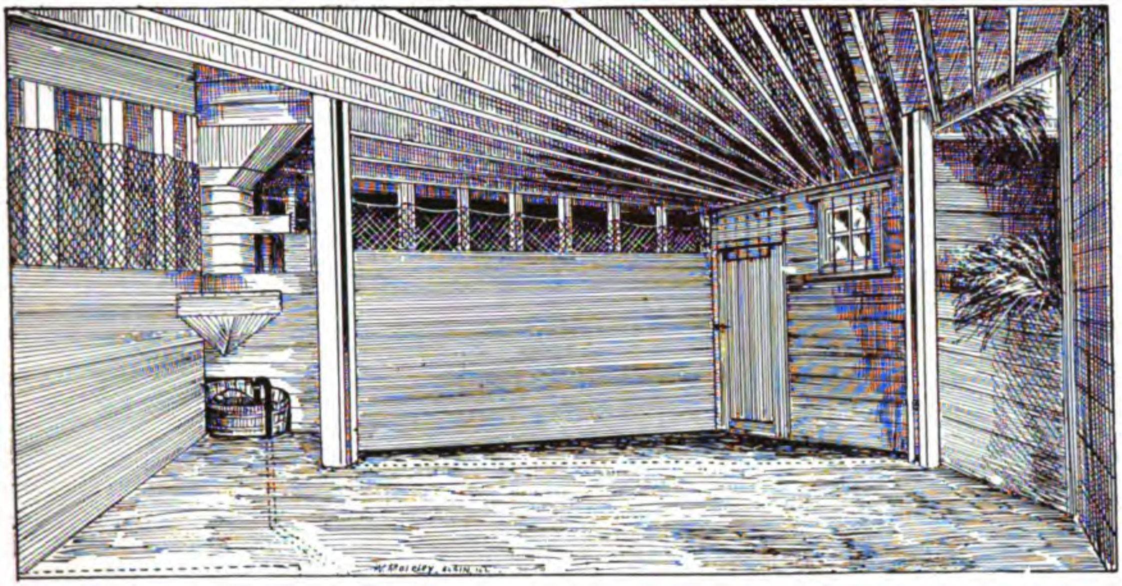


FIG. 178. CONVENIENT COLT STABLE WITH PARTITION REMOVED.

high, the upper 2′ being made of woven wire.

The necessity for natural development of young horses in the open air and on green feed in order to secure the highest usefulness when grown led Mr. Dunham for many years to pasture his young stallions in the summer; and the losses incurred by accident where numbers were kept together prompted the devising of the plan just described.

Mr. Dunham found the use of these buildings and pastures of great advantage. Where the animals are put in a healthy condition there is almost entire immunity from disease. By this means health and natural growth are secured and accidents and unsoundness are rare.

A MULE BARN.

As a type of special-purpose building the mule barn shown in the accompanying illustration, *Fig. 182*, is admirable in its way. It is designed for about 165 mules and the arrangement is commendable. The mules are fed, watered, harnessed

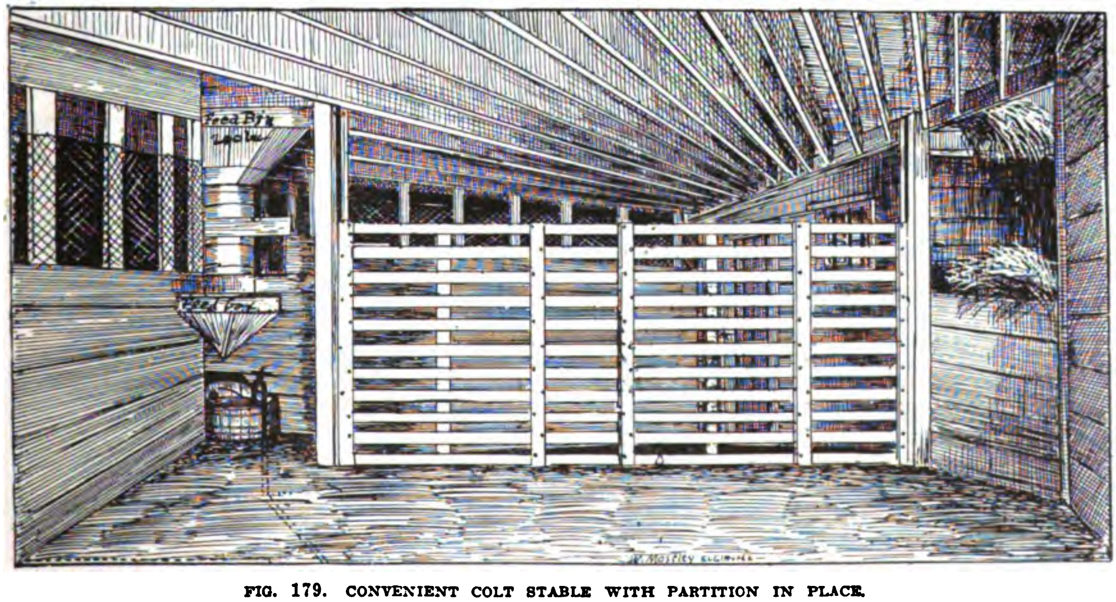


FIG. 179. CONVENIENT COLT STABLE WITH PARTITION IN PLACE.

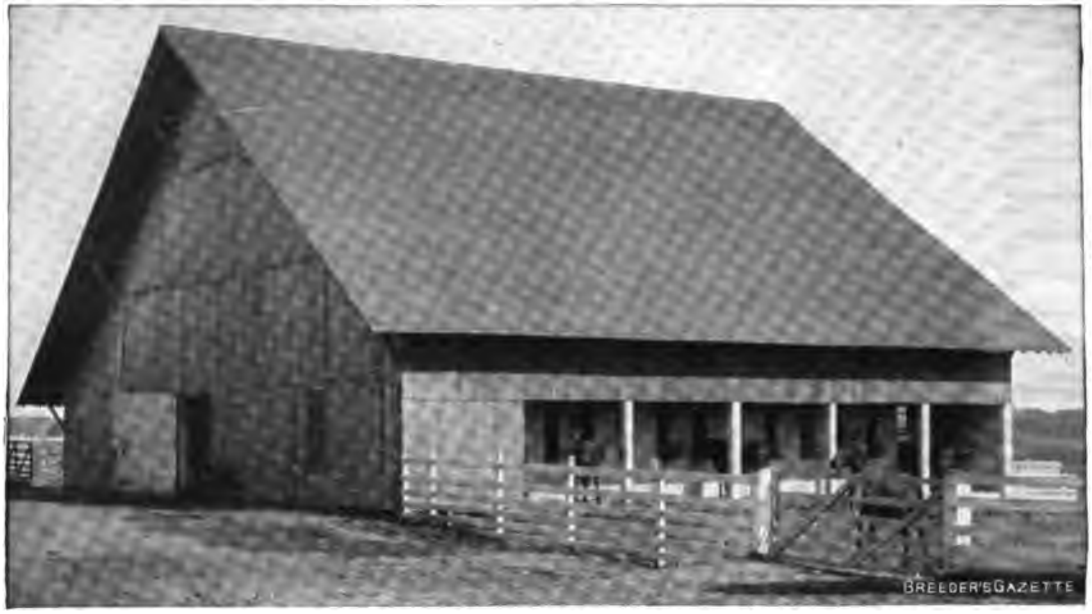


FIG. 180. A KENTUCKY MULE STABLE.

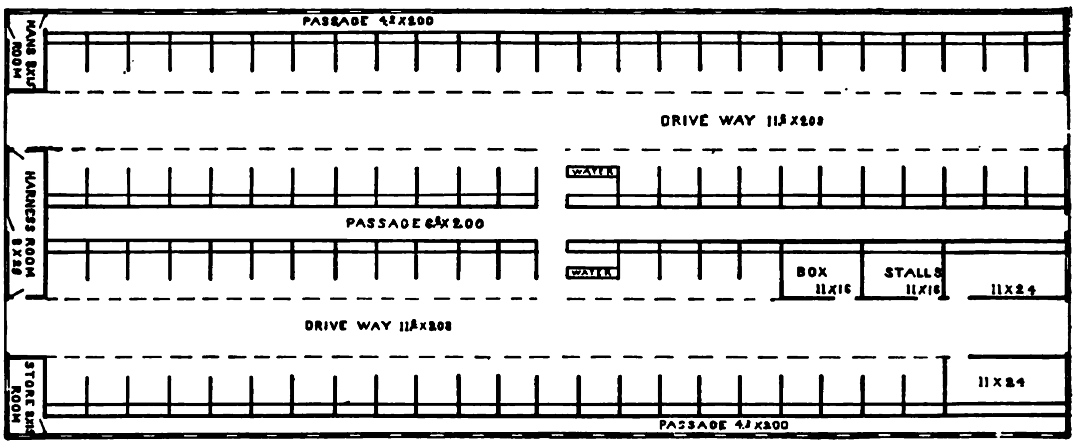
and taken out without interfering with one another. The sanitation is excellent; the light is ample; the provision for aeration is sufficient and there is ample warmth in cold weather.

As the barn is quite wide three carriages and three tracks are used in filling it with hay. This saves a great deal of hand labor in mowing away the hay. The floor plan (*Fig. 181*) explains itself. Painted neatly this barn presents a very attractive appearance.

FIG. 182. A MULE BARN (REAR ELEVATION).

STABLE FOR THREE HORSES.

Figs. 183, 184, 185 and *186* show a plan containing one box-stall, two single stalls and room



FLOOR PLAN OF BARN 84 X 200

FIG. 181. A MULE BARN (ARRANGEMENT OF GROUND FLOOR).

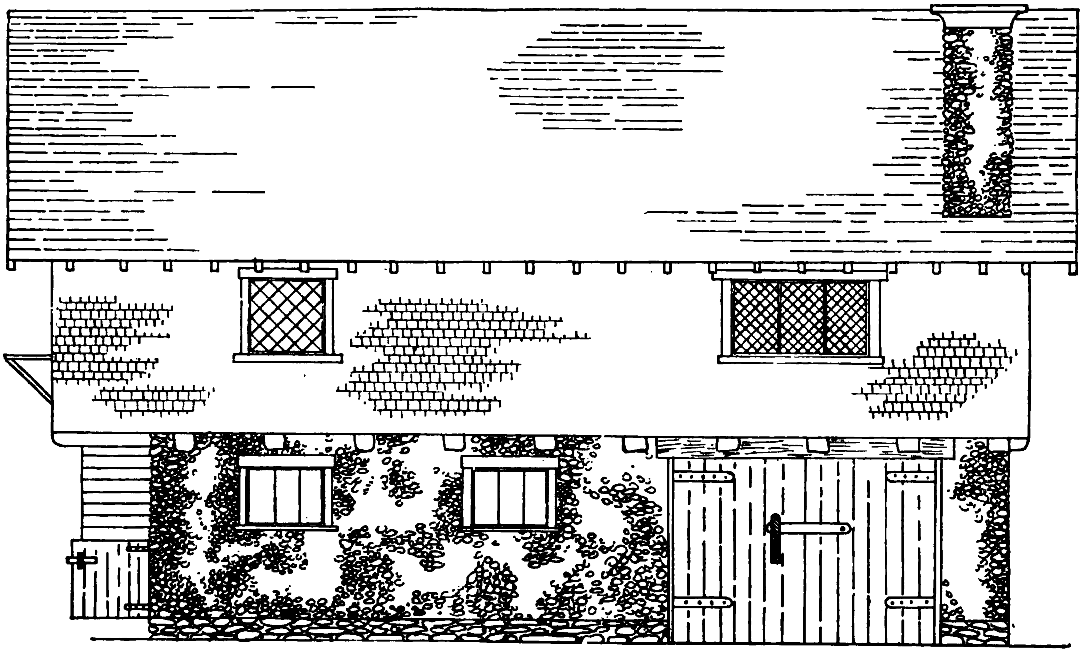


FIG. 183. STABLE FOR THREE HORSES (SIDE ELEVATION).

for two carriages. The two small stalls are each 5′ wide, and the box-stall is 10′ x 16′. Then for the carriages a space 16′ x 16′ is provided with a wide door that will admit either vehicle without disturbing the other.

The upper story has a projection on each side and at the end so that it will overhang a little way, which greatly adds to its beauty and picturesqueness. The outer stairway is convenient and looks well. The arrangement of the upper story may be according to the taste of the builder; if there is a man to live there the plan shown will be very satisfactory.

The lower story is built of cobblestones. The building of such walls is inexpensive. A simple box form as for a solid concrete wall is used, and the cobblestones laid on the side of it, the other side being left smooth for the inner wall surface. The concrete is merely put against the cobblestones, not on their face; it holds them secure. Thus such a wall is really cheaper than a solid concrete one. A thickness of 12″ will serve for such a wall.

The upper story should be either of plaster or shingles, the chimney of cobblestones. This stable is very beautiful, and useful as well.

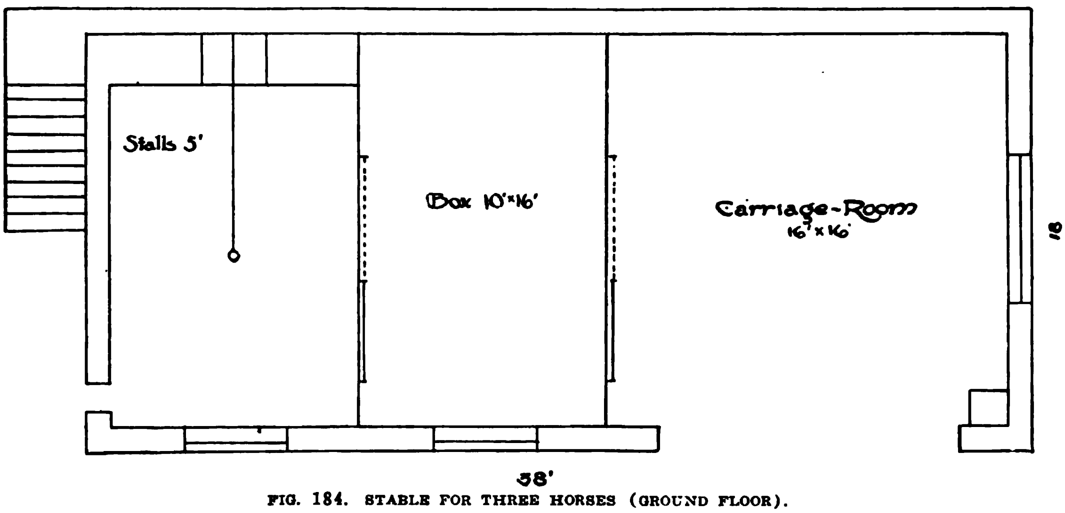


FIG. 184. STABLE FOR THREE HORSES (GROUND FLOOR).

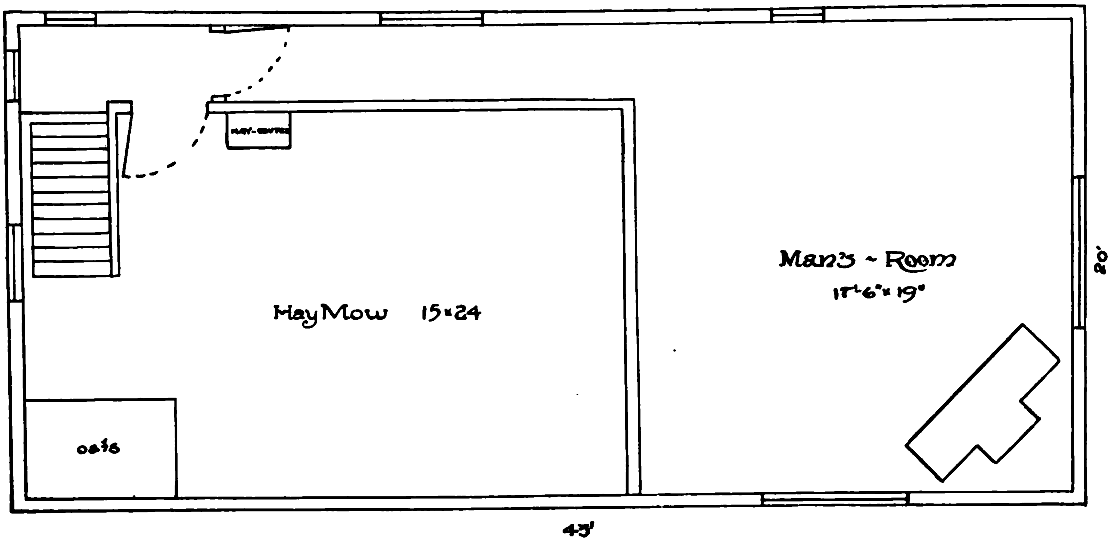


FIG. 185. STABLE FOR THREE HORSES (HAY MOW PLAN).

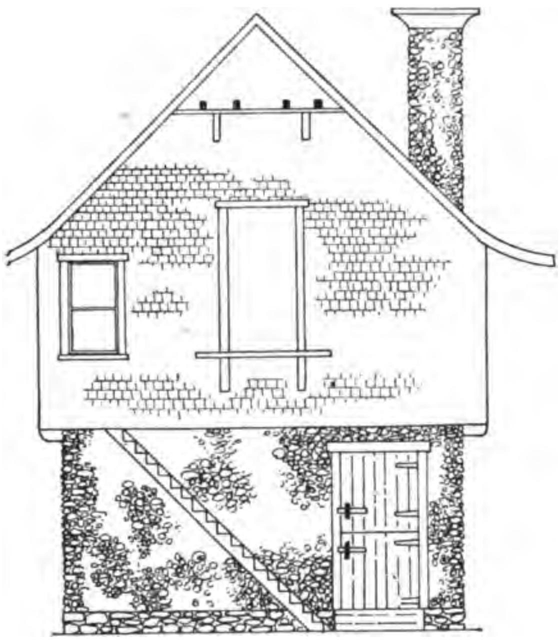


FIG. 186. STABLE FOR THREE HORSES (END ELEVATION).

SHED FOR MARES WITH FOALS.

Mares with young foals which are turned out in the early part of the spring, and remain out until late in the fall, should be provided with some sort of shed to protect them from the cold rains. This will prevent them from getting all kinds of sickness, such as distempter and coughs, which are common among horses. Many young animals have been stunted in growth by being subjected to all kinds of rough weather, and some die and are broken in constitution from exposure.

This shed (see *Fig. 187*) may be placed in the corner of the pasture field, and used at their own free will. The shed is 12'x24' which will house comfortably three mares and their foals, and in the corner may be placed a trough or troughs.

It is always desirable to erect upon the farm buildings which are comfortable as well as ornamental and pleasing to the eye. Of course every man builds according to his means and own taste. The door should be amply wide enough to prevent the mares from being jammed or crowded, as the case may be. A foundation should be built with the level of the ground, on which the sleepers rest; these should be 10'x10', or in accordance with the size of the building. All the rest of the timber, that is, the framework, with the exception of the siding, is 4"x4" lumber. The height of the building is 8½', which will prevent mares striking their heads against the ceiling; in fact, there is no danger of this, as there is no ceiling. The roof may be covered with tar paper

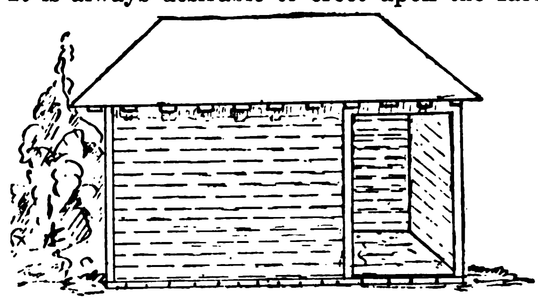


FIG. 187.—SHED FOR MARES WITH FOALS.

FIG. 188. LARGE IOWA HORSE BARN (ELEVATION).

or shingles, the latter being the cheaper of the two. The shed should be whitewashed once or twice a year, to guard against vermin. The cost is slight when complete.

A LARGE IOWA HORSE BARN.

This barn (see *Fig. 188*) is 288′ long by 80′ wide and contains over 450,000 feet of lumber, the approximate cost being $20,000. Eighty 12′ box-stalls are provided, with an exercising arena 48′x80′ in the center of the barn. (*Fig. 189.*) The feed boxes are hinged in the center so as to swing in and out of each stall, the mangers being between and above the boxes which reach across two stalls except at end stalls. They are indicated on the plan by small circles over each stall. Second floor is reached by an outside bridge and contains a driveway down the center 24′ wide, the floor all over being double and mismatched

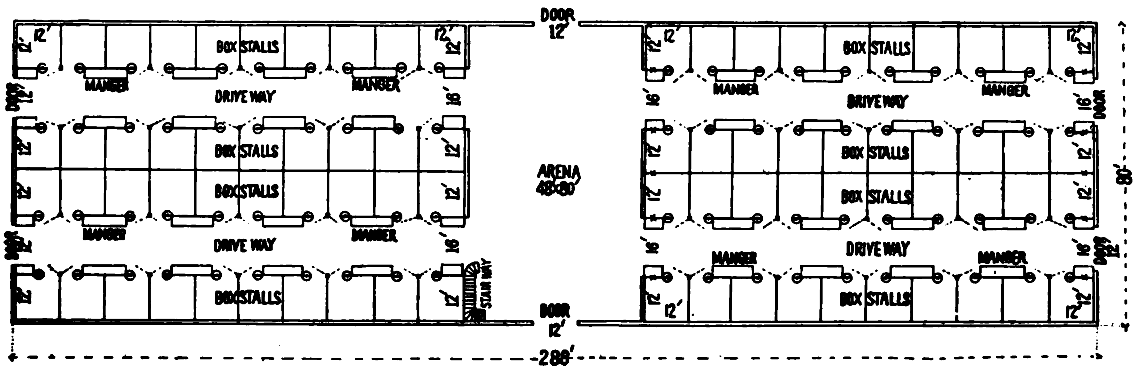


FIG. 189. LARGE IOWA HORSE BARN (GROUND FLOOR).

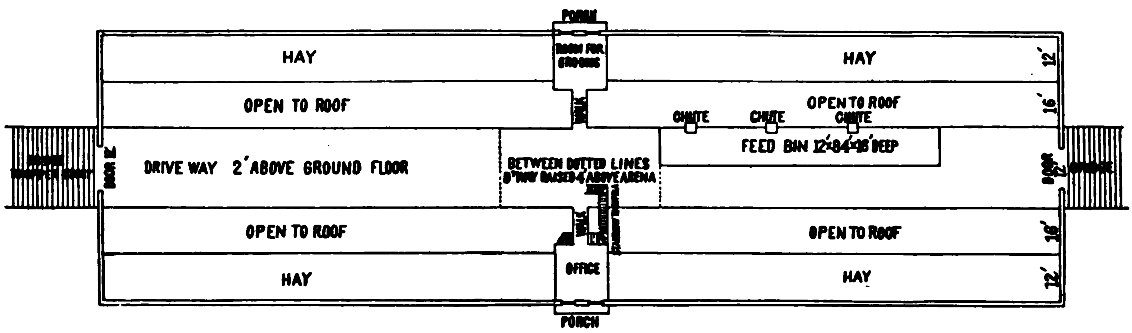


FIG. 190. LARGE IOWA HORSE BARN (SECOND FLOOR).

so nothing can fall on the horses below. On the first floor the mangers are outside of the stalls, which permits of a wagon being driven through so as to unload feed on each side without having to get off the wagon. The stalls are made of 2' x 4' hickory perpendiculars, 2" apart, indestructible and giving perfect ventilation. The doors to stalls are double—an inside door of heavy slats and an outside tight door—so that by a little arrangement near the big outside door at side a man can open or shut them all simultaneously. Plan of second floor is shown in *Fig. 190.*

BARN FOR 18 HORSES.

The size of barn shown in *Fig. 191* is 40'x50' with 24' posts. All the stalls are single except two box-stalls. A single stall is more satisfactory

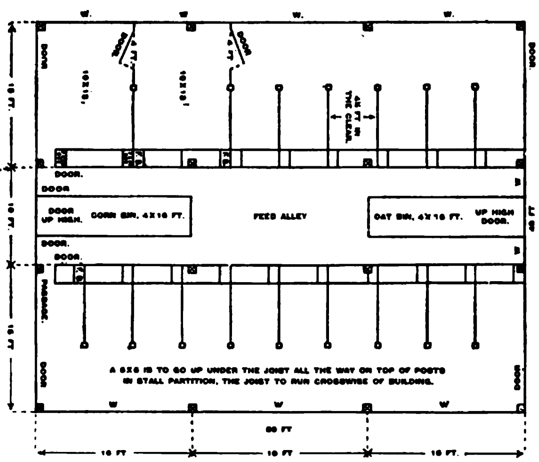


FIG. 191. BARN FOR 18 HORSES (GROUND PLAN).

than a double stall. There are mangers and feed boxes in the box-stalls so two horses can be kept in them if necessary. A feed alley along the center is provided with bins for two different kinds of grain. By having 24' posts there will be ample room for storing enough hay and straw to last from one harvest to another. Place a hay door at either end, whichever is most convenient, 4' wide and 8¼' high on sides of door. For outside sheathing use common 10" stock boards with battens or if a very good tight sheathing is wanted use 10" stock boards shiplapped and then battens on them. Paint the battens before putting them on; also give the barn a priming coat before the battens are put on.

BARN FOR HORSES IN TEXAS.

Fig. 193 shows a barn to contain six stalls for horses, two large box-stalls, for mares and colts and in the center an open space for farm implements and wagons and buggies; also bins for cottonseed and corn with room above for storing plenty of hay and to set a feed cutter.

This barn is 32'x64' with bents spaced 16' apart. Two spaces are devoted to the tools and

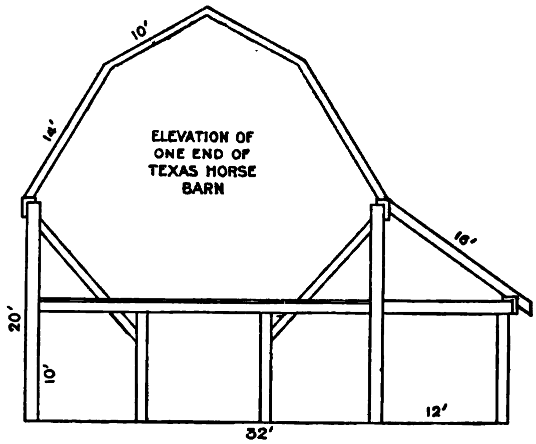


FIG. 192. BARN FOR HORSES IN TEXAS.

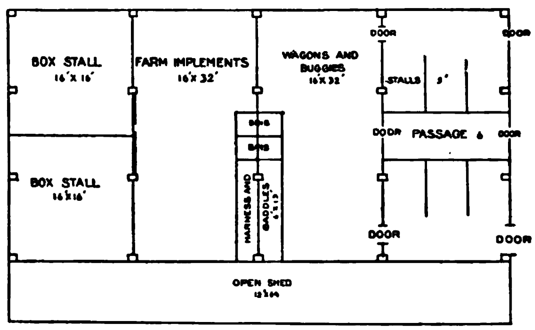


FIG. 193. BARN FOR HORSES IN TEXAS (PLAN).

wagons, one to two box-stalls at one end, and at the other end there is room for the six single stalls with a feed alley 6' wide and horses facing it. (See *Fig. 193.*) There is ample room in the loft for forage. There might be a bin up there for cottonseed and a spout leading to the bin below. This lower bin would perhaps better be put next the side rather than in the center, as indicated (*Fig. 193*), as it would be more readily filled when hay was stored in the loft. It should all be of joist construction, as described elsewhere in this book.

BARN FOR 20 HORSES IN INDIANA.

This barn (*Fig. 194*) with central driveway 10' wide, and stalls on each side, with the horses fed from the rear, is a cheap one, and very serviceable, too. It cost about $1,000. It is not quite so convenient for feeding as when there is an alley in front of the horses, but that costs a great deal more money. Barn is 32'x80' with 16' bents, which cut up into three stalls, each a little more than 5' wide in the clear. There are three roomy box-stalls and the corn-

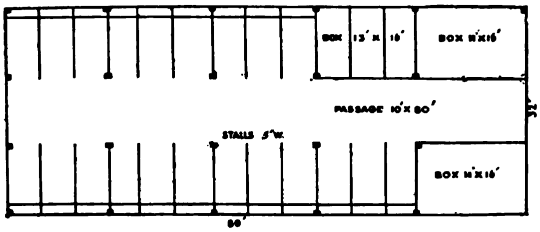


FIG. 194. BARN FOR 20 HORSES IN INDIANA.

crib is in a separate building nearby, the oats stored above and spouted down at one end. It might be well to put in a track in the alleyway that has on it a manure carrier, so that in case the attendant does not have a team hitched up he can clean the stable and run the manure outside promptly. There might be a feed carrier run on the same track. Let the posts be 16' or 18' with self-supporting roof.

The best floor is of hard clay, using plenty of litter, though the floor of the central driveway may well be made of cement dropped down 4" lower than the floors of the stalls and sloping toward them at each side.

BARN FOR SIX HORSES IN OKLAHOMA.

This barn (*Fig. 195*) is 32'x32', with a 10' passage in the middle and the horses are fed

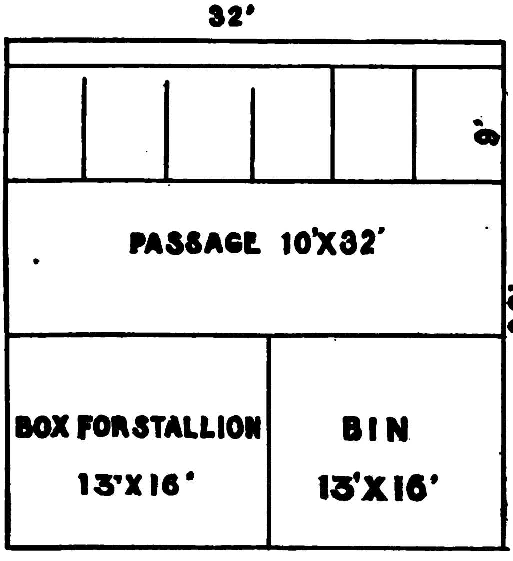


FIG. 195. BARN FOR SIX HORSES IN OKLAHOMA.

from the rear, thus saving the room that a feed alley would require. This gives a snug little barn, with room enough and no waste space. Let the posts rise 16' and put on a self-supporting roof with joist frame.

SMALL STABLE FOR TWO HORSES.

Fig. 196 is of a plan for a stable to hold two horses, with place for feed, harness and buggy. This little stable is of low cost and very convenient. The addition of one box-stall will be a

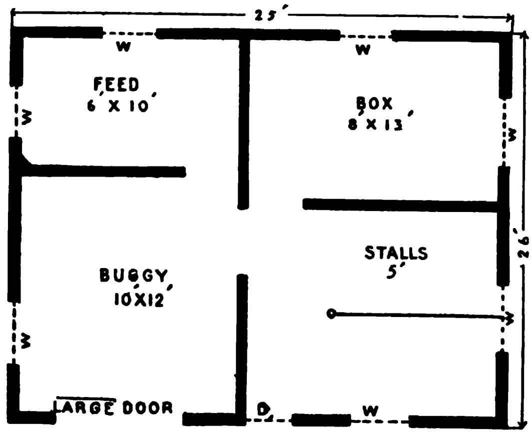


FIG. 196. SMALL STABLE FOR TWO HORSES.

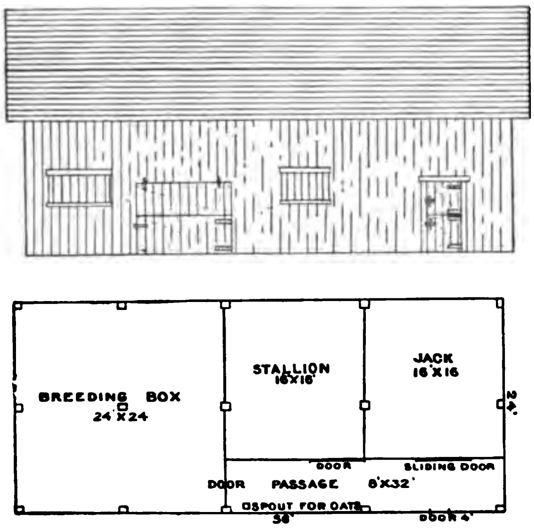
great convenience, especially useful should one of the horses be sick. Indeed no stable should be planned without one or more box-stalls. The building will of course have a loft above for hay and there should be an oat bin above the feed room. Two sets of harness can easily hang in the buggy room.

Let the windows be as high up as possible and hinged at the bottom, opening inwardly to permit the air to pass over the horses without blowing directly upon them. Make the stable door a "Dutch door"; that is, divided horizontally in the middle so that the upper half may be opened and the lower half remain closed.

BARN FOR HORSES AND SHEEP.

Fig. 197 shows a plan for a barn to hold a jack, a stallion and 58 breeding ewes.

Hard clay is used for the floors, and the barn is 24' x 56', with two box-stalls, each 16' x 16', and a passage 8' wide, with a place for the ewes 24'x24'. (*Fig. 198.*) As the breeding season is usually after the sheep leave the barn their room will serve well for the breeding pen. At other times one of the sires might be taken out and his stall made use of. Make the ceiling 10' in the clear, put in plenty of light, make wide doors and large windows high up, and the oat-bin place in the hay mow where it can be filled by hoising up oats in the sack by means of a hay lift. The oats will then spout down



FIGS. 197 AND 198. BARN FOR HORSES AND SHEEP.

into the passage way. Build with two bents 16′ apart and two more 12′ apart, hang a wide door in the sheep department, divided so that one-half of it hinges at its upper edge, the lower half as a gate hangs. Use the joist frame and self-supporting curb roof.

PLAN FOR HORSE AND HAY BARN.

The horse and hay barn shown in *Figs. 199* and *200* is thus described by the farmer who proposed building it:

"This is a hay and horse barn for a 300-acre farm. It is of joist frame construction, all dimension lumber of hardwood. Shall we use good shingles, costing $5 per thousand laid, or galvanized roofing? Will the roofing require as much sheeting as the shingles? We estimate that the roofing could be laid at one-fifth the cost of shingles. We feel that the shed roof, being only one-quarter pitch would not give satisfaction with shingle roof. Will 8′ in the clear give head room to operate a manure carrier and dump on low wagon as spreader? Will a 15′ stall give room for a carrier when harness is hung behind horses? *A's* are 5′ slide doors; *B* 4′ door; *C* 6′ door; *D* 12′ door giving entrance to bay; *E* carrier track; *F* 12′x14′ box-stalls; *G* 7′ stall allowing carrier to pass horse; *H* thirteen 5′ stalls. The attic over horses is planned capacious enough to allow storage room for generous amounts of straw. We do not like a corncrib in a barn, so have planned a rat-proof one outside."

The subjoined comment is made: "This plan is in the main excellent. Galvanized corrugated iron is first-class roofing material and is very durable. It requires less than half the amount of sheeting that shingles require and lays very

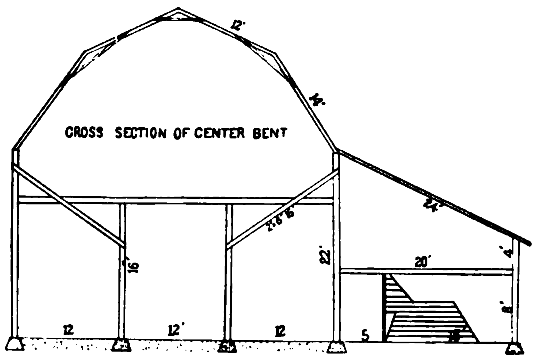


FIG. 199. HORSE AND HAY BARN (CROSS-SECTION).

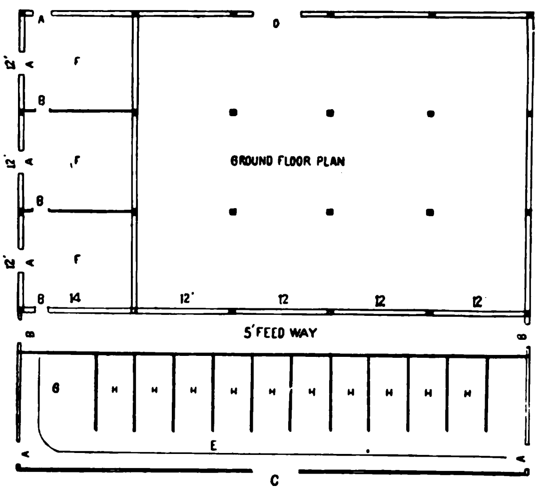


FIG. 200. HORSE AND HAY BARN (FLOOR PLAN).

rapidly. Eight feet in the clear gives plenty of headroom for a manure spreader and 9′ gives a horse room, so that 15′ allows a manure carrier to pass behind. The location of the corncrib outside the barn where rats will not enter is wise."

A CONNECTICUT HORSE STABLE.

The horse stable shown in *Fig. 201* has an 8′ sliding door in front and at the left on the entrance are four convenient harness closets. Turn to the left and on entering the stable and at the left are stalls; there is no turning the horse around. The grain room is in front of the stalls and a small door opens above the manger to feed oats. The hay is in corner racks and stairs lead from the grain room to hay loft.

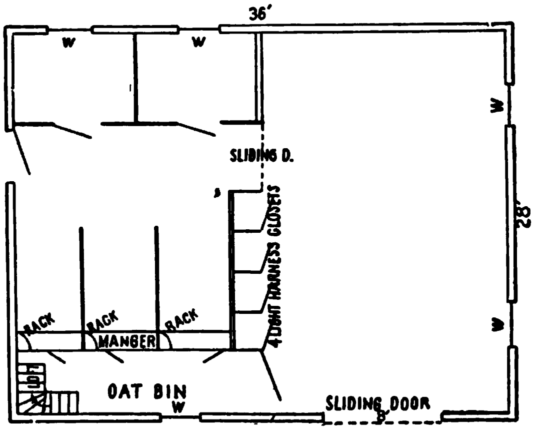


FIG. 201. CONNECTICUT HORSE STABLE.

A HANDY SMALL STABLE.

Another farmer commenting says: "The plan is a very common one and seems to me the acme of unhandiness; the alleyway is an unnecessary waste of space; hay must be handled twice to get it to the horse; there is an unnecessary number of doors and worst of all one must lead his horse out (*Fig. 202*) doors and around to another part of the barn to hitch up. A box-stall 8'x14' is large enough if there is an exercising paddock in connection. My plan (*Fig. 202*) shows a stable which I have used for many years and find very satisfactory. I am able to hitch up inside the barn and do not have to crawl through the manger or go around the barn to get to my horse after feeding.

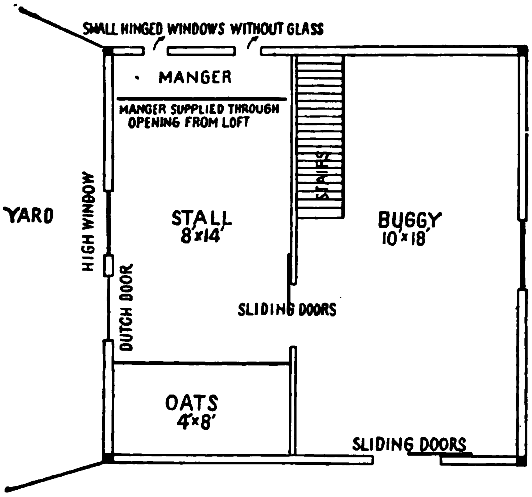


FIG. 202. A HANDY SMALL STABLE.

PLAN FOR A SMALL STABLE.

An Ontario farmer criticising a small stable, remarks that a stall 8' wide will rub the hair from the quarters and tail of a horse when he turns (for it will see to it that its head is not rubbed, unless it is of the small pony type.) He says: "Make the stall 2' wider—10'x14'. It is a great convenience to have the sliding door slide both ways and I like it to run in the wall so the post at *P* is 6" (*Fig. 203*) to the inside but still supports the studding and overlays.

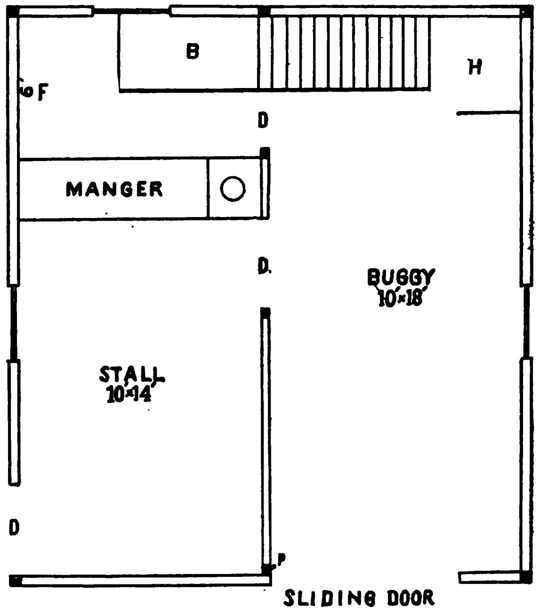


FIG. 203. PLAN FOR A SMALL STABLE.

Then I can open the door wide enough at *P* to allow me to go in or out or take the horse out under saddle without cramping the buggy to the front end of driving room or running it outside. By having the stall door at *D* it is much handier to unhitch inside—horse simply walks out of shafts and stands till I lift harness and he walks into stall without coming back past buggy where he may very easily skin his legs on hubs. Both stall doors are divided so that I can leave the top third open in warm weather. *H* is harness room. Stair rises towards left and hay is put down into feedroom *F* which requires to be filled each other day. I do not like to climb up a stair each time I feed my horse and I do like to sprinkle water over all hayfeed. Some years it is almost impossible to get hay free from dust, and a 'heavey' horse is easier made than cured. To be sure, this sprinkling occupies nearly 45 seconds each day, but plenty of men waste that much time. *O* is a box for oats and *B* is an oatbin, and I do not have to carry oats from one end of stable in through the stall to manger at the other end. The window in the stall is screened with chicken wire. The oatbin is filled either at the window (a shade below level of wagon-box) or from the buggy room. The man who delivers may take his choice. I pay him at the house.''

BARN FOR STALLIONS IN MISSOURI.

The plan shown in *Fig. 204* is for a barn 36′ in width from outside to outside. The foundation wall need be only 35″, the nail girts and siding taking 3″ on each side. The driveway is 10′ and the box-stalls a trifle less than 12′.

Fig. 204 shows a cross section through the middle, showing how the open center is made. The rafters are spliced at the curb by 1″ boards nailed on each side. Each rafter, consisting of two parts, is made in a form on the ground so that each one will be like all the others. They are then raised to the scaffold at plate level and one of the peak boards nailed on; the other cannot be put on until the pair of rafters is raised in place. Then the brace under the rafter is spiked on. It may either be spiked directly to the rafter, or, better, fitted and spiked directly under and reinforced with short pieces of 6″ boards nailed on each side.

The tie across the ends is made with two lines of 2″x6″, having them of different lengths to break joints; if they cannot be had to reach clear across, on top of these use 2″x10″ flat with another like piece over the joint for a splice.

The hay door should be from 8′ to 10′ wide; the jambs on each side can be built up of 2″x8″ or solid pieces can be used. Plates are made of 2″x10″ or 12″ and start on top of the end ties and are spliced on top of the posts with a short piece of 2″x8″ underneath, which is first spiked to the top of the post. The braces explain themselves. Do not spare the nails and spikes. For the cross beams use a good many 6″ steel wire common.

STABLE FOR 25 HORSES.

A stable intended for 25 horses is designed to have two rows of double stalls spaced along a middle drive 8′ wide, the stalls each 9′ long (see *Fig. 206*). The feed alley in front of the horses is 4′ wide and in front of that again a system of bins, each 8′ wide and with sloping floors that will permit all the grain to be drawn out from spouts. Hay may be fed down through chutes 24″ square, each chute accommodating two horses. In order to use the chutes care must be taken in mowing away hay not to cover the openings, though if the mow is to be filled quite full the chutes should extend on up to the roof.

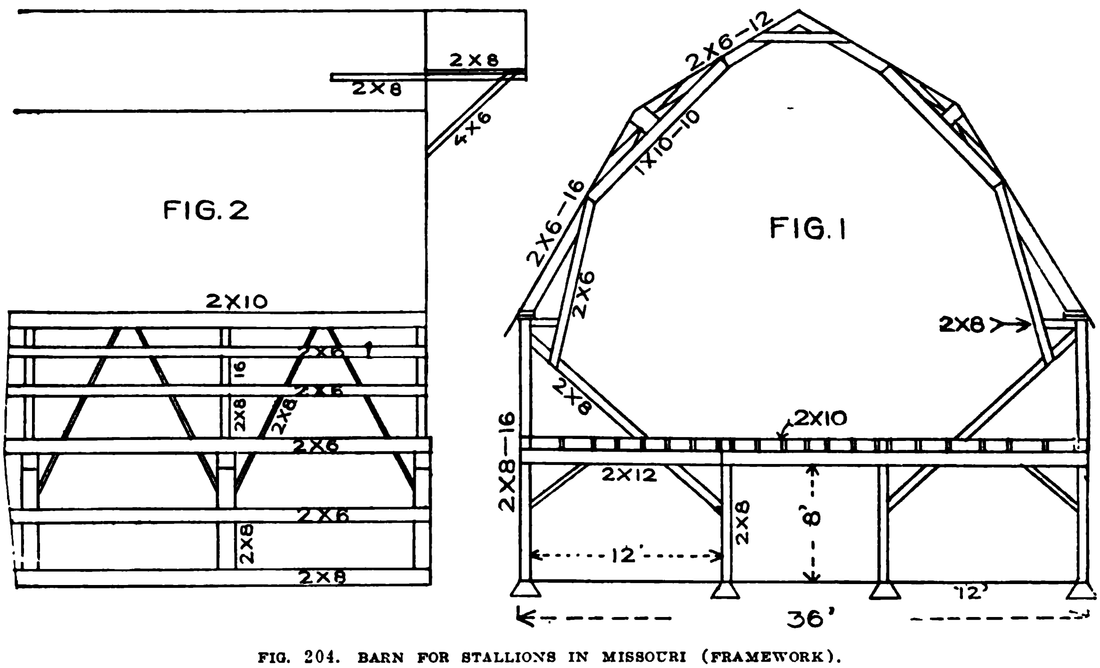


FIG. 204. BARN FOR STALLIONS IN MISSOURI (FRAMEWORK).

They must be quite smooth on the inside, else hay will lodge in them. Two box-stalls are provided and a harness room 16'x17'. Altogether this will be found a most convenient stable. A concrete water tank may be provided just outside the door. The grain bins may all be filled from the outside, or from the mow floor, where there may be built in a conveyor running the length of the barn with spouts to each bin.

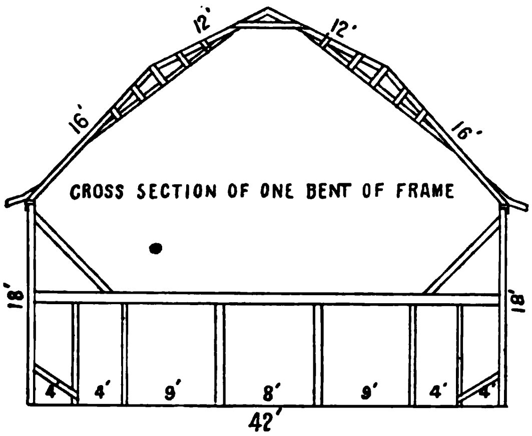


FIG. 205. STABLE FOR 25 HORSES (FRAMEWORK).

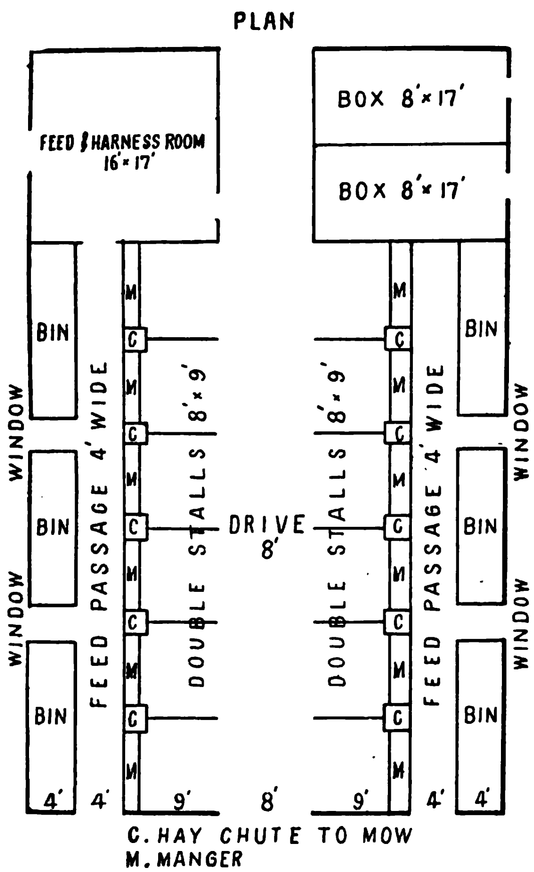


FIG. 206. STABLE FOR 25 HORSES (FLOOR PLAN).

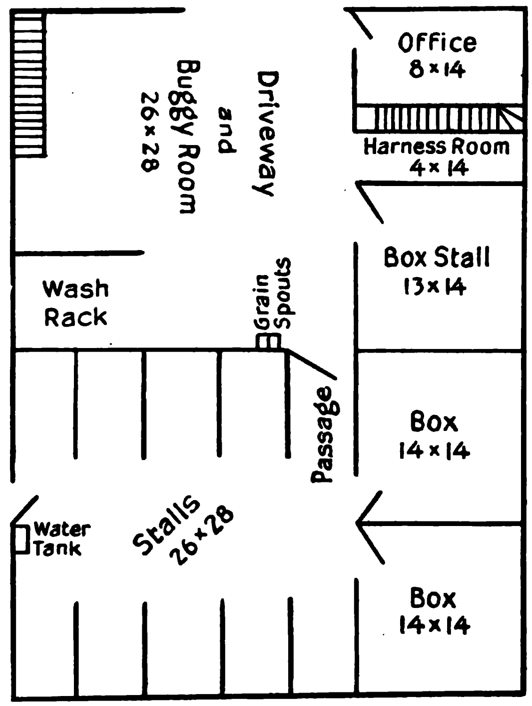


FIG. 207. PLAN FOR A SMALL LIVERY STABLE.

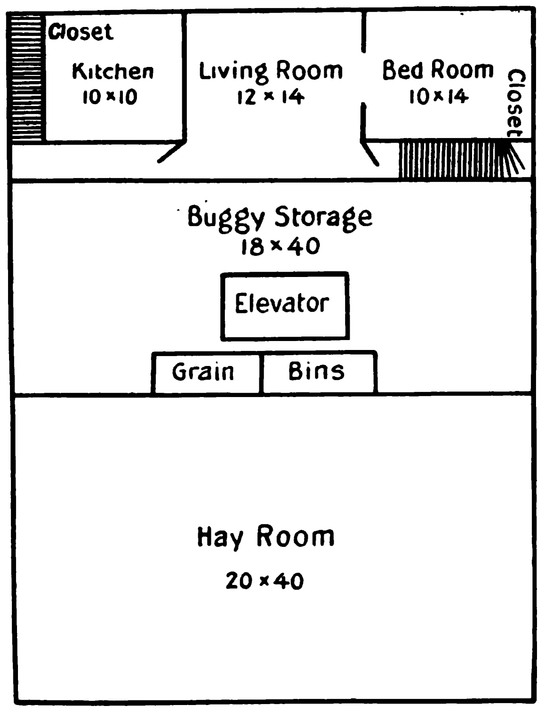


FIG. 208. PLAN FOR A SMALL LIVERY STABLE.

PLAN FOR LIVERY STABLE.

According to the plans of the livery stable shown in *Figs. 207* and *208*, the horses are shut away from the draft of the front doors which are always open. Under the office stairs is a closet for clothing, robes and blankets. The whip rack is just inside the harness-room door. The three rooms above are for housekeeping or some of the help. A buggy elevator runs from the drive floor to the buggy storage room above; grain can be elevated on this and emptied into the bin above. Put a track and hay fork in the hay room so that hay can be taken in from the back end. Floor the driveway and stables with cedar 3″ thick. It is easy on the feet and never gets slippery. Concrete is not recommended for livery stables, though it is often used in such buildings. It dulls the calks of the shoes, so that horses require frequent reshoeing.

NORTHERN ILLINOIS HORSE BARN.

Figs. 209, 210, 211, 212 and *213* represent architects' plans for a horse barn 99′ 2″ long by

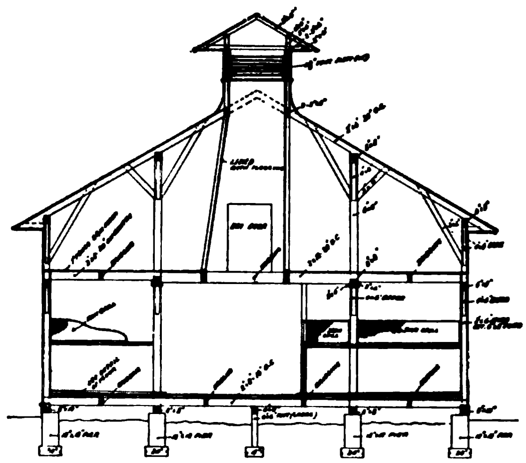


FIG. 211. NORTHERN ILLINOIS HORSE BARN (FRAMEWORK).

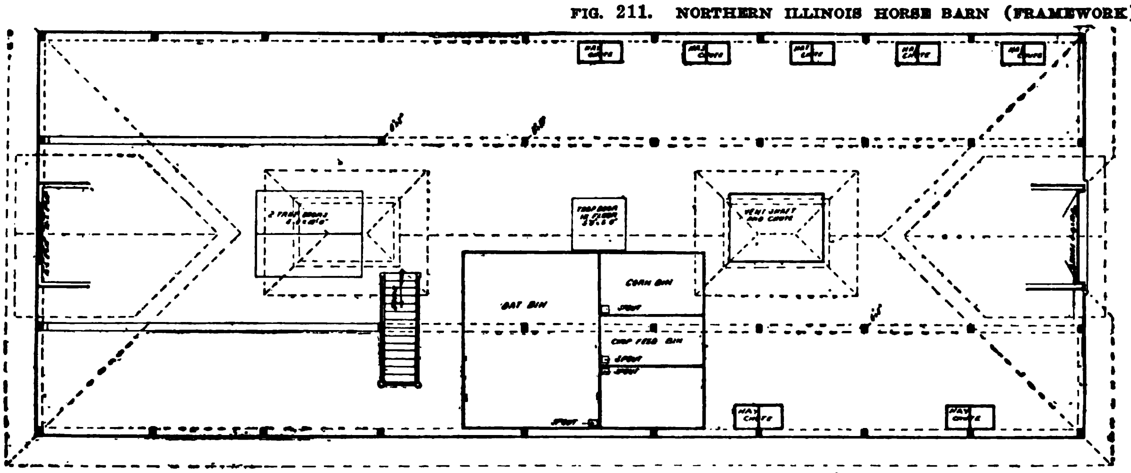


FIG. 209. NORTHERN ILLINOIS HORSE BARN (HAY MOW PLAN).

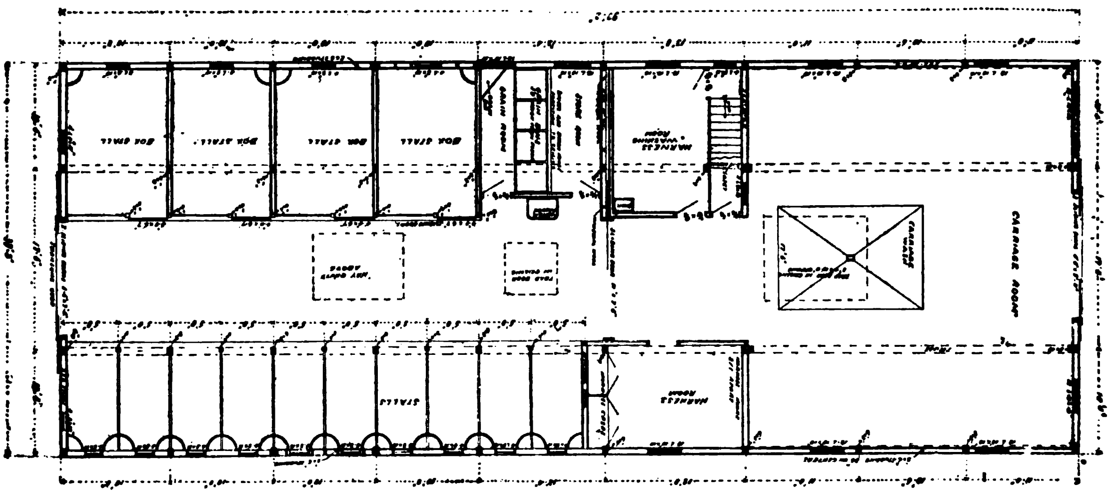


FIG. 210. NORTHERN ILLINOIS HORSE BARN (GROUND FLOOR).

38′ 2″ wide. This barn contains four box-stalls, 10′ wide, with sliding doors and ten single stalls 5′ wide. There is also a carriage room 38′ long at one end of the barn and extending the whole width the other dimension. The harness room is

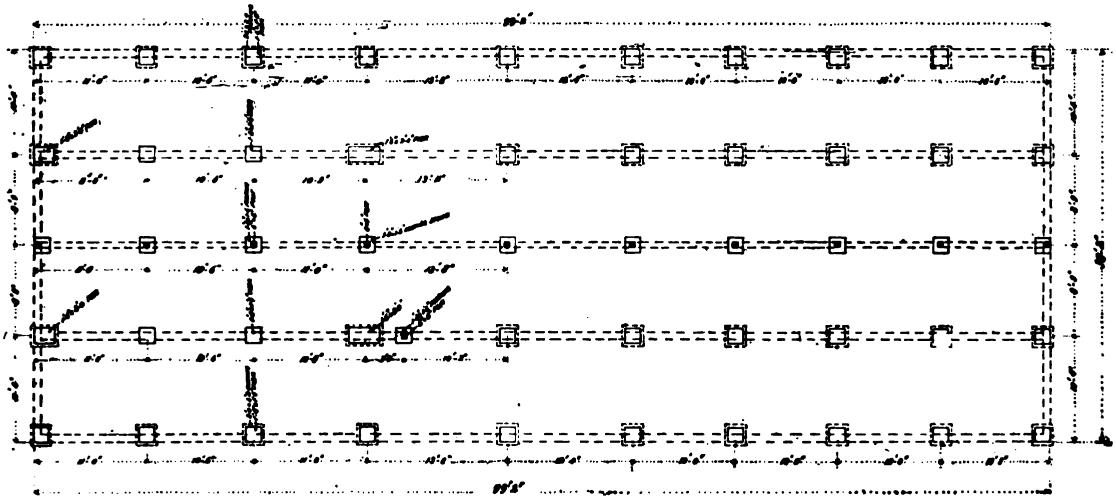


FIG. 212. NORTHERN ILLINOIS HORSE BARN (BASEMENT PLAN).

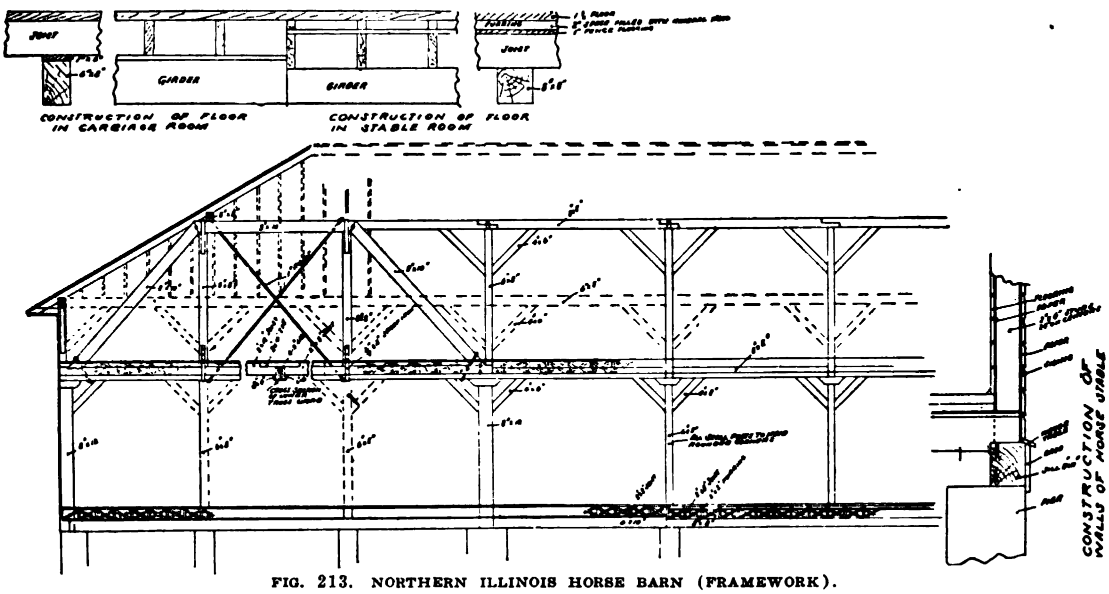


FIG. 213. NORTHERN ILLINOIS HORSE BARN (FRAMEWORK).

13′ 8″ long and 10′ wide, across from which is a place for washing harness. The grain bins are in the attic and feed is distributed by means of chutes.

AN INDIANA ROUND HORSE BARN.

In *Figs. 214, 215* and *216* is shown in detail the construction of a circular barn, located in central Indiana. The foundation and second floor plan are built substantially as shown in *Figs. 215* and *216*, with the exception of the driveway, which was raised to the line of the second floor and not dropped in below the floor as indicated. The most important change made was in the rafters. Instead of building it in four sections, as indicated in the plan, one continuous rafter was made, thus avoiding by that means the purlin plates, which are very difficult to get into place. The rafters are all in one piece made by using 1″ x 8″ pine boards and cutting them 8′ long and nailing the three boards substantially together, protecting all the cracks. This makes a very excellent job and the roof is very easily constructed in this way, with derrick to put the rafters in place. Each rafter is made on the floor of the barn in the same form and then afterwards raised to its place. The circular plate on which the cupola rests is constructed very much on the same plan as a wheel; the outside rim is made of boards 1"x8" substantially nailed and spiked together; spokes run out from the airshaft every 2' apart on the band. The inside strips in the manger as indicated by the plan are left out, and the framework of the ventilator is made out of boards 2" x 6", using four for each post, three side by side and one spiked onto the edges. This makes a very solid, substantial airshaft; the posts on the outside of the manger and the end of the box-stall are made 6" x 6" instead of 2" x 6". It is very important to have good, subtsantial headers above the outside doors—in some places timbers 8"x10" and across the large front door, which is 16' wide, boards 2" thick and 16" wide three thicknesses. This is absolutely necessary in order to preserve the strength of the circle; for foundation, stone laid in cement is used.

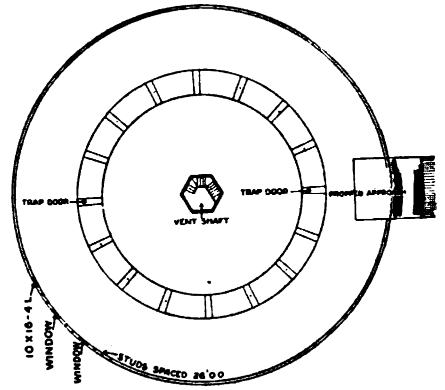


FIG. 215. INDIANA ROUND HORSE BARN (SECOND FLOOR).

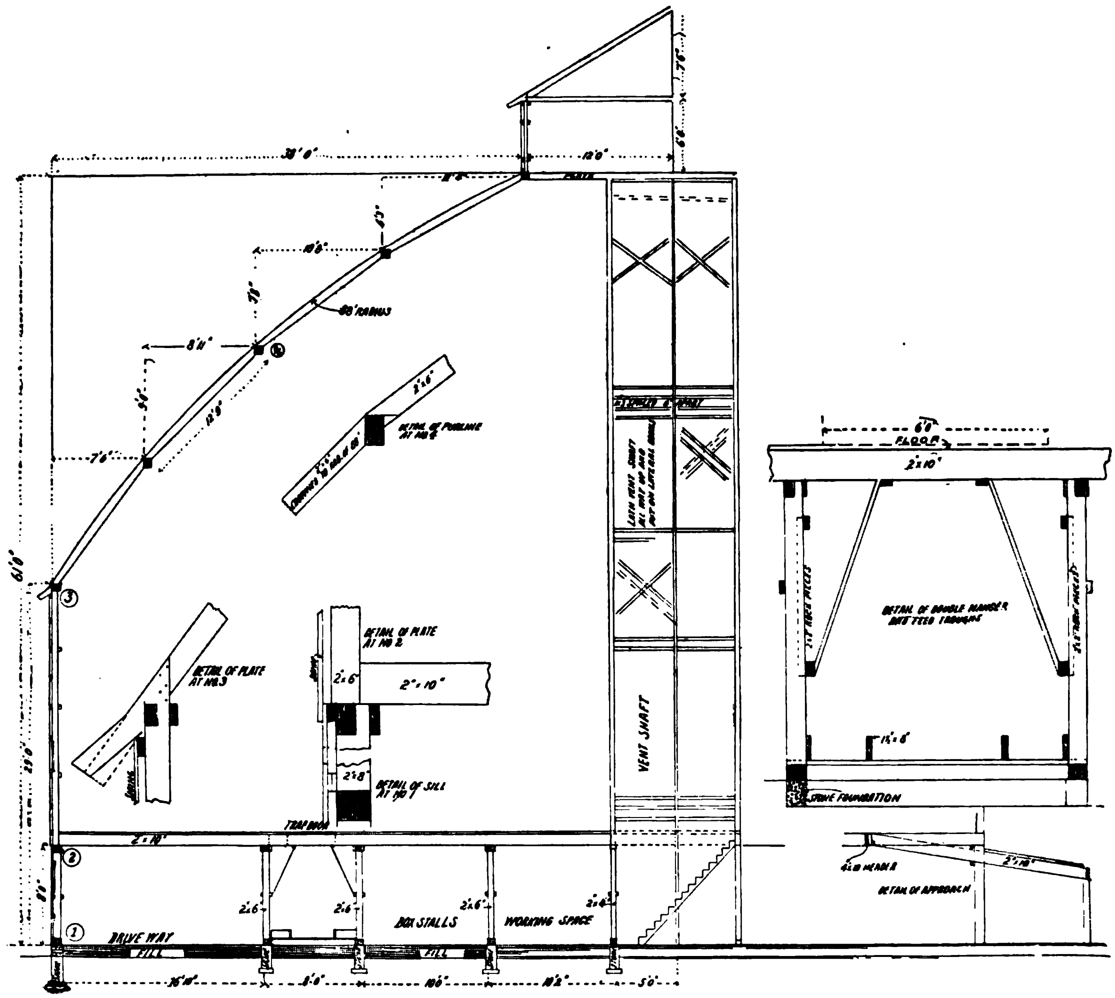


FIG. 214. INDIANA ROUND HORSE BARN (SECTION).

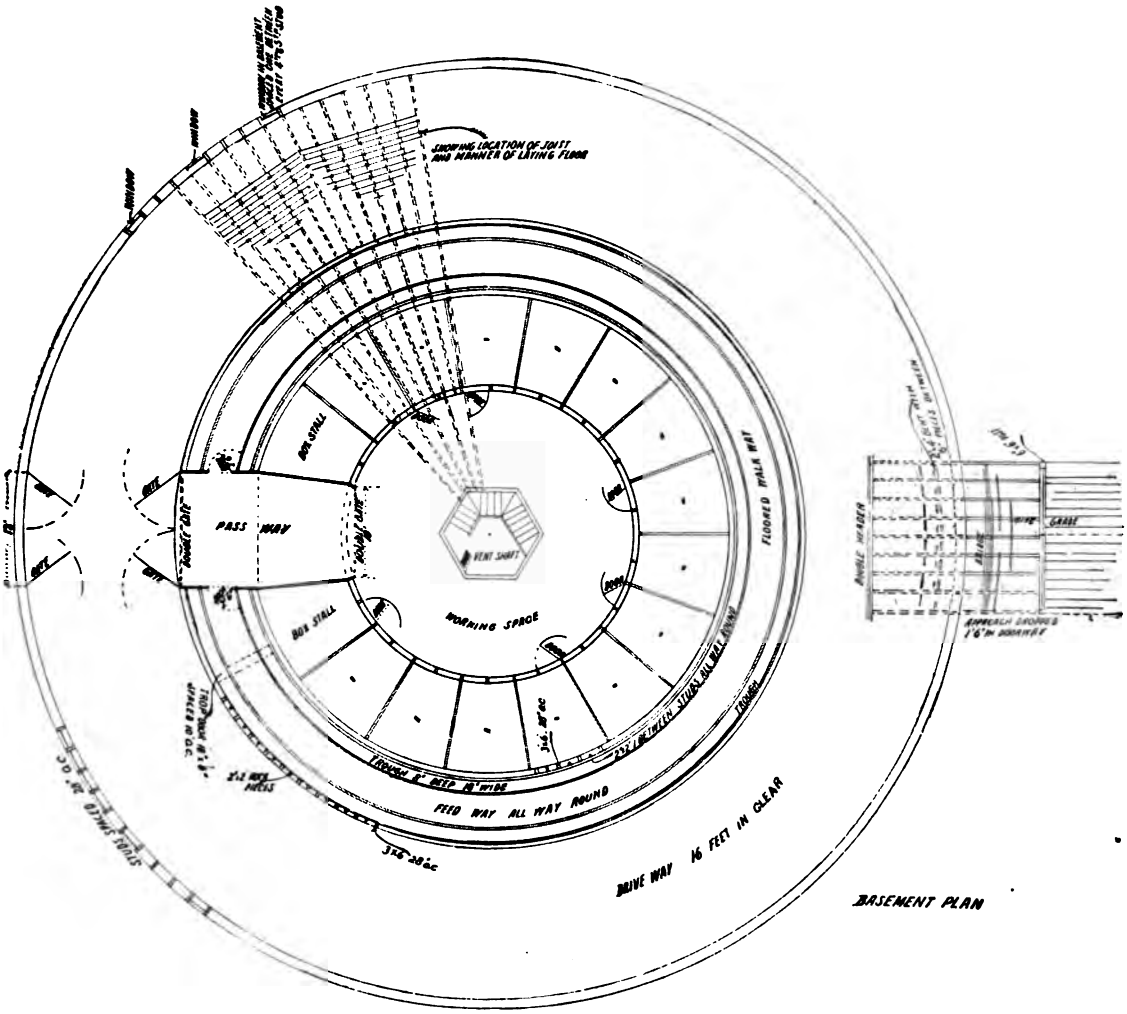


FIG. 216. INDIANA ROUND HORSE BARN (BASEMENT PLAN).

FIG. 217. SANITARY DAIRY BARN (ELEVATION).

DAIRY BARNS.

We are fast coming to realize as dairymen that comfort for the dairy cow is second only to her feed in the production of cheap and wholesome milk. The dairy cow, unlike the beef animal, returns her vitality daily. She cannot store energy and fat thereby enabling her to withstand low temperatures and storms without lessening the milk flow. Each generation of dairy cows is farther removed from nature's plan of self-support and reproduction. We are constantly adding new burdens until the up-to-date dairyman is not satisfied with less than 350 pounds of butter or its equivalent in milk.

The dairy sections are located in those latitudes where stabling must follow for nearly six months and with those who are working upon high-priced land, the stabling is a factor during the greater part of the year. Another problem has also confronted the dairyman. As he more and more surrounded the cows with artificial conditions, he discovered unless unusual precaution were taken, that disease instead of health followed, and it is only within a very recent period that we have been able thoroughly to combine comfort and health, which means nothing more or less than warmth, light and pure air.

Until these were possible, we had no form, size or mode of construction that could be called standard.

Stables were built providing all the way from 200 cu. ft. to 1,500 cu. ft. air space per cow. One man said she must have air space enough to last from night until morning, another said better have bad air than cold air, and so we each had a notion of our own. When Prof. King formulated the theories and practices of ventilation into a concrete plan, he laid the foundation for dairy stable construction upon a basis to which all could tie.

We have now come to recognize that a well-fed 1,000-pound cow can warm about 500 cu. ft. of air space and maintain a constant inflow

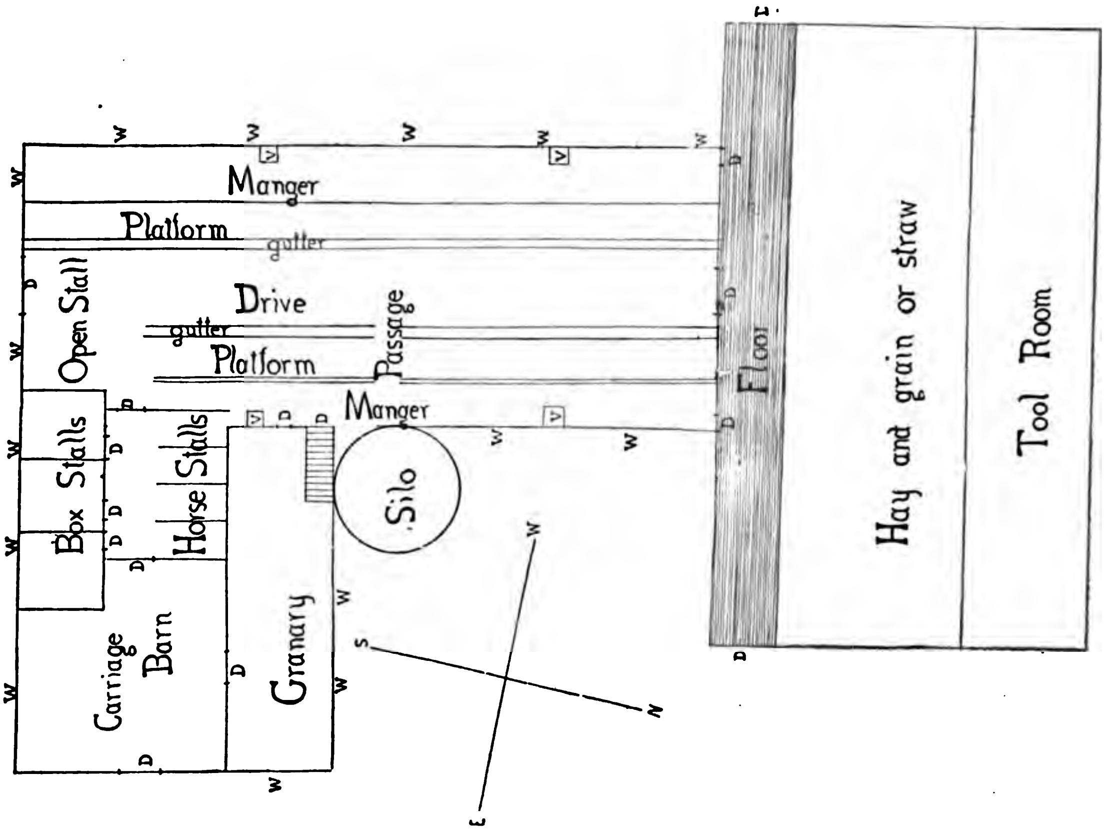


FIG. 218. SANITARY DAIRY BARN (GROUND FLOOR).

of cold air. Not a sudden draft and then ceasing altogether, thereby reducing her vitality and "catching cold," but putting her under conditions more uniform than the balmy days of June, with no storms or dampness. Many so-called modern stables have been warm but damp.

Better have low temperatures and a dry air than high temperatures and dampness. Dampness breeds disease in every form of life.

A damp house means colds, bronchial troubles and tuberculosis. A damp hen house produces roup. A damp cow stable brings its train of evils, including that most threatening and formidable of all, bovine tuberculosis.

Much has been written and said concerning this form or that form, whether we should build a plank frame or the old-style mortise and tenon, whether the roof should be self-supporting or held together by purlin posts and plates. To be sure this is right and modern methods of plank frames and self-supporting roofs have advantages, but they are all inconsequential to the dairyman when compared with the now obtainable essentials: warmth, light and pure air. These practically cover the whole question of sanitation and hygiene.

SANITARY DAIRY BARN.

The barn shown in *Fig. 218* was built 6 years ago by H. E. Cook, the well-known eastern authority on dairy matters, on his farm in New York State. Mr. Cook says: "When our knowledge was not as well organized as it is today, I endeavored to build a sanitary barn, one in which any form of animal life could safely be housed, even including the human family, and to accomplish this at a cost within reach of any progressive dairy farmer.

"Formerly it was generally supposed that sanitary barns were only within the reach of the wealthy. Unfortunately this state of affairs had prevented the hard-working dairyman from attempting such construction. Now we find that a habitable stable costs but little more than one not suited to animal life.

"Barns may be built high or low, the stable in the first story with storage above or built shed-like without storage. It seems to me preferable to use the space above for storage as a matter of economy; for with a perfectly tight ceiling all chance for escape of moisture and foul air into the hay loft is cut off. We have storage above and also at one end, as shown in plan. (*Fig. 219.*) The manure is hauled direct from stable each day, entering through hay floor drive, turning and passing out between cows at scuth end. The granary and silo are both convenient to the feed mangers. Box-stalls are found in the same room with the cows. The horses are also kept in same apartments. They could be separated if desired. The floor outline is shown in *Fig. 221,* all being built of cement. The windows (*Fig. 220*) give 4 sq. ft. to each cow. More rather than less is desirable. Storm windows are put in about the first of December. This prevents frosting and more perfectly insulates the room. The side walls are made of matched ceiling inside and outside, the studs with the space filled with straw, although dry planer shavings are preferable. Here we have at the minimum cost a most perfect insulating material. So completely is this the case that the ceiling rarely swells in the long cold winters. We have some cement plastered wall that is more desirable and when I build again I shall plaster both ceiling and side wall instead of using matched lumber. The wall must be smooth and tight in either case. The stable should not be over 8′ or 9′ from floor to ceiling."

SOUTHERN ILLINOIS DAIRY BARN.

The dairy barn shown in *Figs. 220* and *221* was built in southern Illinois by the late H. L. Borden. It is a frame structure on stone piers from 1′ to 2′ off the ground. It is used

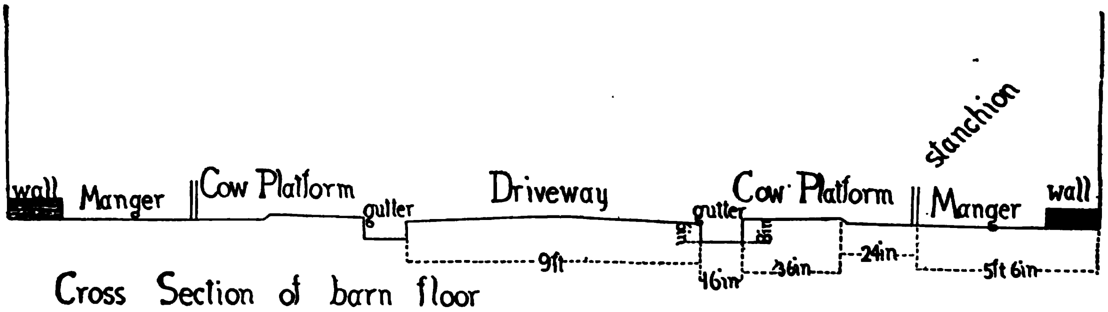


FIG. 219. SANITARY DAIRY BARN (SECTION OF FLOOR).

FIG. 220. SOUTHERN ILLINOIS DAIRY BARN (ELEVATION).

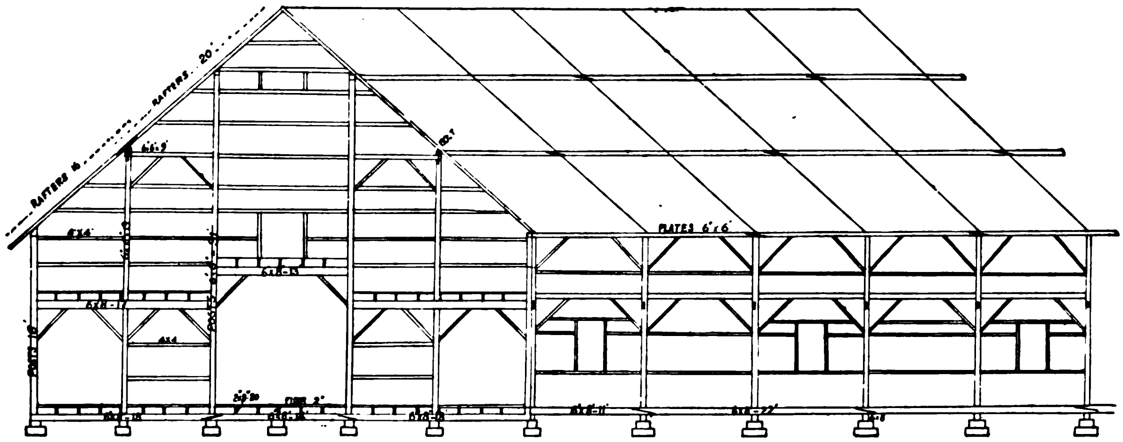


FIG. 221. SOUTHERN ILLINOIS DAIRY BARN (FRAMEWORK).

as a cow stable and has a loft overhead for hay, which is elevated by hay slings in the center of the barn. The cow stable consists of two rows of stalls (see *Fig. 222*) with some box-stalls. Each single cow stall is 5′ wide. The passageway behind the cows is wide enough to allow the passage of a two-horse manure spreader, which saves the handling of the manure very often. The barn cost about $2,400.

A ROUND DAIRY BARN.

The accompanying plan of barn for a dairy farm was designed some years ago by Prof. F. H. King for a Wisconsin dairyman. The design was the result of a request for a plan of a barn for a dairy farm which would accommodate 80 cows and 10 horses and which would also permit of driving behind the cattle in cleaning and in front of them in feeding green fodder. A silo, a granary and storage place for dry fodder sufficient for all the animals were desired, and the whole was to be covered by the same roof, to be conveniently accessible in all its parts, but not very expensive.

The plan in several fundamental features em-

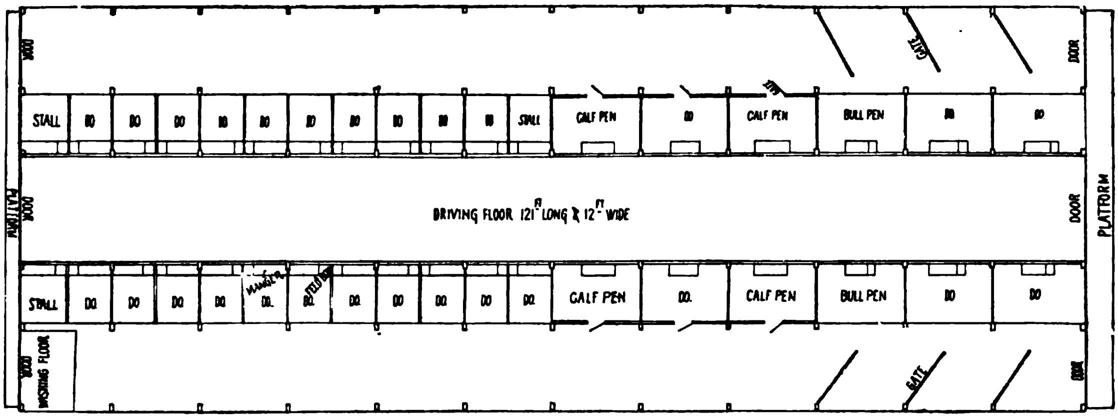


FIG. 222. SOUTHERN ILLINOIS DAIRY BARN (GROUND FLOOR).

bodies ideas which are believed to be worthy of general imitation:

1. Whatever other advantages or disadvantages a shelter for live stock possesses, it should in no way interfere with the best performance of the animals housed.

2. The shelter should be so built that the heat necessarily given off by the bodies of animals housed shall be sufficient to maintain the best stable temperature during cold weather and at the same time admit of ample ventilation, while during warm weather the surplus heat may readily escape.

3. The construction should be such as to admit the needed amount of light to all the animals housed.

4. The construction of the shelter should be such as to reduce the labor of caring for the animals to the smallest amount which will admit of the largest yearly net profit.

5. The form and arrangement of the buildings should be such as to necessitate the least first cost and the smallest maintenance expense compatible with the necessary accommodations.

Figs. 223 and *224* show bird's-eye views of the interiors of the first and second stories designed to show the construction of the barn and the arrangement of its interior. It will be seen that in form the barn is cylindrical, covered with a conical roof, which is surmounted by a cupola of the same form. The barn is 92′ in diameter and 28′ from sills to eaves. A cylindrical silo 24′ outside diameter and 34′ deep, having a capacity of 14,126 cubic feet, occupies the center. Around this silo in the first story 98 adult cows are accommodated in two circular rows facing a common feeding alley 9′ wide, and behind each row of cattle is a wagon drive 6′ wide for cleaning the barn, which leaves and returns to the common single board entrance.

Extending entirely around the silo in the second story is a barn floor 18′ wide, from the outer edge of which, though chutes leading to the feeding alley in front of the cattle, green fodder can be delivered to them from the wagon or dry fodder from the storage space above. This floor also permits of driving around the silo and out at the entrance after unloading, even when the silage cutter is being run to fill the silo.

On the outside of the barn floor, on the right of the entrance, is stable room for 10 horses, 16′ from front to rear, 34′ frontage on the barn floor and 55′ from end to end at the outside. On the left of the main entrance is a workshop and granary whose combined floor space equals that occupied by the horses. In the rear of the silo is a space 16′ deep for farm tools, having 32′ frontage on the barn floor and possessing a floor space equal to 16 x 40 square feet. Between the tool room and the horse barn on one side and the granary on the other are two hay bays which, together with the space above the barn floor, tool room, granary and horse barn, furnish ample storage space for dry fodder.

The silage is delivered to the cattle barn from the silo through a triangular chute shown in *Fig. 223*, extending up the inside of the silo; in one side of this chute there are doors and attached to the other is a fixed ladder by which any desired level in the silo may be reached.

The foundation of this barn consists of four concentric stone walls, the inner one carrying the walls of the silo and through them the central portion of the floors and roof; the two middle ones carrying the stationary uprights of the stanchions, and through them the floor, main posts, purlin plates and roof, while the outer one supports the walls of the structure. The laying of the walls to a circle and leveling them was a simple matter and accomplished with the aid of a straight-edge, one end of which was fixed to a post in the center, with the lower edge at the level desired for the top of the walls. The movable end of the straight-edge rested on a ring of boards tacked to stakes driven in the ground outside the wall being built. The inner wall was first built and the straight-edge lengthened as necessary. The frame of the barn consists almost wholly of 2″ stock and the only long timbers are the eleven posts carrying the purlin plates. No mortise and tenon work was used in its construction, all work being done with the hammer and saw. The first story sills of the barn are single 2″ x 10″ plank sawed in 4′ sections and bedded in mortar on the walls, the sections having been sawed on a bevel determined by the direction of the radii of the barn. On the sills 2″ x 10″ studs are set 2′ apart and constitute the outer frame of the basement; 2″ x 12″ studs set flatwise on the two middle walls, at the right distance apart to serve as the uprights of the stanchions, and 2″ x 12″ studs in the walls of the silo, as shown in *Fig. 223*, constitute the vertical supports for the second story. The sills of the second story consist of short pieces of 2″ x 10″ plank spiked down upon the ends of the three outer circles of studding, as shown in *Fig. 223*, and of three thickness of 6″ boards bent around the upper ends of the silo studding and resting in the shoulders sawed for them. Two thicknesses of plank rest on the stanchion supports, but the outer sill is single; upon these 2″ x 12″ joists are distributed, as shown at *5*, *Fig. 223*, and these carry the floor of the second story.

Each of the posts carrying the purlin plates rests on four 2″ x 10″ joists spiked together and resting on the sills carried by the two rows of stanchions, the particular stanchion uprights where these posts come being strengthened by 2″ x 6″ studding spiked to them at the edge not occupied by the cows. On the tops of these posts short pieces of 2″ x 10″ plank are spiked, as shown at *1*, *1*, *1*, *Fig. 224*, and upon them the purlin plates rest, spikes being driven upward into them to hold them in place.

The rafters and studding for the second story are 2″ x 6″ stuff, the latter being set 3′ apart, and the lower ends of the rafters are carried by two layers of 2″ x 6″ pieces spiked to the tops of the studding, the upper layer breaking joints with the lower. *Fig. 224* shows the manner of placing the rafters.

The rafters were cut so that their ends when in place were vertical and the fascia was formed by springing a board to them. The lower one or two rows of roof board were sawed in short sections, reaching from rafter to rafter, and then fencing was used, full length, and sprung to the rafters over the remainder of the roof. It was not necessary to cut shingles in laying, except on the cupola, and in laying them each man was provided with a "horse," made by driving spikes through one edge of a short piece of 2″ plank, which served as legs and prevented sliding. A mark was filed in the edge of the shingling hatchet at a distance from the nailing face equal to that which the shingles were laid to the weather, and this served as the only guide in placing them, which was done rapidly and readily, the men following one another round and round.

This barn is covered outside with drop siding, sprung and nailed to the studding so as to break joints, and on the inside of the cattle barn, horse barn and granary with shiplap.

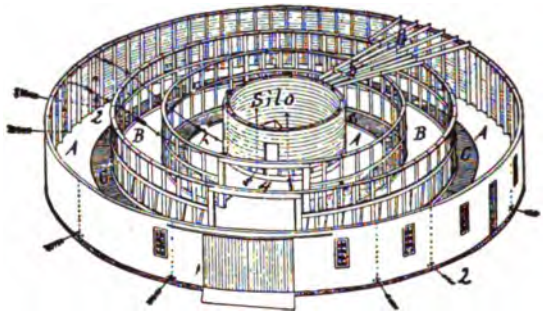


FIG. 223. A ROUND DAIRY BARN (FIRST FLOOR).

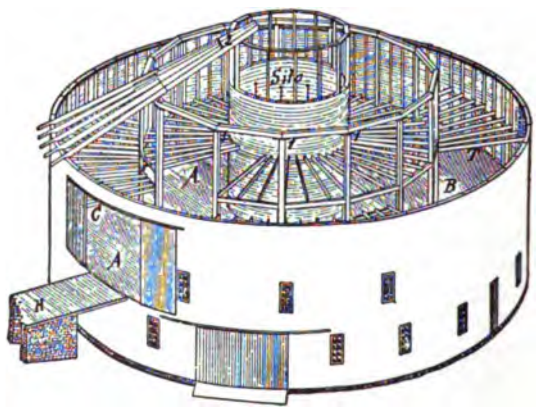


FIG. 224. A ROUND DAIRY BARN (SECOND FLOOR).

In the construction of the silo, 2″ x 6″ studding were used above the basement, these being spiked side by side to form the 11 long ones, which extend to and help support the roof. The lining of the silo consists of three layers of ½″ lumber formed by ripping common fencing in two, and between these are two layers of tarred paper. The same kind of lumber forms the outer covering of the silo and the spaces between the studding act as ventilating flues for the cattle barn.

The large doors slide open and are made of matched fencing nailed to cleats having the same curvature as the sides of the barn. These cleats are made by springing the boards into the desired curvature and then fastening them securely together while in that attitude. When this is done they remain bent as if they had grown in that form.

The feeding mangers in the cattle barns are made by forming the earth in the shape of shallow, round-bottomed troughs in front of each row of cattle, raising the earth between them into a broad rounded ridge. This earth after being thoroughly firmed was plastered with a coat of water lime.

When it is known that air once breathed, unless diluted with that which is fresh, cannot support higher animal life; that one-fifth of the weight of materials taken into our bodies daily is oxygen from the air, and that we must breathe 346 cubic feet of air to get it; that on the average our live stock consumes more air per capita than we do, and that horses have died from suffocation while being shipped in box cars, it should be evident that, coupled with our efforts to secure warm barns, there should also be those to provide ample ventilation. The plan here described possesses a very simple, cheap and effective method. It will be seen from *Figs. 225* and *226* that the 32 spaces between the studs in the walls of the silo, being open at the floor of the cattle barn and also at the top, constitute so many ventilating flues, each 34′ in length. The heat given to these flues by the silage in the silo, the warming of the air in the basement by the cattle, and the suction produced by the wind blowing through and around the cupola, all combine to maintain a strong current of air out of the barn through the cupola and in through the gangs of auger holes in the outer walls shown at *2, 2,* in *Fig. 223.* It will be seen from the arrows in the cut that provision is made for fresh air to enter the barn from all sides, which, rising between the studding and flowing along the space between the joists, falls between the rows of cattle, but is first mingled with the warmest air of the barn, while the coldest and most impure air is constantly drawn out from along the floor. A very important feature in this method of ventilation is that pure air comes direct to all animals alike, while the impure air is drawn out in a uniform sheet all around the silo. It will be seen that this ventilation is secured without sensibly affecting the cost of the building, while at the same time the walls of the silo are kept dry and thereby protected from decay.

The temperature of a barn whose plan of ventilation is the one here described is under as good control as is possible where artificial heat is not employed, because the cold air is introduced at the warmest part of the barn, while it is the coldest and most vitiated air in the barn which is being removed. Then when the barn is too warm the doors to the feed chutes may be opened, thus providing a direct escape of the overheated air from the ceiling.

This barn was built for a little less than $2,400. By combining everything under the single roof, by adopting the cylindrical form which requires the smallest amount of siding, roofing and paint, and which admits of the cheapest and least lumber for the frame, and by distributing the lumber so as to make it perform two or more functions a great deal of economy was secured.

Another advantage which the consolidated barn possesses over several small, scattered structures, and especially where the feeding is done from a central point, as it is in the plan in question, is the large saving of time which it makes possible in feeding and caring for the animals.

The great economy of the circular plan for farm buildings over other types of structure diminishes as the size of the building decreases, but it is nevertheless well adapted to some of the smaller structures, such as horse barns and sheep barns. In any case where an octagonal barn is desired the circular type will always be found cheaper and more stable.

Where a silo is to stand separate from other buildings there is no other type of structure which can be built so cheaply as the circular one, even if its diameter is not greater than 12′ x 16′.

A BARN FOR 20 MILCH COWS.

This barn is designed for 20 dairy cows. It has ample breathing space for them and provision is made for as much light and sun as possible, unless the plan of detached shed with sky-lights is adopted; the manure is removed at the minimum of labor and the entire building is planned to be labor-saving. The little room termed an office, containing lavatory, towels, soap, records and the like, is possibly larger than is needed and in that case it may be narrowed to a smaller limit and another stall or two made of the room. The feed-room is a convenience that no dairyman can afford to do without. Feed is stored in three or more bins above and spouted down to one large mixing bin, where it is measured or weighed, mixed, scooped up and fed.

Reference to the side elevation, *Fig. 225,* shows the window-openings on the south side (turning the building east and west). The over-hang is to protect the doorway where hay is taken in at the end, as there is no space wasted in driveways to unload hay. *Fig. 226* shows the end elevation, and in the gable is noted a combination of window and ventilated shutter

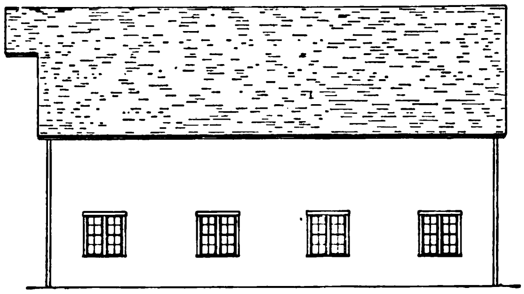


FIG. 225. BARN FOR 20 MILCH COWS.

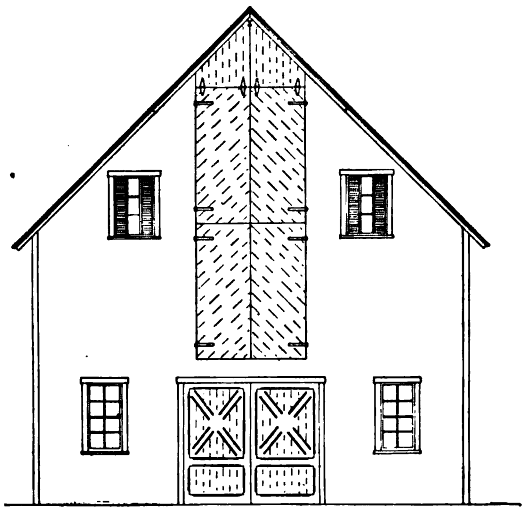


FIG. 226. BARN FOR 20 MILCH COWS.

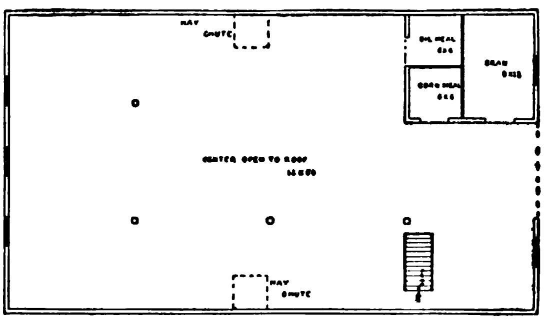


FIG. 227. BARN FOR 20 MILCH COWS (MOW FLOOR).

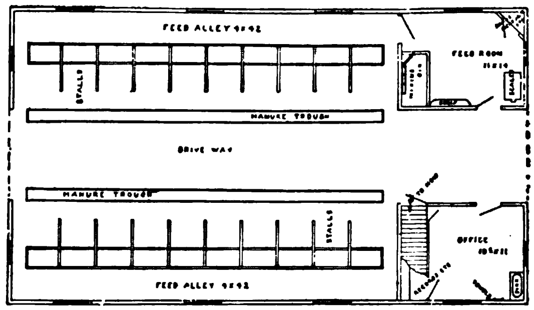


FIG. 228. BARN FOR 20 MILCH COWS (GROUND FLOOR).

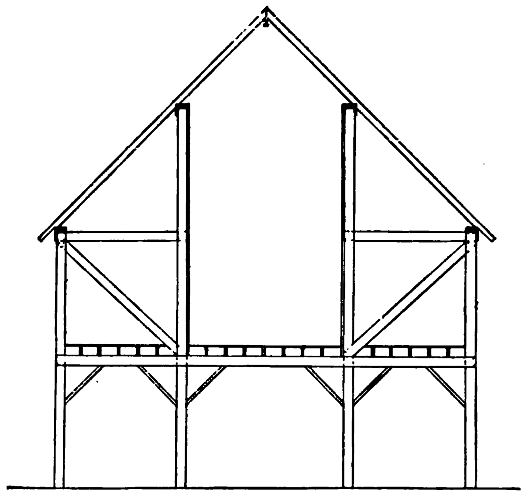


FIG. 229. BARN FOR 20 MILCH COWS (FRAMEWORK).

that looks well and acts well. Providing these at each end there is no need of ventilators in the roof, as ventilation will be upward through the hay-chutes. These may if desired be extended through the roof, though if metallic shingles are not used (which condense vapors) there is no ill effect in letting the ventilation proceed through the gables. The doors to take in hay open down to the line of the floor so that hay may be taken in without raising it to the level of the track. This is an open-center building, with joist-frame construction, as shown in *Fig. 229.* The frame is all of 2″ stuff, is very much cheaper, fully as strong and in every way more desirable than the old-fashioned frame. It is put together with spikes and bolts in a very short time. The basement is made 10′ high, not for the sake of head-room so much as for better air and light.

Fig. 227 illustrates the mow plan; hay is thrown down into the feed-alleys; ladders should be built in the chutes. The stairway is apt to be covered over at times with hay. The bran bin is large enough to allow storage of a great deal of bran.

Fig. 228 shows the arrangement of stalls. It will be noted that there is everywhere plenty of room. The cart can go between the cows and take the manure away. In the space between the feed-room and office the milk-wagon may stand if necessary. The Van Norman stall is used.

This barn is adapted to either beef cattle or dairy cows, though there is no provision for calves, as it was designed primarily for milking.

A HYGIENIC DAIRY BARN.

After studying for many years to learn the best way to fasten cattle in a barn a great many dairymen have come to believe that the best way is not to fasten the animals at all. A good plan is to have a large open shed to which light and air have free access and in which are feed-racks and troughs. This shed should be kept well bedded and aired. The cows, loose and de-horned, stand in it day and night. Adjoining

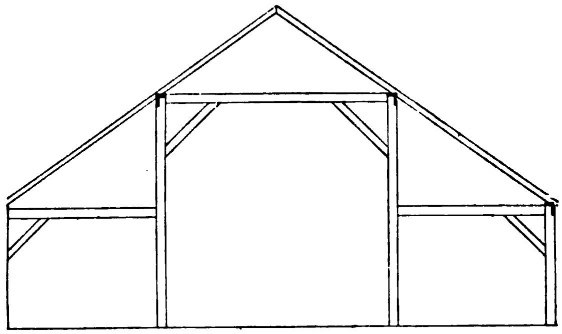


FIG. 232. A HYGIENIC DAIRY BARN (FRAMEWORK).

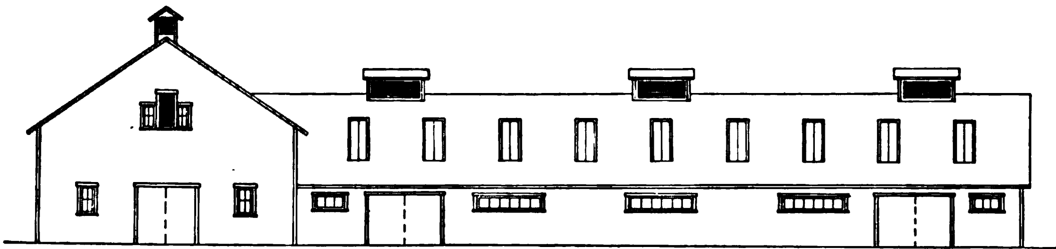


FIG. 230. A HYGIENIC DAIRY BARN (SIDE ELEVATION).

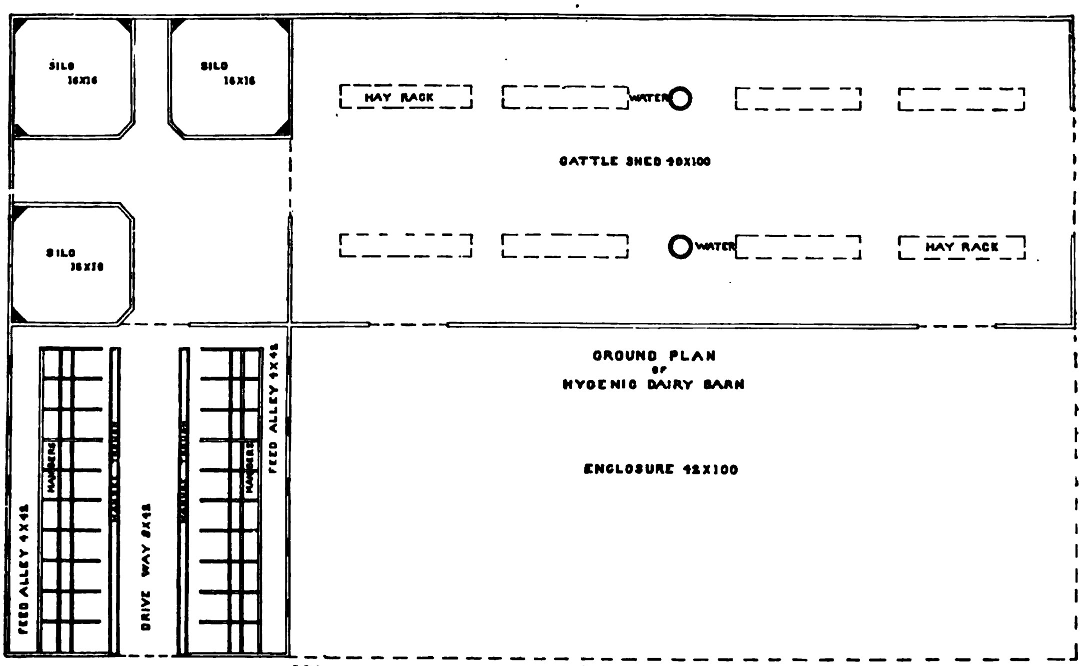


FIG. 231. A HYGIENIC DAIRY BARN (ARRANGEMENT OF FLOOR).

this shed as planned is a small stable fitted with stalls and stanchions where some grain is fed and the milking done. The cows are in their stalls only while they eat and are being milked. The barn should be whitewashed two or three times a year by means of a sprayer that reaches every nook and crack and the floor kept clean. *Figs. 230, 231* and *232* show the plan clearly. The barn is well ventilated and convenient in arrangement. Three silos are shown in *Fig. 231.* No provision is made for storing hay.

A NEBRASKA DAIRY BARN.

The Nebraska dairy barn illustrated in *Fig. 234* was erected in 1896 to house a dairy herd. The floor plan and dimensions are shown in *Fig. 233.* The cows stand in the south L, which is protected by the north L from the winter winds. The two Ls are the same size—each 30′ x 48′, 8′ posts. The barn is floored upstairs as well as down (except the space occupied by silos), and cows stand high and dry 3′ to 6′ above the ground, and there is a window for every two cows. The latter stand in two rows facing in on a feeding alley and are tied with halters. The floor of the manger is level with the feeding alley and for convenience in cleaning the manger is open in front.

There are two thicknesses of boards on all sides, keeping the temperature even and above the freezing point. The silos extend 10′ below the floor and up into the loft, making them about 20′ deep. The silos and the separator-room have a thickness of building paper between the boards. With a separator at the barn only

FIG. 234. A NEBRASKA DAIRY BARN (ELEVATION).

the cream is taken to the dairy-house and the skimmilk is fed warm to the calves and pigs. The barn has a root cellar under the south end and cost $1,300. It will accommodate a dairy herd of about 30 cows.

A PENNSYLVANIA DAIRY BARN.

A very complete, elaborate and convenient barn (*Figs. 235* to *238*) for dairy cattle is thus described by the proprietors:

"Our barn is a polygon of 16 sides. It is

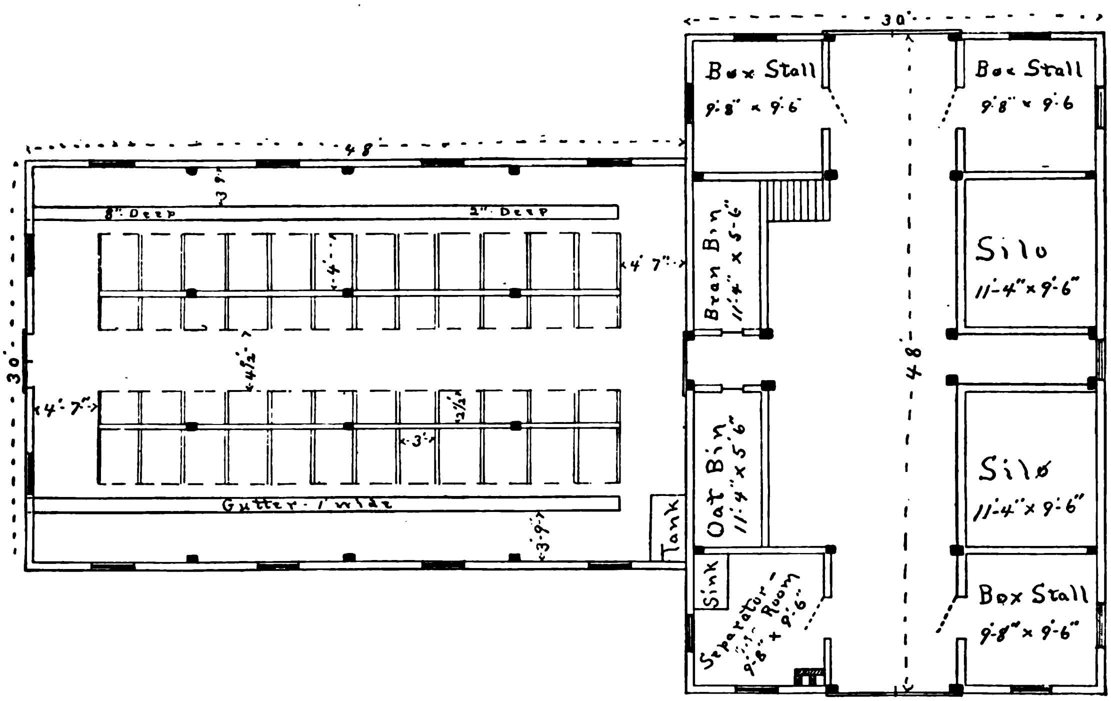


FIG. 233. A NEBRASKA DAIRY BARN (GROUND FLOOR PLAN).

believed that nothing has been neglected which would add to the comfort or healthfulness of the herd. The bran is heated by steam and in winter a uniform temperature of from 40 to 45° F. is maintained night and day, never colder than 40°, never warmer than 45°. Self-registering thermometers in locked cases show at all times any variation from this temperature.

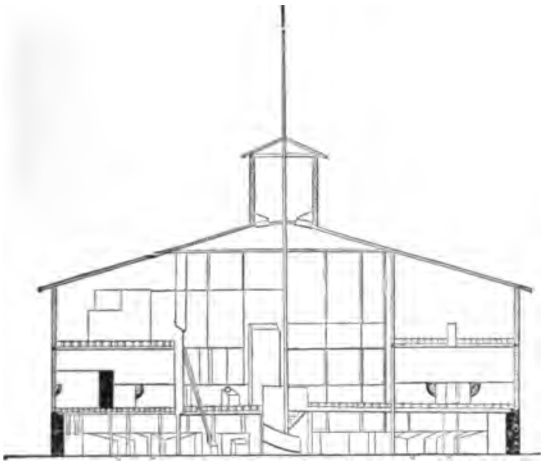


FIG. 235. PENNSYLVANIA DAIRY BARN (FRAMEWORK).

The aim is to maintain a temperature just above the freezing point.

"More attention to proper ventilation has been paid than to all else. The barn is surmounted by a cupola 20′ in diameter. This is open every day and night in the year. The lower sash of each window is raised 8″ and a board

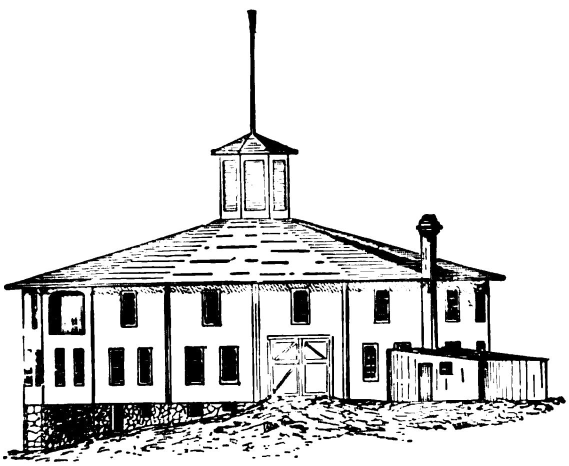


FIG. 236. PENNSYLVANIA DAIRY BARN (ELEVATION).

placed under the sash. A hole 6″ in diameter is cut through this board in which is placed a zinc pipe opening outwardly and turned up on the inside some 3′ in height. This allows for the admission of air between the two window sashes and also of a full current of air through the 6″ pipe, thus preventing any possibility of a current of air striking directly upon the animals. By this arrangement, no matter what the weather

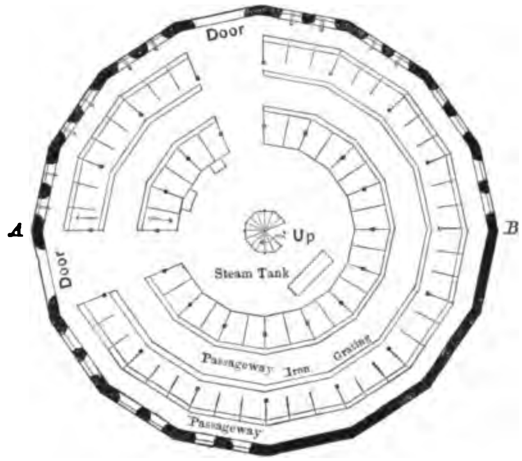


FIG. 237. PENNSYLVANIA DAIRY BARN (BASEMENT).

may be, a full supply of pure fresh air is given to every animal by the current from the lower floor passing up the stairway in the center of the barn and also through two chutes extending from the lower floor well up toward the roof.

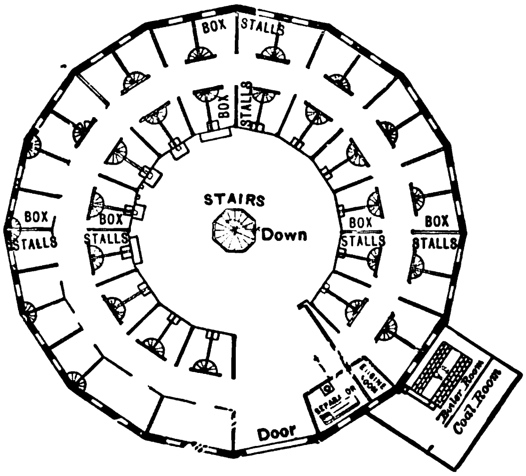


FIG. 238. PENNSYLVANIA DAIRY BARN (FIRST FLOOR).

"The basement (*Fig. 237*) of the stable is devoted mainly to the milking cows. It is laid with concrete. Gutters covered with iron gratings extend back of the cows and terminate in a sewer which leads 100 rods away from the stable. This floor can be scalded out with hot water, the gutters and sewers flushed and the cattle put back in the barn on a dry floor in an hour's time.

"The first floor (*Fig. 238*) is of two thicknesses of matched yellow pine with tarred paper between the layers. Sawdust is used for bedding on this floor, which is devoted mainly to box-stalls, both open and tight, for the service bulls and for cows soon to calve.

"In a room on this floor is placed the cream separator and engine. On this floor is also a

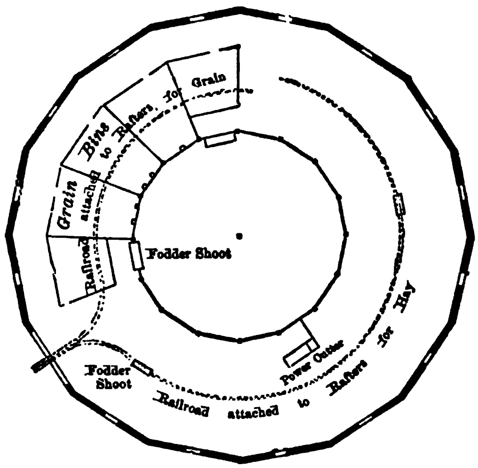


FIG. 239. PENNSYLVANIA DAIRY BARN (SECOND FLOOR).

cleaning machine, which by a system of revolving brushes cleans a cow perfectly in from three to five minutes' time. During the winter months each cow receives a daily cleaning, three men being able by this method thoroughly to clean 160 head per day.

"The second-floor space (*Fig. 239*) is devoted to storage for fodder, grain and bedding and also for power cutter, which cuts one ton of dry corn-fodder into 1-3″ lengths in 25 minutes.

"The barn is lighted by 60 incandescent electric lamps. A night watchman is employed who every half-hour makes a complete tour of the stable, seeing that all is well, a touch of the button enabling him at any time to notify the superintendent of anything wrong. To insure the watchman's wakefulness and attention to duty an electric time detector is in use which keeps perfect record of his movements through the barn."

A WISCONSIN DAIRY BARN.

The barn shown in *Fig. 240* was built by A. Dutton & Son in 1896 in Trempealeau County, Wis. It is 60′ in diameter and built on a southern slope with a basement for stock. Stone was used on the hill side; the rest is built the same as the upper part. The studs are 2′ apart; it is sided with drop siding and sealed on the inside. The basement floor is made of cement. There are 20 patent stalls and room for 15 head of young cattle, six horses and a box-stall. There is a silo in the center 16′ in diameter and 34′ deep. It will hold 150 tons of silage. The studs above the basement are 20′ high; this makes the barn 28′ high to eaves. There is room for 70 tons of hay. A hay-carrier is used on a circle track. On each side of the driveway there is granary room for 2,000 bushels of oats and a carload of bran. The silo is filled from the upper floor.

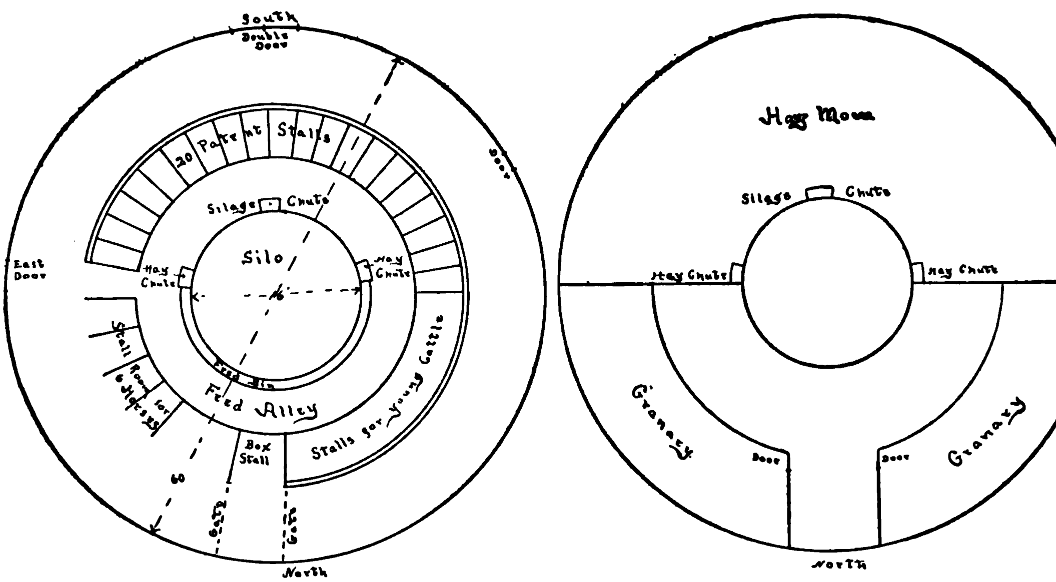


FIG. 240. A WISCONSIN DAIRY BARN (FIRST FLOOR AND HAY MOW PLANS).

DAIRY BARN FOR 20 COWS.

Figs. 241 and *242* show a plan for a dairy barn to hold 20 cows and feed room to cost only $500, with lumber at $8 per thousand.

Make four bents, placing them 14′ apart. This

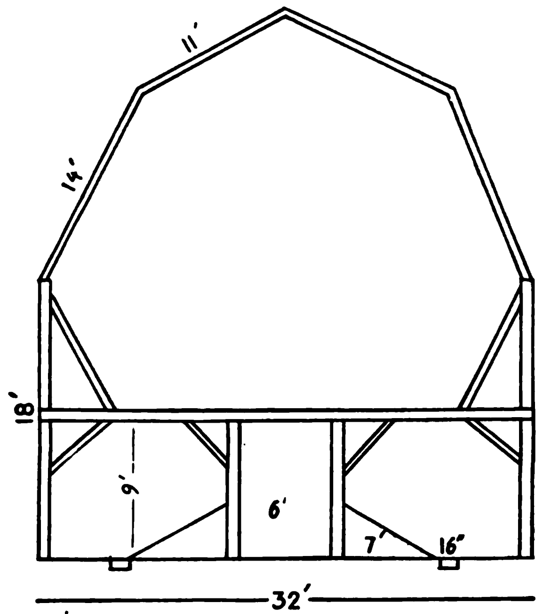


FIG. 241. DAIRY BARN FOR 20 COWS (CROSS-SECTION).

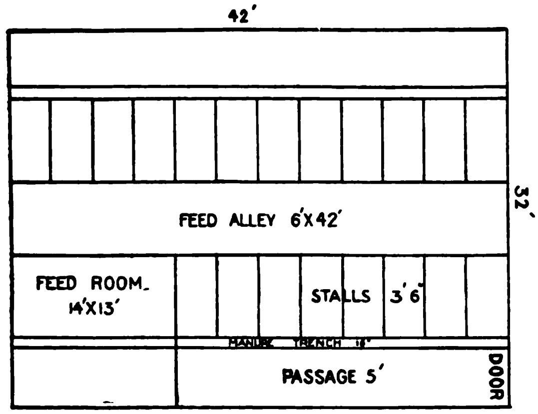


FIG. 242. DAIRY BARN FOR 20 COWS (FLOOR).

will make a barn 42′ long and the width is 32′. Reference to the plans will explain the rest. Put in a manure carrier behind the cows and a feed carrier in front of them if there is money left. The roof braces are not shown but many plans already published show them clearly. The posts 18′, lower rafters 14′, upper rafters 11′, make a building high enough to have much storage capacity.

DAIRY BARN FOR IDAHO.

Plans shown in *Figs. 243* and *244* are for a dairy barn to contain 40 cows and some heifers, with pen for calves and place for bull and stalls for four horses. There is space for two delivery wagons and a room for cooling the milk, besides a feed-room which is supplied from bins in the loft. It contains storage room for about

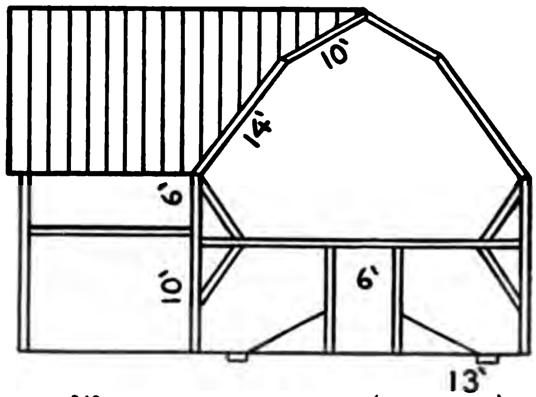


FIG. 243. DAIRY BARN FOR IDAHO (FRAMEWORK).

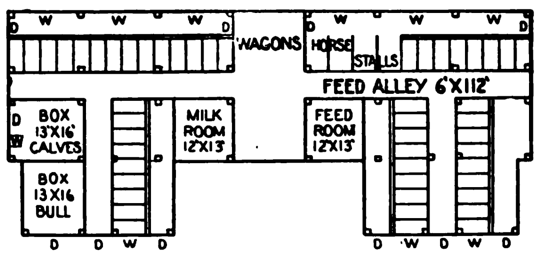


FIG. 244. DAIRY BARN FOR IDAHO (GROUND PLAN).

100 tons of hay and two cars of ground feed. The stable is 32′ wide, 112′ long with two wings each 16′ x 32′. The wagons are kept in the central driveway, the cooling room to one side of it and the feed-room to the other side, each being near to the center of the barn. (*Fig. 244.*) A track and carrier go down the central aisle, with switches to the wings, carrying feed wherever it is desired, and a similar track with carrier behind the cattle removes rapidly and easily all the manure.

Over the driveway and feed-room are great bins for the ground feed which can be cheaply elevated by horse-power, either in sack or in a mill elevator; if it is bought sacked it should be elevated in the sack and emptied in the bins. Hay may be taken in at the driveway and at the ends and thrown down in the feed alleys at convenient points. The framework would be of joist construction, no part heavier than 2″ x 12″ being needed, with self-supporting roof.

FIG. 245. TENNESSEE DAIRY BARN (ELEVATION).

A TENNESSEE DAIRY BARN.

This building (*Figs. 245, 246, 247, 248, 249* and *250*) is a frame structure 54′ x 73′ 6″, exclusive of the silos which are 18′ x 30′, and an annex which is 18′ x 50′. *Figs. 245* and *249* show the general exterior elevations of the barn as approached from the south and west. The silos are situated at the south end of the barn, some 10′ being under the ground. This brings them on a level with the basement and, as they open into the cow stable, it materially lessens the labor of feeding.

The annex on the west side of the barn is two stories high. In the basement are stalls for bulls and calves, while the upper story is devoted to the various wagons and implements needed in farm work. A large corncrib is situated conveniently near the barn. While the exterior appearance of the barn is plain, it is attractive and pleasing to the eye. It is substantially built and is of the type known as a bank barn, and as these present some features of special interest, a digression will be made to call attention to some of the special advantages of this style of barn.

The barn is built into the side of a small hill. By the construction of a retaining wall, which also forms the foundation of the two interior sills, and by projecting the barn forward on the face of the slope, a stable is secured opening on the ground level, and yet sufficiently protected on the north and west to keep it warm in winter. This leaves two faces of the stable foundation exposed, so that a continuous row of win-

FIG. 246. TENNESSEE DAIRY BARN (SHED ADDITION).

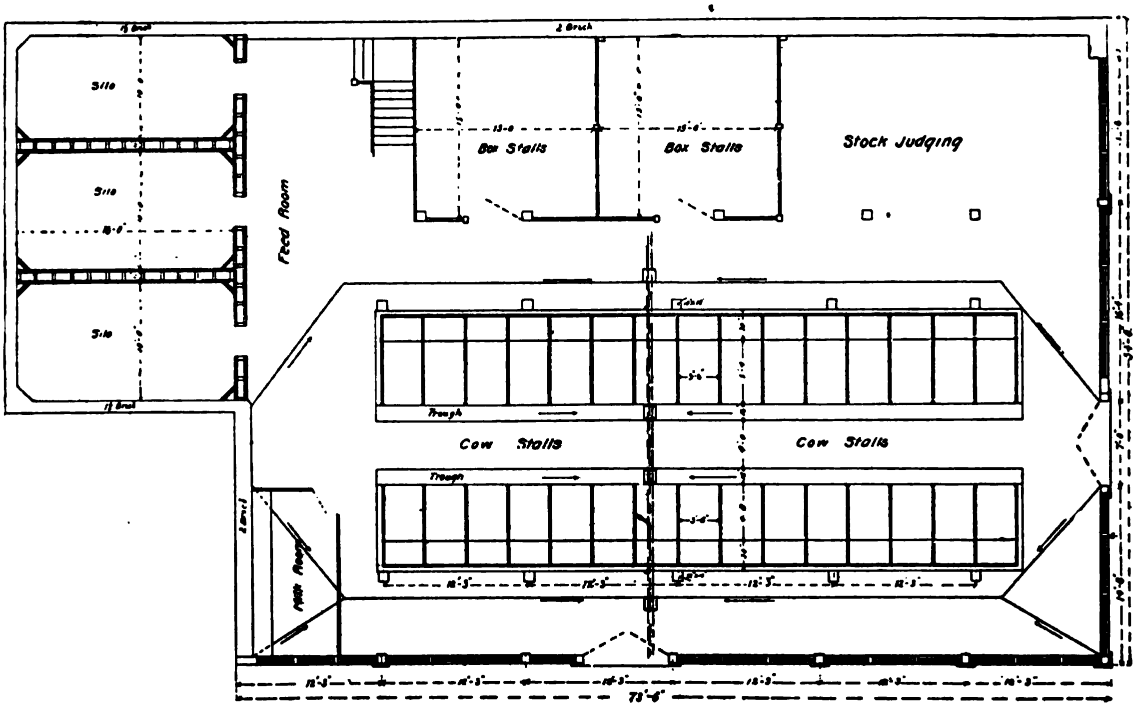


FIG. 247. TENNESSEE DAIRY BARN (GROUND FLOOR).

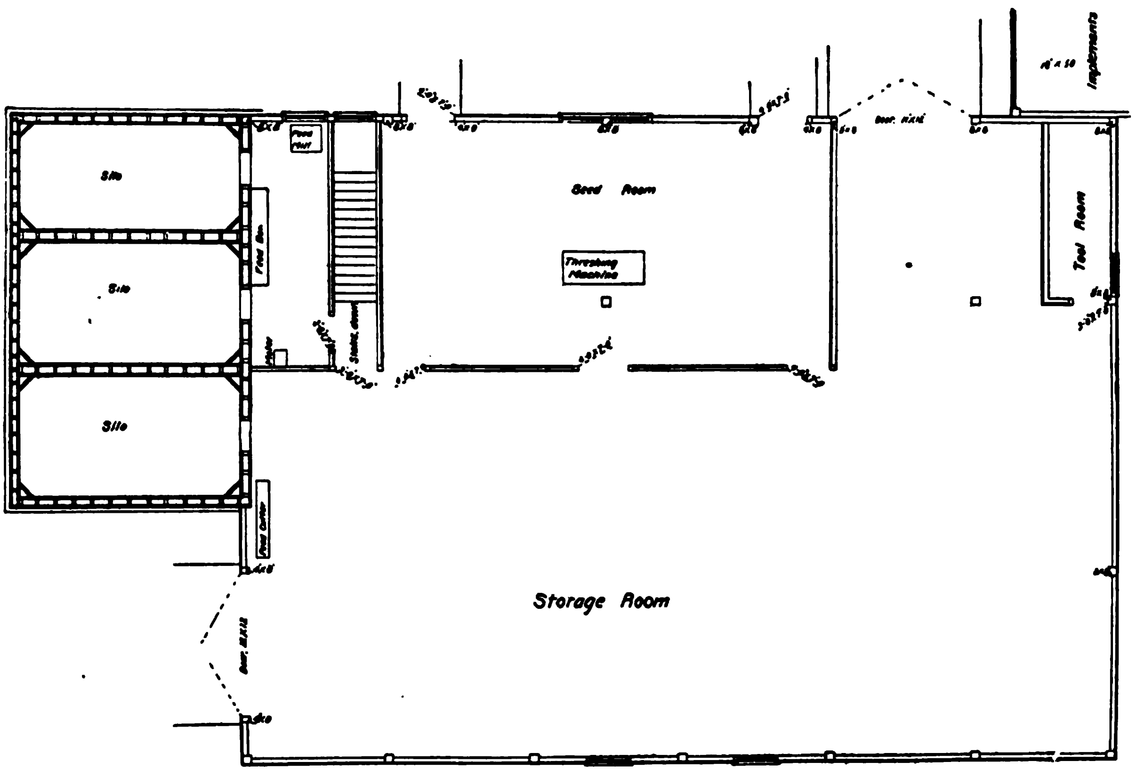


FIG. 248. TENNESSEE DAIRY BARN (SECOND FLOOR).

dows on the eastern and southern sides gives ample light and ventilation. This method of construction brings the second floor on a level with the ground and no artificial bridges are necessary to enter the barn. Generally speaking, in the construction of a bank barn great labor and expense are entailed in the excavation for the stable. In this instance it was only necessary to cut down and level two sides of the slope, thus reducing the labor of leveling to a minimum. The food materials carried in on the second floor are all elevated by suitable machinery, so that the silage, roughness and grain required for the stock in the stable below are easily transferred to the place where needed. There are thousands of natural building sites where barns of this type can be constructed at little expense. While other advantages might be instanced, these are sufficient to impress upon the reader the importance of taking advantage of a natural site when building is contemplated.

FIG. 249. TENNESSEE DAIRY BARN (GENERAL VIEW).

Figs. 247, 248 and *250* present in some detail the transverse section of the barn, the plan of the basement, and of the ground floor or storage barn. From an examination of the transverse section, it will be seen that the posts and plates are of heavy timbers. The roof is trussed from above so as to leave the storage space in the clear. It is of the type known as a saddle roof. As already stated, the brick retaining wall forms two sides of the stable and supports the frame work of the barn; the other two sides are supported by the foundation piers of brick on which rest the heavy framing timbers. *Fig. 250* also shows the situation of the mangers and the arrangement of the gutters in the concrete floor. It provides in detail the several dimensions of the storage barn and the stable and shows the size and character of timber used in the various features of the structure. The factory system of exposed structural timbers was followed in the construction of the stable, and the spaces between the supporting timbers are enclosed with matched ceiling and the whole painted white. This gives an attractive appearance and permits the walls to be washed whenever necessary.

The cow stable (*Fig. 247*) is situated in the basement and is provided with a Portland cement floor, having a sloping surface, as *Fig. 247* indicates. The mangers face the exterior walls of the barn. A 4′ passage is provided between the stalls, and the manure gutters are 16″ wide. The floors and gutter are pitched towards the center, where trap doors connecting with underground sewers are situated, so that the stable can be easily flushed out and kept in a sanitary condition at all times. The floor of the cow stable is raised 4″ above the main floor and above the 4′ passage way that is provided between the stalls. This makes the manure gutters 8″ deep on the side next to the cow and only 4″ on the side next to the passage. While this affords all the advantages of a deep gutter, it lessens the danger of the cows suddenly stepping into a deep trench as they pass back and forth from the platform on which they stand. The mangers are constructed of concrete and extend the entire length of the stalls, and form a part of the floor. The side of the manger, next to the cows, is 6″ high and 3″ thick, with a rounding bottom. The opposite side is 16″ high and maintains the same thickness. The width of the

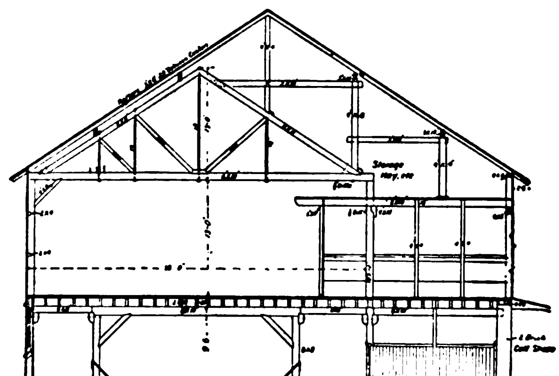


FIG. 250. TENNESSEE DAIRY BARN (FRAMEWORK).

manger is 2′ 6″, and it does duty for both feed and water. The barn is supplied with water from the city mains, and hence there is ample force to carry it all through the building. The mangers have a grade towards the center and by putting a plug in the central outlet, the cattle can all drink at will, and at the conclusion the trough can be thoroughly flushed out and kept sweet and clean. It will thus be seen that this method of construction makes the mangers practically perfect from a sanitary standpoint. For experimental purposes, we have found it necessary to provide divisions between these mangers. This has been cheaply accomplished by cutting out a section of board the shape of the manger, hinging it over the lower angle of the stall division with hoop iron, placing a 2″ x 6″ scantling at the near side of the manger and fastening the division firmly by a sliding bolt lock. These partitions are so nicely adjusted that they prevent the admixture of the different cows' feed, and at the same time just sufficient space is left to enable the free movement of water through the entire length of the feeding trough. Their mobility and ease of adjustment are a decided advantage when it becomes necessary to scour the manger.

Stalls are provided in the stable for 30 cows. As already stated, the heads face outward. The stalls are of iron gas piping with the division posts sunk into the concrete to a considerable depth and strongly braced so that they are firm and rigid. These stalls consist of adjustable gates and panels supported by a woven wire mesh. To the front of the stalls is attached a strong support which runs the entire length of the stable and being bolted to the stall divisions gives them rigidity. The doors open by means of a spring so that as the cows are milked they may be turned out if desired. These stall divisions also keep the animals separated so that ease of milking is possible and there is no danger of one cow tramping on the udder of another. They also present a handsome appearance and are strong and durable. They enable the strictest cleanliness and do away with the necessity of tying the animal. This gives the animals perfect freedom and allows them that comfort which is essential to their well-being. The chains across the stalls just in front of the gutter prevent the cows from standing or lying in the droppings. By moving the adjustable swinging panel the stalls are easily adapted to the size of the animal. The idea is to keep the panel adjusted so that all the droppings will fall in the gutter. It will be observed that the stalls in this barn are of two sizes, namely: for large and small cows. All the stalls on one side have a uniform width of 3′ 6″ in length and on the other 4′ 8″ in length. This permits the convenient accommodation of cows of different sizes and is a point worthy of consideration. While these stables cost more, they are economy in the end. It has been thought by many that cement floors would not do well, as they would be too hard on the animals feet. There is nothing in this objection, as animals have, in other places been kept on these floors many years without injury.

The basement also contains a stock judging room where specimens of the different classes of live stock are brought in and conveniently examined and scored by the agricultural students. This brings the students in actual touch with

FIG. 251. BROOKSIDE DAIRY BARN (BIRD'S-EYE VIEW).

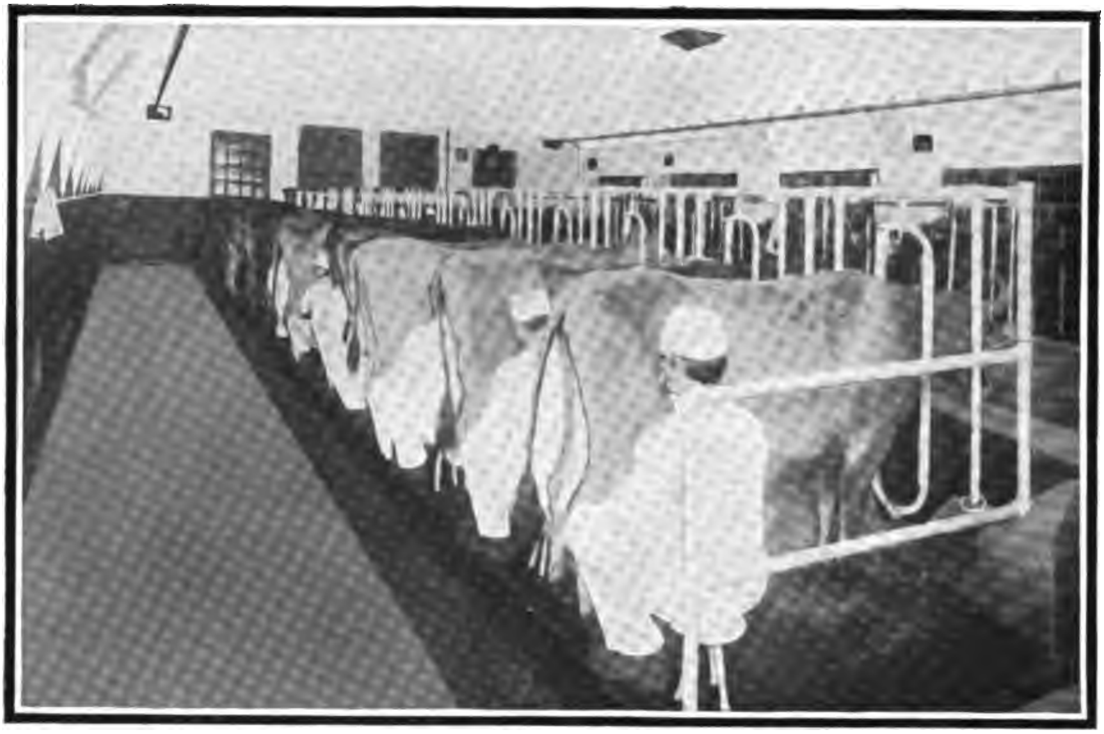


FIG. 252. BROOKSIDE DAIRY BARN (INTERIOR).

the specimens and make the work practical. It also enables the work to go on at all times and provides a comfortable and convenient place in which to do the work. Box-stalls are provided also in the basement for sick animals and for calves. Closets are conveniently placed for tools and other sundries needed in the stable. The milk room occupies the southeast corner and is partitioned. This building is a part of the Tennessee Experiment Station's equipment.

BROOKSIDE DAIRY BARN.

Figs. 251, 252 and *253* show a dairy barn that is laid out with the King system of ventilation, the arrows pointing in being inlets and those pointing out, outlets. (*Fig. 253.*)

The windows allow for over 7′ of glass per cow and are doubled in winter to keep from allowing the inside temperature to fall too low.

The width of about 39′ inside allows for a walk behind cows of 6′ and gives ample room for mangers in front and passage between the rows. A barn of this type when finished properly will score 100 per cent according to the score adopted by the Dairy Division of the Department of Agriculture at Washington.

The framework for stanchions and partitions between the cows are all of galvanized iron pipe with galvanized steel stanchions. All interior finished in cement.

The building being one story contains no post, the only surface in the barn to collect dust being the top of the 1¼″ pipework.

In such a barn as this with the care they take the owners say they have been able to produce milk that has shown no bacteria growth in samples taken from the wagon in New York City and has averaged 100 for weeks. This will be better appreciated when it is understood that the Milk Commission of New York allows 30,000 bacteria per C. C. for certified milk.

HILLCREST DAIRY BARN.

Hillcrest Farm Sanitary Dairy, located in Southwestern Missouri, has been recently built from plans of the owner (see *Figs. 254, 255, 256, 257* and *258*), after visiting a number of the celebrated dairy barns of the country, embracing the best features of a great many of these modern structures, and including these at a comparatively moderate cost.

The great drawback of the sanitary dairy barn to the average farmer is the heavy expense. No system of drainage by iron pipes and cement, concrete floors and mangers, properly built, can be cheap, but the Hillcrest idea as a model dairy barn is to show that the essential

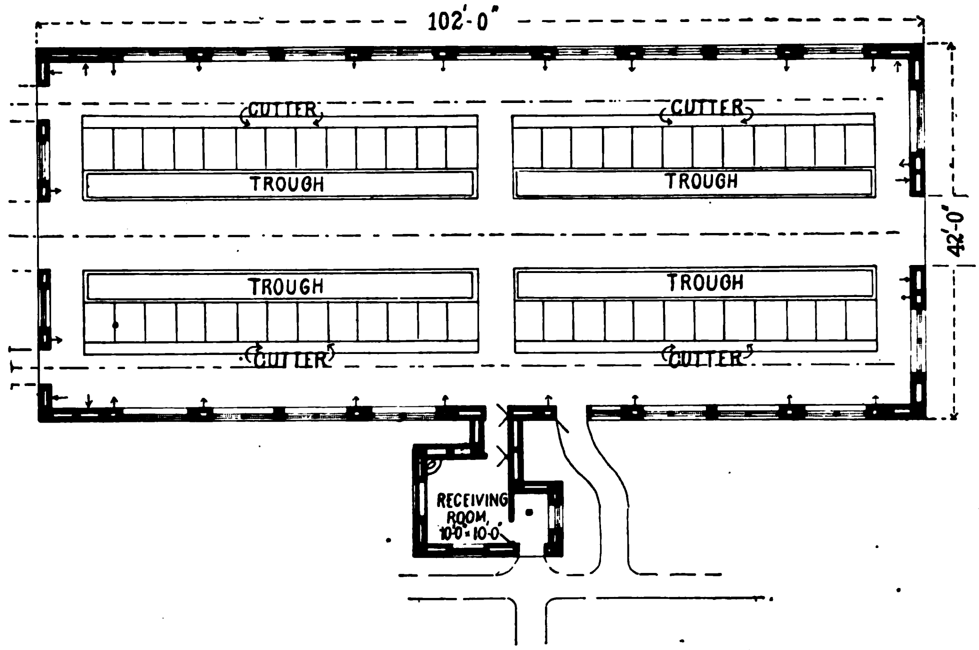


FIG. 253. BROOKSIDE DAIRY BARN (ARRANGEMENT OF GROUND FLOOR).

features of sanitation are not out of the reach of the dairy farmer. The especial idea running through this plan is the one of convenience and economy in feeding and caring for the stock.

It will be noticed that the silage car can run through the feed barn to the entry between the rows of cows (*Fig. 255*) without the feeder being exposed to the weather. With heads to the center, the cows are fed in more uniform time, and the feed is easier swept back to the manger if it is scattered than if a single line of cows faced outward to the wall. Then the cows are spared the glare of light facing the sun against the windows.

The King system of ventilation gives entire freedom from odors in the barn, and in addition to the pure air, a temperature of not less than 40° is maintained, the outside thermometer standing at zero.

The barn is lined with building paper and ceiled; windows on each side and end give abundance of light, so essential to the destruction of bacteria or germs which contaminate the milk.

The cows always enter at the same door, and on being turned out take the opposite door, which avoids confusion and crowding.

The watering system has been changed from

FIG. 254. HILLCREST DAIRY BARN (ELEVATION).

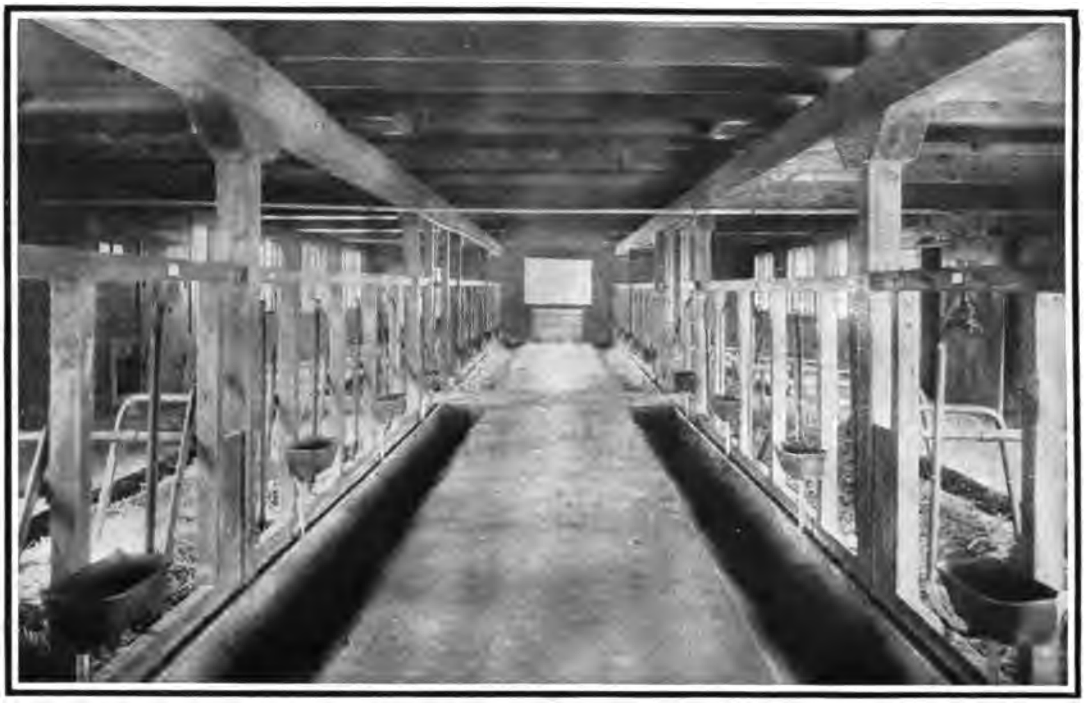


FIG. 255. HILLCREST DAIRY BARN (CENTER ALLEY).

using the continuous manger for watering because the cows at the end of the string became very nervous waiting for the water to reach them, and the watering was only at set times. Now, by a system of automatic water boxes, regulated by a tank and float valve, water stands before each cow all of the time, a very important item where cows are kept up during cold weath-

FIG. 256. HILLCREST DAIRY BARN (INFIRMARY).

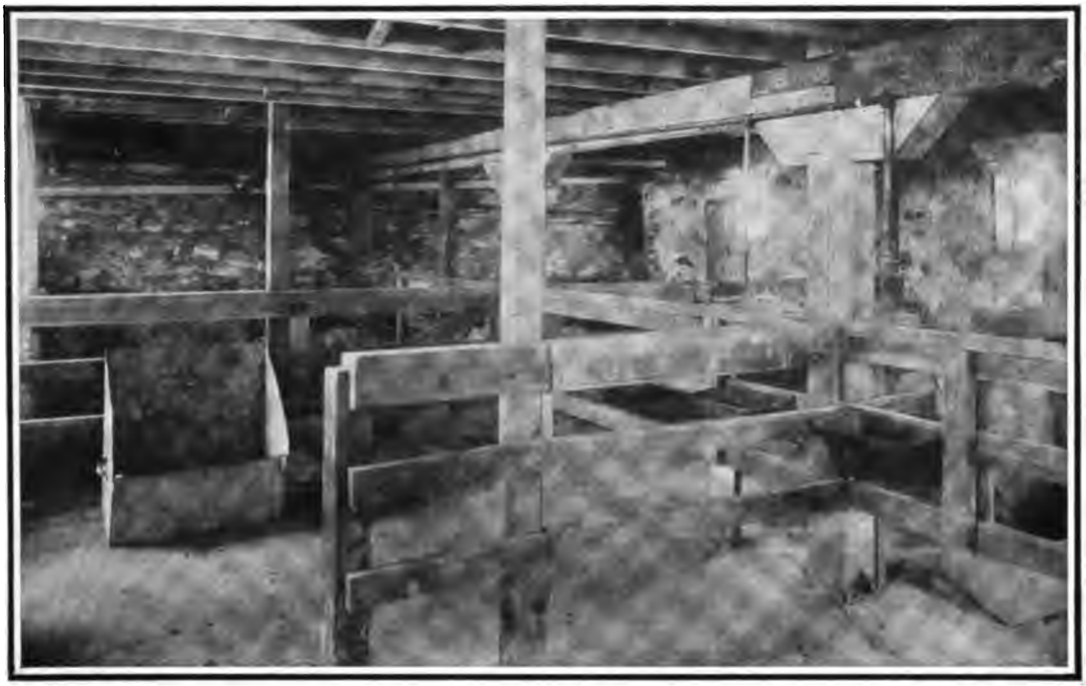


FIG. 257. HILLCREST DAIRY BARN (PIPING).

er. The milk flow was at once improved when the cows had access to water at their desire to drink.

The milking is done in sections of 10 cows, each man being responsible for the condition of his cows. He must weigh up his milk before turning it into the funnel in the wall of the dairy, whence it passes over the aerator, and

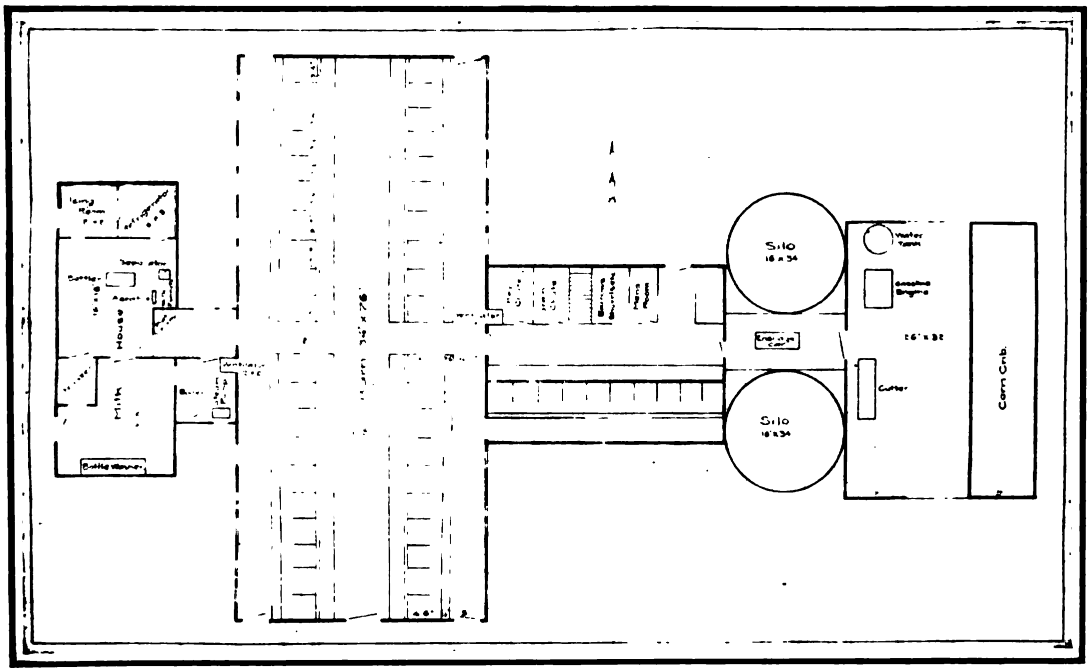


FIG. 258. HILLCREST DAIRY BARN (FLOOR PLAN).

is at once chilled to 50°. The milk then being bottled and sealed is set in the icing room ready for delivery.

The cleaning of the stable is done by removing the solid manure with wheelbarrows to the spreader standing in an adjoining lot, whence it is scattered as directed, daily. The liquid manure washed out of the gutters by hose into an iron pipe sewer system, properly trapped into a cistern away from the barn and pumped into a tank wagon, is sprinkled over the fields, the most valued of the fertilizer thus being saved.

Water is supplied from a deep well for the dairy from a filtered cistern for the barn use. It is pumped from a lake, fed by springs, into a cistern by a 2 H. P. gasoline engine. This water is clear and cool and gives abundance of water for flushing the floors. The floors in the cow barn are of cement, the stalls being covered with an inlaid planking which prevents the injury to front knees and to udders, heretofore experienced, when the cows lie on the cold, wet cement floor.

The "Infirmary" is provided with eight box-stalls for cows during calving. (*Fig. 256.*) On arrival calves are at once removed to the nursery and fed the first 10 days on whole milk from a bucket. Subsequently, separator milk and oil meal is the ration. The fact that never a calf has died on Hillcrest Farm, except three from accidental causes, speaks for the advantage of a sanitary care of young calves. Scours has never existed in the herd.

The silos are two in number, 16′ x 32′, with cement bases 4′ deep, giving 36′ depth in all. (See *Fig. 258.*) These are designed to feed the herd for 8 months. Adjoining the silos and also under continuous roof, are the silage cutter, also the feed mill, which furnishes, apart from bran and oil meal, the ground concentrate. An experiment is being made with alfalfa. If this proves successful, the silage and alfalfa will reduce to the minimum the expense of feeding for milk. At the present cost of hay of all kinds the problem of roughage for those who do not have the fortunate addition of a silo to their equipment, becomes a very dear one.

FIG. 259. BARN FOR YOUNG DAIRY STOCK (ELEVATION).

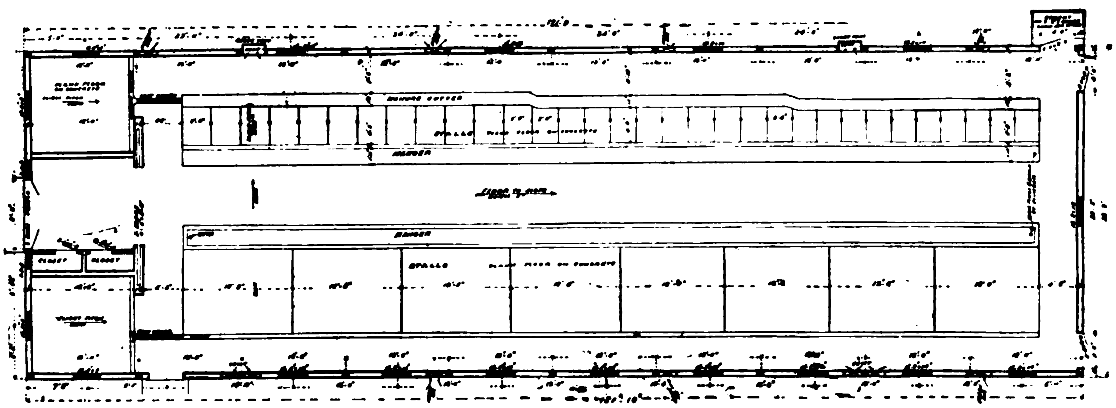


FIG. 260. BARN FOR YOUNG DAIRY STOCK (FLOOR PLAN).

FIG. 261. BARN FOR YOUNG DAIRY STOCK (STALLS).

FIG. 262. BARN FOR YOUNG DAIRY STOCK (CENTER ALLEY).

BARN FOR YOUNG DAIRY STOCK.

Architects' plans and photographs shown in *Figs. 259, 260, 261, 262* and *263* are for a barn built principally for the housing of young dairy stock. There are eight roomy box-stalls and 32 ordinary stalls. The flooring where the cattle stand is plank over cement. (See *Fig. 263.*)

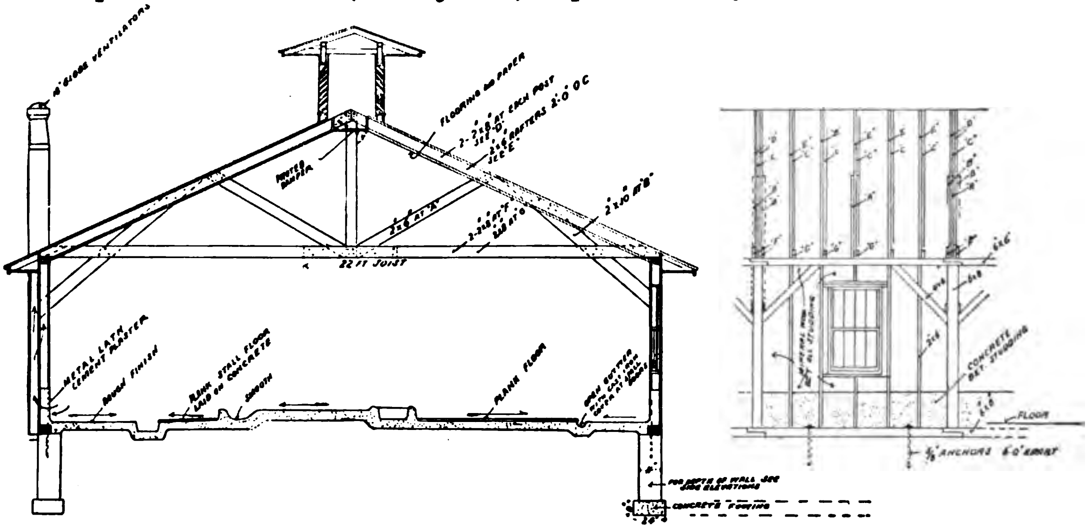


FIG. 263. BARN FOR YOUNG DAIRY STOCK (FRAMEWORK).

A ROUND DAIRY BARN.

The round dairy barn shown in *Fig. 264* is 90' in diameter, having stanchions on the ground floor for about 75 cows. A round silo holding nearly 400 tons extends from the ground to the

FIG. 264. A ROUND DAIRY BARN (ELEVATION).

roof under the cupola. There are no cross beams except those supporting the floor above the cows, so nothing is in the way when storing hay. The separator and power room is located behind the inclined road leading to the upper doors. Economy of lumber and convenience in feeding are claimed for round barns.

A NEBRASKA DAIRY BARN.

A Nebraska farmer, asking for a plan for an up-to-date dairy barn to hold 40 cows and eight horses, has a bank facing south. He is thus advised:

We will use the bank by building a wall 5' high, as shown in *Fig. 265,* and back about 5' will build a second retaining wall of concrete. The arrangement of the two walls will let light and air into the basement, and by sloping the earth away from the inner wall toward the tile drain shown the basement will not be damp.

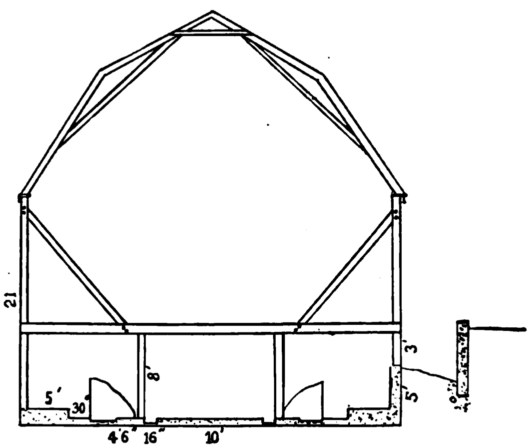


FIG. 265. A NEBRASKA DAIRY BARN (FRAMEWORK).

Provide abundance of windows on both sides. The floor will all be of concrete. Observe that under the cow the floor is 2" lower where her front feet stand than back, and with a distinct offset. This holds her bedding and enables her to lie down or kneel down with comfort. The raised walk in the feeding alley is best. Referring to the ground plan, *Fig. 266,* it is seen that there is a wide passage between the cows where a manure spreader may be driven if desired, cow part, using sliding doors, as horses require more air and endure more cold than dairy cows. There are several systems of ventilation if abundant windows are used, each one hinging at the bottom and opening inwardly, and if they are intelligently managed the cows may have fresh air and not suffer from cold. If the King system is adopted the openings leading to the loft must be kept carefully closed, else it will not work. The King system is the best known

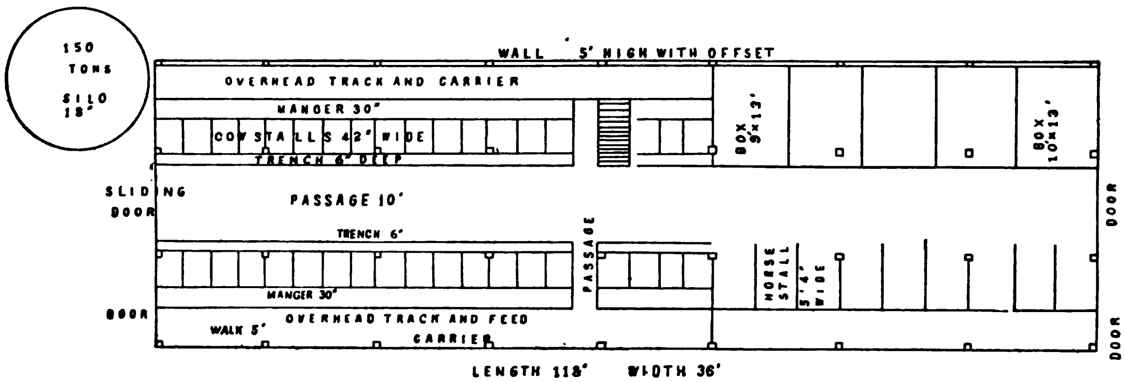


FIG. 266. A NEBRASKA DAIRY BARN (GROUND FLOOR).

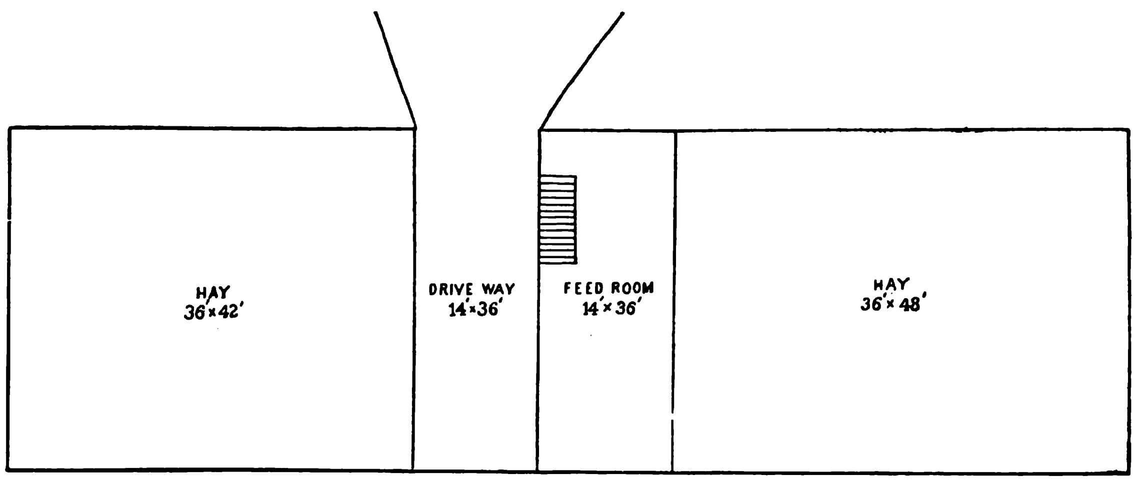


FIG. 267. A NEBRASKA DAIRY BARN (HAY MOW).

though it will be wise to put an overhead carrier system there for use when it is not convenient to use the manure spreader. There is no feedroom on the bottom floor, spouts from above coming down in the feed alleys, making it unnecessary to have a feedroom below. Close the horse part off from the for a dairy barn. A bridge will lead to the mow floor. Hay will be unloaded from this place. Wagons must be backed out. A feedroom is provided in which may be many or few bins, depending on the needs of the user. The silo is designed to hold 40 pounds per day of silage for 40 cows for six months.

SWINE BARNS AND HOUSES.

What would be the business future of the swine breeder whose hogs were compelled to be exposed to the cold blasts of winter or the glaring sun of summer? What would their condition be if they were obliged to eat and sleep in filth? What would the pig crop be if the sows were allowed to farrow in the fence corner some cold stormy night with only the canopy of heaven to shelter them? Answers to these questions will urge the proper equipment of the farm for the breeding of pure-bred swine. How extensive the equipment should be will depend of course on the number of animals to be carried on the farm and the amount of money to be invested.

First a swine breeder should have necessary buildings for housing the herd, the feed, the apparatus for mixing and preparing the feed and the procuring of the necessary water. There are many kinds of buildings for this purpose, many of which are satisfactory. Breeders have different ideas regarding this matter, many preferring the large gloomy hoghouse or building where the whole herd may be kept under one roof, and where the bedding, feed, water and everything pertaining to the comfort of the animals may be kept convenient and used with the least labor, and where all the work in caring for the herd may be done under cover. This plan has many advantages and where adopted the buildings should be so arranged that as much sunlight as possible may be admitted to the pens and feeding floors. There are other breeders who prefer the outdoor individual house large enough for only one sow and her litter, with a grass lot of at least one-half acre where the sow and pigs may always be by themselves. This latter plan will of course occupy considerable land, at least where the herd is large, and will necessitate considerable fencing into lots along either side of a lane and the hauling of all the feed to the different lots at each feeding time. But this plan insures both abundant pasture for the sow and litter as well as plenty of room for the necessary exercise and has the advantage of always affording clean quarters for the hogs and freedom from disturbance for sows farrowing.

There are many different plans for both the large houses and small individual houses, from which may be selected whatever best pleases the breeder. As much or little expense may be put into the building of hoghouses as the breeder desires.

All buildings for breeding and feeding swine should be strongly built and made of good material, and all should have floors both for feeding and sleeping apartments. Floors made of wood are preferable in the sleeping quarters, being warmer and more easily kept dry. Where the large hoghouse is used many prefer the feeding floor to be constructed of concrete or cement and the sleeping floor of wood. Where the building is used for the feeding of a large number of swine together some prefer the feeding floor to be constructed along the outside of the building, and in such instances the floor should be constructed of concrete or cement, raised slightly above the surrounding surface. A cement feeding floor of this kind properly made would be practically indestructible and would be easily kept clean either by sweeping or flushing with water.

Where the individual system of houses is used there is no necessity for a feeding floor except a small one about 8′ x 8′ in one corner of the lot most convenient to feed, and this only for the use of the litter where the pigs may be fed secure from the intrusion of the mother. She may be fed near them from a single trough.

Where the individual houses are used it will be necessary to have a feedhouse or building so arranged that all feed may be kept there in separate bins, where water may be easily obtained either from an elevated tank or from a pump in the building and where the mixing of the feed may be done. With this system the easiest way to distribute the feed to the various lots is to use a wagon not to exceed 12″ in height from the ground, and large enough to hold three or four barrels of feed set upon it. Such a wagon with a pair of shafts and a gentle horse kept for the purpose of hauling all feed and water to the different lots make it very easy for the feeder to care for 100 or 200 hogs in a short time with very little labor.

Where the feeding is all done in one building or house a feed carrier suspended from a steel track above the alley is the most convenient way to handle the feed, as it requires but very little effort to carry a large amount of feed in this manner along the alley.

There are many kinds of troughs on the market. Some of them are good, others better and some absolutely worthless. Old-fashioned wooden troughs are about past. They are expensive because so soon destroyed, and are always damp and convenient for animals to put their feet in while eating. There are several types of galvanized iron troughs as well as two or three cast iron troughs. One of the latter is made for animals of any size and is absolutely unbreakable. This trough weighs 122 pounds, is round and accommodates eight animals, and whether small or large animals they are never crowded, as the trough forms a circle. A hog or a pig can not get his feet into it, for the reason that he eats out of a cup just large enough to stick his nose in. These cups are filled from the center in a receptacle where the feed falls on a cone, thus being evenly distributed to the eight individual cups which are separated by a heavy iron rod, and the pigs can eat only from the cup before them. These troughs are always clean, having no place for the feed to lodge and become foul. This style of trough possibly is not suited to pens along a feeding alley in a building, but for outdoor use it is admirable for feeding slop. The matter of feed troughs is of great importance, as all feed fed in the condition of a slop or mush should be fed in good troughs easily kept clean. No feed should ever be fed on the ground, unless it may be ear corn where the ground is frozen or is hard and smooth.

A breeding crate should always be used. This is an important matter. By this method of breeding the number on the ear tag or the ear mark may be taken and entered in a book at the time of breeding, giving day and date. There are several kinds of breeding crates and the breeder can easily learn which is best for his purpose.

Another necessary fixture on the swine breeding farm is a good dipping tank. This is of great value not only for the purpose of disinfecting swine, destroying vermin and mange but in keeping the skin and hair in a healthy condition. Such a tank sunk into the ground with a chute from an incline where the animals slide down into it and have to swim through the dip will pay on any pure-bred swine farm. It is of great value in preventing disease.

Another valuable appurtenance is a first-class feed steamer. It is generally admitted that while cooked or steamed feed is of no advantage so far as economy or nutriment is concerned, it is of great value in the feeding of young pigs during the cold months, as young pigs fed on warm feed either cooked or scalded with hot water thrive almost as well during cold months as through the warm weather. It is also of value in feeding brood sows during the winter season, as a mixture of clover hay, or where possible alfalfa, run through a feed cutter and mixed with meal, bran or middlings and steamed or mixed with hot water is an ideal feed for brood sows.

MODERN HOGHOUSES.

The following is contributed by Prof. Wm. Deitrich of the Illinois Experiment Station:

In order to raise swine most successfully in a country with a cold or varied climate, it is necessary to have some kind of a hoghouse. The question that first presents itself is what kind shall it be? In studying the swine industry from the market standpoint and from the breeder's standpoint it appears that for greatest success in the swine business it is desirable to produce two litters a year from mature sows and to have these farrowed so that they can be put on the market at the most favorable time.

Following is a general discussion of the location and construction of hoghouses and a detailed description and method of operation of a hoghouse that has recently been planned and built at the Illinois Experiment Station.

The proper location of a hoghouse or shelter of any kind for swine is one of the first essentials to success in swine husbandry.

In providing shelter for swine, as well as for other classes of live stock, surroundings should be furnished that conform as near to nature as the improved condition of the animals and circumstances of the owner will permit. Swine in the wild state inhabit the forest where shade, water, protection from cold winds and natural soil are abundant, and where they may select dry or damp localities as they please. The best surroundings then for swine are those that will satisfy their natural desires, but so modified and improved as to promote the largest financial results.

The best location for a hoghouse therefore is one that is well drained and well lighted, and one that will permit access to pasture, to good shade and to a stream of running water that is free from disease germs, and where also there are opportunities for making wallows in clean mud.

If the building can be placed on a sandy or gravelly soil it will afford better drainage than a clay, silt or peaty soil would furnish. Light and shade are desirable for reasons that are apparent to everyone.

Pasture should be accessible, as considerable food is obtained from the soil in the form of roots, worms and insects, as well as many materials that are not foods, but are necessary to

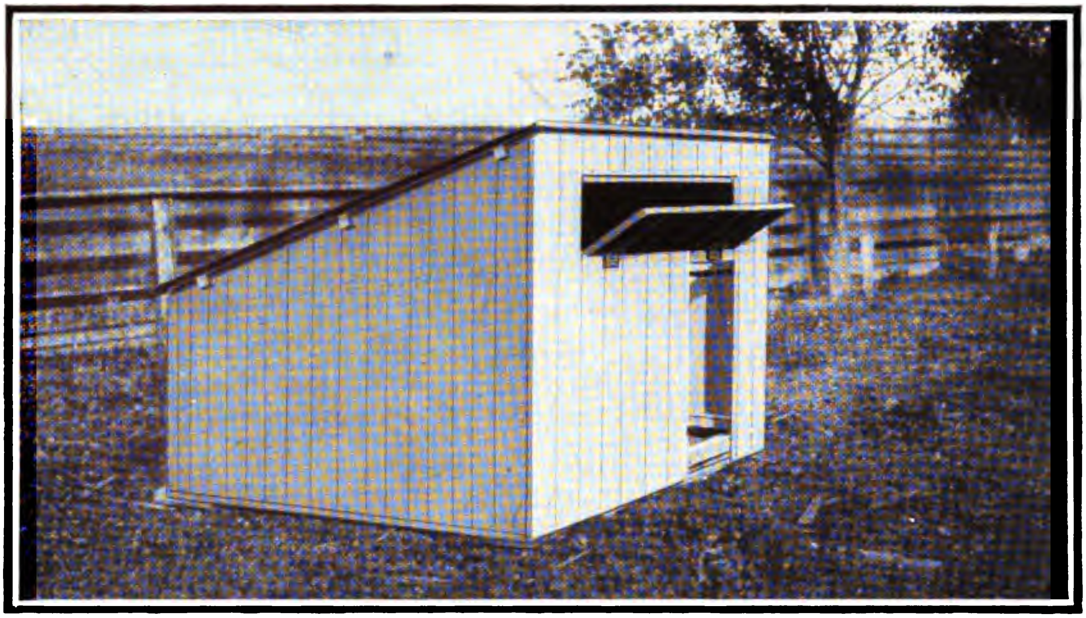


FIG. 268. BONHAM HOGHOUSE SET UP.

the health of the pigs. A limestone soil is preferable because the water from such a soil as well as the soil and stones themselves furnish the lime that is so essential in building up bone. A rolling pasture is preferable because it furnishes better drainage and a form of exercise that is conducive to the production of a large percentage of lean meat. It also tends to produce strong legs with upright pasterns, which, from the breeder's standpoint, are among the first essentials of a good hog.

A stream of pure running water is desirable,

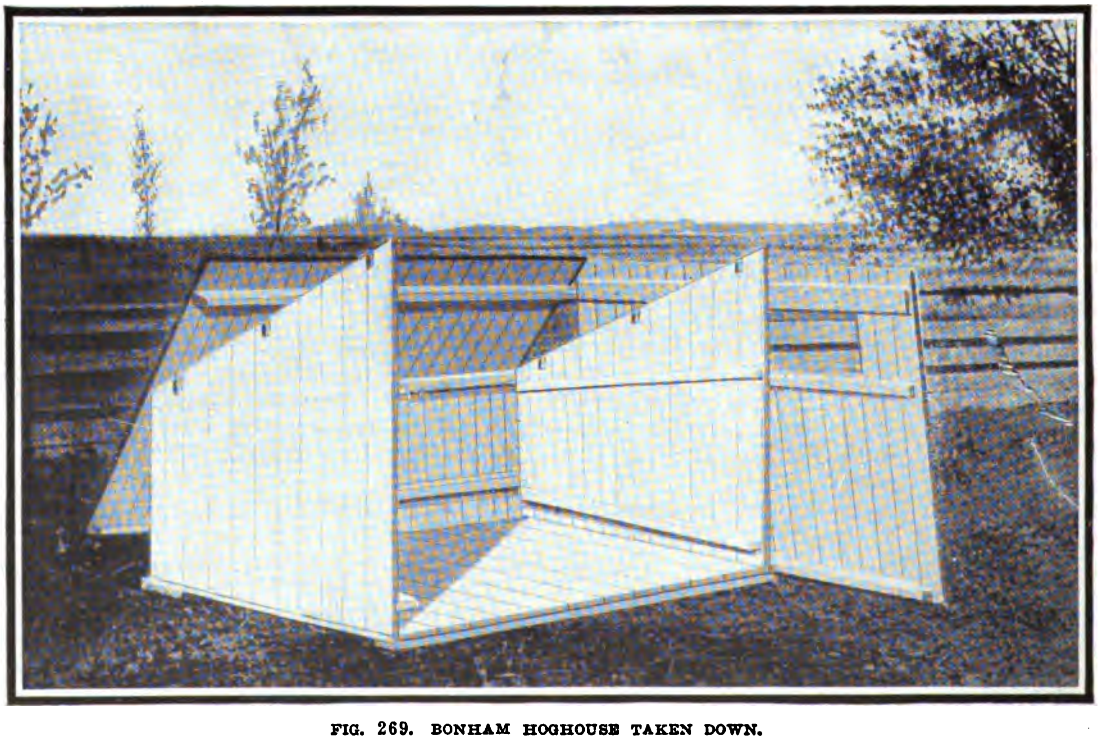


FIG. 269. BONHAM HOGHOUSE TAKEN DOWN.

for then drinking water in the best form will be available at all times and will be more wholesome than it would be were it supplied in a trough where it is bound to become more or less warm, stagnant and foul. If there is no natural stream at hand water pumped from a well by a windmill or other motive power will supply the need. A clean mud wallow is enjoyed more by swine in the summer time than any one other condition that may be furnished them. It keeps them cool, destroys lice and keeps the skin in a good healthy condition.

The two general classes of hoghouse most in use are individual houses and large houses with individual pens. A hoghouse that is best for one man under his conditions and manner of handling swine may not be best for another where the conditions and manner of handling differ. This difference is due to the originality of different breeders who have solved the problem in regard to hoghouses to suit their individual tastes and conveniences.

Individual hoghouses, or cots, as they are sometimes called, are built in many different ways. Some are built with four upright walls and a shed roof, each of which (the walls and roof) being a separate piece can easily be taken down and replaced, making the moving of these small houses or cots an easy matter. This is shown by *Figs. 268* and *269.* The primary object of this pighouse is to secure shelter, warmth, sunshine and pure air at reasonable cost, and the secondary object is to have it as handy for feeding and handling the sows and pigs as possible. L. N. Bonham of Ohio perfected this plan.

This house is 5'x6'. Four scantlings 2"x2" x 12' and two scantlings 2" x 4" x 12' will make the frame and roof supports. The bottom rail is 2"x4", the others 2"x2". The three pieces for the roof are cut 6' 6" to give a 3" projection of roof beyond the sides. *Fig. 268* shows the house set up and the drop window partly down. *Fig. 269* shows the top off. The construction is readily seen. After the house is ready to set together have the floor made just large enough to let the sides of the house set outside the floor. The cost of this house is about $5. It pays to paint the roof every three years but the sides will last without paint as long as the roof is painted. Taken down each fall and spring and whitewashed and set up against a fence or in a shed until needed it will give long service. Other individual houses are built with two sides sloping in toward the top so as to form the roof as in *Fig. 271.* These are built on skids and when necessary can be moved as a whole by being drawn by a horse. They are built in several different styles; some have a window in the front end above the floor, while all may have a small door in the rear end near the apex for ventilating purpose. These are also built in different sizes. Indeed, there are about as many forms of cots as there are individuals using them. The form in which these houses or cots are built is of little significance so long as the general principles pertaining to the health of the animals and the convenience of the breeder are observed.

FIG. 270. A LARGE HOGHOUSE (ELEVATION).

The arguments in favor of this type of house for swine are that each sow at farrowing time may be kept alone and away from all disturbance; that each litter of pigs may be kept and fed by itself, consequently there will not be too large a number of pigs in a common lot; that these houses may be placed at the farther end of the feedlot, thus compelling the sow and pigs to take exercise, especially in winter, when they come to the feed trough at the front end of the lot; that the danger of spreading disease among the herd is at a minimum; and in case the place occupied by the cot becomes unsanitary it may be moved to a clean location.

Although individual houses have certain characteristics or advantages in their favor, large houses, if properly built, also have some points of advantage, and these are good sanitation, serviceability, safety in farrowing, ease in handling hogs, and large pastures, involving little expense for fences.

In order to be sanitary a hoghouse should admit the direct rays of the sun to the floor of all the pens and exclude cold drafts in winter, be dry, free from dust, well ventilated and exclude hot sun during the summer.

Fig. 270 shows a hoghouse built with this purpose in view. The building is 30′ wide with an 8′ alley running lengthwise through the middle, between two rows of pens. It stands lengthwise east and west with the windows on the south side. The important factor to consider in this connection is the height of the windows represented at *E* and *D* in connection with the width and manner of construction of the building. The window *E* is so placed that at noon of the shortest day of the year, the ray of light which passes through the upper part will fall upon the floor of the south side pen on the opposite side from the window. This allows the total amount of light coming through the window at this season of the year and this time of the day to fall upon the floor within the pen. In the morning and in the afternoon when the sun is not at its highest point, a part or all of this beam of light will pass beyond the pen. Consequently, during the late winter months, there will be a maximum amount of sunlight on the floor of the pen.

The lower part of the window *D* in the upper part of the building performs the same function for the pen on the north side of the alley as does the window *E* for the pen on the south side. By this arrangement of windows there is possible a maximum amount of sunlight on the floor of the pens in winter which will serve to warm the interior of the house and especially the beds during the latter months of winter, thus making it possible to have pigs farrowed very early in the season. Sunlight not only warms and dries the building, but destroys disease germs, thus making the building both warm and sanitary. Sanitation is further augmented by the upper part of the window *D* which, when open, acts as a ventilator. It is supplied with weights so it can be opened and closed at will by an attendant while standing on the floor of the alley.

To have this arrangement of windows in the latitude already noted it is necessary to have the top of the window *E*, which throws light into the pen on the south side, 5′ 6″ from the floor. The upper window, which throws light into the pen on the north side, is longer, but a point in this window the same distance above the lower end as the height of the window *E* should be 9′ 8″ from the floor. This necessitates a flat roof for the part of the building south of the alley, which must necessarily be made of some material that will shed water at a slight pitch. The wall on the north side of the building is made as high as that on the south side, but the roof on the north side and alley is made steeper so as to have more air space and good ventilation. This part of the roof, then, may be made of shingles.

Dryness should be furnished by thorough drainage; freedom from dust by sprinkling with water, and the rays of direct sunlight should be prevented from entering the pens during the hot part of summer days, which in the mentioned hoghouse is done by the manner of construction of the building, the lower window being shaded by the eaves and the rays passing through the upper window fall upon the floor of the alley.

In order to be most serviceable a hoghouse should be constructed so that it can be used every day in the year. If this can be done, it is permissible to spend more money in the construction than would be warranted were the building to be used only a few months during the year. In order to be an economizer of labor the house should be planned so that the largest amount of work may be performed with the smallest amount of labor, which with the present scarcity of labor is a very important factor.

Farrowing pens should be supplied with fenders which prevent the sows crushing the pigs and should be built so that the attendant may lend assistance if necessary both with convenience and safety. By having all the hogs under one roof handling becomes simpler and in case of bad weather much more convenient.

An argument that has been advanced against the large hoghouse is that by having a large number of brood sows in such close proximity to each other, if one is disturbed or molested in any way all the others will become fretful, and when feeding is commenced at one end all the rest will become uneasy and injure their litters. This argument may hold where the partitions are solid board fences, but by the arrangement to be described the sows can see one another and see what is going on about them, and not being strange to one another or the attendant will not be disturbed to so great an extent. If the feeding is done regularly and in the same order each day, the sows or pigs soon become accustomed to the system and wait patiently for their turn. Furthermore, by this arrangement of wire partitions the little pigs are more easily tamed and

FIG. 271. AN INDIVIDUAL HOGHOUSE.

will do better because they will not become frightened every time a person passes the pen.

By having a large hoghouse the hogs can be kept together and allowed to go in a drove from the hoghouse to the pasture or to any other available field on the farm, and with very little training each sow with her litter will return to her own pen at night, thus necessitating few pastures.

In *Fig. 273* is submitted the ground plan of the hoghouse which is shown in *Fig. 270.* It is 120′ long by 30′ wide and is represented in the figure by *O S T U.* *X Y* is the alley which runs lengthwise through the middle of the building and is 8′ wide. This permits of driving through the building with a wagon, which allows the feed and bedding to be hauled in where it is needed and the manure to be loaded on the wagon directly from the pens and hauled to the fields.

The doors at either end of the building and one across the alley shutting off the pigs from the rest of the building are shown by *R.* The pens *A* are 10′ wide and 11′ deep. Each pen has a doorway *M* leading to the outside which is opened by a door sliding upwards. There is also a door *N* opening to the alley on the inside. This door is so hung that when it is open it will turn the pigs toward the front end of the house where they are to be weighed. It also permits of changing pigs from one pen to another pen and is of easy access for the attendant. *L* represents the trough which is placed on the side of the pen next to the alley and which with the arrangement of a swinging panel above this trough, as is shown in *Fig. 273,* makes feeding a very easy and convenient operation. The fender in the pen is shown by *K* in *Fig. 273.* This consists of a 2″ tubular iron bar placed on iron posts of the same dimensions and set in concrete in the floor. This bar is placed 8″ or 9″ above the floor and about 6″ from the wall and is to prevent the sows crushing the pigs at farrowing time. The sow will necessarily make her bed in this corner, as the other three corners are occupied, two of which have doors and the other the feed trough.

D in *Fig. 273* shows the platform scale on which the pigs are to be weighed as desired. This scale is fitted with a frame and the door on the next side to the alley shown at *Q,* opens so that when the pigs come down the alley it will facilitate turning them upon the scales. At the other end of the scale platform is a smaller door in the frame which opens through a door *P* of the building, thus allowing the pigs to pass from the scale room directly to the outside, where there may be a loading chute leading to a wagon.

F is the feed mixing room in which are feed bins for feeds of various kinds represented by *I.* There is also a door, *J,* leading to the outside from this room. *H* shows the hydrant from which water is obtained for mixing slops, watering hogs, and for attaching the hose to sprinkle the floors. *E* shows the stove that is used for heating the water in winter for mixing slops.

G shows the office, and *C* the feed bins in which the feed is stored as it is hauled to the hoghouse. The opening to these feed bins is from the main alley of the hoghouse from which they are filled directly from the wagon as the feed is brought in. The feed is then taken out in smaller quantities as needed and put into the small bins in the feed mixing room from which it is weighed out to the pigs at feeding time.

B shows an alley which leads through the door *T* to the yard *V* on the outside. Opposite this is the yard *Z.* These two yards are not connected with pens on the inside of the building, but are used as board pens and are supplied with separate cots and feed troughs on the outside. The rest of the pens on the outside shown in the cut, as *A*, are of the same width as the pen inside and are 28′ long. They are connected with the pens on the inside by means of the doors mentioned, the outer end opening to the lane which leads to the pastures. The partitions between these pens on the outside are made of two lengths of common fencing, one 16′ and the other 12′ long. The 12′ length is next to the building and may be made into a gate so that it will swing. By opening all these gates and swinging them one way, and away from the building, an alley is made along the outside of the building in case it is not desirable to use the alley in the building for taking out the manure. But this is not so convenient as driving through the alley on the inside.

There is a 4″ drain tile laid from each pen in the building to the main lines on either side, which are placed on the outside of the pens, leading off down the ravine. The tile opens up through the floor of the pen by means of a perforated iron disk which is laid in the bell end of a length of sewer pipe. The floor is made to slope toward the drain so that it can be flushed with water.

Fig. 272 shows the interior section of the hoghouse containing the pens. All the gates and partitions on the interior are made of wire netting panels. Wire is considered better for this purpose than lumber for several reasons, as follows:

(1) There are no obstructions to light. The rays of light coming through the windows are not prevented from reaching the floor where they are most needed; they keep the floor or bed in which the pigs sleep dry, warm and disinfected.

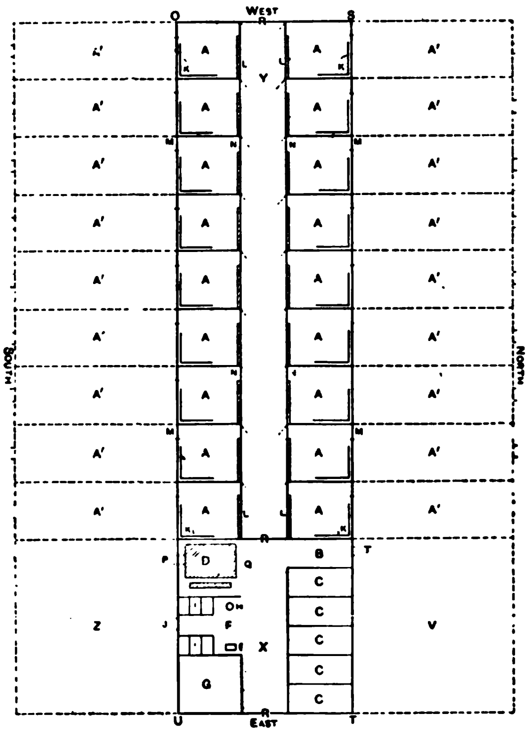


FIG. 273. A LARGE HOGHOUSE (GROUND FLOOR).

FIG. 272. A LARGE HOGHOUSE (INTERIOR ARRANGEMENT).

(2) By this means there is no opportunity for disease germs to lodge in cracks and crevices or to be harbored in the shadow of solid fences. In case the hoghouse should ever become infected with disease germs of any kind it can be disinfected much more easily and thoroughly.

(3) Wire partitions allow the hogs always to be within sight of one another and of the attendant. By this means the sows, when they are shut up to farrow, will not become estranged from one another, and will not be so likely to fight after returning to a common pasture.

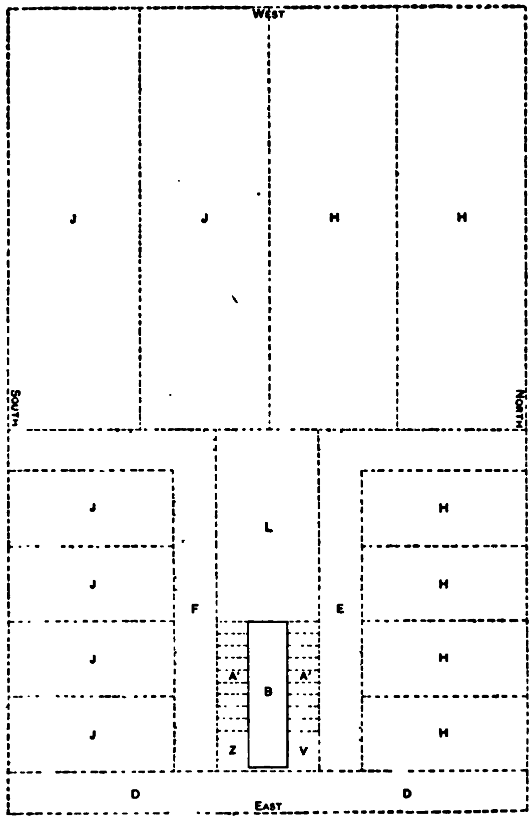


FIG. 274. A LARGE HOGHOUSE WITH LOTS.

Part of the floor of the hoghouse is made of hard brick laid on side in the pens and laid on edge in the alley; the remainder is of cement. Lumber is not used because being necessarily laid on the ground to prevent cold air or cold drafts getting beneath the floor it would rot out too quickly, making it very expensive. Brick is thought to be a little warmer in winter than cement and not so slippery, but both are being tried. Brick of course is colder in winter than is lumber, but this can be obviated by using bedding or by making an overlay (portable floor) of 1″ lumber for the corner of the pen where the bed is made.

The hoghouse is divided into unit lengths of 10′ each, this being the dimension of the pens parallel to the long dimensions of the building.

Where there is proper drainage an earth floor is probably the best kind of a floor in a hoghouse, although it is a little harder to keep in repair. Therefore, by omitting the floor, tile drain and eave troughs, the building still contains all the essential features and costs approximately $122 per unit length of 10′ which contains two pens. If the carpenter work and painting can be done with the regular farm help at odd times when there is no other employment at hand, the building can be constructed for approximately $100 per unit length of 10′. This includes the labor as well as the material on the tar and gravel roof, which is the flat roof on the part of the building south of the alley, a 2′ brick wall underneath the structure and the iron posts, gates, panels and fenders which cost at the rate of $13.60 per pen.

The total cost of $2,110.55 does not take account of grading, hauling cinders, nor of the fence posts.

A hoghouse should be located so that it will give access to pasture. *Fig. 274* shows an arrangement by which this can be accomplished. *B* represents the hoghouse, *A* the small pens on the outside adjacent to the pens on the inside, and *V* and *Z* the boar pens mentioned. *L* represents a small pasture that may be used for a boar or any other hog or pigs. *D* is the lane by which the hoghouse is approached. *E* and *F* are lanes leading from each side of the hoghouse to the pastures. *H* represents the pastures for the hogs that have access to the north side of the building and *J* the pastures for those on the south side. This arrangement is not absolute, but may be made to suit the location or the fancy of the builder.

The hoghouse is planned to supply the needs of the man who grows pigs for the general market as well as of the man who produces high-class breeding stock. It will permit of producing two litters a year from the same sows. This, it is very often said, cannot be done successfully. But the cow, the mare, and many other animals will support one young at the udder and at the same time another within the uterus. The sow can produce two litters a year and never be supporting more than one at the same time. Then why not have her do this and return more profit to her owner and at the same time keep good mature sows in the herd rather than sell them to avoid keeping them all the year for a single litter, which necessitates breeding from young, immature and untried gilts?

The sows are bred to farrow in February. In order to insure exercise during the winter months, they are allowed to run on a pasture or in a barnyard during the day and to come to the hoghouse at night where they sleep and are fed both night and morning. Each sow is trained to come to her own pen, which can be done with very little trouble. About a week before farrowing time, each sow is confined to her pen, having access of course to the small yard on the outside. She is kept there till the pigs are from one to two weeks old and by this time they have learned to know their own dam so that all can go out together. The sows and their litters are then fed in their respective pens each morning and evening until weaning time. At this time the sows are taken away and bred for the second litter, which is to be farrowed in August. After weaning, the pigs are fed, each litter in its respective pen, in the hoghouse, they also having access to pasture during the day. This is the growing period for the pigs and in order to get the best results it is necessary to feed them under such conditions that their feed can be controlled. When it is time for the sows to farrow again they are returned to the hoghouse and pigs taken out to a separate lot and finished for market. At this time the pigs may be put on full feed and be fed in larger droves.

This process is repeated twice each year, but in winter when the weather is cold a few pens at one end of the hoghouse, or a separate shed on the outside, must be reserved for the brood sows and later for the fattening hogs.

A hoghouse built and operated according to the plan outlined makes it possible to perform a maximum amount of work with a minimum amount of labor and to put the pigs on the market at seasons of the year that are out of the ordinary, and it can be expected that pigs thus marketed will sell for higher prices than those that are marketed along with the general supply.

HOGHOUSE AND FEEDING FLOOR.

A plan for a hoghouse for 100 hogs and a feeding floor for hogs is shown in *Fig. 275, 276* and *277* to which the subjoined description applies:

Concrete makes the best and cheapest feeding floor. It is rather cold for sleeping room, and is not as dry as a board floor. Dryness and warmth are necessary for young pigs.

Ten pens 8′ x 8′ will accommodate 100 fattening hogs. In front of these pens make a concrete floor 12′ x 80′. For foundation and nail ties of the house set on edge five 2″ x 6″ x 16′ joists on north side, one 2″ x 6″ x 8′ on east, one 2″ x 6″ x 8′ on west and five 2″ x 6″ x 16′ on south side and spike together at corners. Make the foundation 8′ wide outside measurement. Cut eight 2″ x 4″s 7′ 8″ long and place with tops flush with the outer joists for partition ties and spike to keep in place. Then drive enough strong stakes to keep all in line. Fill in with 3″ of concrete made of 6 parts of crushed

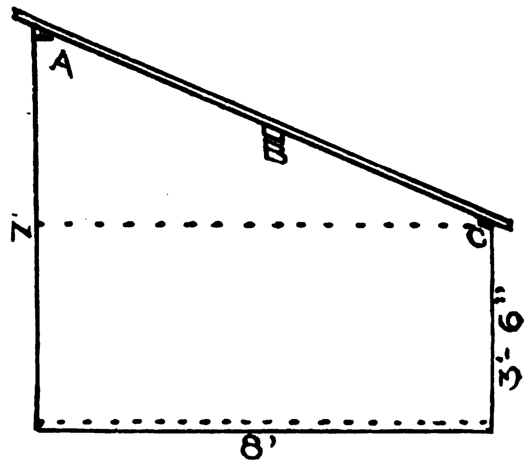


FIG. 275. HOGHOUSE AND FEEDING FLOOR (SECTION).

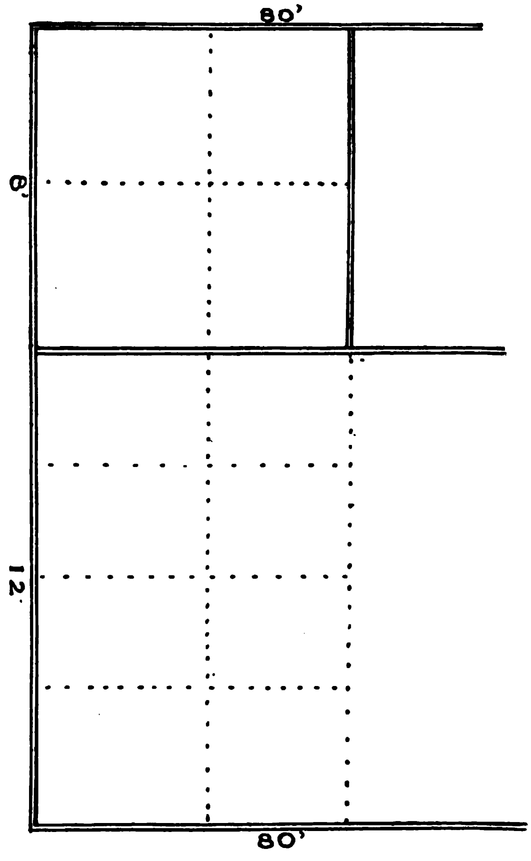


FIG. 276. HOGHOUSE AND FEEDING FLOOR (PLAN).

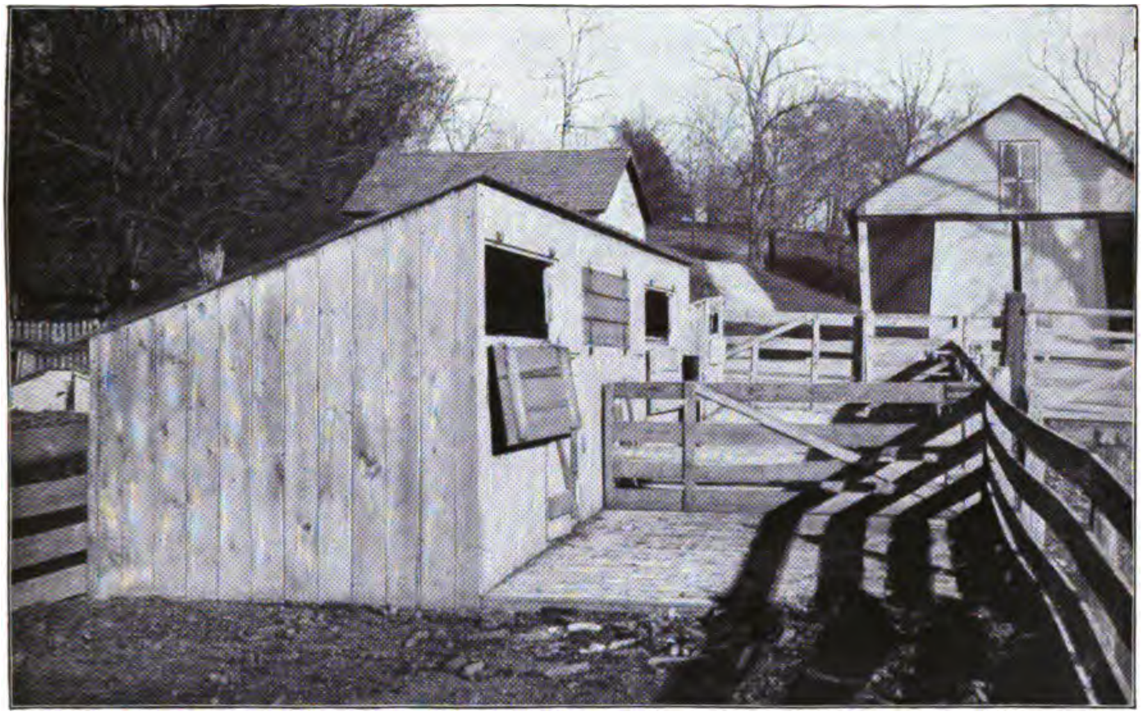


FIG. 277. HOGHOUSE AND FEEDING FLOOR.

stone or gravel or screened cinders to 1 part of good Portland cement. Tamp evenly until the water begins to show on the surface. After this sets finish with a coat of cement, 1 of cement to 3 of coarse clean sand. Use a straight edge 9′ or 10′ long to finish up level with the 2″ x 6″ and 2″ x 4″ ties. Trowel down to a good finish and be careful that there are no depressions to invite water and ice.

This done, lay off the feeding floor 12′ x 80′ by setting on edge a 2″ x 8″ x 12′ joist at each end and five 2″ x 8″ x 16′ parallel with front of house 12′ away. Secure the corners and joints and stake well and fill in with concrete as in the foundation for the pens. Finish flush with the tops of the outside joists. A better job will be had if a concrete curb is made instead of using the wood outside curb, but it will cost more. As the concrete is finished it must be cut through in squares not over 5′, better 4′ or 3′ to insure against cracks that are sure to follow expansion and contraction with changing temperatures. After the cement has well set fill all the cuts made with hot pitch or coal tar roof paint; this keeps out water, yields to expansion and adds to the life of the floor. This should be hot and poured in from a vessel with a lip or spout to secure a small stream.

The erection of the pens on the foundation is easy. We need 20 2″ x 4″ x 16′ and 11 2″ x 4″ x 8′ for nail ties and roof support, and 1,800 feet of 16′ lumber, free from knotholes. To this add shingles or metal for roof. Make the rear of the house 3′ 6″ and front 6′. The top rear nail tie acts as nail tie and roof support. The front has two nail ties, one 3′ 6″ above floor and the other 6′ above the floor; this also is a roof support or plate. Another 2″ x 4″ must be the center support of the roof. The sheeting must run up and down and is ready for shingle or metal, but it will pay to cover with tarred paper before laying shingles or metal, as it will be warmer and keep out snow. It will pay to make the siding double and use tarred paper between, as this actually keeps out snow and wind, which are disastrous at farrowing time. The doors in front should be 2′ x 3′ and hung on hook hinges. A drop window 18″ x 5′ 6″ will give air and sunlight, opening south. After cutting the cement floor into blocks pass a tool along the cut and round the edges. Round the edges of the floor, too, as this will prevent crumbling that is sure to follow with edges sharp and rough.

LOVEJOY FARROWING HOUSE.

The farrowing pens designed by A. J. Lovejoy of Winnebago Co., Ill., are each situated in the middle of an acre lot and on either side of a driveway, the divisions being made by the use of wire fencing. The houses are 8′ square. Four 16′ boards make the floor, and the roof and sides are made of matched flooring, lined with building paper, and that covered on the inside with common lumber. The houses are set to front south. There is a door in both north and south ends and a window in the south end, the latter being hinged at the top with rope and pulley attached so that it can be swung up out of the way when it is open. In cold weather and early spring the north door is closed, and if necessary the south openings also are closed, fresh air being secured through the ventilator in the roof that is made by carrying the ridge a trifle higher than the sides that comprise the roof. This is shown clearly in *Figs. 278* and *279.*

In hot weather the houses are converted into summer resorts by leaving both doors and win-

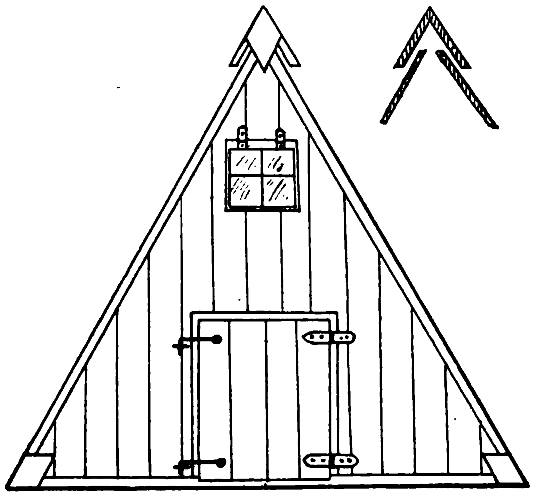


FIG. 278. LOVEJOY FARROWING HOUSE (CONSTRUCTION).

FIG. 279. LOVEJOY FARROWING HOUSE.

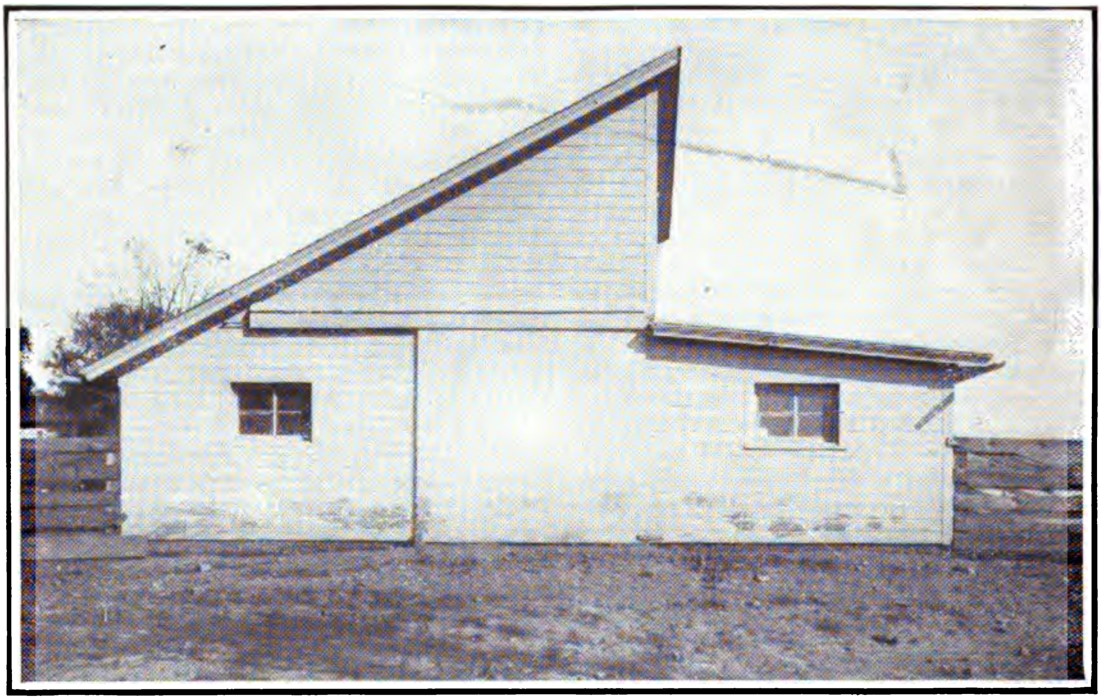


FIG. 280. HOUSE FOR PIGS (SIDE ELEVATION).

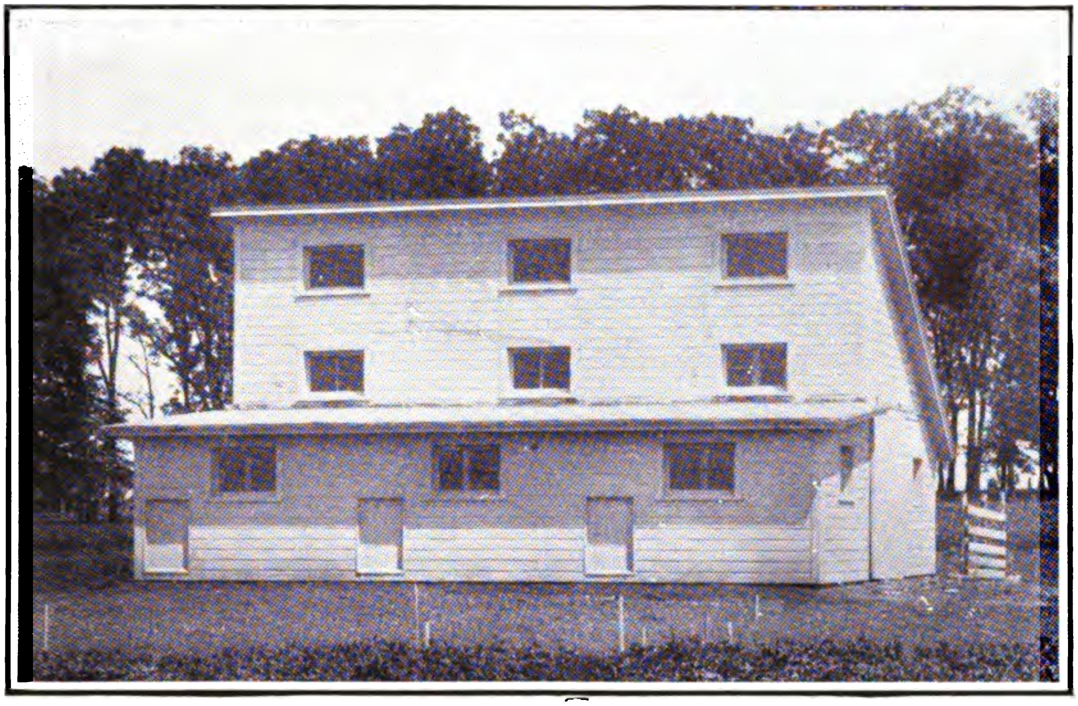


FIG. 281. HOUSE FOR PIGS (FRONT ELEVATION).

dow open. Each house is nicely painted with two coats and trimmed in white and costs complete about $10. They are set up on blocks in the summer to keep the floors dry and in the winter time they are dropped to the ground and banked to keep the wind out from under the floor.

HOUSE FOR PIGS.

The building shown in *Figs. 280* and *281* is for pigs. To build a hoghouse simply for wintering pigs is not a wise thing to do. The hogs should be made to grow and fatten. A hoghouse to be good must necessarily be somewhat expensive, but it can be built so as to be used both for farrowing and feeding purposes, consequently may be used the entire year, and this would counterbalance the initial cost.

A hoghouse should be sanitary, serviceable, and accessible to pasture. To be sanitary it should admit of the direct rays of the sun to all of the pens, exclude cold drafts in winter, be well ventilated and exclude the hot sun in summer. To be serviceable it should be so built that it may be used at all times and for all purposes. It should also be built with the idea of economizing labor in the care and handling of the swine. To be accessible to pasture it must be built so that the pigs have a free passage between pasture and hoghouse.

THE MORGAN HOG BARN.

F. W. Morgan's hog barn on his Rock County farm in Wisconsin is a T-shaped balloon-frame building, ceiled on the inside and outside, and having a shingle roof. (See *Fig. 282.*) It is 280′

FIG. 282. MORGAN HOG BARN (SIDE ELEVATION).

wide and extends back 130′. There are in all 52 pens, each with a small rustling box for winter use and an outdoor addition extending back 24′. There is a 9′ shed roof extending from the barn proper over this. Each outdoor pen has a cement wallowing trough, so that each hog gets two rooms and a bath. At each end of the barn are rooms 24′ square and 20′ high, which are kept at an even temperature during the winter, and are very useful in case of young pigs. The entire floor is of cement. The large room in the center is 30′ square and 24′ high. It is supported by truss work inside so as to be entirely open. It is used as an engine and mixing room. *Fig. 283* shows the details of interior arrangement.

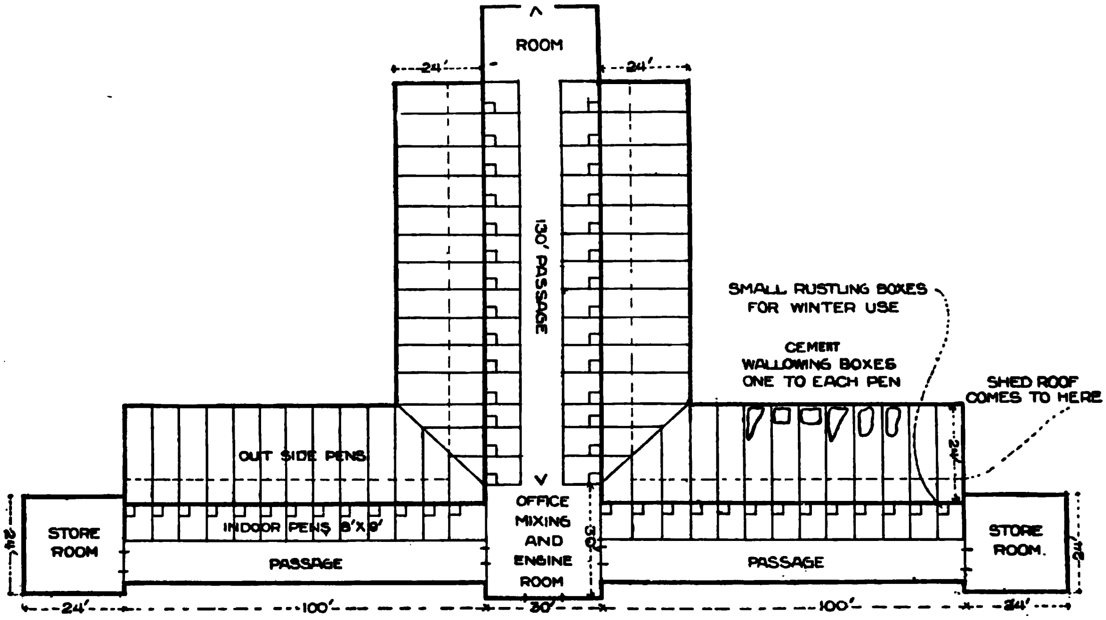


FIG. 283. MORGAN HOG BARN (FLOOR ARRANGEMENT).

A NEBRASKA HOGHOUSE.

The hoghouse erected by S. McKelvie & Son of Clay Co., Neb., faces south and is 24′ x 36′. It stands on level ground and is built on a brick wall 2′ 6″ high and the space underneath the building is utilized for shade in the summer and makes a warm sleeping room for cold weather. There are two doors in the south wall, also two directly opposite in the north wall. The north doors are closed in the winter and the late summer and fall pigs that are weaned run in there to sleep, having the space divided so that the fall pigs take one-half and the summer ones the other half. By opening all the doors in the summer the pigs are enabled to get in out of the extreme heat and the flooring of the house gets thoroughly dried.

The flooring of the building is made of 1″ lumber and doubled and the stuff used should be clear of knots so there will be no leaks to let water through. The sides of the building are also double. The first is common sheeting and on this was put building paper and then the best 6″ drop siding. This makes a wall that wind does not blow through. Tar paper also was used under the shingles. This makes a warm roof and keeps the wind and fine snow from driving through. Besides it gives a warm building which is ventilated by raising one or more of the upper windows shown in *Fig. 284*. The north roof is 17′ long and the south roof is 12′ long. The offset in the roof where the windows are set in to give light for the north pens is 3′ 8″. This is the space between the roofs. A large window can be used here if so desired.

The interior is divided as follows: A 4′ aisle runs through the long way east and west, leaving 10′ on each side to divide up into pens. This divides it into five pens on each side, two of each five being 6′ x 10′ and three 8′ x 10′ with a door to each pen. One pen is used for stove and bunk. By the construction of the front and roof as shown sunshine is admitted in the pens during the greater part of the day, particularly during the middle of the day, when it is most beneficial. The pens are made of movable partitions, so that if desired one or all of them can be raised and the entire floor used for feeding. It makes a very good place to fatten hogs during the winter in case it happens that it is not wanted as a breeding house, as less feed is needed to keep up the animal heat. The chimney or flue is at one end and 2′ north of the aisle. The stove is at the

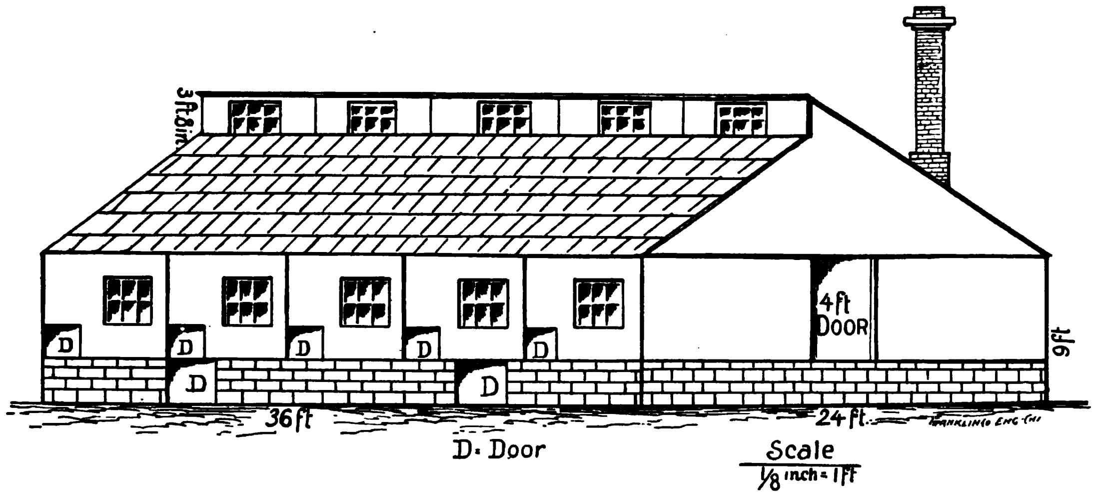


FIG. 284. A NEBRASKA HOGHOUSE (ELEVATION).

other end and the pipe runs the length of the building and heats it with very little fuel. Where the cost of fuel is not much of an object heating could be done with steam. Where a steam cooker is used the building can be heated conveniently and very evenly. The hogs get into the house by approaches (not shown in the illustration) made to lead to each door and are 8′ long, one end resting on the ground and the other end just below the door. This makes a gradual slope and the hogs walk up easily on the slats which prevent their slipping.

This is an all-purpose hoghouse and a farrowing place in particular, where no matter what the weather the litters can be saved. After the pigs are farrowed and a few days old and the weather will admit they are hustled out on the ground into lots of about one-eighth of an acre, which are provided with small houses 7′x7′ made of shiplap 5′ on south end and 2′ 4″ on north, with a drop door in the south side to let in the sunshine. Here they are kept for a time, one sow and litter to a lot. Here they have the ground to run on, which, like daylight and sunshine, is essential. These small houses and yards are all that are required for pigs during mild weather, but for early or late fall pigs it would no doubt pay to build such a house as described. The cost of this building was about $250. It was built about 10 years ago.

AN EXPERIMENT STATION HOG BARN.

The swine barn erected at the Nebraska Experiment Station is intended mainly for winter

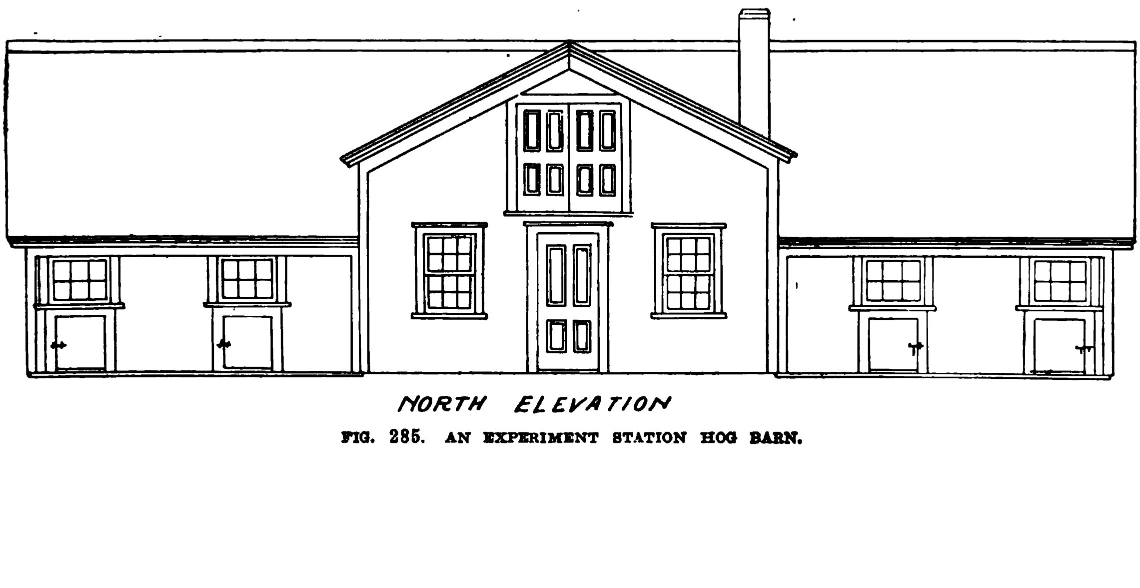
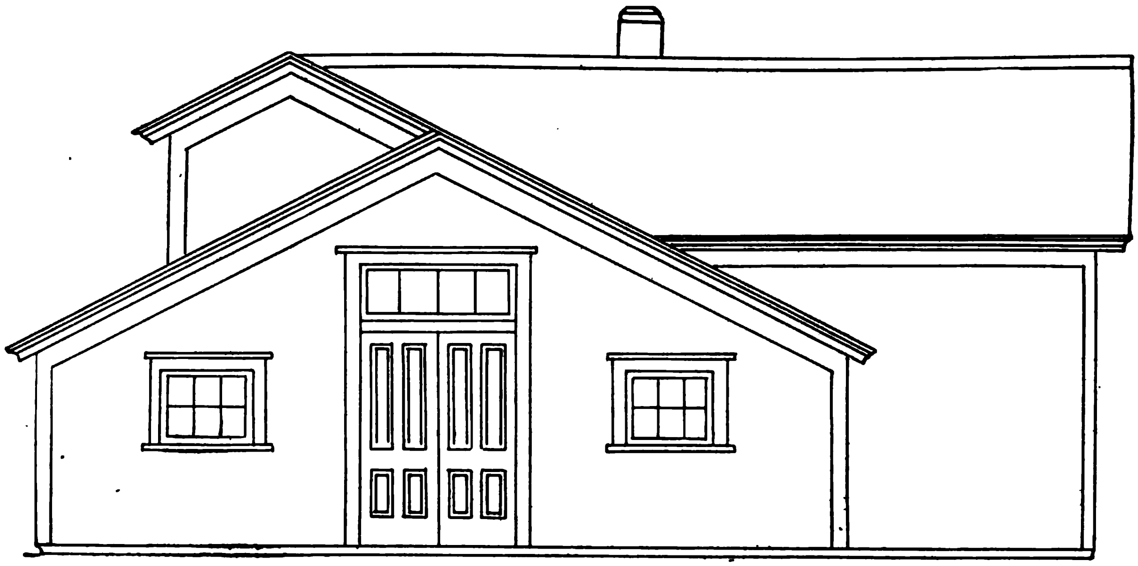
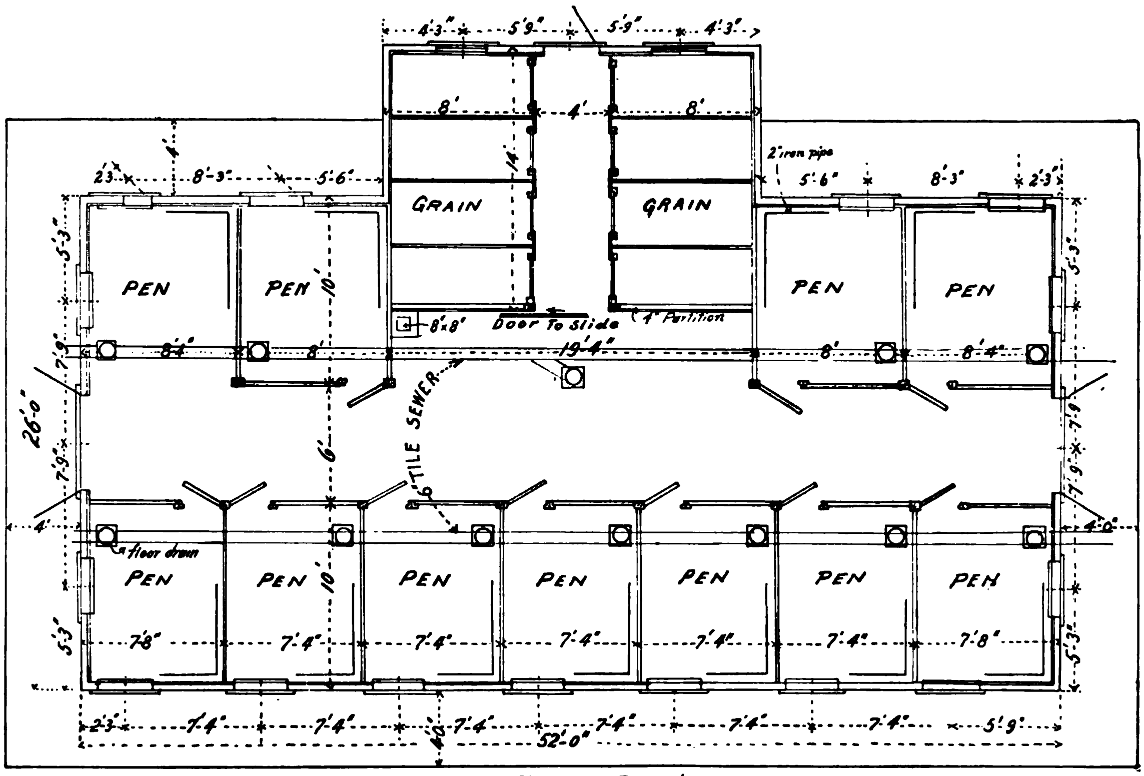


FIG. 285. AN EXPERIMENT STATION HOG BARN.



END ELEVATIONS

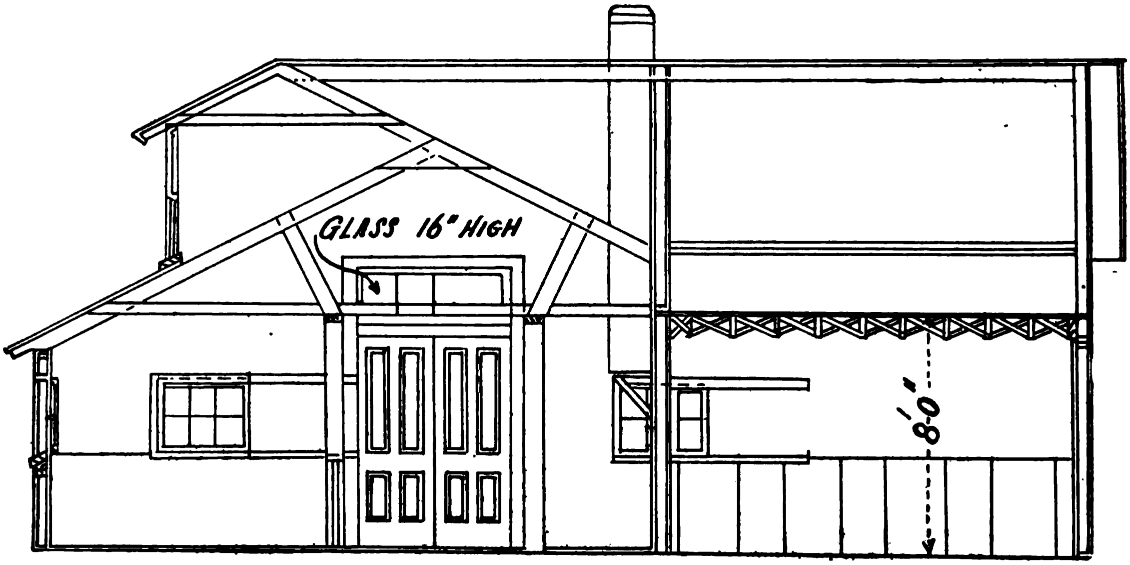
FIG. 286. AN EXPERIMENT STATION HOG BARN.



FIRST FLOOR PLAN

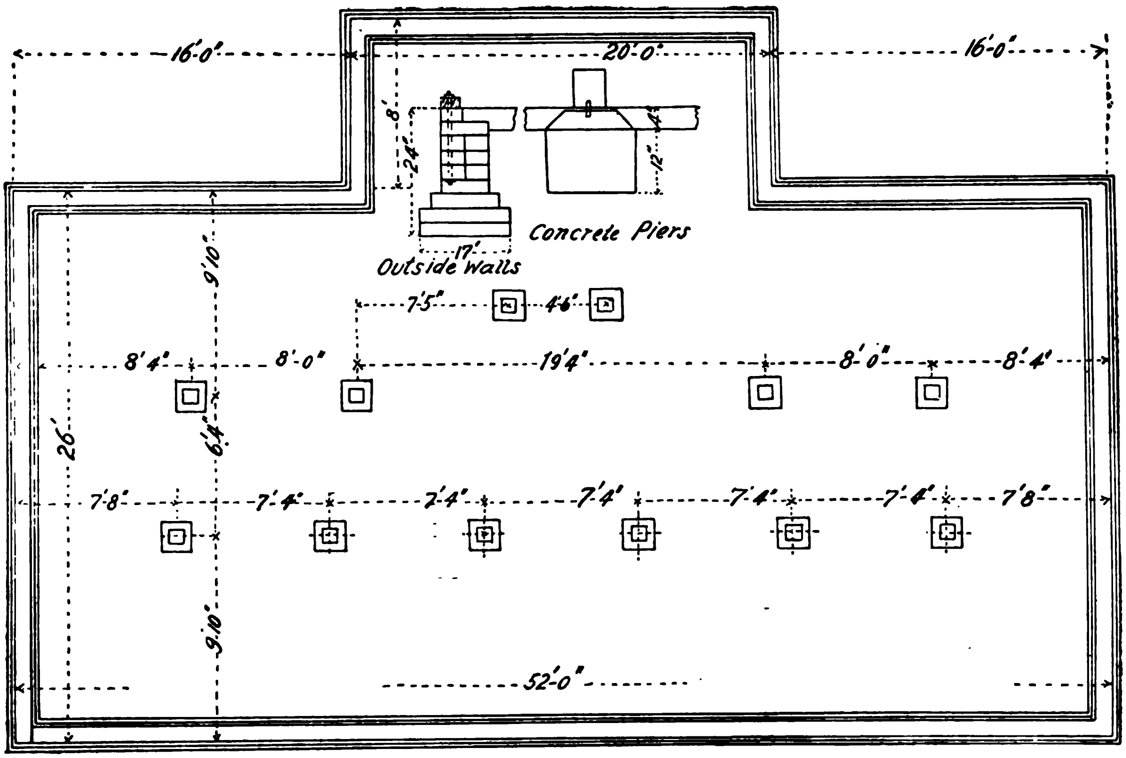
FIG. 287 AN EXPERIMENT STATION HOG BARN.

use and for early farrowing. Although it has been demonstrated that the small house is most practical for a large part of the year, it still remains true that at certain seasons of the year the swine barn which can be kept warm and dry by artificial heat if need be and can have



CROSS SECTION

FIG. 288. AN EXPERIMENT STATION HOG BARN.



FOUNDATION PLAN

FIG. 289. AN EXPERIMENT STATION HOG BARN.

abundant sunlight, is necessary to every good breeder. In Nebraska, at least, the pigs of March and early April farrow are liable to suffer from cold storms and even from zero weather at farrowing time. The weather is equally liable to be warm and rainy with a condition of

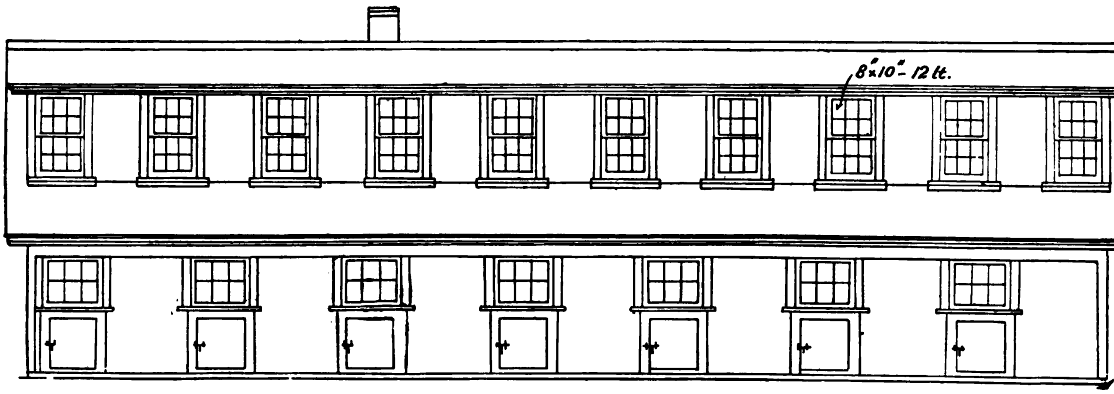


FIG. 290. AN EXPERIMENT STATION HOG BARN (SOUTH ELEVATION).

mud which makes it necessary to have floors for a short period.

The house in question is 52′ long and 26′ wide in the main part, the projection for hay and grain storage making it 34′ wide over all. It provides 11 good pens for brood sows, with ample light in all these pens. It has cement floors, with a sewer, and a trap in every pen near the feeding trough and a stove which can be used when necessary to keep the house warm. In each pen is a guard made of gas pipe to prevent the sows crowding the pigs to the wall. The cement floors will be covered with a light board floor when the house is in regular use, but at other times these floors will be taken up and at all times can be removed to clean and disinfect the house. It is probable this house will not be used largely in summer time, as the practice at the Nebraska Experiment Station is to keep all hogs in small fields of a half-acre or one acre each, allowing not more than two or three litters to run together, and preferably only one litter in each field.

This house is covered with drop siding on the outside and is sheeted with flooring on the inside. The windows are so arranged that the sunshine will fall upon the floors within the pens during the months of February, March and April.

The objection which might possibly be urged against this house by the farmer is the cost, which may be higher than is necessary or possibly than is warranted, in the construction of a house which accommodates only 11 pens, but which gives ample storage capacity for grain, with storage for baled straw above, and can easily be made comfortable for an attendant to stay in the barn at night. The cost of this barn is about $2,200. We present the architect's complete plans. (*Figs. 285* to *290.*)

AN ILLINOIS HOGHOUSE.

The peculiar feature of the windows at the apex of the roof serves to admit, in the early spring, the warm rays of the sun on the north row of pens, the south row being lighted by the lower tier of windows, thus affording a sun bath

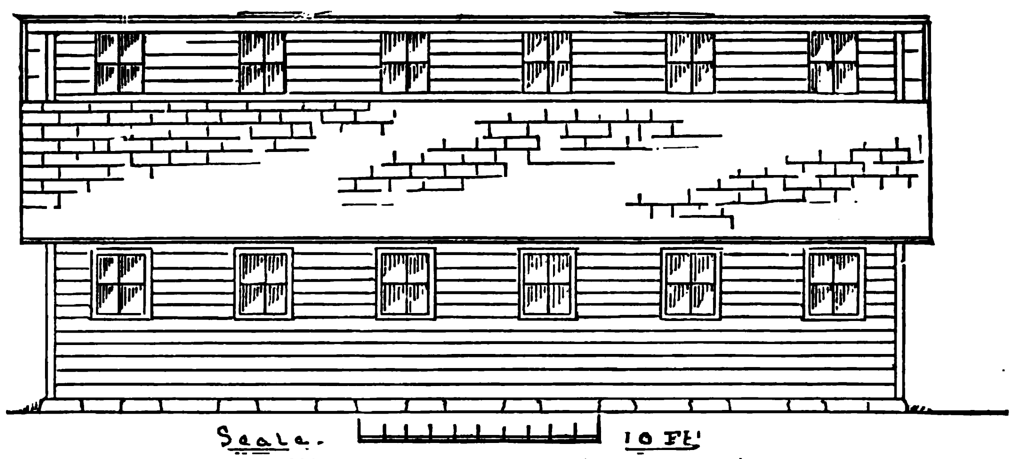


FIG. 291. AN ILLINOIS HOGHOUSE (SIDE ELEVATION).

to all the occupants, the value of which in swine raising is well known. (See *Figs. 291, 292* and *293.*)

The foundation is made of blocks of stone which are laid about 4′ apart. Sill beams are of 6″ x 6″ lumber. The frame consists of 2″ x 6″ scantlings placed 2′ apart and which are 7′ high. There are two rows of 4″ x 4″ posts—one on

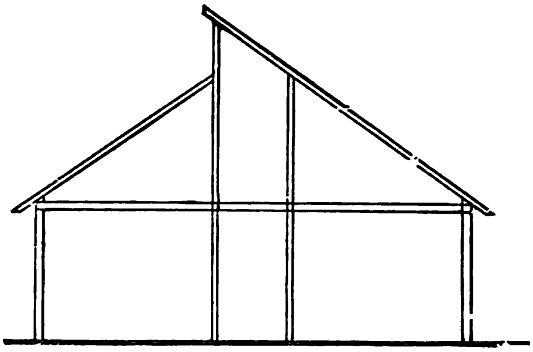


FIG. 292. AN ILLINOIS HOGHOUSE (FRAMEWORK).

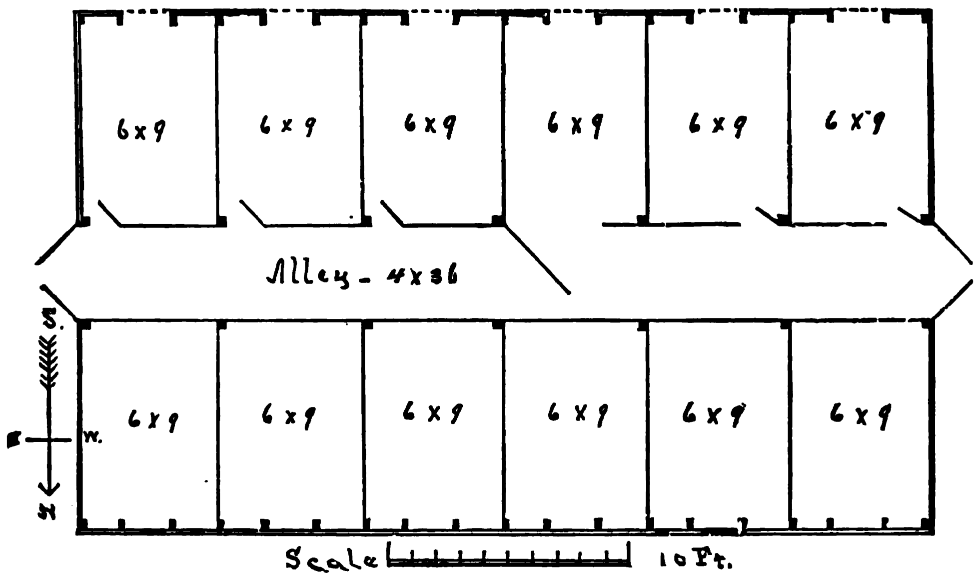


FIG. 293. AN ILLINOIS HOGHOUSE (ARRANGEMENT OF FLOOR).

each side of the alley, 6′ apart, extending to and supporting the roof, as shown in *Fig. 292.* Girts of 2″ x 6″ go across every 6′. Plate beams consist of a 2″ x 6″ and 2″ x 4″ spiked together. Rafters are 2″ x 4″ and 2′ 6″ apart. The roof is one-third pitch (see *Fig. 291*) and is made of sheeting and shingles. Sides are of drop matched 6″ siding. Eaves and gables project 13″. Floor joists are 2″ x 8″ and 2′ apart. Floor of 2″ plank. Windows are 2′ by 2′ 3″. Those above are made to slide sideways and the lower ones up and down. All the partitions are movable drop partitions except those adjoining south of the alley and the middle cross partition. The total cost of this building was about $200.

HOUSE FOR 20 SOWS.

The house illustrated in *Fig. 294* is practically rat-proof. The plan shows a row of feeding pens around the building with a concrete floor. This floor is on the level of the board floor in the breeding or sleeping stall and the concrete in the alleyway through the center of the house. The concrete feeding floor and alleyway are to be built first and with a fall of 2″ in the length of the building to give drainage so that the alleyway may be flushed out often. In extremely cold or stormy weather it may be desirable to feed and slop the sows in the sleeping pens.

In building fill the spaces under the floor with cinders or coarse sand or fine gravel and in this lay the nail ties for the floor, so that the cinders or sand will fill the space completely up to the floor. This makes the floor solid, warm, dry and effectually shuts out rats, as they cannot burrow in cinders. The cinders should be at least 6″ deep; deeper is better. The durability of the concrete floors depends on the construction. A poorly built concrete floor is short-lived; a well built one is practically as lasting as granite. The concrete and board floors can all be made before the building is erected, but one will have a firmer building and fences to erect the frame of the building and set posts for the outside fence before laying concrete.

The plan of construction (*Fig. 294*) gives sizes and lengths of material, so that any handy farmer can do the carpenter work. The siding is what is called patent siding, tongued and grooved. It should be well dried before it is put on. It is covered with redwood shingles. The sash have six lights, each 8" x 10"; they can be in pairs, as indicated. To get a better distribution of sunlight they should be distributed so as to divide the dead space equally between windows. The deck sides are not perpendicular, but have an 8" slope in the 2½' of height, thus admitting more direct rays of the sun. By this arrangement of sash one can have sunlight in every corner of the house and by hinging half of the sash and elevating or lowering it as in a greenhouse one can have almost complete ventilation.

By doors opening into the alley one can change or sort the sows or pigs readily, and from the end or sided doors sows can pass to as many different grass lots or fields as are available. If one wants fire in the house for heating it or making slop he can arrange that in the alley and have a flue put in the deck when building. More space for stove or boiler may be had in the center of the house by setting the partition of a stall on each side back one foot, thus making two small stalls 6'x7' and stove space 8'x8'. In building, every other partition of stalls may be made movable but this is a matter for each man to settle for himself. A cistern or drive-well will add to the convenience and place water at hand.

The cost of the building not painted will be about $200. This plan places the health of the herd above the convenience of the herdsman. Sanitary conditions are the first requisite of health, and these mean plenty of sunlight, pure air and clean dry sleeping places. The cement floor outside favors a clean house inside, reduces inroads of filth and rats and adds to the comfort of the sows and pigs.

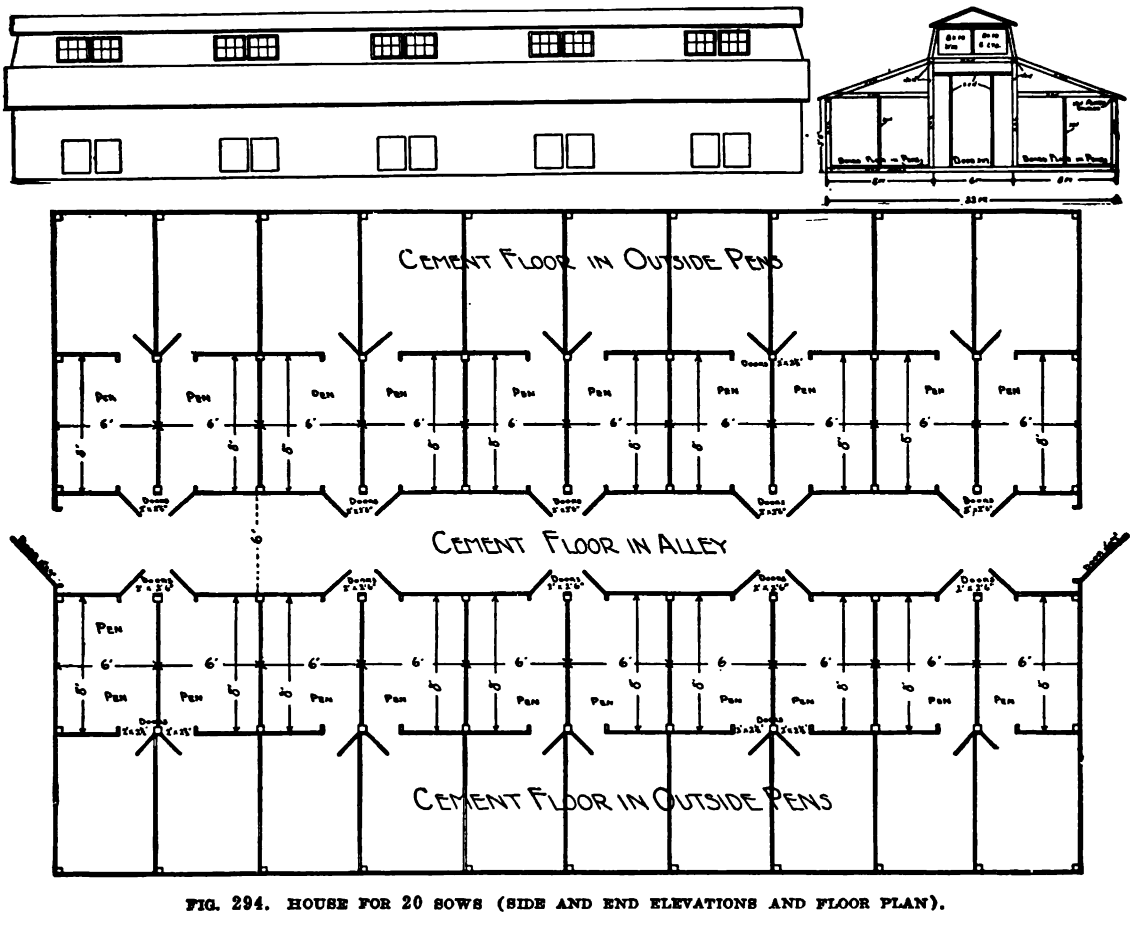


FIG. 294. HOUSE FOR 20 SOWS (SIDE AND END ELEVATIONS AND FLOOR PLAN).

HOGHOUSE FOR SOWS AND PIGS.

The hoghouse shown in *Figs. 295* and *296* is intended for sows to farrow in. Pigs when weaned may also be fed in it. This house is 68'x30'; stalls are 6' wide and 10' deep, a row on each side; this leaves 10' in the center for a feeding floor to feed young pigs on and two bins on each side at the north end for feed 8'x10' and a mixing room 8'x10' for cooker. Water is to be piped to mixing room, concrete is to extend from *A* to *B*. The object of the concrete not extending all over the whole floor is to have 5' of dirt at the back end of each stall for pigs and sows to lie on.

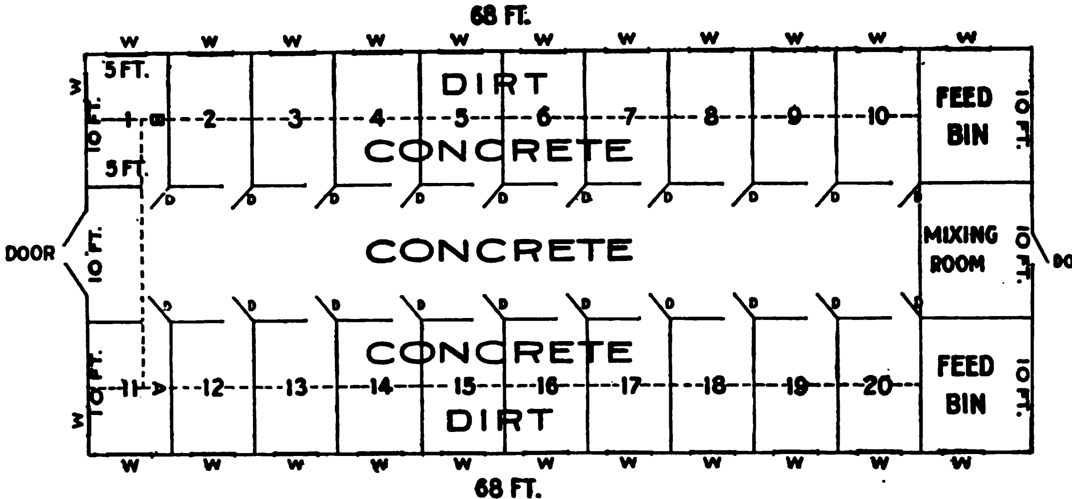


FIG. 295. HOGHOUSE FOR SOWS AND PIGS (GROUND PLAN).

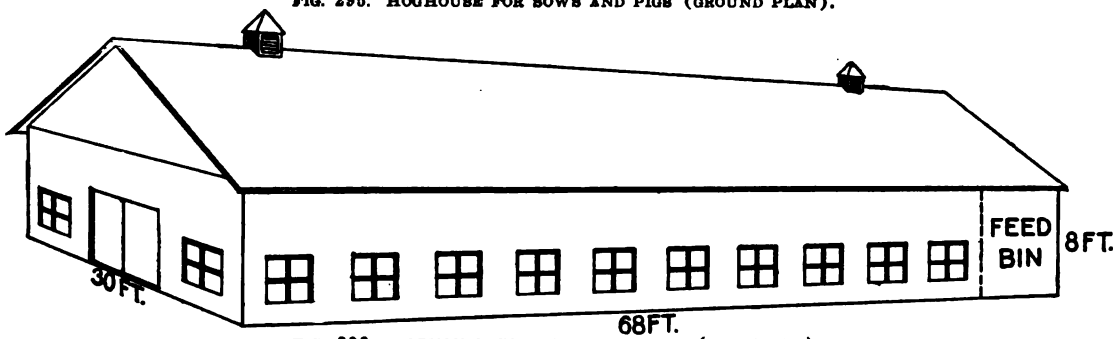


FIG. 296. HOGHOUSE FOR SOWS AND PIGS (ELEVATION).

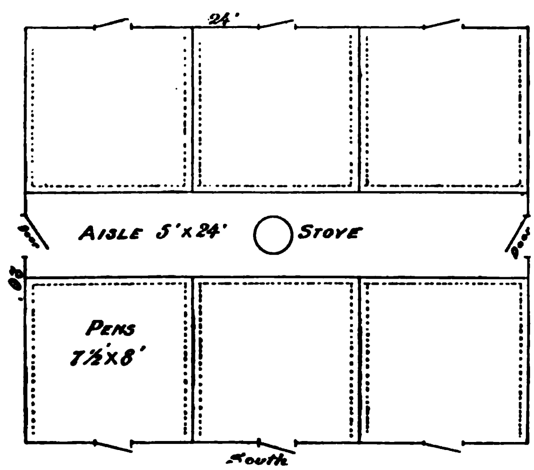


FIG. 297. FARROWING PEN FOR EARLY LITTERS.

FARROWING PEN FOR EARLY LITTERS.

For warmth, sunlight and convenience the farrowing pen shown in *Fig. 298* is unexcelled. Its foundation is on stone pillars. The joists are 2"x6" by 20' long; the floor is tight. The south side is 6½' to the eave; north side 4' 8" to eave; highest point of house, 12'; 4"x4" corner posts and also to roof in center. The sides are all boxed tightly, papered and weather-boarded. The roof is sheeted down solid, papered and shingled with best shingles. Sash are 2½'x 6½' each. The partitions and doors are made of matched flooring and are 33" high and movable. The dotted lines around each farrowing pen (*Fig. 297*) are a 2"x4" hardwood scantling with bottom 8" from floor and with inside 8" from partition. According to some swine breeders it is an advantage to use matched flooring for partitions, as it prevents one sow from knowing what her next neighbor is doing, and one disturbs the other but little. A pen 8'x16' for each farrowing pen is on the outside of the house, and is made so one pig cannot get in his neighbor's pen, thus allowing the sow to be fed outside of the house and exercise for sow and pigs when the weather will admit. The cost of this house complete was about $125.

AN IOWA MOVABLE HOGHOUSE.

The hoghouses used at the Iowa Experiment Station are made as indicated in *Fig. 299.* The dimensions are 8' square, with 2' 8" corner posts and 5' rafters. The pen is supported by five 2" x 4"s running from end to end and sawed slanting at the front end, the two outside pieces having holes for attaching a rope, thus enabling the house to be drawn by a team and placed in different locations when desired. The floor is made from four rough boards 1"x12"x16' cut in the center, and the roof is made of grooved roof boards 1"x10"x12', cut in the center. The sides and ends are made of 8" drop siding, and the pen when complete is given two coats of paint. All dimension pieces are of 2"x4". The roof window is 2'x5' and covered by a hinged section of the roof the same width, which may be opened or closed to admit or exclude sunshine. The door is 2' 6" x 2' 8", and the opposite end contains a gable window 2' x 21" for light and ventilation. The pen complete, including windows and painted two coats, will cost about $12. After the pigs are old enough for the sows to be turned together as many as three sows and 18 pigs may be accommodated.

They may also be used for fattening hogs, and for this purpose they possess some important advantages over larger apartments or shed room, chief among which is that they can be readily moved and placed where desired, and also that pens of this size prevent the hogs from piling up and injuring themselves by overcrowding. Another point is that this system permits the hogs to be moved readily to clean, fresh quarters as often as may be desired. This is the most effective way of disinfecting after a scourge of hog cholera. This system of handling hogs may be modified as experience or varying conditions dictate.

FIG. 299. AN IOWA MOVABLE HOGHOUSE.

A MARYLAND HOGHOUSE.

Neither corn nor pork can be successfully produced without plenty of sunshine. In the North this sunshine in winter will have to be brought into the pens through glass. In more southern latitudes under normal conditions it is only necessary to face the pen to the south; allow the sun's rays to reach to the back of the pen on the beds and give good shelter and protect from the north and west winds.

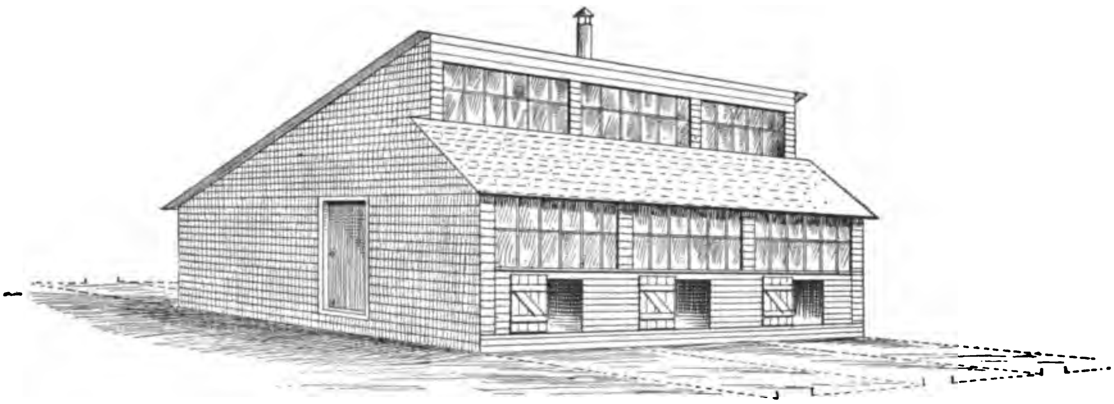


FIG. 298. FARROWING PEN FOR EARLY LITTERS (ELEVATION).

The end elevation and floor plans, designed by the Maryland Experiment Station, give almost a complete idea of the pen at that station, which has met with every general favor. A few of the points in construction are given as follows:

1. It is faced to the south (*Fig. 300*) so as to permit the rays of the sun to shine on the beds of the pigs at the extreme rear end of the pen in the winter season, and also to give shade in that portion in summer. 2. The lattice construction between the pens at the ends and rear admits of a free circulation of air in warm weather. 3. The location of the manure pit (see *Fig. 302*) in the center and below the level of the sleeping and feeding floors with all drainage toward it aids materially in maintaining a proper sanitary condition. 4. The ease and facility with which the manure can be removed. 5. The swinging gates close the pigs into their beds while the manure is being loaded. 6. The swinging fronts to the pens permit the food to be easily placed in the trough and evenly distributed so that the pigs have an equal chance at feeding time. 7. The manure pit is concreted, which enables the saving of all liquid excrements, which with the pig amounts to 51 per cent of the total manure value. 8. Ease of changing pigs from pen to pen. 9. Feed bins are placed in front of each pen, which facilitates feeding and enables keeping different feeds for each pen if desired. (See *Fig. 301.*) 10. The general plan can be used and the dimensions and materials modified so as to meet the demand of circumstances.

FIG. 300. MARYLAND HOGHOUSE (ELEVATION).

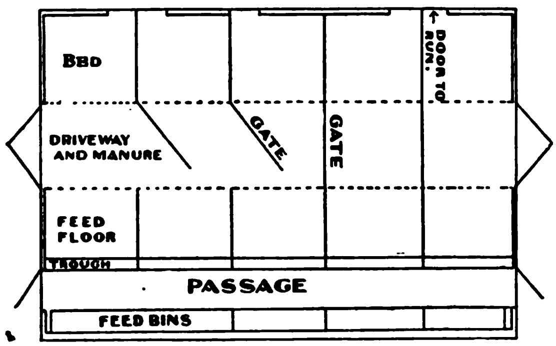


FIG. 301. MARYLAND HOGHOUSE (FLOOR).

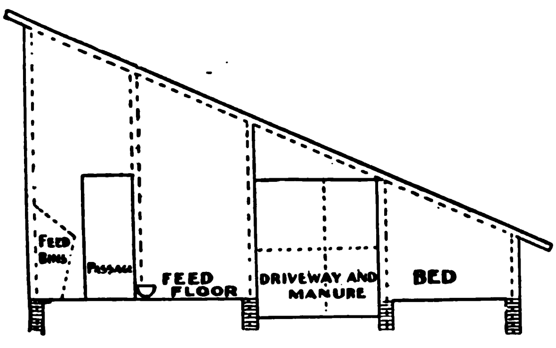


FIG. 302. MARYLAND HOGHOUSE (SECTION).

HOGHOUSE AND STORAGE BARN.

An up-to-date hoghouse must first of all provide for abundance of sunlight and pure air, for without these the health of the herd is imperiled and the very object of the outlay is defeated. The object of a stock shelter is to protect the animals from inclement weather and to furnish the comfort requisite to health and thrift. Its second use is to reduce the labor and expense of feeding and caring for the animals. Here is a case where the good of the herd is paramount to the convenience and comfort of the herdsman.

We know it is desirable to make the roof and foundation do as much for the building as possible, as these are the expensive features of a

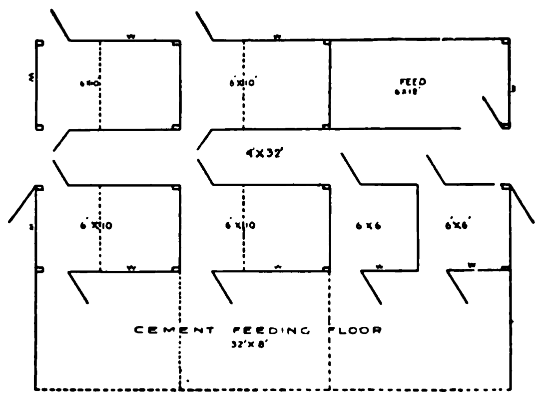


FIG. 303. HOGHOUSE AND STORAGE BARN (FLOOR).

structure, but they are not the whole thing, nor the chief thing of value. As the sows and pigs are not the consumers of the corn fodder and alfalfa to any extent it would be economy of labor to store these in the horse and cattle barn. It would be convenient to store pigfeed in the hoghouse, and as this is not so bulky we can provide room for that in the north end of the building and not interfere with sunshine and ventilation, so necessary for the sows and pigs.

If we make a two-story hoghouse with room enough in the upper story sufficient to justify increased cost of floor, strong enough and close enough to carry and preserve the fodder untainted, we shall need to have the lower story as low as practicable. Six feet may do, but this makes it impossible to have sunlight and ventilation requisite to best health of herd. To allow storage overhead and also secure sunlight and ventilation we can slope the floor for 3′ back, up 3′ to outer wall. This will cost more, but allows plenty of sunlight and ventilation, without which it is a waste of money to build a hoghouse.

The ground plan (*Fig. 303*) given provides six pens and a feed room in the northwest corner. Two of the pens are 6′x6′ with a movable partition; the other four pens are 6′x10′ with a movable board floor 6′ x 6′ for bed, leaving a space 4′x6′ on the uncovered concrete, easy to clean and on which waste bedding will take up the moisture.

As soon as the weather will permit the sows should be fed outside on the feeding floor. This will be for the health of the sows and promotive of neatness and dryness in the house. The frame is of 2″x4″x12′ and drop siding. The joists for the upper floor are 2″x4″x16′, being supported by four 1″ x 4″ stringers attached to the upright 2″ x 4″s in making the aisle and pens. If the drop siding is not free from knots and thoroughly dry it will be better to cover first with shiplap up 6′ and line with paper, before putting on the drop siding. With a concrete floor there can be no wind from below and no rat harbor.

Floor and joists are saved, which will cost as much as the concrete, but a concrete floor without a movable wooden floor in the sleeping pen is too cold, though with the arrangement suggested it is the warmest, driest floor made.

AN INDIANA HOGHOUSE.

Figs. 304 and *305* show a hoghouse 120′ long by 8′ wide with front side 8′ high and rear side on the outside 5′x19′. Each room has a door 3½′ high. It has 24 rooms 5′x8′; also 24 pens that lets the sow out into the outside pen, and each outside pen has a gate to let the sow out into a lane 10′ wide. This is for convenience in getting each sow into her pen.

The floor inside the barn is of cement, as is the one in the outside pen, and the whole house is double weather-boarded with building paper between. There are 12 windows in front of this barn; each window lights two rooms inside. There are four lots adjoining the barn of 1½ acres each, so six sows with their pigs can be turned out in each lot when the pigs are small. The rooms on the inside are all partitioned with a gate that can be taken out, thus throwing the

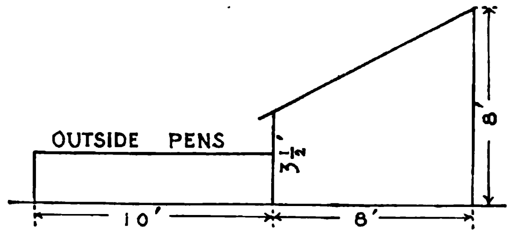


FIG. 304 INDIANA HOGHOUSE (SIDE SECTION).

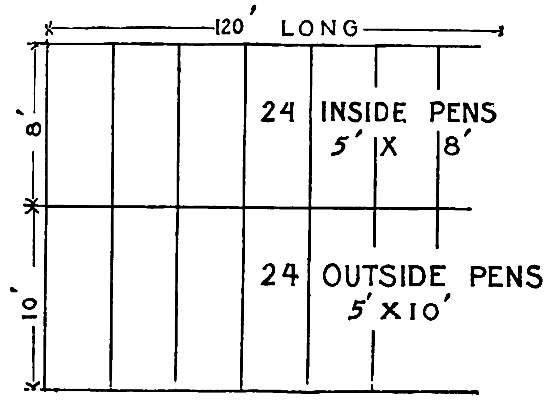


FIG. 305. INDIANA HOGHOUSE (FLOOR PLAN).

entire barn into one room 8′x120′. This is for feeding hogs. Or the barn can be made into as many pens as desired to accommodate different-aged hogs.

CORSA'S HOGHOUSE.

W. S. Corsa of Illinois thus describes the hoghouse shown in *Figs. 306* to *311:* "There are just a few cardinal principles to bear in mind in building a permanent hoghouse. These are largely summed up in remembering that such a house is to be built for the comfort of the hogs rather than the convenience of the herdsman. Fortunately these two considerations are not necessarily opposed to each other. In building a permanent hoghouse, as in building anything permanent, consideration should be given to location. It would seem to be better to place such a building reasonably near the individual lots and away from the general group of farm buildings. For many reasons this may not always be feasible, but it would seem to be good practice to keep the hogs away from the barns and adjoining buildings.

"The nightmare of the permanent hoghouse

FIG. 306. CORSA'S HOGHOUSE (FRONT ELEVATION).

is disease, so that the sanitary conditions are always the deciding ones, as sunshine, the cheapest and best germicide, in every pen at some hour of the day; plenty of ventilation without draught and no harboring place for filth.

"Our house is located with reference to the individual hog lots and houses. It stands on ground with a decided slope to the south, giving good, natural surface drainage. At the rear an open wood of natural forest trees on somewhat higher ground affords material protection from the north and northeast storms of winter. Having with some care located the site, we started in on the foundation by digging a trench 6" wide and deep enough to go below the frost line. With this concrete foundation brought to the proper level we filled in the hollow parallelogram with gravel and rock, tamped it well and

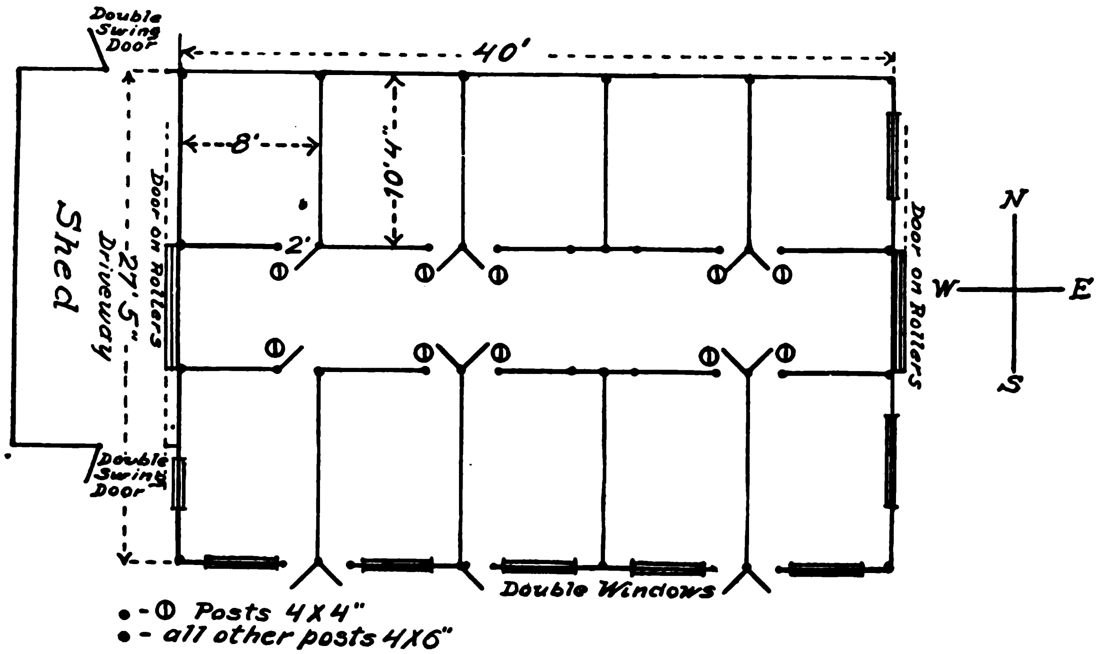


FIG. 307. CORSA'S HOGHOUSE (FLOOR PLAN).

covered the entire surface with concrete, making the floor rat-proof and water-proof. Iron pins were placed in the concrete wherever there were to be posts in the building. For siding we used boards that had seen service for two years as stack covers. Where it is intended to use con-

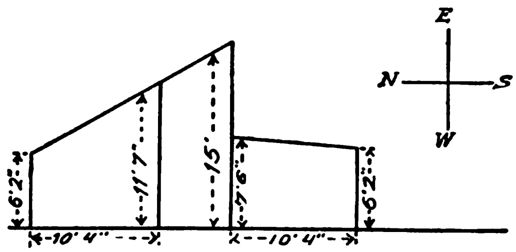


FIG. 308. CORSA'S HOGHOUSE (END SECTION).

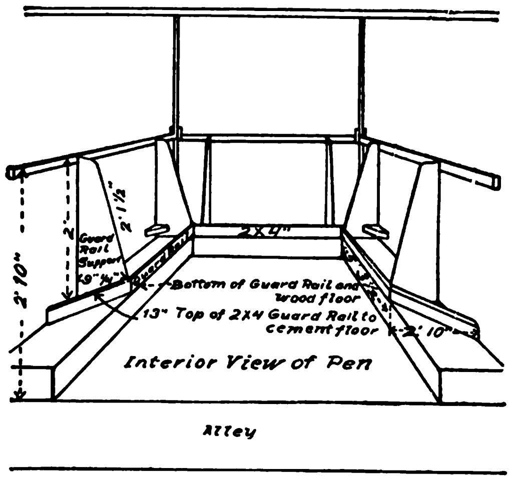


FIG. 309. CORSA'S HOGHOUSE (INSIDE OF PEN).

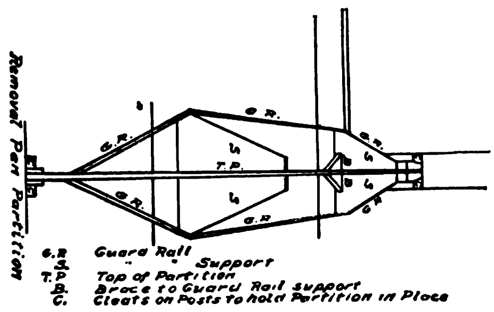


FIG. 310. CORSA'S HOGHOUSE (CONSTRUCTION).

crete on exterior, old lumber not only may be used, but has the advantage of having the shrink out of it. The finishing boards were then put on and then the chicken wire, 1" mesh, was stretched. Hang your strip of chicken wire as you would wall paper. Start at the top, make that secure, then fasten one edge, after which stretch sideways, then fasten the bottom. Do not use strips of wood or laths to keep the wire out from the side, but use screws, about 1¼", bury the wire in the heads of the screws and give a half turn. Wherever the wire might touch the wood place a screw. Fence staples will keep the wire from leaving the screw heads. Use screws and staples generously. The first coat of concrete, made 2 parts sand to 1 cement, will just cover the wire netting. Before that is entirely dry apply finishing coat of 1 part sand, 1 cement, and float even with the finish boards. Concrete fills in cracks between siding boards and effectu-

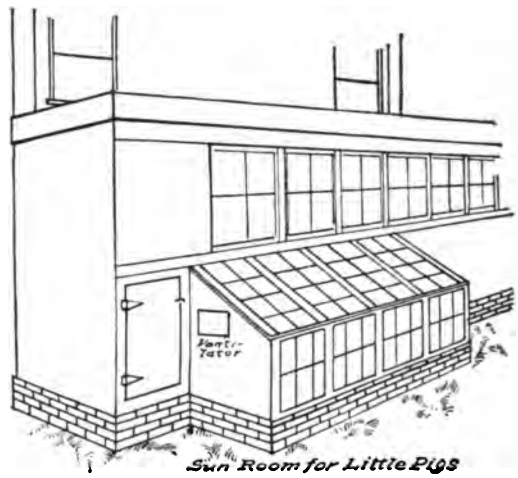


FIG. 311. CORSA'S HOGHOUSE (SUN ROOM).

ally stops all draughts and sifting in of snow in times of driving storm. Concrete was used on the entire exterior except on south front above the low roof, which was finished in shingles. The appearance would have been improved if the shingles had been laid irregularly. This low roof is quite flat, and is consequently covered with prepared roofing. It is important that this roof be kept almost flat, so as to bring the upper large windows as low down as possible to let the sunlight shine directly into the back row of pens. Remember to make ample flashing where this low roof joins the shingle front above; otherwise any southerly storm will be in evidence in your hoghouse. One more important feature of this low roof: At the lower edge is a box gutter tinned in 6" wide. At the west end it is 1" deep and at the east end 4". Down spouts should be boxed in and run into tile. All this helps to keep the premises dry. Ordinary gutters would be less sightly, less durable and interfere with the sunlight at the east end of the lower row of windows. The main roof is covered with shingles.

"All posts are set on iron pins bedded in the concrete. The corner posts are 6' and the 2" plate gives ample room for a man to walk around without fear of bumping his head. The pens are 10′ 4″ long by 8′ wide, and have a satisfactory floor of inch boards made in two halves each 10′x4′. This does away with the chill from the concrete and the tendency to rheumatic sows and pigs. The pens are separated by removable partitions (*Fig. 307*) which slide down between cleats on the posts. The partition 2′ 10″ has a 2″ x 4″ guard rail on both sides. At customary times we take up wood floors, remove the partitions and clean house. *Fig. 309,* interior view of pen, shows guard rail supported on partition. This leaves the floor surface entirely unobstructed. This is important. We use a wood rail instead of gas pipe, because it is not so cold, and finally we use a "rail" instead of the customary guard board, because the rail lets the sun between it and the partition, to the great comfort and health of the little pigs. The bottom edge of this 2″ x 4″ guard rail is 8″ above the board floor. The bottom of the triangular guard rail support is 9″ long, so that when the 2″ x 4″ guard is nailed on there is a protecting space for the little pigs of 11″. The guard rail at the rear of the pen is attached by its supports permanently to the 2″ x 6″ nail girts. At the front of the pen the guard rails are brought on a slant from the support and attached directly to the partition. This gives a little additional room in front for feeding, and does away with sharp corners, especially necessary at entrance to pen. Doors to the pens are 2′ wide; a heavy hinge, 6″ butt and 10″ strap, with bolts and screws, will discourage even the occasional uneducated and untamed sow.

"The hog trough is conspicuous for its absence. Do not use a hog trough in a permanent hoghouse. Above all things do not build one in. No amount of care can keep a trough clean inside and outside. We prefer to use a galvanized pan. Those we have are 27″ x 16″ and 5″ deep, a very good size and depth for sow and her little ones, and when the meal is over the pan is taken out of the pen. The alley between the pens is 6′ 6″ wide. This is a convenient and comfortable width. The narrow alley is a nuisance, and if built to save either room or money is misplaced economy. The floor of the alley is the bare concrete, and made a little rough by sprinkling with sand, so the hogs will not slip. At each end of the alleyway are sliding doors the full width of the alleyway and 6′ 8″ high. The upper windows are 5′ 8″ x 2′ 5″, double sash, each sash with two panes 12″ x 30″. Both sash are hung by weights so they may be raised or lowered, affording splendid ventilation. These large upper windows should never be omitted. They throw the sunlight down into the back row of pens instead of up against the roof, as would a smaller window. The lower windows are double windows, with single sash 2′ 4″ x 2′ 8″ and four panes 12″ x 14″. These sash are hung at side about center, so the top will swing in and the bottom out. When they are open you will notice the fresh, cool air comes in at the top, and you have ventilation and an abundance of fresh air without any direct draught on the pigs.

"At the west end and outside of the farrowing house proper, but connected with it by sliding doors located just under the lower west windows, is the life-saving station in the winter pig business—the sun room. Here warm sunshine and fresh air make the youngsters happy enough to scrap, and so they doze and get their exercise by turns for an hour or more, until warm lunch is served by mamma in her own apartment. Then a little "beauty sleep" and outdoors they go racing around their lot like the lusty youngsters they are. The little sun room shown in *Fig. 311* is invaluable. The glass part is very cheap. In the front are four barn sash of three lights, each 10″ x 16″; top glass is lapped hothouse fashion; floor dimensions are 12′ x 3′. We get a warm floor by laying up a brick wall a few inches high and filling in with sand and laying a board floor on the sand.

"This farrowing house is in no wise elaborate. It is substantial and well built. Several causes which contributed to the $500 cost of this building would not obtain in a second attempt today."

A HOGHOUSE FOR BROOD SOWS.

This plan (*Figs. 312* and *313*) is for two houses for three sows each. There is practically no increase of cost, while there is great gain in the ease with which the smaller building can be transferred from lot to lot. Moreover, this plan enables one to separate sows so as to accommodate age of sows and time of farrowing. When it comes to feeding pigs or shotes they will do better to be graded as to age and size. The width of the building is 8′ and the length 16′ and the height 3′ 2″, which enables one to use 16′ stuff and cut with no waste. The sills and frame can be made of 2″ x 4″ stuff. The long sills should be doubled and separated by inch blocks every 4′. This will give strength and durability, as the open space between the sills will let them dry out more quickly than when nailed flat together. The front sloping elevation of 2′ is to be covered with flooring excepting a space of 2′ x 2′ 2″ in front of each pen. This will permit the use of a sash containing six 8″ x 10″ lights, after the sloping boards are put in place, leaving an opening of 2′ x 1′ 10″. Over this lay the sash which lap over the boards 2″ on each side. Now put a strip an inch square on the under side of the projecting roof, allowing the sash to be drawn to one side for ventilation. Instead of a strip below put two buttons to lap over the lower edge of the sash to keep the wind from lifting it. The boards for this sloping front should project roof-like at the foot and fit up against the roof at the top, and if properly laid the sash will fit snugly and move to one side 1″ or 2′, as required for ventilation. The

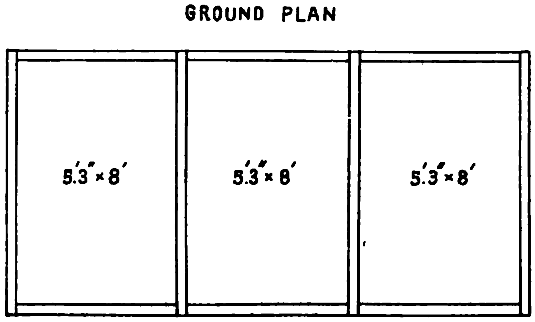


FIG. 312. HOGHOUSE FOR BROOD SOWS.

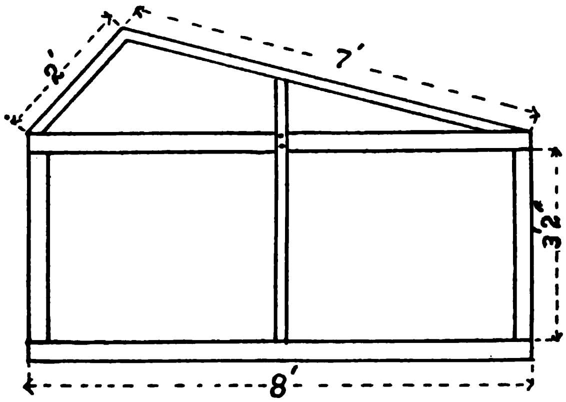


FIG. 313. HOGHOUSE FOR BROOD SOWS (END SECTION).

roof may be of shingles, paper or metal. The weak place of all such houses is the sill resting on the ground. It will pay to put an extra sill under this frame so arranged as to keep the building sills dry. The two partitions in each house may be cut from 16′ barn boards and dropped into slots made by nailing cleats to inside of frame for partition boards to drop into.

A TYPE OF HOG SHELTER.

An Indiana swine breeder is thus quoted: "I have tried practically all of the individual hog-houses that I could hear of, but the house of which I submit a floor plan and sketch (*Figs. 314* and *315*) has been more satisfactory in every respect. It affords plenty of floor space for an ordinary sized sow and litter, and is light and airy, with perfect ventilation. In fine weather the larger door is left open; this closes the smaller door. During stormy weather the large door is kept closed; the small door then affords ingress and egress to the sow. From the location of the small door it is practically impossible in the stormiest weather for the bed to get wet, and we have had sows to farrow in zero weather and as yet have lost no pigs on that account. By buying all of the materials the house will cost besides the work of construction, about $6.25. Two men during a short winter day can construct one. In building ours we used frame

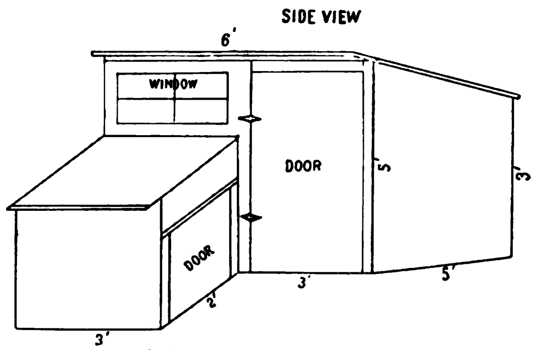


FIG. 314. TYPE OF HOG SHELTER.

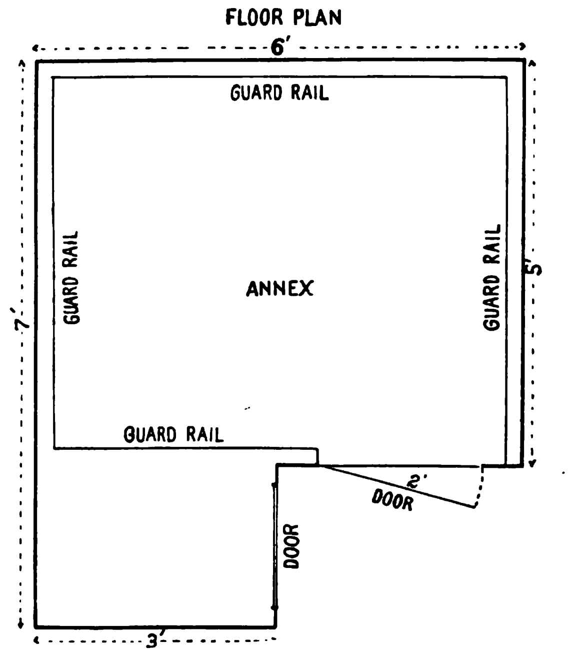


FIG. 315. TYPE OF HOG SHELTER.

stuff and flooring that had been left over from other buildings; this materially lessened the cost. On almost any farm in the timbered regions the majority of the materials can be had with little trouble and at small cost. The house can be placed on runners and moved wherever needed."

Commenting on this hoghouse, an authority says: "The annex to the individual hoghouse, while it adds to the cost of material and increases the labor of construction, gives air and freedom to the inmates. Unless the sow and pigs are to vault over the guard rail shown between the annex and the pen it will be necessary to omit that rail and have guard rails on only three sides, which are ample, as the sow can not crush pigs against open space. This annex acts as a storm shield or door, and prevents direct draught on the inmates."

A HOGHOUSE FOR $400.

L. N. Bonham of Ohio thus describes the $400 hoghouse shown in *Figs. 317* to *319*: "The plan here given will accommodate 10 sows and their pigs—or more by removing a sow, after the pigs are old enough to move, to other quarters. Sunlight and good ventilation are of greater importance than convenience for herdsmen. We have tried to make things handy and have a room for corn, but as a rule we do not advise storing corn in a crib to which rats may have access from adjoining buildings. Unless one has a corncrib near it will be a vast saving of steps

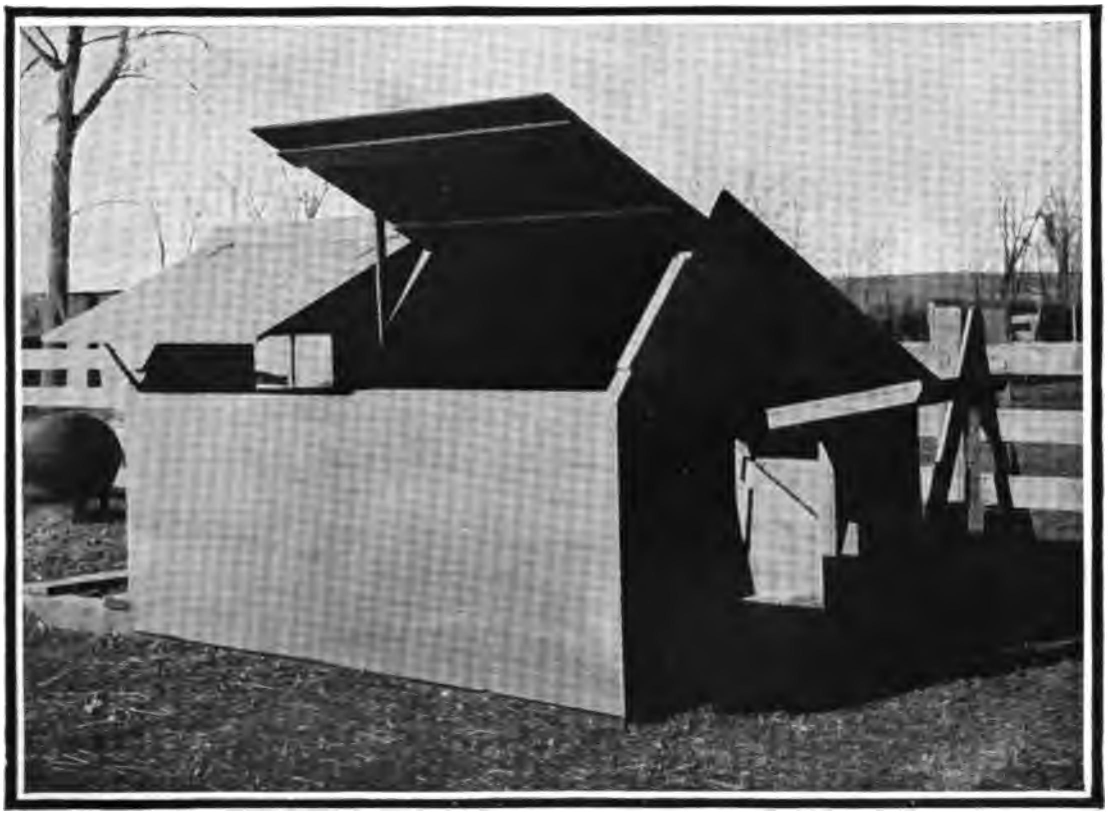


FIG. 316. ANOTHER INDIVIDUAL HOGHOUSE COMMONLY USED.

ANOTHER INDIVIDUAL HOGHOUSE.

This house is used at the Nebraska Experiment Station and is built on runners, 6′ x 8′, and floored. (See *Fig. 316.*) The sides of this nest are 3′ high, with a double board roof having a long and short side, the short side of the roof opening up so as to let the sun into the pens on warm days, or it can be held partly open to give ventilation in the summer.

to have some corn in the hoghouse, but we would advise keeping only a wagonload or so in the crib here. In this way the crib floor will be cleared of corn as often as a wagonload of corn is fed out, and this will prevent its becoming a breeding place for rats. It behooves every farmer and feeder of hogs to build against rats, so far as posssible. In this plan we have a cement floor 56′ x 24′. There is no place for rats to hide except in the corncrib or bedding room in the second floor. If these are emptied frequently it will be an immense check on rat breeding. Notwithstanding there are so many considerations in favor of a cement floor, we advise a movable wooden floor over the cement floor of the breeding pens. This wooden floor may be 5′ x 8″, sufficient for the bed, keeping the sow and pigs from the chill that is sure to come from lying on the cement floor, unless bedding is very abundant. Opposite to the corncrib is a room 8′ x 8′ for ground feed and a space 8′ x 8′ for a slop barrel and pump or faucet, if one has water pressure from windmill, tank or distant spring. If not so provided, then put down a cistern to receive the water from the roof. Here is opportunity for a small outlay to have a full supply of water. While one is at it, put a force pump in and with a hose be able to flush out the alleyway and troughs frequently, and in warm weather give comfort to any feeders or breeders that may be in the house. Room and chimney are provided for a stove or feed cooker, as desired. A ventilator or airshaft beside the chimney will give ventilation without opening windows in severely cold weather. Whenever fire is needed ventilation is called for, since it is not

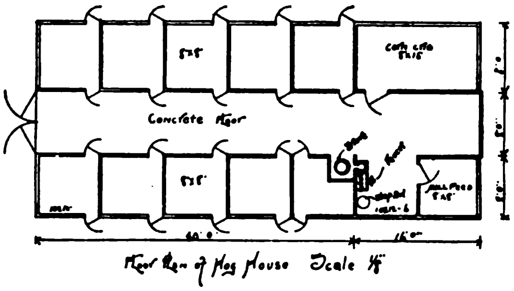


FIG. 317. HOGHOUSE FOR $400.

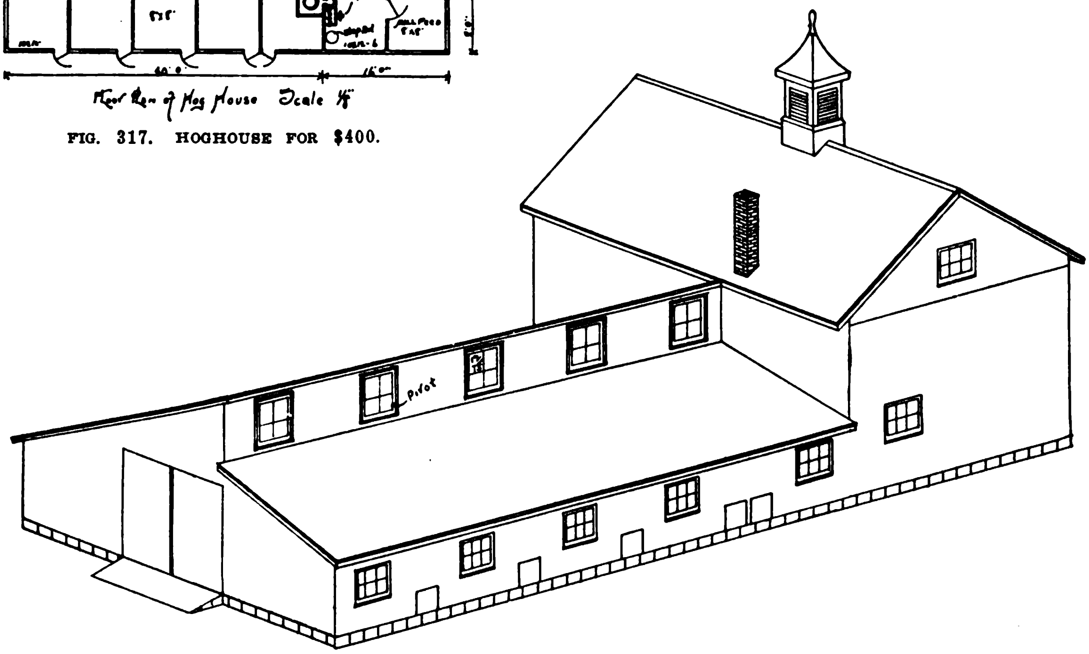


FIG. 318. HOGHOUSE FOR $400 (SIDE AND END ELEVATION).

economy to try to heat up all outdoors. If windows and doors are properly fitted and the siding is good or double, such a house will keep out drafts and be comfortable without a fire. It is provided for to meet emergencies of cold storms at farrowing time. The alley is 8′ wide, so a wagon or cart can be used for cleaning the house often and carrying the litter to the fields at once, both to keep the surroundings clean and get the most benefit from the manure. The plan does not show outside pens, which are necessary in all weather when sows or pigs can go outdoors. The concrete in the alleyway should be 5″ thick and that in the pens 3″ or 4″. The estimated cost of this house complete, not including a cistern,

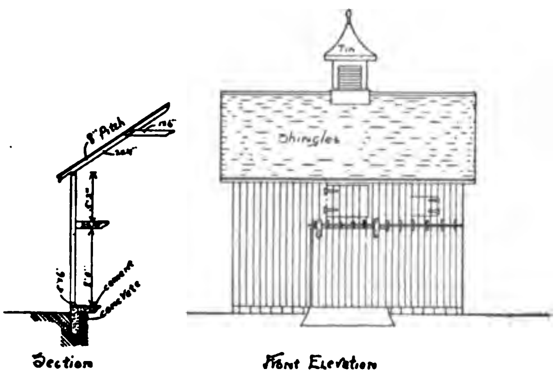


FIG. 319. HOGHOUSE FOR $400.

is $400. From the plans as given any builder can furnish an itemized bill of materials."

HOUSE FOR TWO BROOD SOWS.

This house, shown in *Fig. 320*, 8′ x 16′, is arranged for two brood sows, with ample light in front and arranged with an automatic swing door for one pen and a full-height door cut in two parts for the other pen. This house is considerably warmer than the single nest, and when additional warmth is secured by the use of a lantern it is probable that it can be made warm enough for all except the most extreme weather. As a rule, two brood sows with their litters will occupy one house without disturbing each other or without the litters robbing each other. The sows can also easily be trained to occupy separate nests, which prevent the danger of overlying young pigs. This house has been found quite satisfactory. The cost would vary with localities, but somewhat exceeds $100. It is built upon runners and can be drawn from one location to another, as desired. It is floored, so that it is always thoroughly dry. One objection to this house is that unless more ventilation is furnished than is provided it becomes too hot for summer use.

FIG. 320. HOUSE FOR TWO BROOD SOWS (ELEVATION).

INDIVIDUAL HOGHOUSES.

A Missouri farmer thus describes his hog breeding plant: "My lots are planned to come together in a wedge shape with an apex 8′ wide running back 40 rods; 8′ admits a wagon and 40 rods long permits the plow and long stretches of woven wire (see *Fig. 321*). Each individual lot is well sodded with a mixture of red and white clover, timothy, red top, blue grass, orchard grass and meadow fescue, and contains 140 square yards. In this lot is a hoghouse 3′ high and 8′ square, open on the south and covered with galvanized iron. All these lots converge to a point, as a wheel. The hub is where the steps are saved in feeding and watering. At this hub we have a small feedbin, and before putting in the feed the hub was graded level for all six pens. Here we have cement troughs connected with a tee to a main pipe the full distance of all pens, so that each cement trough in each pen being level, when one is filled all are the same, and watering can be done in short order. The pipe is large, and if mud collects in these tees or the main the plug can be unscrewed and the system flushed, cleaning all. In this hub we have under the storage grain bin a trough for sweet milk. Of course a little corn is kept here all the time, and one would be surprised how soon the little fellows learn the way in and out. They become weaned sooner, learn to depend upon themselves and tease the sow less than when in a close house. The individual hoghouse is away from noise. The sow's instinct tells her to hide, and she must come up for feed to the hub before she can have anything

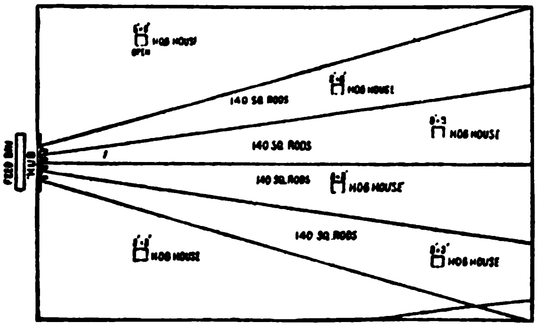


FIG. 321. INDIVIDUAL HOGHOUSES (PLAN).

except water. This is generally three days; then she can digest and assimilate what is given her without playing havoc with the litter. I do not allow the use of these individual pastures to sows younger than two years old, as they are uncertain, but if a good sow is found she should not be known as a grass widow on the meat marts until eight or ten years old."

A GOOD TYPE OF HOGHOUSE.

The hoghouse illustrated in *Fig. 322* is described as follows: "We make it 6′ square on the ground, both doors to be hinged so they will open and close readily; 12′ boards make the side and roof. Use good soft pine flooring; it is lighter and much easier to move when necessary than heavier lumber, 4 pieces 2″ x 4″ and 6′ long


FIG. 322. GOOD TYPE OF HOGHOUSE.

are for sills; 2 pieces 2″ x 4″ and 6′ long are for ridge and plate. The door in the roof can be opened when the sun shines. Sunshine is the best tonic known for little pigs in early spring, and the door is essential when the sow needs attention at pigging time as a means of entrance, and, as is sometimes the case, a very hasty exit. We lose a very small per cent of pigs farrowed in these houses.

A SINGLE HOG BARN.

A swine breeder asking for a plan for a single hoghouse with one row of pens with facilities to let in sunlight, is thus accommodated: As light and air are more readily admitted from above than from the sides of pens, and as the windows are not so liable to be broken, we suggest a roof with rafters one part long and the other short, and with a steep pitch at one end. With a single row of pens the feeding usually is done outside. Where there is much snow the floors must be cleaned before feeding. Pens 6′ x 8′ are large enough for individual houses set in a lot where sow and pigs can graze; but when we build several pens in one house a small lot is needed in front of each pen. Hence 8′ is about as little space as it is wise to use. A pen 8′ x 8′ with a lot 8′ x 10′ in front is large enough for a

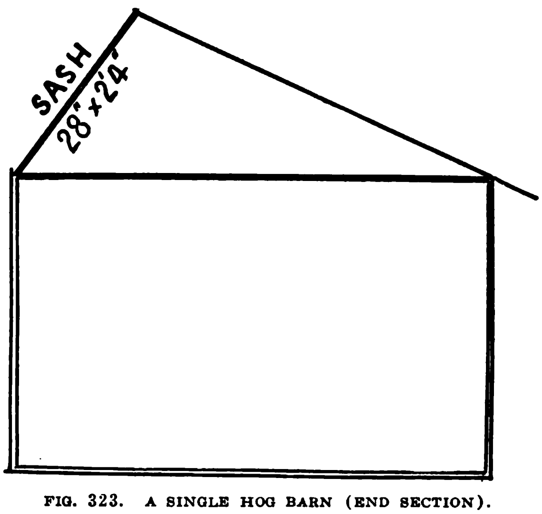


FIG. 323. A SINGLE HOG BARN (END SECTION).

sow and litter for the first six weeks, after which the pigs may be fed with others away from the sows. Providing for this lot in front make the pens 8′ x 8′. This will require the long rafter to be 8′ long and the short one 2′. The sash is 24″ x 28″ with six lights 8″ x 10″. The sash is as wide as the space between the rafters from center to center. The sash are hinged at the top and can be lifted from bottom for ventilation and yet keep out rain. For each pen there may be four sash, but two will be abundant, and the intervening space covered as the roof. The partitions between pens will tie the building together. The height of building is 4′; thus 2″ x 4″ x 16′ stuff of 16′ boards cut without waste. Such pens need floors of either concrete or wood. Concrete is cheapest in the long run, and provided a slat floor is placed under the bedding concrete has many advantages. Shiplap lumber put on perpendicularly does for siding if good and free from loose knots, but barn boards with cracks battened are more reliable, and warmer, and stronger. (See *Fig. 323.*)

SHEEP BARNS AND SHEDS.

In the Old World there is little housing of sheep. In England many flocks are in the open the year round; in France they are housed and artificially fed winter and summer in some parts, mainly no doubt because of the great value of the land and the cheap labor. In America cold winters, drenching storms and intense summer heat are encountered, so that there is in the region north of Tennessee and east of Colorado need for provision for shelter.

Inexperienced flockmasters err in making too careful provision for shelter. Sheep need to be dry and out of the wind—that is all. Many expensive sheep barns fail because of lack of fresh air. Sheep have been fed in these expensive barns at a loss, and in later years they have been fed in the open yard alongside the barn, the feed being stored within at a profit.

The sheep is not a hardy animal. A native of mountainous regions, it is used to having its lungs full of pure, fresh air. Deprived of this no amount of feed or coaxing will make it thrive. Some one has said that "the worst enemy of a sheep in the barn is another sheep." The sheep barn then needs primarly two things: a water-tight roof and provision for the entrance of an abundance of fresh air. Add to these things provision for storing a large amount of forage and a supply of pure water, and the sheep barn should prove satisfactory, whether it is built cheaply or expensively.

Perhaps the best manner of ventilation is by having all of two sides provided with continuous doors, divided horizontally, the lower half swinging outwardly like a gate, the upper half lifting up horizontally, as a box lid lifts, and held up by props hinged to the doors. These doors may then be opened slightly to admit some air during a blizzard, wider on a cold day, entirely up whenever the weather is warm and the air sluggish, and one side may be left wide open at all times. It is better to leave off the upper doors altogether, leaving mere open spaces there, than to provide doors and then forget to open them.

Sheep bear crowding together in the fattening flock, and six square feet of floor space to a fattening lamb eight months old is ample. Twice that will suffice for a pregnant ewe. Crowding them without providing fresh air is of course to be avoided.

Movable racks are best. Make them of such length that they may be set to form partitions in the barn. The most economical hay-racks are those in which the sheep thrusts its head in between the slats, then eats without pulling the hay out and trampling it beneath the feet. Try to prevent this waste by making very narrow slats and the waste is doubled, as all hay is first drawn through the narrow spaces before being consumed and very much of it is wasted. Provide plenty of racks, so that every lamb can eat at the same time. It matters little how many sheep are kept in a pen if the air and water are pure and each lamb has a chance to eat at will. Certainly in the breeding flock there must be separate pens for the ewes advanced in pregnancy and many small pens for ewes that have lambed. These pens may be built of simple tight panels about 4′ high and 5′ long, two panels hinged together, and when opened at right angles and hooked into a corner of the room they form the other two sides of a very convenient small pen.

A small yard paved or concreted attached to the sheep barn is indispensable. Do not make it large, as it will cause loss of droppings and be more difficult to keep dry.

The fattening flock should be confined to the barn at all times save when feed is being put in; then it is convenient to run them in the yard. In this way the saving of manure is material and the lambs or sheep fatten faster, as they have little exercise. There should be provided inside a flood of pure air for them.

Water should be in abundant supply, and so convenient of access that the sheep have no difficulty at any time in satisfying their thirst. It should be kept pure enough for man's use. Sheep are dainty in their appetites, and readily detect foulness in the water.

When the sheds are kept well littered with dry straw there is no harm in permitting the manure to accumulate to considerable depth. The tread of the sheeps' feet prevents its heating, and all is saved. It should be hauled out, however, as fast as the condition of the fields will allow and all cleaned out on the approach of warm weather. Sheep manure being rich in nitrogen it is good economy to sprinkle the barn frequently with finely ground phosphate rock or phosphate flour or with acidulated rock or acid phosphate. Applying the manure to the land with a manure spreader it may be put on more thinly when so treated. The manure from sheep barns forms a considerable source of profit, and has made some farms famous.

A dipping tank is part of the indispensable sheep barn furniture. It may be of galvanized iron or cement. It may be 16″ wide at the top, 8″ at the bottom, 4′ long at the bottom and 10′ at the top, giving an incline on which sheep may walk out. All sheep that have traveled on cars are probably infected with scab germs. Dip them thoroughly before they go into the sheds. Turn them in wet and allow them to rub their wet sides against the posts and racks. All home sheep are apt to be ticky. Dip them once a year and the ticks may be eradicated. There is no stock on the farm more miserable than poorly cared-for sheep.

A WISCONSIN SHEEP BARN.

This barn built by F. W. Morgan in Wisconsin is of ordinary balloon frame construction ceiled on inside and outside with shingle roof. (*Fig. 324.*) It is 182′ wide by 155′ long in the shape of a cross. The entire floor is of grout construction. In the front is a shearing and engine room, and in one corner of the center of the barn is a small turnip house. On all sides of the barn are hay self-feeders. The wings are 32′ wide. The plan shown in *Fig. 325* gives a clear idea as to arrangement.

FIG. 324. A WISCONSIN SHEEP BARN (ELEVATION).

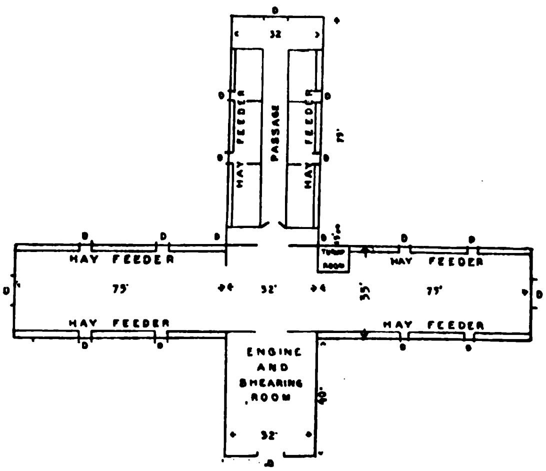


FIG. 325. A WISCONSIN SHEEP BARN (FLOOR PLAN).

A NEBRASKA SHEEP BARN.

On a Nebraska farm where from 5,000 to 7,000 lambs annually are raised two large barns have been constructed according to the affixed plans. The barn in which the greater number of the lambs are dropped is shown in the ground plan, *Fig. 326,* lower design. There is a loft above in which hay is stored and chutes down which it is thrown to be fed in the permanent hay-rack shown. This hay-rack partitions off the space so that the central part is used for one class of ewes, generally the ones least advanced in pregnancy, while those showing nearness to lambing are placed in the outer space.

The small pens on three sides of the barn are for the reception of ewes after lambing, or in some cases before lambing. They are 4′ x 6′ in size, furnished with convenient gates, with a wooden trough communicating through the partition to furnish two pens with water, which is carried in buckets. There is also a small feed trough to each pen.

The hay feeding arrangement is unique. At the outside of the building there is a bin-like addition with hinged lids that open upward, as shown in *Fig. 326*. This is the hay feeder. Partitions across the front keep the lambs out while allowing the hay to be pulled through readily. The hay is placed in the feeders from wagons along the outside. Where hay is generally stacked outdoors, this arrangement has much to commend it.

Grain is fed the ewes before lambing in a small yard outside the barn. The dimensions of the building are 88′ x 112′, the basement story 10′ high. The mows should have a height of at least 10′ at the plates, making a 20′ post.

A fence divides the barn lengthwise in the center and a system of gates is so conveniently arranged that sheep are very easily managed in it. Allowing 12 square feet to the ewe and lamb, this barn will carry 2,000 ewes. It will not hold a liberal amount of hay for that number, and the chief and only important defect of the building is its lack in height.

It is a question that must largely be settled by environment and individual preference whether this is a cheaper type of barn than the barn in which the hay is stored in lofts and the entire floor space devoted to the sheep. In each of these barns hay is rapidly placed by machinery and horse-lifting. While no elevation of these buildings is shown, the intending builder can readily adapt another elevation to fit, choosing from among the forms of pole or joist frames.

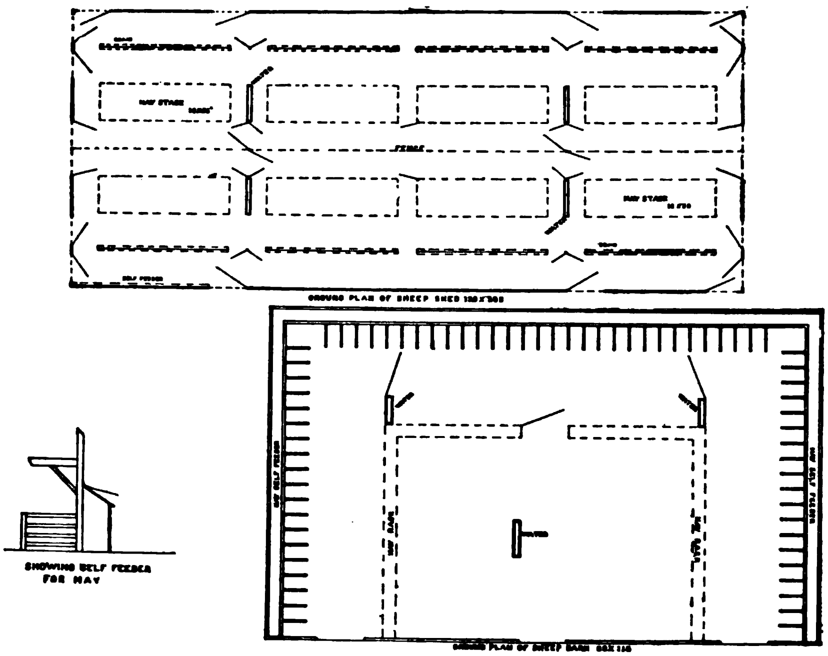


FIG. 326. A NEBRASKA SHEEP BARN (ARRANGEMENT OF INTERIOR).

Fig. 326 shows a very large western barn, the dimensions of which are 120′ x 288′. See upper part of plan. It is comparatively low, has no loft, but instead is more in the nature of a covered yard. The hay is stacked in this building in long ricks or mows 16′ x 56′. There are eight of these ricks. The roof of the building rises in steps, there being plenty of windows and change of air through them, so that the light and ventilation are good. Self-feeders are provided in this barn, so that winter lambs may be produced and old ewes fattened with their lambs.

A COLLEGE SHEEP BARN.

The sheep barn built several years ago at the Wisconsin Experiment Station is believed to embrace many features worthy of general adoption by practical sheep-breeders, and several points that are vitally essential to successful sheep husbandry are brought out.

The building (see *Fig. 330*) consists of a main part 24′ x 30′ two stories high, under the whole of which is a root cellar and two wings reaching out at right angles from it. The east wing is

125′ long, 18′ wide and one story high. Only a part of this is shown in the cut.

The south wing is 100′ long, 18′ wide and two stories high. An alley or passageway 4′ wide is partitioned off along the entire west side of the building by means of a low, fence-like

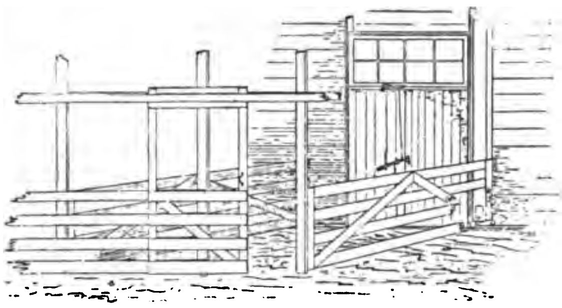


FIG. 327. A COLLEGE SHEEP BARN (SLIDING GATE)

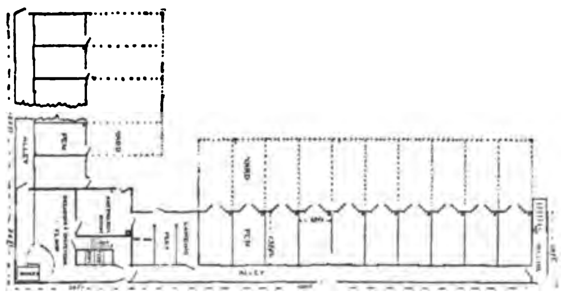


FIG. 328. A COLLEGE SHEEP BARN (FLOOR).

partition (see *Fig. 328*). This leaves a space 14′ wide and a little over 83′ in length, exclusive of a lambing room that may be occupied by the flock as one large room, or it may be divided into any desired number of pens up to ten by means of a light but strongly fastened panel that rests in grooves made for it at each end (see *Fig. 327*). These panels are easily managed, and when placed in position are entirely secure without fastenings of any kind.

Since it has been explained how all the space in the shed may be used as one room, we will from now on consider the building as it is when divided into ten parts. Each pen is 8′ 4″ wide and is entered from the passageway through a sliding gate (see *Fig. 327*) that is suspended from a 2″ x 4″ scantling which is fastened in a horizontal position to the upright pieces of the passageway partition.

Each pen is provided with a low flat-bottomed trough for the feeding of grain and also a large hay or fodder rack, as in *Fig. 329*. This hay-rack is made with a tight front which prevents chaff and dust from falling into the eyes and fleece of the sheep while feeding, and is also adjustable so that not only the angle of the front but the width of the opening at the bottom where the sheep throw the feed out may be changed to meet the necessities of the feed that is being used. The feeder or trough that is below the opening where the feed is drawn out serves an admirable purpose in catching all the finer parts of the hay or fodder that would otherwise be trampled under foot and wasted. This hay-rack, as illustrated in *Fig. 329*, can easily be changed so as to meet the requirements of ordinary feeding by making it so that sheep can feed from both sides and long enough to reach across the shed. It may serve the double purpose of feed-rack and partition.

Experince has taught that adequate ventilation must be provided in all sheep buildings if trouble in their management would be avoided, and it appears that the building that is best adapted to the successful care of a flock is the

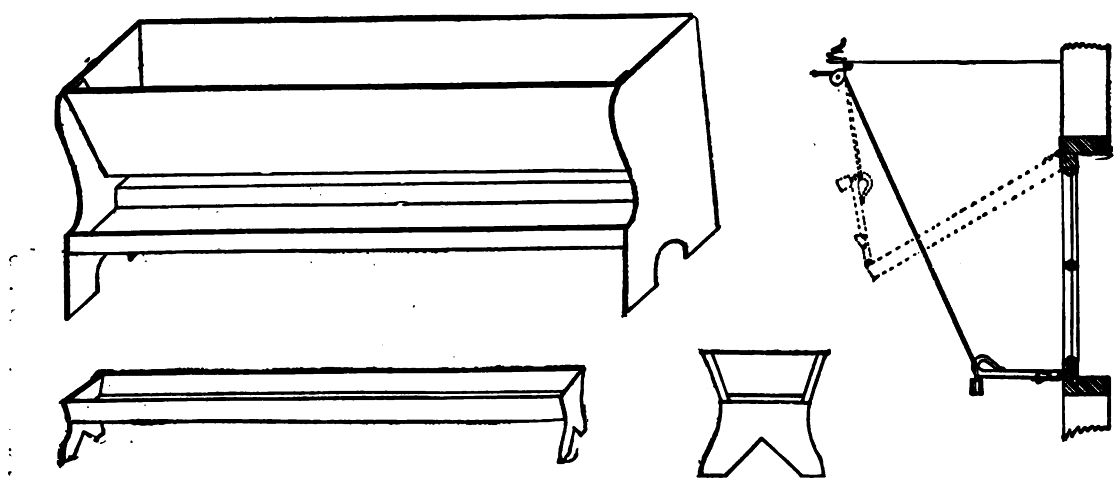


FIG. 329. A COLLEGE SHEEP BARN (HAY-RACKS AND WINDOW DEVICE).

one that may be the most readily and completely changed from an open to a closed shed, according as the weather makes one or the other of the conditions essential. In recognition of these necessities each pen has double doors that when opened out into the yard make an opening that lacks only 38″ of being as wide as the pen. The manner in which these doors are operated and fastened may be seen in *Fig. 327*. One door is bolted securely at the top and bottom by bolts operated by a level, as shown in the figure, and the other one fastened to it by means of an ordinary thumb-latch, so that one or both doors may be opened at will. A slight upward movement of the lever allows both doors to swing open, and when pushed shut a similar downward movement locks them safely.

Over these double doors are windows that are the same width as the doors and 2′ high. These windows are hinged at the top and are opened and closed from the passageway by means of a rope that runs over two small pulleys. The windows are provided with a fastening device (*Fig. 329*) that works automatically. A pull on the rope from the passageway unlocks the window and raises it at the same time. When the rope is released the window closes and locks itself. Since the windows are operated from the hallway, time is saved and annoyance and confusion to the sheep are prevented.

From what has been said it is easy to see how readily the barn may be converted into an open shed. If the weather is stormy but not cold the flock can be kept in the barn with the doors closed and the large window left wide open, which will insure the admission of an abundance of fresh air without the bad results following the exposure to a draught directly upon their bodies. Should it become necessary to close the barn tight there still is ventilation by means of shafts that are constantly carrying off air from near the floor of each pen. These shafts (see *Fig. 330*) are simply wooden boxes that start a foot from the floor and extend up through the roof as high as the peak. They are made by nailing two 8″ and two 10″ boards together. Near the bottom on one side of the shaft is an opening for the admission of air, the flow of which can be regulated by a door that is hinged at the bottom and pushed into the shaft.

A lambing-room occupies the space of two pens in the partition adjoining the main barn. It is 14′ x 16 2-3′. This room is inclosed by tight walls on all four sides, with an outside door and a door leading to the shepherd's room. The wall next to the alleyway and that next the first pen are provided with wide hanging doors hinged above, extending horizontally, which reach from about 2′ below the ceiling to a point 4′ above the floor. In cold weather they are fastened down; at other times they are swung to the ceiling, leaving the pen light and airy. By means of movable partitions this will accommodate six or eight ewes at lambing time.

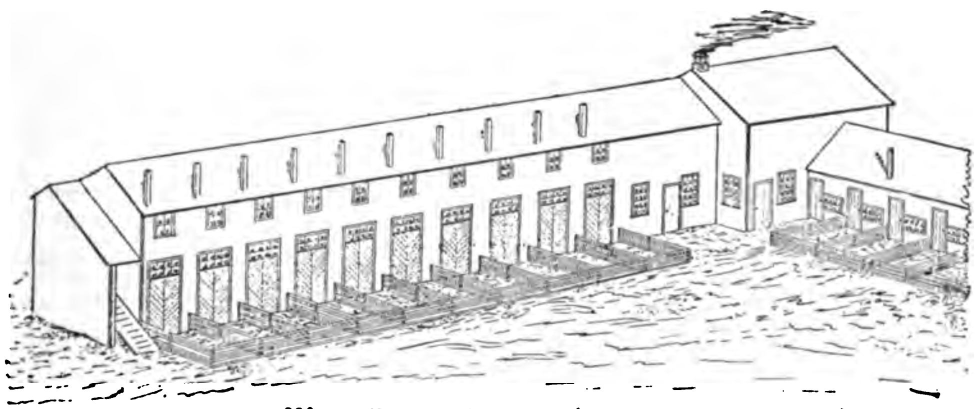


FIG. 330. A COLLEGE SHEEP BARN (SIDE ELEVATIONS AND PENS).

The second story is also arranged for sheep. The floor is constructed of 1″ matched material with a coating of gas tar mopped on while hot. There are no permanent partitions of any kind upstairs. The space is divided by means of light fence panels. The sheep in going to and from the second story pass up and down through a chute at the end of the barn (*Figs. 330* and *328*).

The east or one-story wing has a 4′ passageway along the north side which leaves a room 14′ wide by 125′ in length. This may be occupied as one room or divided into any number of pens up to 15, which is the maximum. The gates and panels are similar to those described in the south wing.

A reference to *Fig. 330* will show that the main barn is arranged to be convenient for both wings. The scales are located in the corner where the passageways from the wings meet. By this plan the sheep may be let out from any pen in either wing and driven along the passageway to the scales. The shepherd's room is in the southwest corner and by means of small windows in the partition a view of the whole interior of both wings may be had. A door from this room opens directly into the lambing-room and if necessary the lambing-room can be warmed from the shepherd's room.

The dotted lines beside the shearing and inspection floor in *Fig. 328* represent a railing 3′ high that forms the passageway partition, and the space between this railing and the shepherd's room is used as a shearing floor. Feeding bins and stairways leading to the second story of the south wing and to the root cellar below occupy the rest of the space on this floor, as shown in *Fig. 328*.

A BABY MUTTON FACTORY.

A moment's study of *Figs. 331, 332* and *333* will show that the dominant ideas about the construction of this building are ventilation, light and sunshine—three things absolutely essential to success in raising baby mutton.

The building faces the southeast and is 26′ x 52′ with 16′ posts. The lower story is 7′, the upper 9′, and as the rafters have a rise of 10′ there is ample space for hay and fodder. The

are high enough from the ground to furnish resting places for the lambs. The water is brought by piping from a nearby wind-pump. The trough is an 8′ galvanized iron one hung in pivots at each end and can quickly be tipped over for cleaning.

A bran bin reaching from the nail tie of the lower story to the nail tie of the upper story holds two tons and does not rob the sheep of any of the floor space. A paddock 40′ x 50′ at the west end, placed there after the photo was

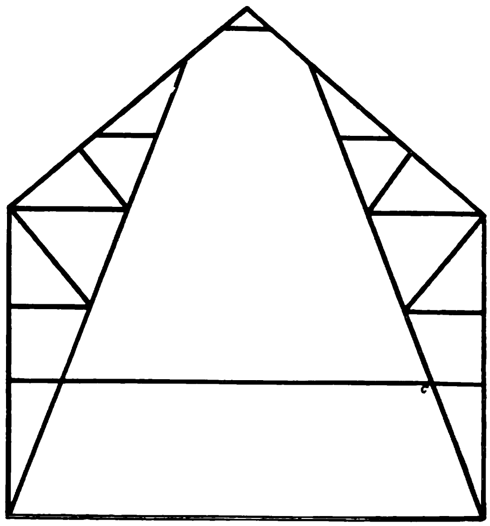


FIG. 332. A BABY MUTTON FACTORY (FRAME).

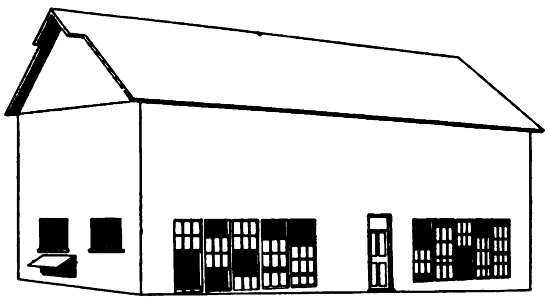


FIG. 331. A BABY MUTTON FACTORY (ELEVATION).

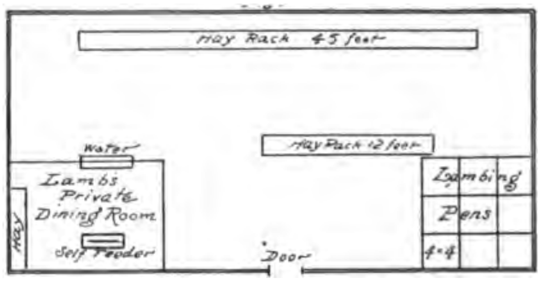


FIG. 333. A BABY MUTTON FACTORY (GROUND PLAN).

windows in front are 3′ x 6′ and the sash are raised and lowered at will. Those in the end are hinged to open inside. Around the back and northeast end above the nail tie are six doors each 24″ x 30″. A 10′ flap door admits the sheep without crowding.

During the winter there are often spells of warm, muggy weather which make ventilation a serious problem. At such times the small doors should be opened and the lower sash raised. This admits fresh air next the ground and any unpleasant odors are quickly dispelled. Every foot of floor space is utilized, and the hay racks

taken, gives ample room for exercise when the weather is good. The building is largely tenon and mortise, but the three inside bents are somewhat different. The long braces are about 25′ long, are spiked to the rafters above (see *Fig. 332*) and the posts below and rest on the foundation. They are also spiked to the girders and to the short braces, which are 2″ x 6″. This makes a strong brace and leaves unobstructed room for the hay fork.

The frame and joists are of oak; the rafters of sugar tree; the mow floor and nail ties of elm; the siding of pine shiplap; the sheathing rough pine; the roofing, felt. The foundation is made by placing stone pillars under the posts and filling the space between with bowlders, gravel and cement. Therefore there are no cold draughts near the ground in rough weather. Two hay chutes drop the feed directly into the long rack. These and the stairway assist in making the ventilation perfect.

A UTAH SHEEP SHED.

Willard Hansen's Utah sheep barns or sheds (*Figs. 334* and *335*) are large enough to accommodate 500 ewes and lambs and 600 to 700 yearlings. In the breeding shed there are 10 large pens 32′ square, planned for the accommodation of 500 ewes. The division between the sections is a long feed rack. Each section may be divided into four smaller pens. A movable hurdle from the water trough to the door divides into two and by swinging the lamb-creep into place two other divisions are made. In the center of the pen facing south is a door 16′ wide and 4′ high; above this are two doors 8′ wide which swing in, and on either side of these two other doors which also swing in. The windows above the center doors may also be opened by swinging in from the bottom. This arrangement makes it very easy to turn this into an open or closed shed, as the weather may demand. The water trough is of galvanized iron and the amount of water is regulated by an automatic float. As will be noted the location of this water trough is such that the sheep in all four pens into which the larger pen may be divided have access to it. The doors in the

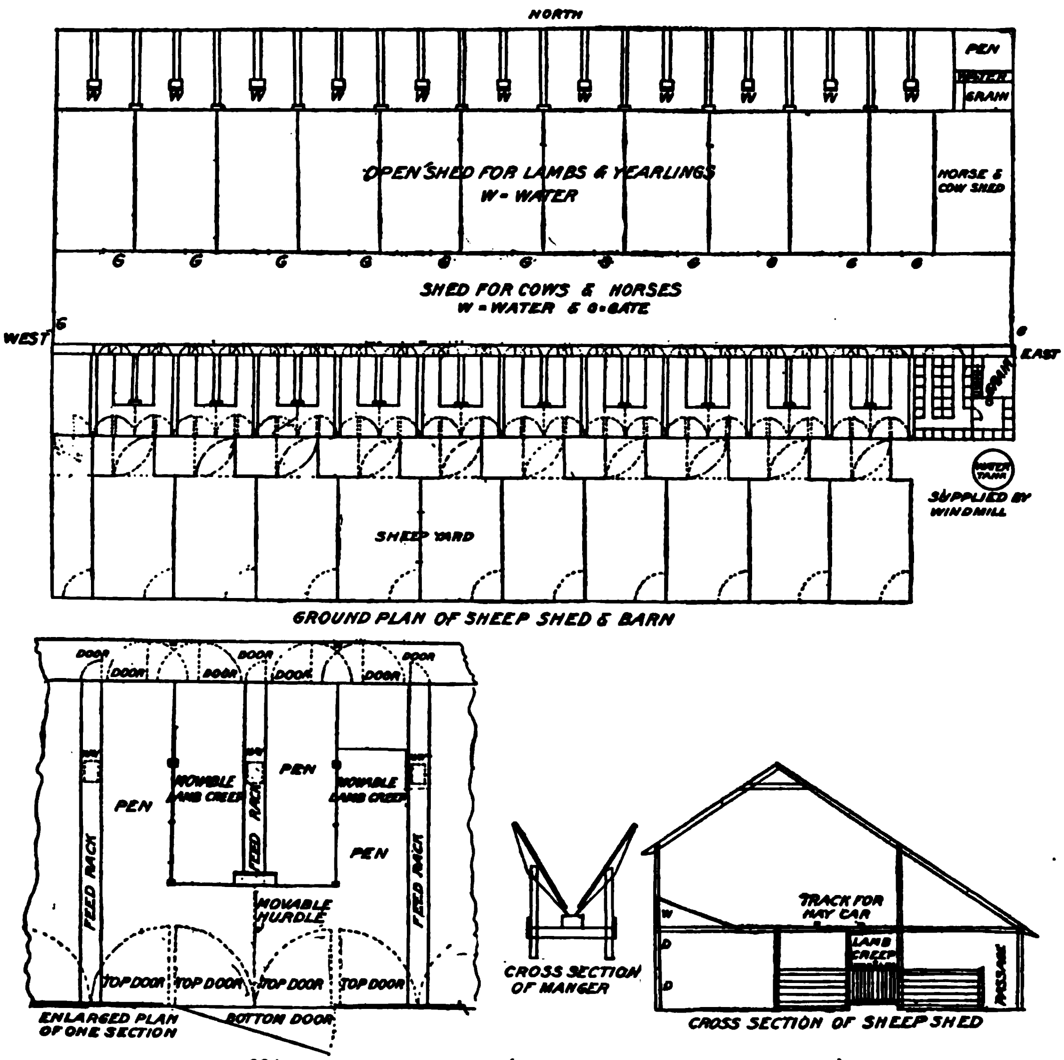


FIG. 334. A UTAH SHEEP SHED (ARRANGEMENT AND CROSS-SECTION).

passageway on the north are arranged to give greatest facility in changing sheep from pen to pen. In the lambing season Mr. Hansen keeps the ewes with twins and triplets in the smaller pens where he has opportunity to give them extra care if needed. Later these small pens with the lamb creeps in position are used to feed the lambs their grain and some choice hay for their special benefit. At one end of the shed are the lambing pens; a section is provided with a stove where weak lambs may be cared for. At this end also is the granary. Above the sheep pens there is storage room for about 100 tons of hay. The rest of the hay is stacked about 100′ west of the shed. In the winter the hay is loaded from the stack onto a wagon and with slings and a derrick from 1,000 to 1,500 pounds of hay is transferred at one lift to the car and from there through the hay chutes to the mangers below.

South of the sheds are the yards or runs. By the arrangement of the door and a gate, as shown, there is either a driveway 16′ wide along the whole front of the shed or an open passage for the sheep from the pen to the yard. The shed on the north is for feeding the lambs during their first winter. The arrangement is similar to the breeding shed, but this is open in front of each pen, no doors being provided. The hay is thrown in from the wagon on the north through doors at the end of each manger. The sheep can be divided as their feeding demands, 50 to 60 in a pen. The shepherd can pass from pen to pen through the boxes shown on the end of the long mangers.

BARN WITH GLASS-COVERED SHED.

This sheep barn for 100 ewes is distinctly a sheep barn; there is no room in the basement for any other stock, while the floor above is all devoted to the storage of hay. Grain may be stored in moderate amounts in bins built above the racks at the side.

The plans (*Figs. 336* and *337*) show a building 36′ square, with posts set 12′ apart. The shed at the side is also 12′ wide and 36′ long. It is built with a brick, stone or wooden wall 4′ high, all above being glass, set as greenhouse glass.

The barn should face east and west, so that the glass shed may be on the south side. At the end there are doors at each bent so that wagons may readily pass through to remove the manure. These doors are all in two parts, the upper part hinging at its upper edge and raising up as an awning rises, the lower half swinging as a gate. It will be noted in the floor plan that there are two posts, set opposite the door posts and 2′ away, against which the doors may be fastened if desired; this gives the sheep opportunity to pass around the end of the hay-racks, or when the doors are closed the barn is divided by the hay-racks into three long pens.

FIG. 335. A UTAH SHEEP SHED (ELEVATION).

In explanation of the floor plan (*Fig 337*) *H* shows hay- racks, which are also so constructed that grain is fed in them at will; *PP* are posts supporting the barn; *C* shows the chutes 4′ square down which hay is thrown; *DD* are doors; *WW* are water troughs; *GG* the troughs or self-feeders for lambs. The lambs gain access to this shed by means of a creep and have it to their sole use unless it is desirable to put a few old sheep there so that they will have a better chance.

The elevation (*Fig. 336*) shows a type of joist frame with open center for taking hay up from the outside. It is 16′ to the square, with half-pitch roof and holds ample forage for the 100 ewes and their lambs. For cheapness, convenience, good ventilation, comfort to the sheep and general all-around practicability this barn is admirable. With the upper doors raised and the wind circulating through, it is cool in sum-

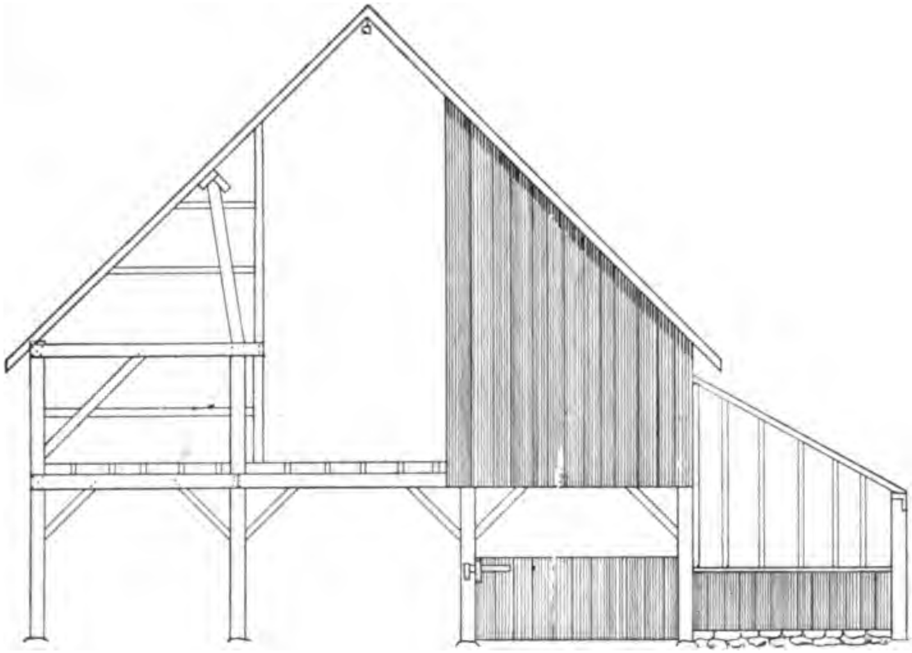


FIG. 336. BARN WITH GLASS-COVERED SHED (END SECTION).

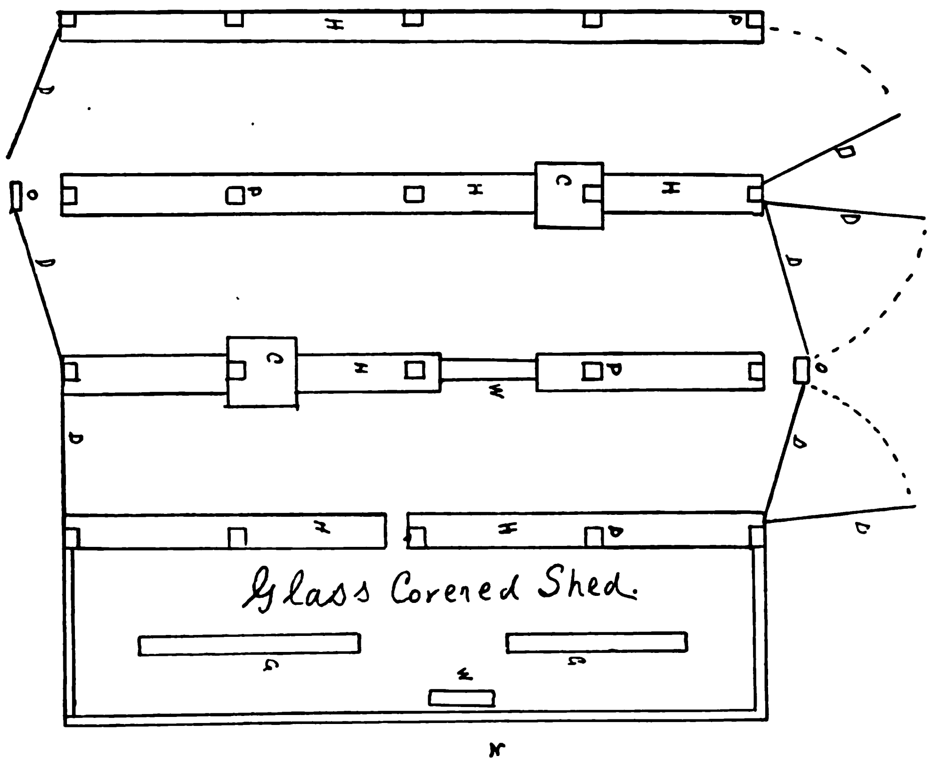


FIG. 337. BARN WITH GLASS-COVERED SHED (ARRANGEMENT).

mer; with the doors lowered it is a warm winter barn and with the ventilation that comes from the hay chutes there is never any danger of too much closeness in it.

INTERIOR OF A SHEEP BARN.

The sheep barn in which the arrangement of hay-racks is shown (*Fig. 338*) is 34′ x 50′. In *Fig. 338 H* stands between the posts dividing the barn into four compartments. Each rack is separate from the building and may be removed or turned around across the alleys if desired. At each end of alley is a door of full width to admit of a team passing through for convenience of cleaning out manure and also to allow of perfect ventilation. These doors should be in halves, divided horizontally, the lower half swinging, the upper half raising on hinges affixed to its upper edges. This confines the sheep while allowing free circulation of air.

The doors are hung by common strap hinges, 12″ or 16″ size, and are held open by two ⅜″ ropes fastened up about 10′ and with rings in them that catch in spikes driven in lower edge of doors. A good way is to use small wire rope, as the weather will not affect it. There may easily be devised other convenient devices for raising the doors.

C is the hay chute, and through it by means of a ladder the mow is reached. *W* is either a hay-rack or water-trough, as thought best. If a trough it is not so wide. It may be supplied either by a hydrant or float-valve. It is better to have water in the yard on the south side of the barn, there being comparatively few days when it is so cold that the sheep would not prefer to drink there.

To give access to the various alleyways the arrangement shown at *P* and *R* is very satisfactory. It consist of an extra post in the ground about 2′ from the barn. To this post

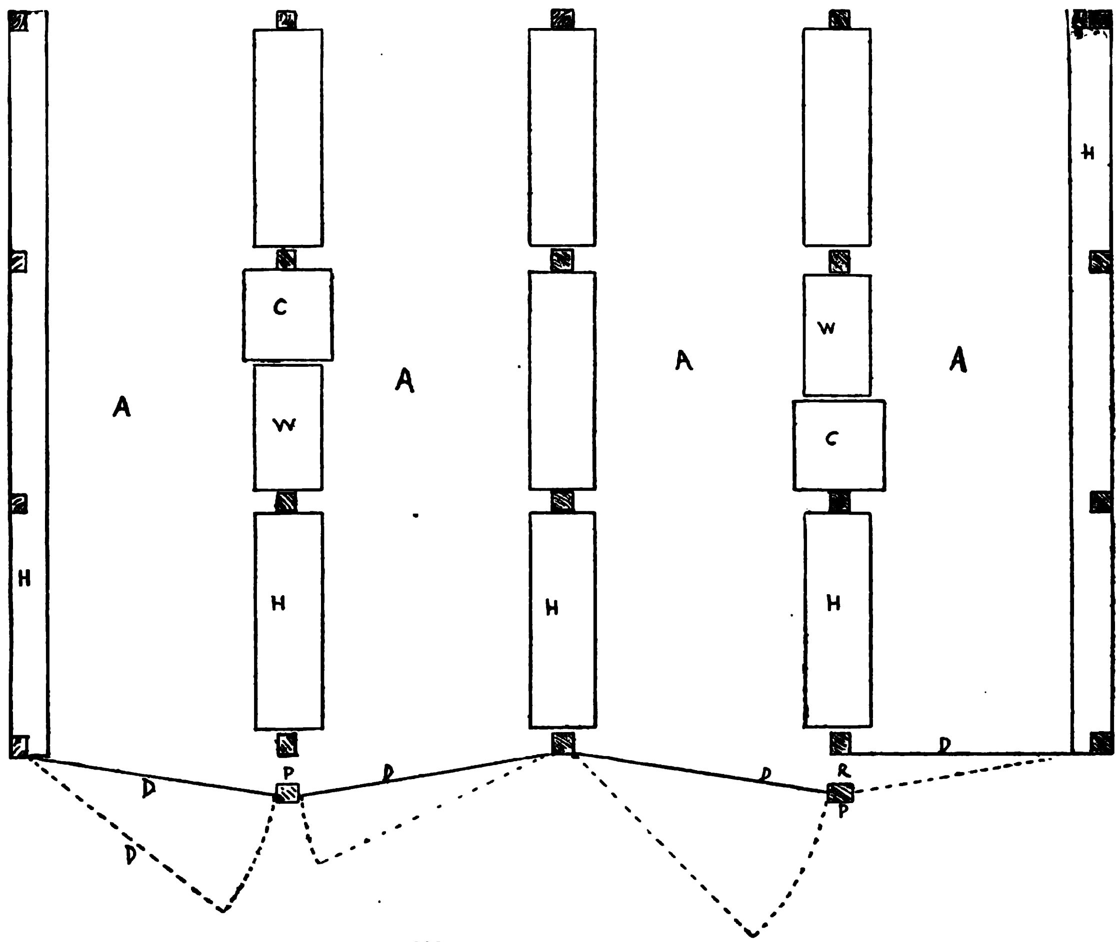


FIG. 338. INTERIOR OF A SHEEP BARN.

the doors latch when desired, allowing man or sheep to pass from one alley to the other. This is used during mild weather when the sheep are not desired separated into flocks. One such arrangement is to be put on the opposite side of the barn.

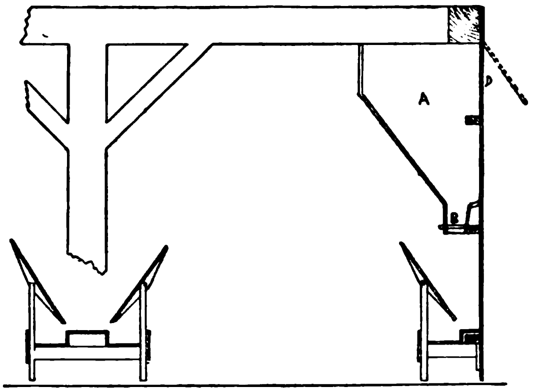


FIG. 339. INTERIOR OF A SHEEP BARN (SECTION).

There may also be gates through the hay-racks but that is a waste of rack space. Hay is taken from either side of the chute, so that all racks are filled without traveling across the line of the hay-racks. The arrangement of doors at *P* allows of the sheep being assorted while passing through, the operator standing at the door and by opening or closing it turning the sheep into yard or into the adjacent alley.

Fig. 339 shows a cross-section of one alley with section of the hay-racks adjusted to receive the hay. These racks are used for either hay or grain and when grain is to be put in the hinged sides are turned over, making a square box open at the top into which the ewes cannot see. The grain is then put in and all filled, the sides are turned back as shown and at once the ewes begin eating at nearly the same time. It may also be desirable to provide a few self-feeders for the ewes suckling their lambs. *A, Fig. 339,* represents a meal bin which may extend along a good part of each side. It is filled at *D* from outside (or inside if preferred) and the meal is drawn out at *B*. The meals should be mixed before being put into this bin.

A SMALL SHEEP BARN.

The plan and elevation (*Figs. 340* and *341*) are of Joseph E. Wing's designing and of the barn he says: "For the average farm it is nearly an ideal sheep house. It may be built of any length and may inclose two or three sides of a yard. Being narrow it is readily ventilated and is easily divided to accommodate the breeding flock. There is no waste material in the frame and no encumbering posts. The height to plate is 16′, the width 20′; the width without central posts makes necessary the use of the 2″ x 16″ joist-bearers and the long supporting braces. Hayracks are put in anywhere but should be of such length that two of them turned crossways will make a division in the room. The doors

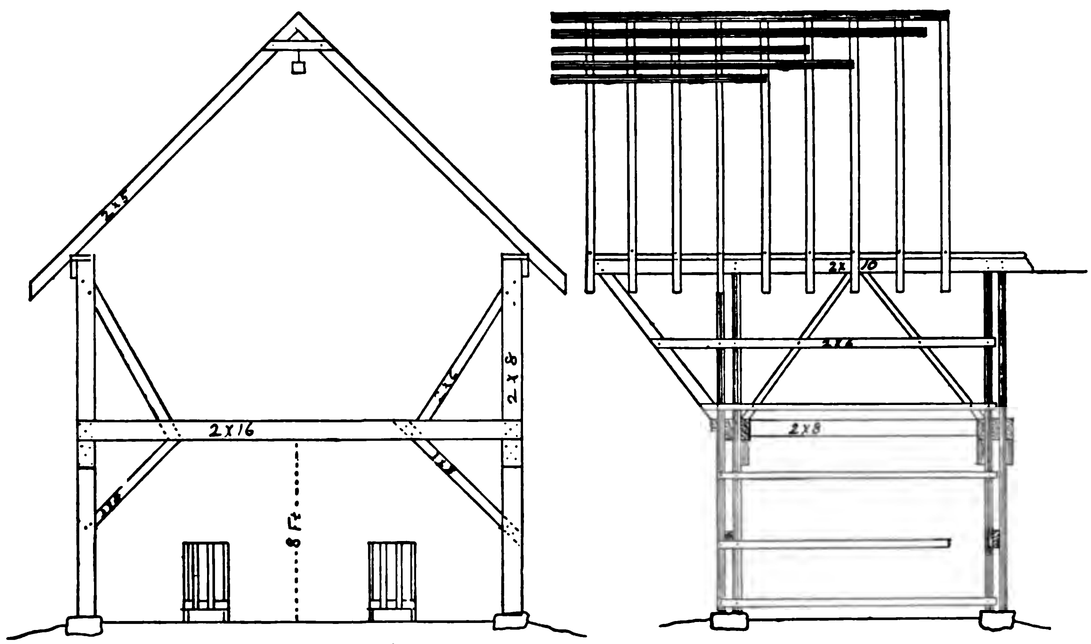


FIG. 340. SMALL SHEEP BARN (FRAMEWORK).

should permit driving through lengthways and crossways. The bents may be 12′ or 14′ apart, better 12′, so as not too heavily to burden the joist-bearers.''

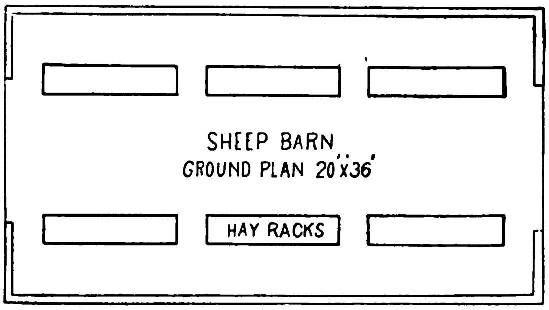


FIG. 341. SMALL SHEEP BARN (GROUND PLAN).

BARN FOR FEEDING SHEEP.

It was the idea of a feeder in Illinois to have a barn to hold 500 sheep with four pens of 125 each and an extra pen in which grain would be fed, all under cover. This building was designed for him and is made up of five squares, each 40′

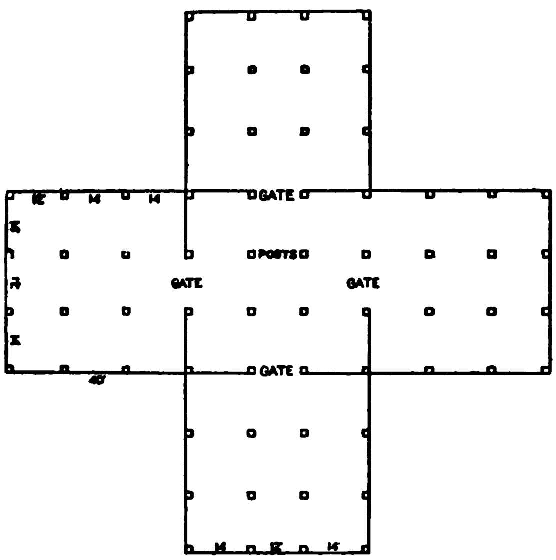


FIG. 342. BARN FOR FEEDING SHEEP.

x 40′. (See *Fig. 342.*) The central square is for feeding and each flock takes its turn at the troughs. While the sheep eat grain, hay is placed in their quarters, to which they return. The building is of joist construction with curb roof. The middle part contains large cribs and bins to which grain is elevated by horse-power. The upper story is lighted from the roof.

A LAMB FEEDING SHED.

A cheap and practical shed for feeding about 400 lambs is thus described:

Fig. 343 shows an elevation of the frame. The rear is 6′ high, the front 24′, and the width 40′. A portion of the higher part is floored to hold hay. All of two bents may be floored if desired. The frame should be of the simplest, either 6″ x 6″ posts with joist-construction plates and tier or all of joist construction. The plates should be 2″ x 10″; the roof should be of shingles, which should be nailed with either galvanized wire

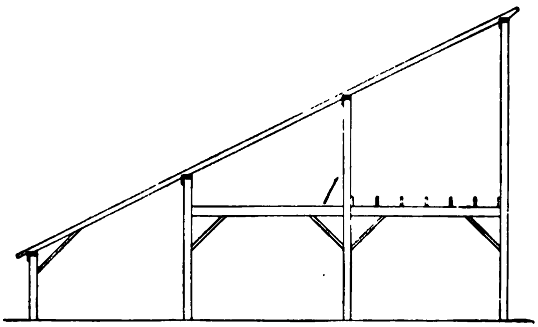


FIG. 343. LAMB FEEDING SHED (SECTION).

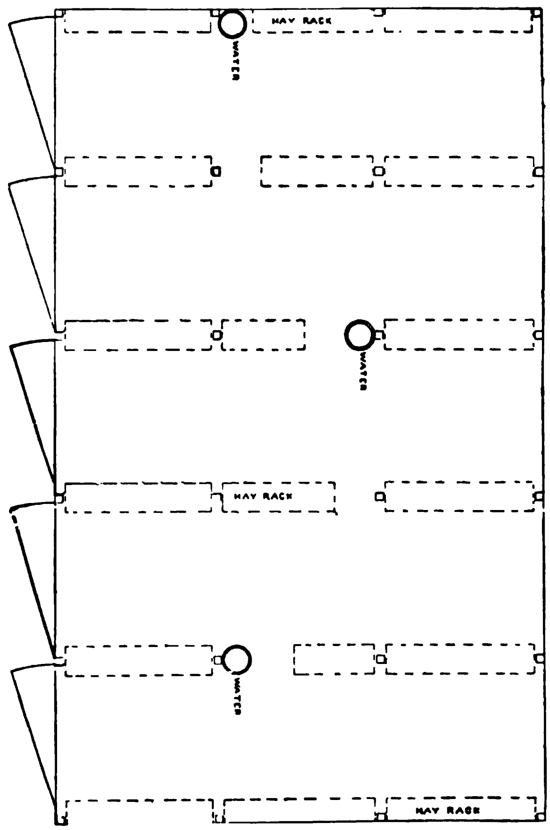


FIG. 344. LAMB FEEDING SHED (FLOOR PLAN).

nails or cut nails. Common wire nails do not last well.

Fig. 345 shows the front elevation of the shed. The doors turn to the south and each bent has its large half-door. It is not necessary to provide doors to the space above the half-doors. In feeding lambs these spaces would

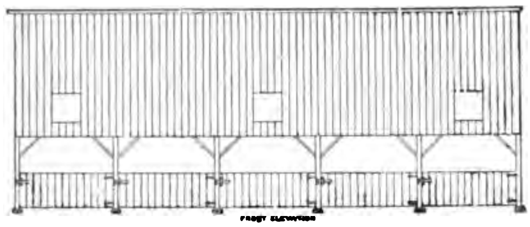


FIG. 345. LAMB FEEDING SHED (ELEVATION).

not need to be closed on the south side often enough in a season to make it worth providing them. If they are provided with doors they should be hinged at the upper edge so as to open upwardly.

The length of this building is 60′. The bents are spaced 12′ from center to center. Hay is put in through the upper windows. A track could be attached to the rafters and hay taken in by carrier at the end.

The floor-plan is shown in *Fig. 344.* The racks are not stationary. Doors are provided at the middle of each end so that a team may pass through when cleaning out manure. The racks may be set aside from the middle bents during this process. Water will flow through all the troughs or be kept at a level by means of float-valves.

A LAMBING BARN FOR THE SOUTH.

The lambing barn illustrated in *Figs. 346, 347* and *348* has a joist frame, but has no interior posts, the width being but 20′ and the joist-bearers running crossways of the frame and made of three pieces of 2″ x 16″ stuff and further supported by braces above and below. The upper brace passes between two of these joist-bearers and also between the two pieces of 2″ x 8″ (see *Fig. 347*) that compose the posts which sustain a good deal of weight, leaving the joist-

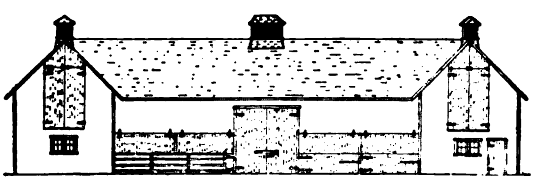


FIG. 346. LAMBING BARN FOR THE SOUTH (ELEVATION).

bearers only 10′ of unsupported span. The floor joists should be let in between these joist-bearers; that is, cut just long enough to slip down and spike fast at the ends, so there will be no waste of space as there would be by putting

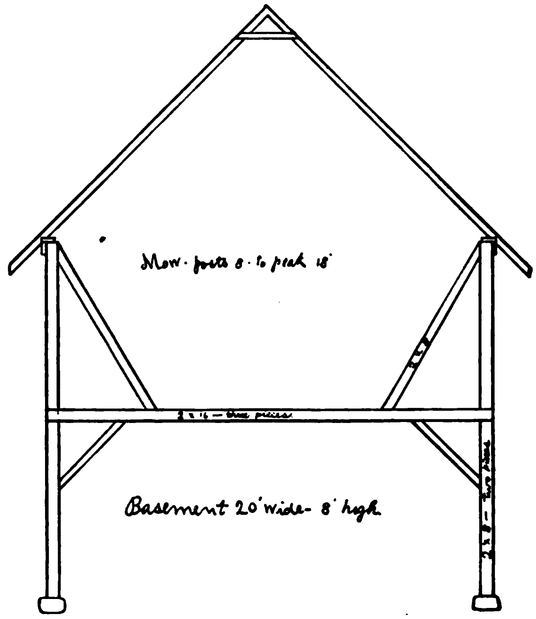


FIG. 347. LAMBING SHED FOR THE SOUTH (FRAMEWORK).

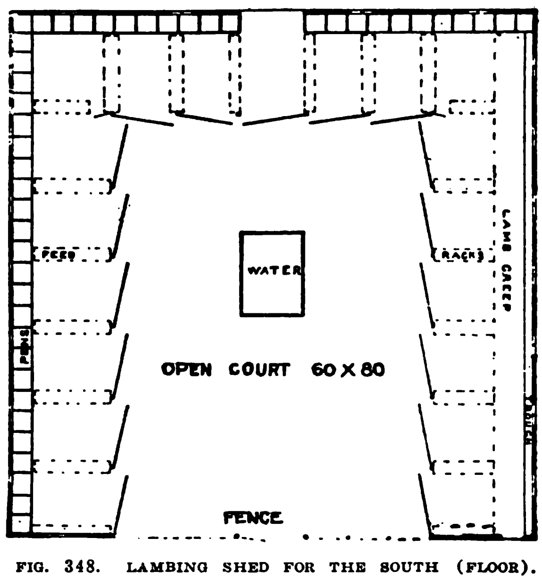


FIG. 348. LAMBING SHED FOR THE SOUTH (FLOOR).

them on top. There is no great weights to sustain.

The nail girts are simple 2″ x 4″s or 2″ x 6″s spiked on. A track runs the length of the barn under the peak. The building is three parts of a hollow square, enclosing a court open to the sky 60′ x 80′ (*Fig. 348*). In this will be a tank, preferably of cement, into which the roof water is led and maybe a spring made to pour through a pipe. Of course the open side is to the south. On two sides are many small 4′ x 4′ pens, in which ewes may be confined at lambing time; these may be stationary or movable. Simple panels 4′ long, two hinged together and provided with hooks so as to be put together as nailed, is an admirable arrangement, as it gives all the space to the flock except when pens are needed. It will be noted that there are many pens divided off by the feed-racks, each opening by a wide door to the yard, so that one can separate the ewes according to his needs, or, turning the feed-racks about, throw two or all of them together.

On one side is the creep for the winter lambs. The doors are all on the court side and are double, one opening as common doors and gates do, the other swinging up as an awning swings, to let in a little air or a great deal of the sun, as desired. The court should be cemented or paved so there will never be mud, and the gate to the court should swing either way so sheep can never crowd it shut and injure themselves. There should be spouting along the court side of the building to carry away the drip. This building is nearly ideal for a southern situation where the ewes get a considerable part of their feed in the fields yet require some forage, grain and shelter. It does not hold enough forage for a far northern location, but could be built wider and taller.

A GOOD LAMBING SHED.

While there is no doubt that lambs born in winter are generally worth more than those born later there is more or less risk in having them appear in the ordinary ewe sheds. Good management, therefore, dictates that there should be provided a small building apart from the regular sheep barn where the most forward ewes may be drafted and where they may go through the ordeal of delivery with more attention and greater quiet than can be had in the usual quarters. There are times too when artificial heat is essential.

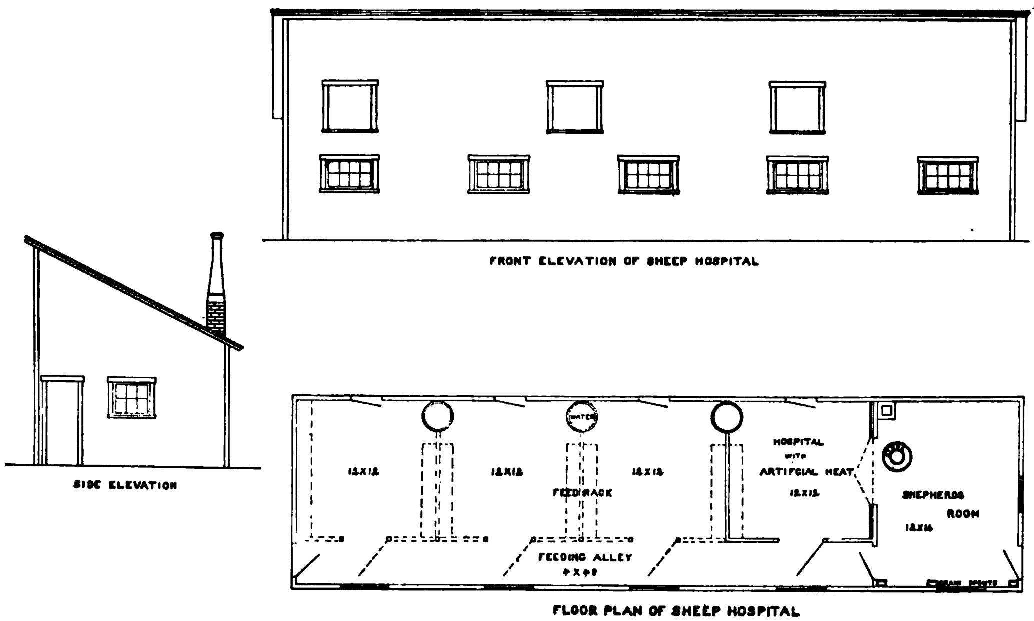


FIG. 349. A GOOD LAMBING SHED (ELEVATIONS AND FLOOR PLAN).

The lambing-shed illustrated in *Fig. 349* is light, warm and easily ventilated; the feed is above where enough hay is easily stored to carry the stock below through the season, the access is convenient and the manure easily removed. Furthermore, it is cheaply built. Reference to the floor plan shows the arrangement of the pens. The water is in half-barrels, all on the same level, connected by means of iron pipe that is buried in the ground and enters the tubs at the bottom. This arrangement insures against freezing and each tub will have in it the same amount of water. A float-valve in the supply pipe will regulate the water in each.

The gates to the pens are so arranged that when they open they hook across the passage, thus closing it and making it easy to direct sheep to any desired pen. The feed-racks are so arranged that lambs can not creep into or through them. At one end there is a room finished off nicely for the shepherd. The pen next to the shepherd's room is completely separated from the other pens by a tight partition reaching to the ceiling, the other pens being merely separated by the feed-racks. Between the closed pen and the shepherd's room there is a sliding door next the stove. One side of the door is covered with zinc. There also is a sliding lath gate, so that by opening the door and closing the gate the heat from the stove will enter the pen. Entrance to this pen is also secured by opening the little gate by the stove.

Plenty of glass is provided so that the sun may come in, and at the rear of each pen is a door out of which the manure is thrown. Hay is pitched into the loft by hand through the front windows, it not being practicable to use machinery in so small a building.

As this building should be free from draughts it is well to build of good matched siding with paper under it or of rough siding and plaster outside the lower story. The windows must face the south or southeast and it may be built any desired length, although if intended to be very long part of it may well be turned in the form of an L. As fast as the lambs grow strong and able to endure the cold they are drafted out.

THORNDALE SHEEP BARN.

The sheep barn at Thorndale, shown in *Figs. 350* and *351*, is a side hill barn 200′ x 50′ with an L on the southeast corner 28′ x 42′, and an extension 30′ x 30′ on the north side (*Fig. 351*). The basement is extended for breeding ewes, the southwest extension for the rams and shepherd's room and to break the northwest winds from the yards. The extension on the north side is for a root cellar in the basement and grain room overhead. The building is constructed on the cantilever principle, thoroughly braced and bolted with 7/8″ iron bolts. The advantages of this construction are that no posts are required above basement, which leaves a practically clear mow the entire length of the building. Strength and cheapness are also claimed but the latter did not receive much consideration. The foundation walls are 2′ 3″ thick and 14′ high above ground, built of faced stone laid in cement and plastered on the outside with a mixture of pitch and tar. The lumber used is all of first quality of the following dimensions: Sills, girts, posts,

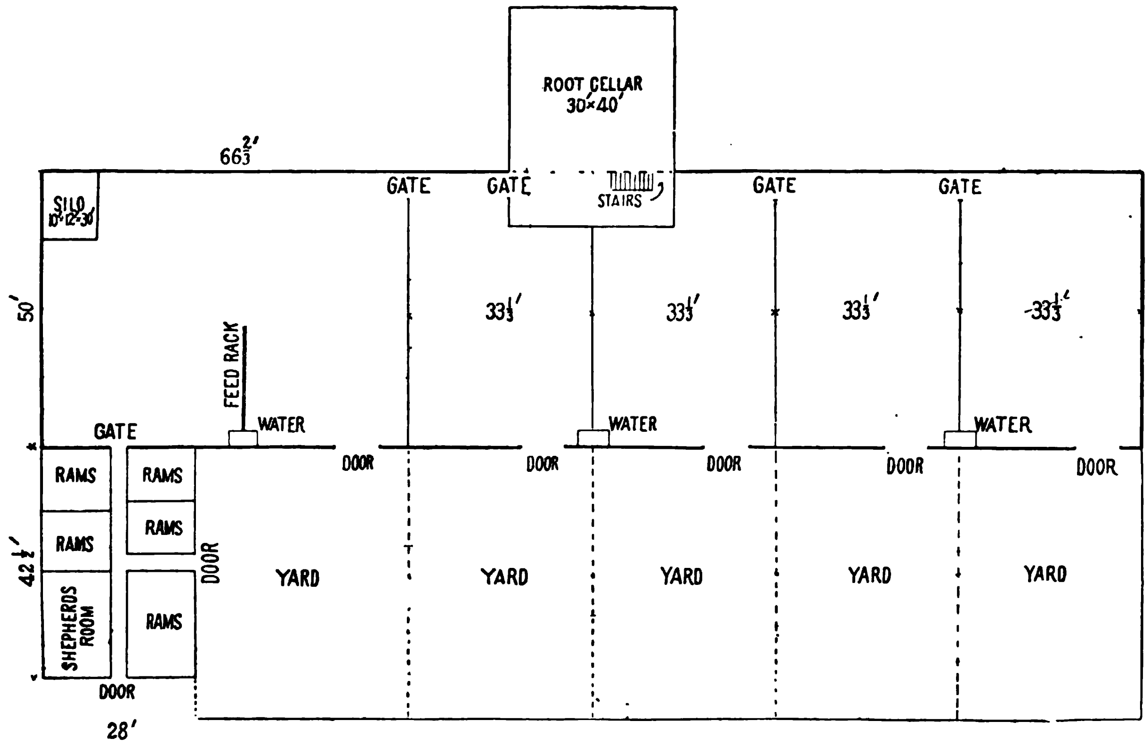


FIG. 350. THORNDALE SHEEP BARN (FLOOR PLAN).

FIG. 351. THORNDALE SHEEP BARN (ELEVATION).

levers and main rafters, 8" x 12"; flooring, 2" x 5" matched; roof sealed tight and shingled with California red cedar shingles. The basement is 14' high and has an abundance of windows. The lower panes of glass, which are stationary, are 30" x 15"; the upper glass is 15" x 15", set in sash and operated by the Hitchings system of ventilation, which is commonly used in greenhouses. It is operated by one crank in the center of the building. By this means we get equal ventilation and save time by opening and shutting all the windows from central point and by one movement. The doors are 7½' x 10', hung by a steel band running over a pulley and run up and down. As the doors weigh but 5 pounds more than the door weights, they run very easily and work very satisfactory. Slat doors are hung in the same way just inside of main door. There is 9' between the center braces, with an iron bar run through, which can be easily pulled out, the idea being to take it out when the feed is being put in, and the ewes and lambs are out in the yards, to allow the lambs the first opportunity of having the first pick of the feed. The doorways are rounded with narrow matched stuff so that the ewes cannot get jammed running in or out. The posts in basement are round 14" in diameter. The corners of all racks are planed off; in fact, there is not a sharp corner in the basement where a ewe can rub her fleece loose. The space is divided in five pens. The silo in northwest corner is 10' x 12' x 30', thoroughly braced and secured. Each pen has access to water and a yard. The L is divided into a shepherd's room and five pens in which we keep the stock rams.

FIG. 352. OHIO SHEEP FEEDING BARN (ELEVATION).

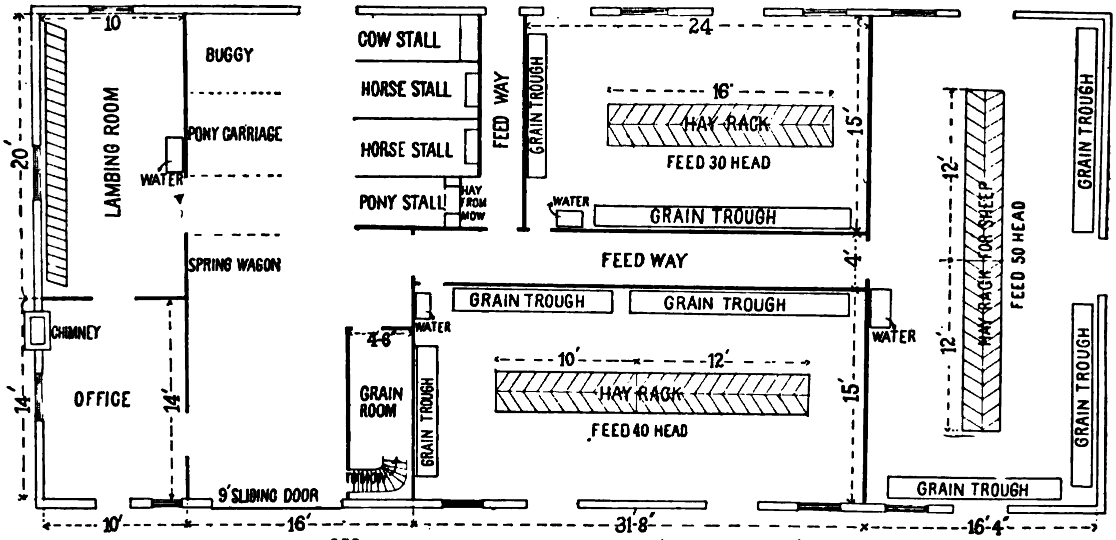


FIG. 353. OHIO SHEEP FEEDING BARN (GROUND PLAN).

The room is perfectly plain and heated by a stove.

OHIO SHEEP FEEDING BARN.

Plans shown in *Figs. 352, 353* and *354* illustrate a very complete sheep feeding barn. The plan of the ground floor explains itself. The hay racks are 3' high, 30" wide, are slatted

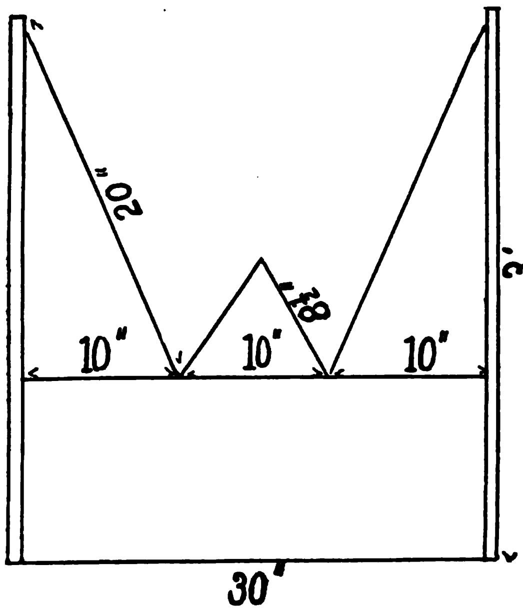


FIG. 354. OHIO SHEEP FEEDING BARN (HAY RACK).

on both sides and hinged at bottom. (See *Fig. 354.*) There is a 500-bushel grain bin in the mow with spout running down into grain room. Hay is taken in at east end of barn and three hay chutes from the mow carry the hay to the lambing room, horses and feedway.

A SHEEP BARN FOR 150 EWES.

A sheep barn for 150 ewes, with room to hold 40 tons of hay in the loft, is thus described: "The ewe needs about 12 square feet of floor space, at least that much, and may be better off with more room after her lambs come. The barn for 500 ewes may therefore be 32' x 60', with the sets of posts 12' apart from centers. (See *Fig. 356.*) This distance permits the placing of feed-racks between the posts and thus divisions may be made, and there is room left to drive through

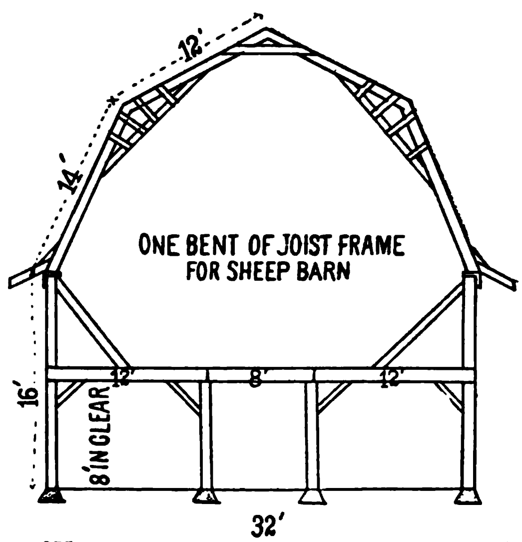


FIG. 355. SHEEP BARN FOR 150 EWES (FRAMEWORK).

transversely to remove manure. The two sides may be all doors, to let the teams pass through; hinges cost little. Or the doors may be omitted on the sides, glass substituted on the south, and driveways be made through the building the long way. There is more head room to drive the short way, however. If winter lambs are to be grown there must be one section made tight and warm, and the use of artificial heat there will be permissible, and probably profitable. Put it in the shepherd's room in a corner and let the fire heat pass through a slatted partition to the lambing room next to it. Hay will be thrown down convenient chutes into large racks and thence distributed. Grain may be binned above

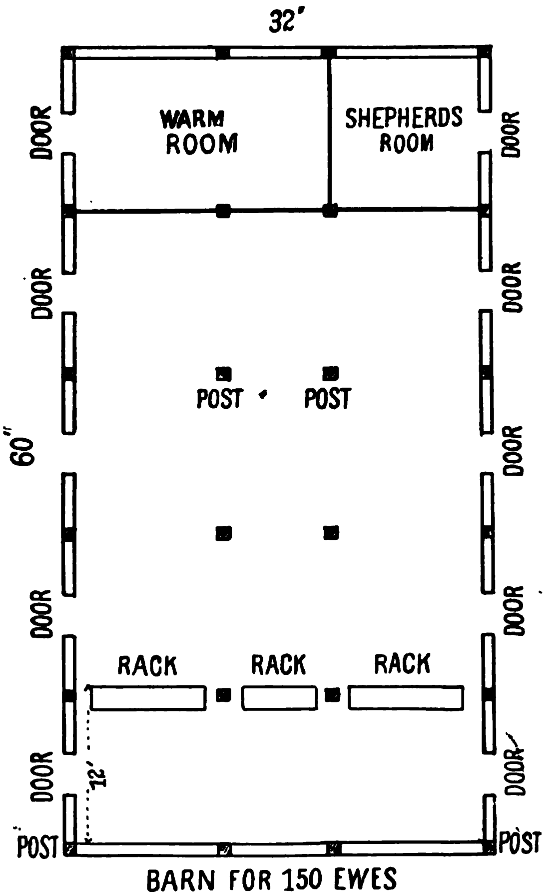


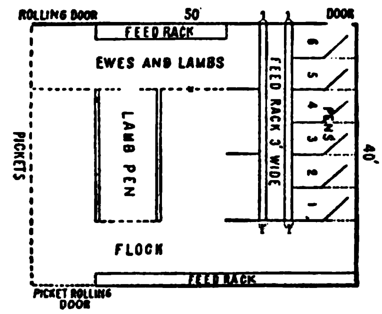
FIG. 356. SHEEP BARN FOR 150 EWES (FLOOR).

the shepherd's room and spouted down. Water may be in a concrete trough between the middle posts, or drawn from a faucet and carried to tubs, or provided by hydrants flowing directly into tubs or troughs. Abundant light should be provided, and chance for ample ventilation; the doors on the south side may be in halves, divided horizontally and the lower half opening as a common farm gate swings, the upper half raising like a box lid or an awning. This lifted door permits the air to enter and pretty well keeps out the storm."

A BARN FOR LAMB RAISING.

An Illinois farmer who keeps about 70 ewes thus describes the barn for lambs shown in *Fig. 357:*

"Our barn is a convenient one and is large enough for about 125 ewes. When the ewes



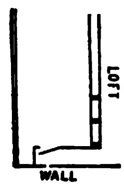


Fig. A.

FIG. 357. BARN FOR LAMB RAISING (FLOOR).

begin to lamb we put the first ewe in Pen 1. Then when the second lambs we put her in Pen 1, putting No. 1 in Pen 2, and so on until all the pens are full. Then we begin to remove them one at a time to the large pen for ewes and lambs. When the lambs are about two weeks old they will begin to eat some small grain. A pen for this purpose has been made (*Fig. 357*) and is provided with small grain boxes on two sides. The ends are made of portable gates. A small creep hole will be noticed in the gate between the lamb pen and the ewes and lambs through which the lambs can pass. These gates may be removed the next fall and again give the flock the entire barn. The gates shown can be set back to any desired place and thereby enlarge the pens and rack room, as more of them have lambs. The gates in the small pens can be made so that by opening them back to the right or left it will make an alley through which any sheep can be driven outside; the others are closed up in their pens. The hay and feed racks are of a good type, and those placed around the wall can be easily filled by leaving a space between the loft floor and the wall. Underneath the slanting board in *Fig. A* is a grain trough in which corn, oats or other grains can be fed. There is also a feedway that has this type of hay and grain rack on either side. By casing tight where the slanting line is in *Fig. A* it prevents the seeds and trash from getting in the wool when throwing down hay."

BARN FOR COWS AND SHEEP.

A Wisconsin farmer thus describes a cow and sheep barn that he built:

"My barn for cows and sheep is 40′ x 80′ and 24′ high, with a driveway in the center. Cows are in one end and sheep in the other. I would like two rows of cows crosswise of the barn, heads out. How much room is required for them with room for the manure spreader to pass between them? Our builder thinks we will get enough ventilation from hay mow in the end and barn floor on the other side. Would it be advisable to cover this kind of a building with one of the prepared roofings? I think the best shingles will cost about $4.50 per thousand."

Commenting on the plan, and answering the questions, Mr. Wing writes: "I should entirely isolate the cow stable from the sheep barn by a tight partition, since the cows cannot endure the amount of air that the sheep will need. I should assuredly adopt the King system of ventilation for dairy cows in as cold a country as Wisconsin. The plan of stalls and cross-section (*Fig. 358*) will explain the construction very clearly. If iron pipe partitions are used between the cows and stanchions of steel these must be put in before the concrete floor is laid. Two methods of making gutters are indicated. We prefer the simple slope to the actual trench."

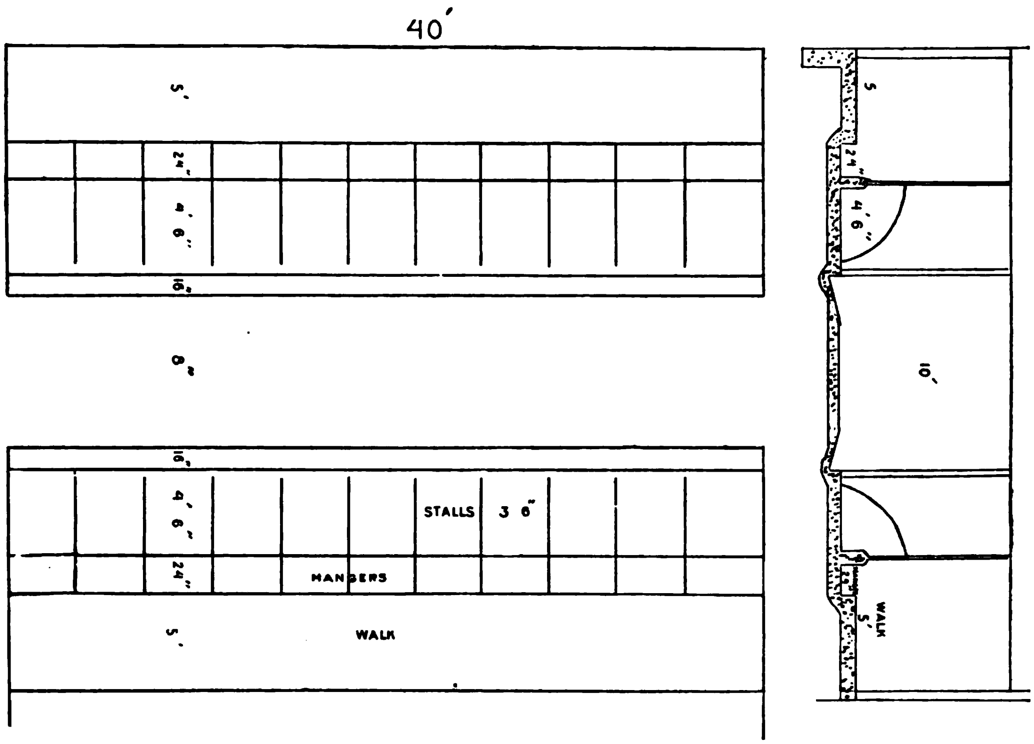


FIG. 358. BARN FOR COWS AND SHEEP (FLOOR ARRANGEMENT).

POULTRY HOUSES.

Too often the location of poultry houses is thought to be of minor importance and consequently is given less consideration than any other farm building. Frequently the other buildings are located first and the poultry house then placed on the most convenient space, when it should have received consideration before the larger buildings were all located.

In caring for the various classes of live stock the question of labor is always an important item, and the class that requires the closest attention to petty details as a rule requires the greatest amount of labor. As poultry-keeping is wholly a business of details the economy of labor in performing the necessary work is of great importance. Buildings not conveniently located and arranged become expensive on account of unnecessary labor.

As it is necessary to visit poultry houses several times each day in the year convenience is of more importance than in case of almost any other farm building. The operations must be performed frequently, so that any little inconvenience in the arrangements of the buildings will cause not only extra expense in the care but in many cases a greater or less neglect of work that should be done carefully each day.

Poultry houses are likely to be more or less infested with rats and mice unless some means are provided to exclude them, and this should be taken into account in selecting a location. It is generally best to locate the poultry house at some distance from other farm buildings, especially if grain is kept in the latter. Convenience of access and freedom from vermin are two desirable points to be secured, and they depend largely on the location. Everything considered it is best to isolate the house.

A dry, porous soil is always to be preferred as a site for buildings and yards. Cleanliness and freedom from moisture must be secured if the greatest success is to be attained. Without doubt filth and moisture are the causes, either directly or indirectly, of the majority of poultry diseases, and form the stumbling block which brings discouragement and failure to many amateurs. It must not be inferred that poultry cannot be successfully raised and profitably kept on heavy soils, for abundant proof to the contrary is readily furnished by successful poultrymen who have to contend with this kind of land. The necessity for cleanliness, however, is not disputed by those who have had extended experience in caring for fowls, particularly the less hardy breeds. That an open, porous soil can be kept comparatively clean with much less labor than a clay soil will be evident to those who are at all acquainted with the habits of domesticated fowls. When the fowls are confined in buildings and yards that part of the yard nearest the buildings will become more or less filthy from the droppings and continual tramping to which it is subjected. A heavy or clayey soil not only retains all of the manure on the surface, but by retarding percolation at times of frequent showers aids materially in giving to the whole surface a complete coating of filth. If a knoll or ridge can be selected where natural drainage is perfect the ideal condition will be nearly approached. Where natural favorable conditions as to drainage do not exist thorough under-drainage will go a long way toward making the necessary amends to insure success.

The material to be used in the construction and the manner of building will necessarily be governed largely by the climatic conditions. In general it may be said that the house should provide warm, dry, well lighted and well ventilated quarters for the fowls. In order to meet these requirements it will be necessary to provide a good roof with side walls more or less impervious to moisture and cold, suitable arrangements for lighting and ventilating and some means for excluding the moisture from beneath. Where permanent buildings are to be erected some provision should be made to exclude rats and mice, and for this reason if for no other the structure should be placed on cement walls with foundation below the frost line. Cheap, efficient walls may be made of small field stone in the following manner: Dig trenches for the walls below the frost line; drive two rows of stakes in the trenches, one row at each side of the trench and board inside of the stakes. The boards simply hold the stones and cement in place until the cement hardens. Rough and uneven boards will answer every purpose except for the top ones, which should have the upper edge straight and be placed level to determine the top of the wall. Place two or three layers of stone in the bottom of the trench, put on cement mixed rather thin and pound down; repeat this operation until the desired height is obtained. The top of the wall can be smoothed off with a trowel or ditching spade and left until the cement becomes hard, when it will be ready for the building. The boards at the sides may be removed if desirable at any time after the cement becomes hard.

For the colder latitudes a house with hollow or double side walls is to be preferred on many accounts, although a solid wall may prove quite satisfactory, particularly if the building is in the hands of a skilled poultryman. Imperfect buildings and appliances when under the management of skilled and experienced men are not the hindrances that they would be to the amateur. Buildings with hollow side walls are warmer in winter and cooler in summer, with less frost in severe weather and less resulting moisture when the temperature moderates sufficiently to melt the frost from the walls and roof of the house.

A cheap efficient house may be made of two thicknesses of rough inch lumber for the side and end walls. This siding should be put on vertically, with good quality of tarred building paper between. In constructing a building of this kind it is usually best to nail on the inner layer of boards first, then put on the outside of this layer the building paper in such a manner that the whole surface is covered. Where the edges of the paper meet a liberal lap should be given, the object being to prevent as far as possible draughts of air in severe weather. Nail the second thickness of boards on the building paper so as to break joints in the two boardings. In selecting lumber for siding it is best to choose boards of a uniform width to facilitate the breaking of joints.

In constructing a roof for a house in the colder latitudes one of two courses must be pursued: either to ceil the inside with some material to exclude draughts or to place the roof boards close together and cover thoroughly with tarred paper before shingling. The ordinary shingle roof is too open for windy weather when the mercury is at or below the zero mark. The fowls will endure severe weather without suffering from frosted combs or wattles if there are no draughts of air. Hens will lay well during the winter months if the houses are warm enough so that the single-comb varieties do not suffer from frostbite. Whenever the combs or wattles are frozen the loss in decreased egg production cannot be other than serious.

Fig. 359 represents a cheap and efficient method of building a poultry house with a hollow side wall. The sill may be a 2″ x 6″ or 2″ x 8″ scantling, laid flat on the wall or foundation; a 2″ x 2″ strip is nailed at the outer edge to give the size of the space between the boards which constitute the side walls. A 2″ x 3″ scantling set edgewise forms the plate and to this the boards of the side walls are nailed. These boards may be of rough lumber if economy in building is desired. If so the inner board should be nailed on first and covered with tarred building paper on the side that will come within the hollow wall when the building is completed. This building paper is to be held in place with laths or strips of thin boards. If only small nails or tacks are used the paper will tear around the nail heads when damp and will not stay in place.

The cracks between the boards of the outside boarding may be covered with inexpensive battens if they are nailed at frequent intervals with small nails. Ordinary building laths will answer this purpose admirably and will last many years, although they are not so durable as heavier and more expensive strips. The tarred paper on the inside boarding and the

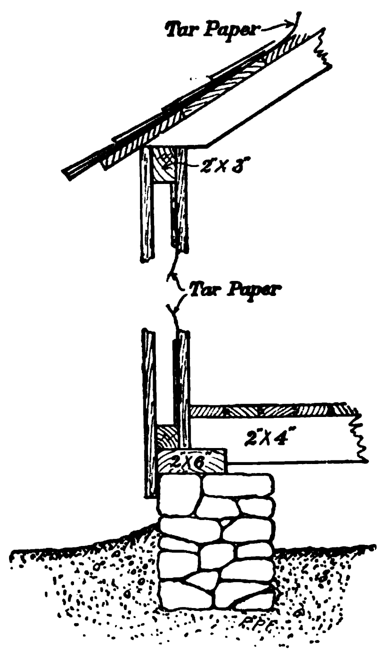


FIG. 359. HOLLOW WALLS AND FOUNDATION.

battens on the outside make two walls, each impervious to wind, with an air space between them.

In preparing plans for a building one of the first questions to be decided is the size and form of the house. If the buildings are made with the corners right angles there is no form so economical as a square building. This form will inclose more square feet of floor space for a given amount of lumber than any other, but for some reasons a square building is not so well adapted for fowls as one that is much longer than wide. It is essential to have the different pens or divisions in the house so arranged that each one will receive as much sunlight as possible, and to secure this some sacrifice in economy of building must be made.

Many poultrymen prefer a building one story high and not less than 10′ nor more than 14′ wide and as long as circumstances require. In most cases a building 30′ to 60′ long meets all requirements. If this does not give room enough it is better to construct other buildings than extend one building more than 60′. It must be remembered that each pen in the building should have a separate yard or run and that a pen should not be made to accommodate more than 50 fowls, or better 30 to 40.

The building should extend nearly east and west in order that as much sunshine as possible may be admitted through windows on the south side. The windows should not be large nor more than one to every 8′ or 10′ in length for a house 12′ wide, and about 17″ from the floor, or at such height that as much sunshine as possible will be thrown on the floor. The size and form of the windows will determine quite largely their location. In all poultry houses in cold latitudes the windows should be placed in such position that they will give the most sunlight on the floor during the severe winter months. One of the common mistakes is in putting in too many windows. While a building that admits plenty of sunlight in winter time is desirable, a cold one is equally undesirable, and windows are a source of radiation at night unless shutters or curtains are provided. Sliding windows are preferred on many accounts. They can be partially opened for ventilation on warm days. The base or rail on which the window slides should be made of several pieces fastened an inch or so apart, through which openings the dirt that is sure to accumulate in poultry houses may drop and insure free movement of the window.

Some means of ventilating the building should be provided. A ventilator that can be opened and closed at the will of the attendant will give good results if given proper attention, and without attention no ventilator will give best results. All ventilators that are in continuous operation either give too much ventilation at night or too little during the warm parts of the day. Ventilators are not needed in severe cold weather, but during the first warm days of early spring and whenever the temperature rises above the freezing point during the winter months some ventilation should be provided. Houses with single walls will become quite frosty on the inside during severe weather, which will cause considerable dampness whenever the temperature rises sufficiently to thaw out all the frost of the side walls and roof. At this time a ventilator is most needed.

A ventilator in the highest part of the roof that can be closed tightly by means of cords or chains answers the purpose admirably and may be constructed with little expense. The ease and convenience of operation are important points and should not be neglected when the building is being constructed. It is a simple matter for the attendant to open or close a ventilator as he passes through the house if the

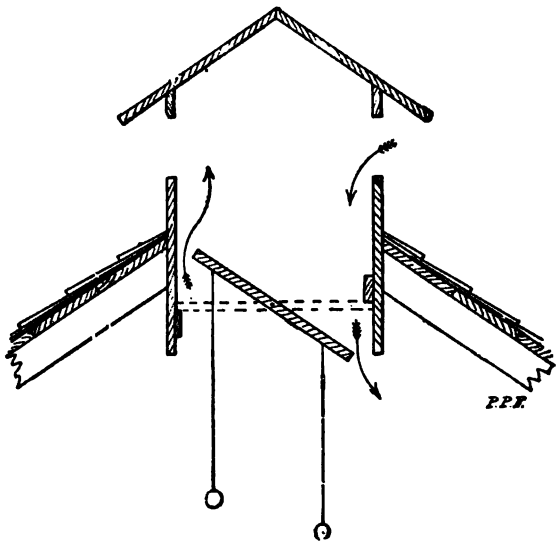


FIG. 360. VENTILATION CONSTRUCTION.

appliances for operating it are within easy reach. *Fig. 360* represents an efficient and easily operated ventilator.

Perches should not be more than 2½′ from the floor and should be all of the same height. Many fowls prefer to perch as far above the ground as possible in order without doubt to be more secure from their natural enemies; but when fowls are protected artificially from skunks, minks and foxes, a low perch is just as safe and a great deal better for the heavy-bodied fowls. It must be borne in mind that the distance given at which perches should be placed from the floor applies to all breeds of fowls. It is true that some of the Mediterranean fowls would not in any way be injured in flying to and from the perches, but some of the heavy breeds would find it almost impossible to reach high perches and would sustain positive injuries in alighting on the floor from any considerable elevation. Convenient walks or ladders can be constructed which will enable the large fowls to approach the perches without great effort, but there are always times when even the most clumsy fowls will attempt to fly from the perch to the floor and come down with a heavy thud, which is often injurious. And furthermore ladders or stairs for the easy ascent of fowls are more or less of a nuisance in the poultry house. The ideal interior arrangement of the house is to have everything that is needed in as simple a form as possible and not to complicate the arrangement by any unnecessary apparatus. The fewer and simpler the interior arrangements the easier the house can be kept clean and the greater the floor space available for the fowls.

Underneath the perches should always be placed a smooth platform to catch the droppings. This is necessary for two reasons: The droppings are valuable for fertilizing purposes and should not be mixed with the litter on the floor; then, too, if the droppings are kept separate and in a convenient place to remove it is much easier to keep the house clean than when they are allowed to become more or less scattered by the tramping and scratching of fowls. The distance of the platform from the perch will be governed somewhat by the means employed for removing the droppings. If a broad iron shovel with a tolerably straight handle is used the space between the platform and perches need not be more than 6″. The droppings should be removed every day.

WARM AND DRY POULTRY HOUSES.

Freedom from dampness is of great importance and the matter of lighting should never be forgotten, for on these two things depend success in poultry keeping. In constructing a poultry house great care should be taken to make it wind-proof. The outer walls should be absolutely tight, in order to prevent draughts from entering even during high winds. If we can prevent the circulation of air currents when the doors and windows are closed we overcome one great obstacle to making fowls comfortable. This means that doors and windows should be well fitted and that walls should be covered with some material which makes them perfectly tight.

Poultrymen began by putting stoves and other methods of heating in their poultry houses. This was found to be a sad failure, for hens kept in a heated house were invariably falling prey to roup and other catarrhal diseases. Then double walls of various kinds were tried from common lath and plaster to elaborately constructed walls with positive dead air spaces between. Gradually poultrymen modified the walls of their poultry houses until now the double wall is almost unknown in some communities, and is exceedingly rare in a poultry house where only practical value is sought.

A poultry house that is built with a shed roof has sides of common barn lumber, the roof being of the same material. This house faces to the south, has a shed roof and is 7½′ high on the highest side, the lower side being 18″ lower. The roof, the north side and both ends are covered with a good quality of building paper, such as is made for outside use. The whole front is simply heavy muslin, commonly called sheeting. This muslin is tacked on two frames which are hinged to the plate at the top so they can be swung inwardly and hooked up next the roof. A wire netting screen prevents the fowls from getting out and enemies from getting in when the muslin windows or sides are swung up. In this house chickens are kept and lay regularly all the time, although the temperature may be down to 26° below zero more than once. The owner says he put curtain front perches in, but found they were not needed, as his hens seemed perfectly comfortable without them.

The curtain front for perches was a great invention. One man says he has kept Brown Leghorn hens, which are supposed to be particularly susceptible to cold, in a house which was not even paper-covered, without any of them being touched by the frost of a very hard winter by providing curtain front perches for them. Any one can arrange curtain fronts for perches without trouble. The curtains are merely common burlap hung from the roof so as to enclose the perches in a little room. The curtains should be long enough to touch the floor all around and the edges of the burlap should be sewed together except at the corners, and the corners should be pinned together at night. This little sleeping room surrounded by burlap walls lets the air through without allowing draughts to be created, and at the same time retains the animal heat from the bodies of the hens so as to maintain a perfectly comfortable temperature in the coldest weather. During the day the curtain may be fastened to the roof. The hens will soon learn to crawl out under the bottom in the morning.

High cold winds affect fowls more than does low temperature. If the air is still do not hesitate to turn hens out any day when the temperature is not lower than ten above zero. In very severe weather keep them in the house, often for several days, giving them opportunity to get exercise by scratching for grain in a deep layer of straw on the floor. In the cloth front house the question of dampness is settled. Such a house, if built in a dry place, never becomes damp. Where glass windows are used and the house is tight there will be some dampness, which will show on the walls as frost in cold weather.

Various systems of ventilation have been devised to overcome dampness, but all ventilators create a draught if they ventilate. A good plan is to open the windows during days when the sun shines. This can be done without danger during the daytime, and an hour or two of open windows in the middle of the day will dissipate any dampness that arises from the breathing of the fowls. The windows should be opened only two or three inches, just enough to create a little current through the house.

Some New York poultrymen, who must contend with much cold weather, build their poultry houses high enough to put in a ceiling, leaving a small loft overhead. The ceiling is made of 3″ boards laid about 1″ apart. The loft is then filled with straw. This allows the air to circulate in such a manner that no draught is created and the straw absorbs the dampness very perfectly. One such house has double walls with 4″ between and the outside is made of lap siding with paper inside and the inside with ceiling lumber lined with paper. Such a house well made is frost-proof and free from dampness, but quite costly.

A CONVENIENT POULTRY HOUSE.

Fig. 361 shows a very convenient poultry house that is 28′ long and 20′ wide with alley 4′ wide running lengthwise through the center. The house is divided into eight rooms, four on each side of the aisle, leaving a space 7′ x 8′ for each room. The 6″ x 6″ sills can be used laid on stone or blocks set in the ground. Use 4″ x 4″ for up-and-down studding spiked 2½′ apart on top of the sills. Use 2″ x 6″ for floor joists 20′ long, spiked to up-and-down posts. Floor with common inch flooring or cement. The center posts, 4″ x 4″, are spiked on top of sills 4′ apart each way, leaving a 4′ aisle through the center of house. The plates on top of the posts and the rafters are 2″ x 4″. Drop siding is best for the studding. The roof is sheeted and shingled. The inside of the house should be plastered with cement plaster. When plastered it is easy to exterminate lice or mites and the plastering can be easily whitewashed and swept off clean.

The partitions and inside doors should all be wire poultry netting fastened on strong frames so that all can be removed when the breeding season is over and the whole house be used in one or two parts, one on each side. Roosts to perch on are not generally used in this house where the large breeds are kept. The floor covered with clean straw 3″ or 4″ thick makes a good roost for large breeds. It is claimed they will do better and never have bumble foot. The straw should be swept out once a week and fresh straw supplied.

The windows may be of any suitable size. The upper windows are half as large as the lower ones. No more windows should be used than the diagram shows, as too much glass light is said to be injurious to poultry.

The yards outside should be 10′ wide and at least 100′ long. To get four yards 10′ on each side of the house the corner pens must be brought out 6′ on each corner of house. This leaves 4′ of the house for each of the outside pens. These pens should also be bedded with straw or litter of some kind from 3″ to 5″ deep and all grain fed should be strewn in this to make the hens work most of their time.

A SUMMER HEN HOUSE.

A practice in some communities is to close up the winter quarters of fowls and compel them to seek shelter elsewhere during the hot summer weather, the object being to rid the

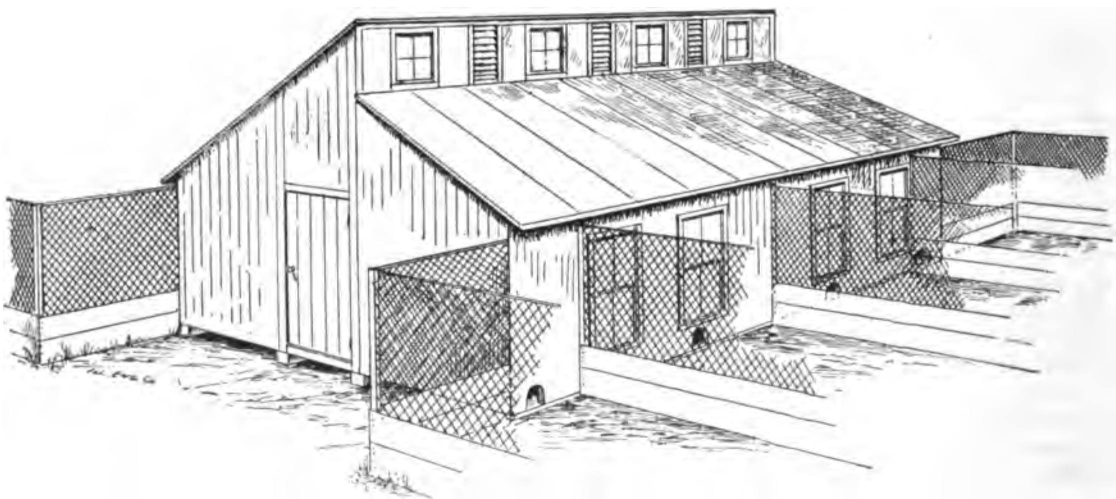


FIG. 361. CONVENIENT POULTRY HOUSE (ELEVATION AND YARDS).

house of vermin, avoid further care of the fowls and give the poultry a cooler roosting place. Those who thus close the hen houses up and turn the poultry out make the mistake of not providing other quarters. The poultry will to some extent take to the trees and this will teach the young fowls to roost there, which not only exposes them to danger during the night but renders it difficult to accustom them to going into a house when fall approaches.

A poultry house is illustrated in *Fig. 362* that has the advantage of being quickly and easily constructed adjacent to the regular house or apart from it, and will serve the purpose of a protection to the fowls during the night almost as effectually as though they were shut in winter quarters under lock and key, provided always that the lock is also applied to the latter.

Its general plan of construction is shown quite plainly in the halftone. It has a shed roof and stands with an end to the other poultry house. The back and the other end are sided with rough lumber. The front is left almost entirely open save for the covering of poultry netting, which serves the purpose of a front and yet it is perfectly open to the air. There is also a door by which the structure may be entered independently of the regular house. The summer house should include an exit other than the regular door for the poultry. After such a house has served its purpose for a summer shelter it still has a further usefulness during the winter as a combination scratching shed and sunning place for the poultry. With this end in view the shed should be closely attached to the regular poultry house. Whether the house is to be used for summer or for both summer and winter, it should have a water-tight roof.

FIG. 362. SUMMER HENHOUSE (ELEVATION).

A SMALL INEXPENSIVE HEN HOUSE.

A cheap and convenient poultry house that can be built by any farmer is illustrated in *Fig. 363.* The building is 10′ x 24′ and should stand facing the south. The sides and ends can be made of rough boards and the cracks battened with laths or strips inside and out, or matched boards can be used and lined inside with building paper. It can be made any height desired and the roof can be made of shingles or matched and grooved boards well painted. *Fig. 363* gives an end view of the inside. A partition should extend the full length 4′ from the north side. This will make an entry (*A*) 6′ x 24′ and a room (*B*) 4′ x 24′, which can be made in two pens 6′ x 12′ if desired. *C* is a movable floor with two roosting poles attached. *D* indicates nest boxes, extending into the entry, with lids so eggs can be gathered without going inside the pen. *E* is a cleated board leading to the nests. The

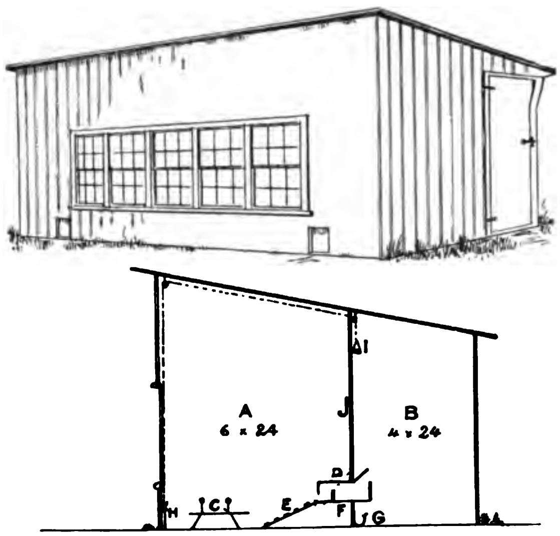


FIG. 363. SMALL INEXPENSIVE HEN HOUSE.

space *F* is made of slats so fowls can reach through to the drinking trough *G*. *H* is a sliding door for the ingress and egress of fowls, which can be opened and closed from entry by means of a cord. *I J* is a door leading from the entry to the pen.

AN ILLINOIS POULTRY HOUSE.

The poultry house shown in *Fig. 364* is 7′ x 16′ and 7′ high at the front side and 4′ at the back, with a shed roof. It may be built of 2″ x 4″ for frame, covered with common rough or dressed boards and battened on the outside with planed or rough battens. Shingles are better for roof than tarred paper, which does not make a durable roof. To make it warm the house should be lined inside with tarred paper and should have at least two 9″ x 13″ six-light windows in the south side near the center of the building. A half dozen flat stones may be used for a foundation just set even with the surface so as to allow the sills to clear the ground. Gravel or cinders to the depth of 6″ may be used for floor. All surface water in winter and early spring should be kept out. The gravel or cinders may be covered with sand so as to make a smooth surface.

The roosts should be built on the north side of inch boards cut into 4″ strips and should have the edges made rounding and set flat side down in notches cut in brackets extending from the back side of the coop. The perches are 2½′ above the floor and under them is suspended a platform to receive the droppings, which can be easily removed every morning or twice a week. The floor can be kept clean by using a common garden rake and raking up all the droppings that may be scattered during the day. The material for the house shown in *Fig. 364* costs, exclusive of floor and paint, about $12.

To build the yards connected with the house set posts 12′ apart and board up 2′ from the ground with common rough 12″ boards; then above that use 2″ mesh poultry netting 36″ wide. This makes a fence 5′ high and no fowl except some of the small breeds will ever fly over it. The boards at the bottom are to keep cocks from fighting through the fence. If desired this house can be used for breeding fowls to accommodate two yards for 12 fowls each by

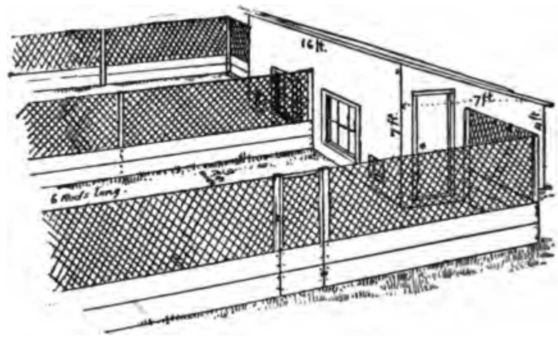


FIG. 364. ILLINOIS POULTRY HOUSE AND YARDS.

running a partition through the center and having each yard connect with one end of the house. The yard should be 50′ wide and 100′ long, north and south, with north end connecting with the house. If a large number of fowls is to be kept a number of these houses can be built in a row, all facing the south, far enough apart to admit of the runs or yards being built 50′ wide. In this case a tight fence can be built between the houses on the north side to keep the cold wind from the fowls.

A HOUSE WITH SECRET NESTS.

The poultry house shown in *Fig. 365* has some good points about it not generally used. It accommodates 100 hens and is 20′ long, 12′ wide and 12′ high at the back side. It has a dirt-proof roosting floor running from the top of the back side to near the bottom of the front. This floor is made of cheap flooring boards and lacks 2′ of being the full length of the building. This space allows one to pass from the house proper to the perches, which are placed along on the upper side of this slanting floor far enough apart to be perfectly clear of each other, the droppings rolling down in front of and outside the building. Underneath the bottom of this floor is made a run extending half way across the width of the building. The top of the run is intended for nests. At the bottom of the back are two rows of secret nests. Make a number of windows in the south and at least two in the back. The perches should not come nearer than 6" of the slanting floor and should be easy

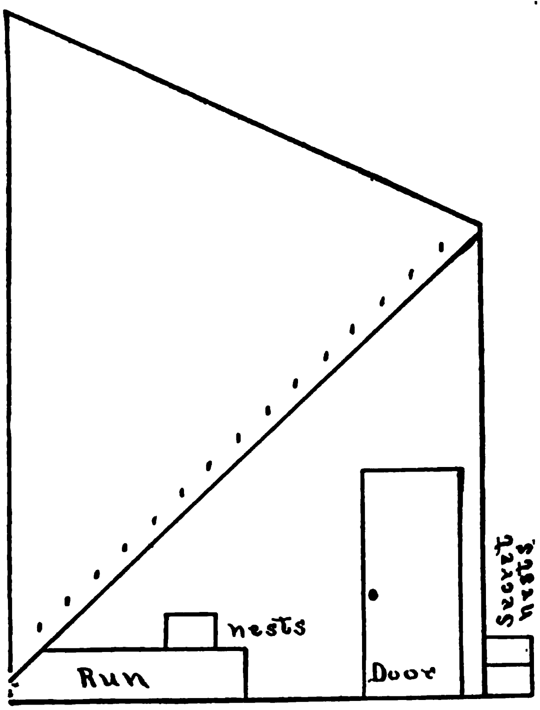


FIG. 365. HOUSE WITH SECRET NESTS.

to remove for cleaning and whitewashing as often as desired. All nests should be movable, one at a time if wanted. An earthen or cement floor may be used. At the bottom of the perches lay a flat board on which to walk.

The secret nests open on the inside, but are built on the outside. Chickens enter at the door and a small open window which is made above the slanting floor at the back end. The opening at the bottom of the slanting floor is about 6" in the clear. The building faces south and has the door or entryway in the east. The double row of secret nests is to the right. Another row of nests is made to the left. These nests are built upon the run, which is open only under the south side of the building. The upper half of the south side is made chiefly of glass.

A SIMPLE TYPE OF HENHOUSE.

One of the essential characteristics of a model poultry house is that it shall not be too expensive to be within the reach of the average farmer. Another essential is that it be warm and another that it be well lighted. The illustration (*Fig. 366*) very nearly explains itself. The front of the house should face the south. It is 10' high in front and 6' in the rear. With a width of 12' the house may be built of 16' boards without waste. No frame is needed except the horizontal girts. Braces should be cut and nailed diagonally to stiffen the building. Put several windows in the front to let in sunlight in winter. All roosts should be on the same level or there will be endless rivalry for

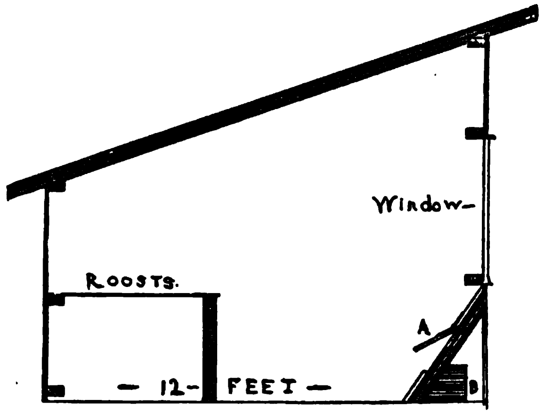


FIG. 366. SIMPLE TYPE OF HEN HOUSE.

high perches. Along the front put the nests. *A* is a hinged board that may be lifted to gather the eggs. *B* is the alleyway through which the hens pass to their nests.

The house may be built 12' x 20' for 100 hens.

HOUSE FOR 150 HENS.

The house shown in *Fig. 367* for 150 hens may be divided into five departments. A good width is 15'. Make a scratching room where the exercise will be had and the food given in deep, dry litter 15' square. Next this is a roosting apartment 5' x 15'. Then make another roosting room for the second pen, then another scratching room and so on the length of the house, which in this plan is 15' x 100'. Let the roof slope from front to rear, the house 5' high at the rear and 8' in front with glass at the scratching room to cover at least a fourth of the space. Let the sun in. Have the glass in front of the scratching sheds so that the windows may open on hinges and the fowls be restrained by wire.

Take the foul air out by means of galvanized iron pipes (with dampers) 6" in diameter running up through the roof and opening near the ground to admit the colder and fouler air from near the floor. Let the roosts be easily removable and all on the same level. Turn the glass side toward the sun. Make the house tight and

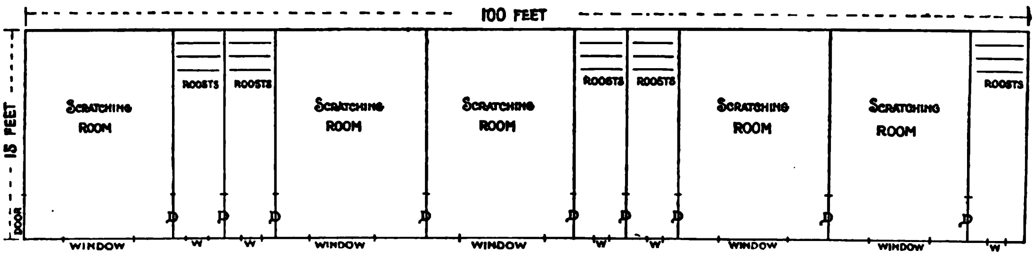


FIG. 367. HOUSE FOR 150 HENS (ARRANGEMENT).

warm by double boarding and tarred paper. Put in a cement floor. The partitions may be made of wire. The doors should swing on double-acting spring hinges so that one may go rapidly through them in either direction.

A PRACTICAL HENHOUSE.

The poultry house shown in *Fig. 368* has a shed roof and faces the south. This house may be 10′ wide and as long as desired to accommodate the number of chickens kept. The scratching shed is in the center of the building and

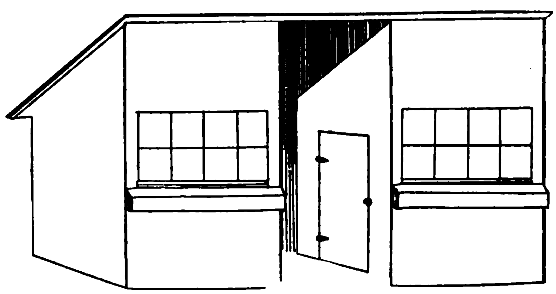


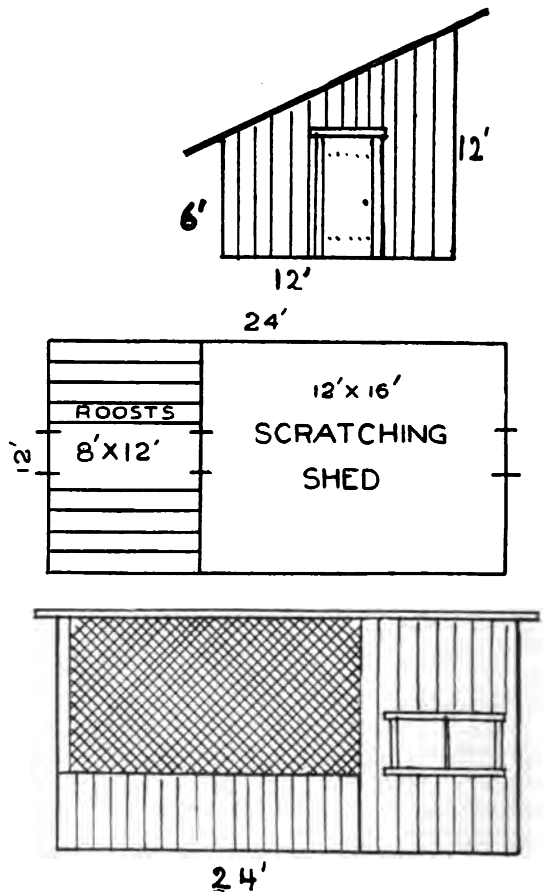
FIG. 368. A PRACTICAL HENHOUSE.

communicates with each room by means of doors, which may be locked at night, thus allowing the chickens to be confined at night.

The roof projects over the south, east and west sides 1′ and is raised 5″ higher than the siding, allowing free ventilation. Two very large windows admit light and warmth. Extending the entire length of each room is a laying box, divided into compartments and covered with a hinged lid, allowing the eggs to be gathered by simply raising the lid in passing along on the outside. Two rooms built in this way are much better than one, because very often one class of fowls should be separated from the rest. The floor should be tight and be cleaned weekly. The inner side of walls should be whitewashed frequently, as the lime will cause vermin to seek other quarters.

A FARM POULTRY HOUSE.

This building (*Figs. 369* to *371*) accommodates from 50 to 75 fowls. Face it to the south to admit the sun; make the sleeping quarters warm; provide an open wire-enclosed front for the scratching shed when built in the cornbelt or, further south, make the floors of earth and keep them well littered; make the roosts movable and not to touch the walls. Farm poultry should not be confined except occasionally; the scratching shed affords opportunity for occasional confinement.



FIGS. 369, 370 AND 371. A FARM POULTRY HOUSE.

A HOUSE SERVING TWO YARDS.

Fig. 372 represents the south side and west end of a henhouse 10′ wide and 20′ long, di-

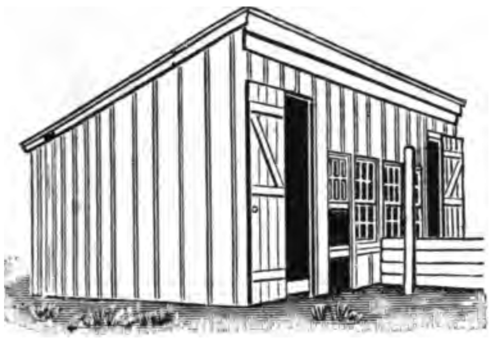


FIG. 372. A HOUSE SERVING TWO YARDS.

FIG. 373. A HOUSE SERVING TWO YARDS.

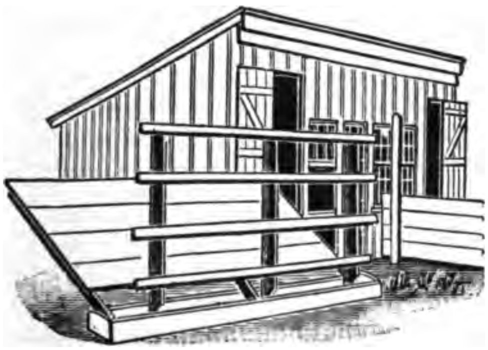


FIG. 374. A HOUSE SERVING TWO YARDS.

FIG. 375. A HOUSE SERVING TWO YARDS.

vided into two rooms by a partition of wire netting. This building serves two yards, as the middle fence between the two yards joins up to the center of the building at the front and back. *Fig. 373* represents the platform and perches removed from the house to the outside, in order to get a good view of it. It stands on the outside in the same position as if in use on the inside. *Fig. 374* represents the perches as raised up against the wall in cleaning, to a perpendicular position. *Fig. 375* represents the perches and platform raised to a perpendicular position for the purpose of cleaning out the trough.

MONTANA POULTRY BUILDING.

Figs. 376 to *379* represent plans of the new poultry building at the Montana Experiment Station. It is a model design and comparatively

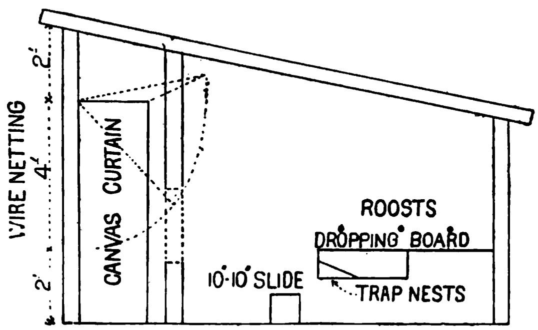


FIG. 376. MONTANA POULTRY BUILDING (END SECTION).

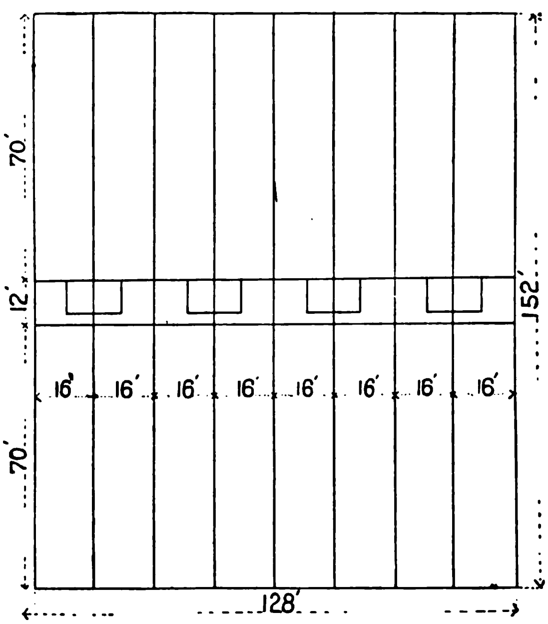


FIG. 377. MONTANA POULTRY BUILDING (FLOOR).

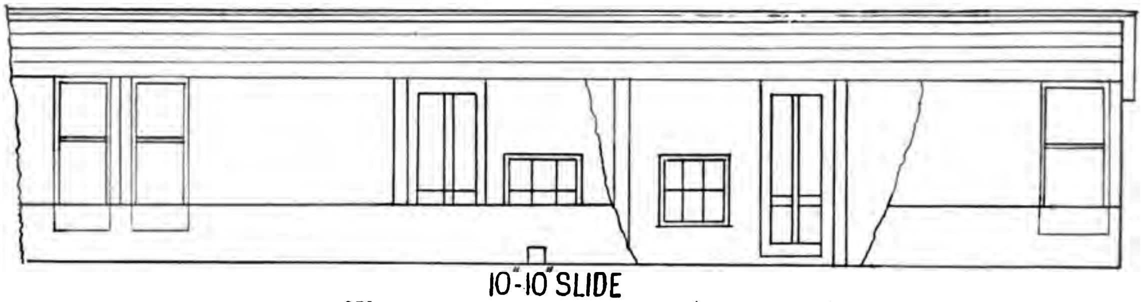


FIG. 378. MONTANA POULTRY BUILDING (SIDE SECTION).

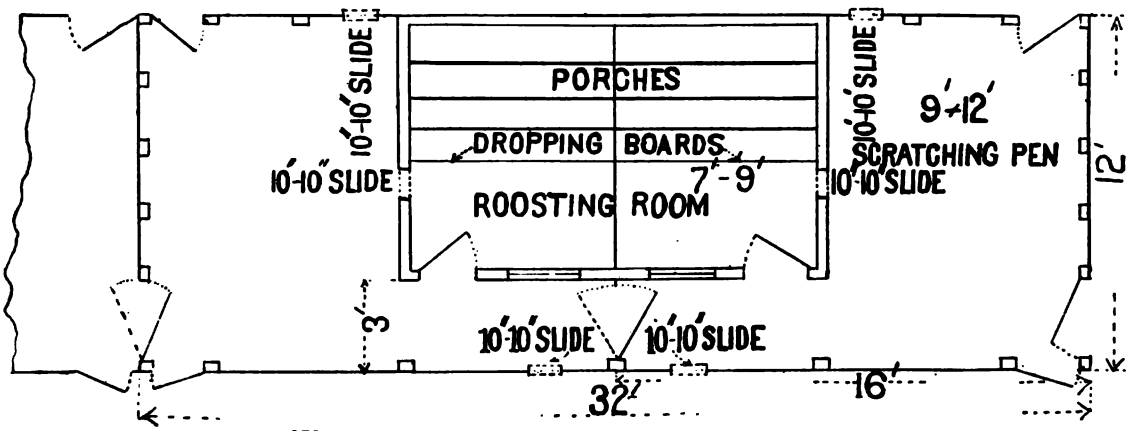


FIG. 379. MONTANA POULTRY BUILDING (INTERIOR ARRANGEMENT).

inexpensive. This house is built with an open curtain front, scratching shed and a roosting room that may be closed up snugly in cold weather. The outside walls at the back and ends are boarded with rough lumber on the studding, then tarred paper and on this rustic siding. Two roosting pens are built together and are divided by a single board partition. The outside walls of the roosting pen have tar paper and shiplap on each side of the studding. The roof of the roosting pen is, first, tar paper on the rafters and then ceiled with shiplap. This gives quite a warm pen and the birds are kept in good health even in the coldest weather.

A MINNESOTA POULTRY HOUSE.

Figs. 380 to *383* give a good idea of the poultry house at the Northwest Experimental Farm in Polk County, Minn. Such a house can be built at moderate cost for size and has been found to be very convenient and satisfactory for raising and handling poultry in Minnesota. The arrangement of yards, nests, roosts, feed bins and colony houses will be readily understood from the pictures submitted herewith. The colony houses are eight in number and are constructed so as to be movable. They are built of matched flooring and covered with a patent paper. They

FIG. 380. MINNESOTA POULTRY HOUSE (ELEVATIONS).

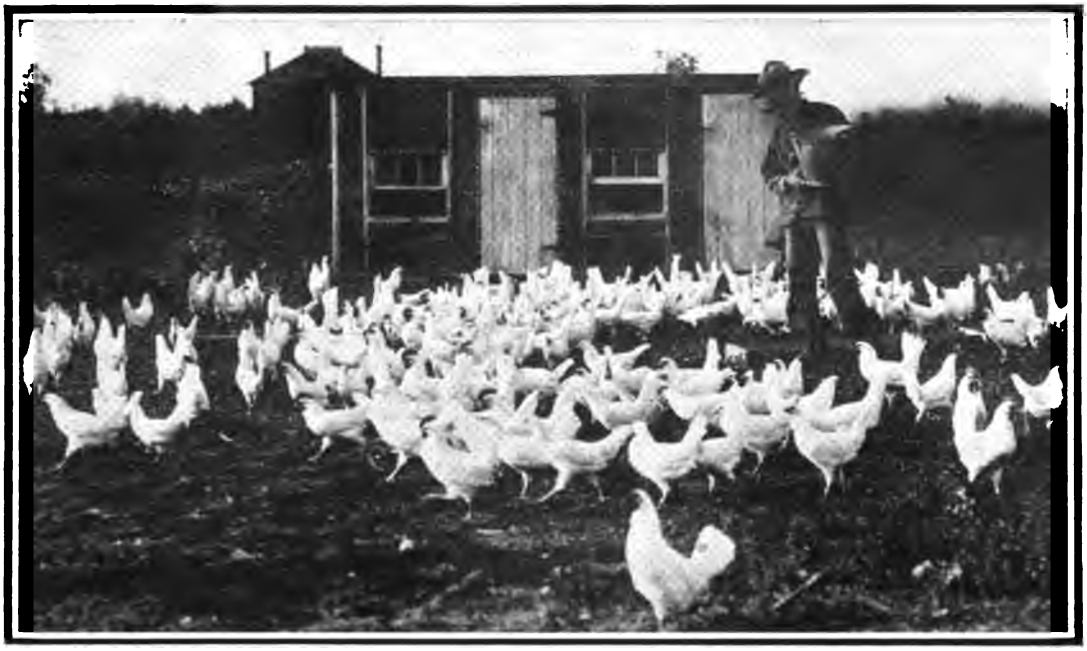


FIG. 381. MINNESOTA POULTRY HOUSE (COLONY DEPARTMENT).

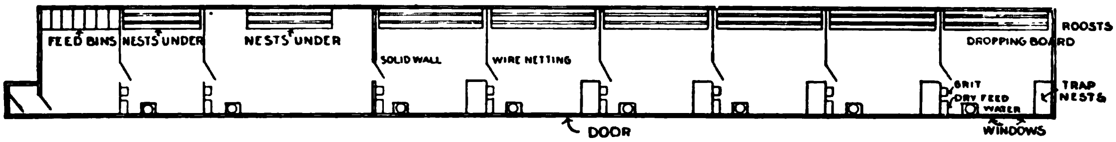


FIG. 382. MINNESOTA POULTRY HOUSE (ARRANGEMENT).

are 6′ x 12′ in size and set on 4″ x 4″ runners. Their height is 3′ at lowest point, 5′ at highest. The dimensions of the main house are 16′ x 148′ and it is 4′ 6″ high at lowest point and 7′ 6″ at highest. The entire plant consists of the principal poultry house, a brick incubator cellar 16′ x 16′, and eight colony houses.

COLONY HOUSE FOR A DOZEN HENS.

A poultry farmer thus describes the henhouse shown in *Fig. 383:* "The open end faces south and 2″ mesh poultry netting encloses the porch-like space which is supported by posts. The series of houses, of which the picture represents one of the units, cost about $15 each, but the expense was not spared in building them. Houses could be built on this plan for much less than these cost. The enclosed north end has a floor in it, but the open-air part has not. The size is 6′ x 6′ on the ground and the peak of the roof is 6′ high. The door is in the south end, as shown in the picture. This plan gives shade, abundance of fresh air and the enclosed space is protected from rains. The owner has used his houses built on this plan for Wyandottes during the winter. To make winter houses of them he simply stands cornstalks on the east and west sides and part of the south, keeping them in

FIG. 383. COLONY HOUSE FOR A DOZEN HENS.

place with a light shingling lath frame. The open space at the door and the windows, one of which is shown in the picture, give light and air."

CONCRETE CONSTRUCTION.

CEMENT—CONCRETE.

Concrete is artificial stone made from broken stone, gravel or sand, or a combination of these united by the use of cement. Cements are of several kinds; some are made from natural rocks in which there is found a right combination of lime and other material; these rocks are burned, ground, then used by wetting and allowing to harden again. The so-called "natural" cements are not usually as good for work requiring strength or durability in situations exposed to water and frost as the other class of cements called "Portland."

The name Portland has not now reference to the place of manufacture, but merely defines the composition of a cement. Portland cements are usually made by the union of lime and clay, burned together, then ground finely. Some cements are made from natural mixtures of marl, some from slag, a byproduct of steel plants. All have approximately the same chemical formation, and in making Portland cements expert chemists are employed to watch the mixtures and see that no variation from the standard is allowed. Portland cement, well made, when rightly mixed with sand, broken stone or gravel, makes an artificial stone impervious to moisture, is uninjured by freezing, and bids fair to be as durable as good stone. It has the immense advantage of being easily moulded into any desired form and thus comes to the aid of the farmer in a multitude of ways.

Good concrete is an artificial stone in which there are no voids, that is, no unfilled spaces, and where each grain of sand or fine material is coated with a thin film of cement, uniting it to the adjacent bit of material. Concrete so made is ideal, and will endure as long, no doubt, as good stone. It is made by right mechanical mixture of materials and right assorting of materials. If clean pit gravel is used it may be found that nature has mixed the ingredients fairly well, since between the larger pebbles there will be an admixture of smaller pebbles and sand. The remaining voids or open spaces now need only to be filled with cement, which from its finely ground condition is well suited for filling these minute spaces, and water added enough to moisten the mass, when it will make a perfectly solid stone.

How does the union of these materials take place? It is not very well understood how cements "set" and harden, but it seems that the small particles of cement when wet partially dissolve and as they "set" they assume crystalline forms and throw out little protuberances which fill all inequalities and pores and rough places in whatever material is next them, and thus get hold and hang on. They may also dissolve, or at least soften, the surface of other hard materials next them, and thus unite in a measure with these materials, for it is well known that cement will adhere tenaciously to smooth stone and even to glass itself. It is readily seen that when cements are setting, or hardening, and the little crystals are forming and getting hold, no motion or disturbance whatever is permissible, else all strength will be destroyed. The time of setting varies; the first set may occur in a few hours, during warm weather; in a day or two during cooler weather, and from that time on the work proceeds cumulatively for a week or ten days, when there is a fair degree of hardness, and for another month the strength increases. It may be said as a general rule that in 45 days concrete has gained its working strength, though it will yet continue to gain for some weeks or even months, varying with the cement used and the conditions under which it is used.

Concrete should not get prematurely dry while it is setting, as when it is dry the process of crystallization ceases, and it is not usually possible to start it again by subsequent wetting. Concrete is often ruined by its not being kept moist while this hardening process is going on.

Inferior cement is made when the voids are not nearly filled, when so little cement is used that two particles of sand or of stone come together with no particle of cement between them. Naturally no union can then take place. Inferior concrete is made when the mixing is bad, and too much cement is in one part of the mass and too little in another part. Poor concrete is made when too little water is used and crystallization, or setting, cannot perfectly take place, or too much water and the cement is washed away. Poor concrete is made when the stuff is disturbed after setting, or is allowed to dry out before it hardens. Any such carelessness will result in a soft, crumbling concrete, unsafe in a building and of short usefulness in a pavement. Poor concrete is made by using a great excess of cement, also since it will be the more apt to crack through the natural contraction of cement as it sets. This fault is not often seen.

A man to use concrete should not be above thinking a little, and the work will warrant thought and care. In beginning with new material one should seek to learn what per cent of voids, or empty spaces, is to be filled. If he has a natural gravel to work with it is very desirable that he learn just how much cement is needed to go with it. A coarse gravel, which may be used in heavy work, usually needs less cement than a fine one, and a gravel that has the spaces pretty well filled with finer material—not earth, but pebbles and sharp sand—will need less than one without the right mixture. If there are spaces between the stones of the gravel plainly apparent to the eye it may be well at the outset to try to add some clean, sharp sand, enough to fill the voids in part. One can do this by taking a measure of gravel, adding a part of sand and mixing thoroughly, then testing to see if it will still go into the measure. It it will, or if it only slightly overruns, it is evident that the addition of that amount of finer material has been a clear gain in economy and strength of the finished material.

To determine how much cement is needed as good a test as can be made is to take two measures (they should be cylinders of the same size at top and bottom for convenience of measurement), fill one with gravel, the other with water. The gravel should be fairly dry. Two buckets holding a gallon or more will serve for this test. When filled and shaken slightly, water should be added to the gravel, slowly, from the measure of water. It should be poured in slowly and let the air escape through the mass. When it will take no more water it is pretty nearly full as to voids. Now measure the water vessel and see how much water has been added to the gravel, or sand, or whatever material is being used. For instance, if the vessels are 12" high and you dip from the water vessel and pour into the gravel four inches of water, then one-third of the space occupied by the gravel is void, and to make a good concrete there should be added one measure of cement to three of dry material. If you find that only two inches of water are taken in, then one-sixth of the space is void, and one part of cement will fill voids in six parts of material; that is, it would fill it if mixing was perfect and complete. If it is imperfect more cement will be needed, and it is wise to add a little more than this rule would call for anyway, say 10 per cent more.

With ordinary good pit gravel it has been found that one part of cement with six parts of gravel makes a good concrete for foundation walls, the basis of floors and the like. For surfacing or for fence posts or any work where coarse gravel cannot be used a finer sort is needed and here the proportions will change till as much may be called for as one to three, or even less, of stone to cement. It is well never to guess as to this vital point in concrete making. Here is where most work is spoiled, material and labor wasted and ruin of endeavor made inevitable. As materials vary so much everywhere there is no prescribing for any case unless one can make the test as outlined.

In many regions gravel or crushed stone is not available and sand, sometimes rather fine, is the only material at hand. With fine sand as much as one part of cement to three parts of sand, or perhaps more cement even than that, is sometimes needed to make a good job. Other and coarser sand will give good results with a smaller proportion.

In large masses, for retaining and foundation walls, gravel may have in it stones as large as apples, so there are not too many of them and there is a suitable mixture of finer particles; this coarse stuff insures a harder concrete with a given amount of cement than if they were absent.

Concrete work should not be done in freezing weather if it can be avoided. Frost will prevent the adhesion of the different layers and will cause the surface to peel off and may ruin the job. Salt is frequently used to prevent the freezing of concrete, which it will do if the thermometer does not drop too low. The amount of salt may be 10 per cent of the weight of water used, or 12 pounds of salt to a barrel of cement. It would seem that owing to its affinity for iron salt should not be used in making reinforced concrete. It is also a good plan to heat the sand and water so as to bring the temperature of the fresh mixed concrete to about 75° Fahrenheit, and to protect from frost thereafter as long as possible. Concrete sets much more slowly in cold weather.

The importance of good mixing can hardly be overestimated, and here is where careless, impatient or lazy men fail. Machine mixing is often good, but machines are usually out of the reach of the farmer. Hand-power machines are not worth considering. Shovels are good and fairly rapid in operation, if manned by willing arms.

Prepare a smooth wooden platform on which to mix; it should be, if much concrete is to be made, about 14' long and 8' wide. There need be no sides to it, though if a small platform or floor is used side pieces about 6" high are admissible. Prepare a measuring box for coarse material. This may be 3' x 3', with a depth of 18", inside measure. That will make it hold half a yard, level full. Make no bottom to the box. As one must leave mixing sometimes to men who are apt to forget, it is wise to mark plainly this measuring box with the proportion of cement needed, as thus: "½ cubic yard, two sacks (½ barrel) of cement" or "three sacks (½ barrel) of cement," as the work may require. This may save serious errors in mixing.

To begin, lay the box on the platform and shovel it half full of material. Add half the cement needed. Fill again nearly full, add the rest of the cement and finish filling. Now lift off the box, leaving the pile of material on the platform. Begin with long-handled shovels, lifting this pile and placing it in another place on the platform. Take each shovelful exactly from the bottom of the pile. Place it exactly on the top of the new pile. Continue this operation till all the first pile has been transferred to the new one. Clean it up neatly, else you will not get an even mixture. See to it that each man observes this simple rule to take each shovelful from the very bottom and lift it to the very exact top of the new pile. Experiment will show the sufficient reason for this; each shovelful of material placed on the sharp cone of the new pile rolls down equally on each side and thus there is quite a good mixture right at once. When the old pile is cleaned up begin on the second pile and shovel it all back to the starting point, observing the same rule. When it is all in that pile put it again into another. That gives three shovelings, and by this time it is very well mixed, well enough for ordinary use, though for exceptionally nice work another mixing is advised.

To add the water, a large sprinkling can is the best thing to use, and it should be provided with a hose that lets water out pretty freely. Let one man put on water, all on one side, and another man hoe away the wetted material as fast as it becomes saturated, not ever letting it run down, as that washes the cement off the pebbles and injures the concrete. When it is all wetted a little more water may be worked into it. It is well to make it as wet as it can be without being sloppy, or water standing on it.

Once it was thought that dry mixtures were best, with much ramming. Now most engineers specify pretty wet mixtures and little ramming. As soon as the concrete is wet hurry it to place, and agitate it just enough to settle it solidly together. The wetter it is, so water does not flow from it, the better and the more readily it is made to assume a compact form, filling the mould, whatever that may be.

Clean up carefully the platform before mixing any more. Use sand and gravel as dry as you can and the mixture will be more uniform.

KINDS OF CEMENTS.

There are four great classes included in the group of "hydraulic cements," as that term is used by the engineer. The relationship of the various cementing materials can be concisely expressed in the following diagram:

- Non-hydraulic cements—
  - Plaster of paris, cement plaster, Keene's cement, etc.
  - Common lime.
- Hydraulic cements—
  - Hydraulic lime.
  - Natural cements.
  - Portland cements.
  - Puzzolan cements.

Non-hydraulic cements.—Non-hydraulic cements do not have the property of "setting" or hardening under water. They are made by burning, at a comparatively low temperature, either gypsum or pure limestone. The products obtained by burning gypsum are marketed as plaster of paris, cement plaster, Keene's cement, etc., according to details in the process of manufacture. The product of burning limestone is common lime.

Hydraulic cements.—The hydraulic cements are those which set when used under water, though the different kinds differ greatly in the extent to which they possess this property, which is due to the formation during manufacture of compounds of lime with silica, alumina and iron oxide.

Natural cements.—Natural cements are produced by burning a naturally impure limestone, containing from 15 to 40 per cent of silica, alumina and iron oxide, at a comparatively low temperature, about that of ordinary lime burning. The operation can therefore be carried on in a kiln closely resembling an ordinary lime kiln. During the burning the carbon dioxide of the limestone is almost entirely driven off, and the lime combines with the silica, alumina and iron oxide, forming a mass containing silicates and ferrites of lime. If the original limestone contained much magnesium carbonate the burned rock will contain a corresponding amount of magnesia.

The burned mass will not slack if water be added. It is necessary therefore to grind it rather finely. After grinding, if the resulting powder (natural cement) be mixed with water it will harden rapidly. This hardening or setting will also take place under water. Natural cements differ from ordinary limes in two noticeable ways:

1. The burned mass does not slack on the addition of water.

2. The powder has hydraulic properties, i. e., if properly prepared, it will set under water.

Natural cement differs from Portland cements in the following important particulars:

1. Natural cements are not made from carefully prepared and finely ground artificial mixtures, but from natural rock.

2. Natural cements are burned at a lower temperature than Portland, the mass in the kiln never being heated high enough to even approach the fusing or clinkering point.

3. Natural cements, after burning and grinding, are usually yellow to brown in color and light in weight, having a specific gravity of 2.7 to 3.1, while Portland cement is commonly blue to gray in color and heavier, its specific gravity ranging from 3 to 3.2.

4. Natural cements set more rapidly than Portland cement, but do not attain so high tensile strength.

5. Portland cement is a definite product, its percentages of lime, silica, alumina and iron oxide varying only between narrow limits, while brands of natural cements vary greatly in composition.

Portland cement.—Portland cement is produced by burning a finely ground artificial mixture containing essentially lime, silica, alumnia and iron oxide in certain definite proportions. Usually this combination is made by mixing limestone or marl with clay or shale, in which case the mixture should contain about three parts of the lime carbonate to one part of the clayey materials. The burning takes place at a high temperature, approaching 3,000 degrees F., and must therefore be carried on in kilns of special design and lining. During the burning, combination of the lime with silica, alumina and iron oxide takes place. The product of the burning is a semi-fused mass called "clinker," which consists of silicates, aluminates and ferrites of lime in certain fairly definite proportions. This clinker must be finely ground. After such grinding the powder (Portland cement) will set under water.

Puzzolan cements.—The cementing materials included under this name are made by mixing powdered slacked lime with either a volcanic ash or a blast-furnace slag. The product is therefore simply a mechanical mixture of two ingredients, as the mixture is not burned at any stage of the process. After mixing, the mixture is finely ground. The resulting powder (puzzolan cement) will set under water.

Puzzolan cements are usually light bluish, and of lower specific gravity and less tensile strength than Portland cement. They are better adapted to use under water than in air.

USE OF CRUSHED STONE.

A better material than gravel is found in crushed stone with its accompanying fine screenings. In some regions this is cheaper than gravel; it makes a harder concrete. The following table of voids in the different materials will be of value. It is given on the authority of W. L. Jackman for the Chicago Producers' Supply Co.:

Material.	Per cent of Voids.
Limestone screenings (crusher run)	16
Gravel	20
Pit gravel	21
E. F. screenings	22
Sand	26

Interpreting this it would be safe to use 1 measure of cement to about 6 of limestone screenings, 1 to 5 of gravel and 1 to 4 of sand.

SOME SPECIFICATIONS.

Sand should be clean and coarse. Clean sand is free from loam or clay, both of which injure cement, destroying its adhesive quality. Sand should be coarse; a proportion of the grains should measure 1/32 of an inch in diameter and if some of them run to 1/16 or to 1/8 or 1/4 there is no objection. Fine sand, even if clean, makes a poor mortar and if it must be used a larger proportion of cement is imperative thoroughly to coat its grains, and more labor in mixing is also imperative.

Use the best Portland cements obtainable. American cement is the best. In estimating do not make the mistake of thinking that 6 barrels of broken stone, 3 barrels of sand and 1 barrel of cement will make 10 barrels of concrete. The sand merely fills the voids between the stones, while the cement fills the voids between the grains of sand and the whole makes slightly in excess of 6 barrels of concrete.

For heavy walls, retaining walls and piers for barns, when screened crushed stone is used these proportions will hold good: 1 barrel cement, 3 barrels sand (11.4 cubic feet), 6 barrels (22.8 cubic feet) loose gravel or broken stone.

BUILDING FORMS.

Avoid using dry wood in building forms. If it must be used it may be soaked before placing. Boards facing the work should be well oiled with linseed oil, which will prevent the cement adhering and leaving a rough surface. If the work is to be plastered after it is finished no oil should be used. In building forms do not drive nails home; leave them so that they can be pulled again. Use care at all times to build forms so that the cement cannot imbed the ends of boards and thus make it difficult or impossible to get them away. With boards 1" thick the supporting studding should not be more than 2′ apart to withstand the ramming and settling of soft concrete. For 2″ stuff the studding may be 4′ or 5′ apart.

The floor joists of a building may be used to construct the forms for the foundation wall with no injury to the joists.

BUILDING FOUNDATIONS.

The excavation should be carefully made, and if possible so that the earth may make one side of the form. If it is carelessly done there will be a waste of concrete towards the top where the wall will be too wide. A trench just outside the wall and some inches deeper should be dug and in it laid tiles, which may be covered with a few inches of clean gravel. On this the concrete will rest. It should be remembered that concrete is capable of bearing an immense weight, so a thick wall is not needed to support any ordinary building; 8″ is usually thick enough. The very bottom where it rests on the earth should be made wider, according to the nature of the subsoil.

Set up a row of studding to hold the form in this manner: Lay down on the cellar bottom a timber; it may be one of the floor joists, or any part of the framing stuff. Let it come within 4″ of the required edge of the wall. Drive a stout stake at the other end of it. Stand up a studding, say a 2″ x 6″, and toe-nail the foot of it to the horizontal piece. Brace the stud as shown in *Fig. 384*. Set a row of these studs and place planking behind them. Now begin filling in the concrete, about 8″ at a time, and settle it down solid. When you have filled the wall around the 8″ begin over again. If material is scant not all the wall need be built at one time. When up to the surface, or where to fill against the earth would make too thick a wall, set up an outer form. This may be tied to the inner one with No. 12 wire, two strands, about the studding and twisted in the middle to bring it tight. Space the planks apart by measured blocks while putting on the wires. See that all is plumb and straight; it cannot be moved easily after it has set. Fill full and level carefully. Let the forms remain on for a few days and take them off with great care to do no pounding or jarring which may crack the wall. Bolts may be inserted in the soft concrete, the heads buried, which will engage and hold any wooden superstructure.

FINISHING THE WALL.

If the form was smooth and neatly put together the wall will be smooth enough for all practical purposes with no further work on it. Where it is seen from the outside it may be desired to give it a more finished appearance. This may be done by coating it with plaster, made of about one part of cement to two parts of sand. The sooner the plaster is put on after the wall has set sufficiently to permit of removal of forms the better it will adhere.

Another finish is given by roughening the wall slightly, thus obliterating the marks of the form. A hammer such as cooks use to bruise beefsteak may be struck against the wall enough slightly to roughen it, and this will give an effect that will appeal to the artistic eye more than will smooth plastering. Plaster, however, if made rich will make the wall impervious to water.

KEEPING WATER OUT OF THE BASEMENT.

A good deal of disappointment has been felt by concrete users when they found water percolating through their cellar walls. This comes from the concrete lying so close to the clay that it dams back the water that would go downward alongside the wall, and thus it gathers head and

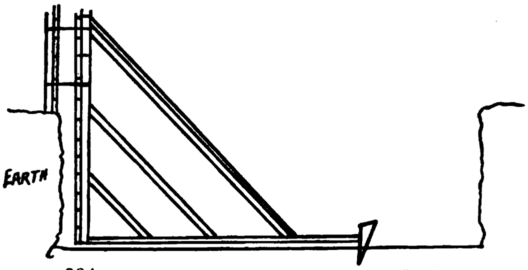


FIG. 384. STUDDING FOR CONCRETE WALL FORMS.

seeps through the concrete. It is especially liable to seep where the work of one day joins the work of the previous day, or at any point where the mixture is not perfectly made or well compacted. Plastering on the inside is not a sure remedy and plastering on the outside is difficult of accomplishment. Prevention of this seepage is simple. The foundation should be dug about 4″ or 6″ wider than the wall requires, and as concrete is put in a board may be set up limiting the concrete and leaving a space back of it 4″ to 6″ or more. In this space clean gravel or coarse sand is put, and as the work proceeds this board may be raised, always keeping it backed with gravel. It is immaterial whether the back of the wall is very smooth or not, so the general thickness is preserved. Surface water reaching the wall will readily sink down through this gravel and reach the tiles, leaving the cellar or basement quite dry.

HOLLOW OR SOLID WALLS.

It is usual to make basement walls solid and house walls, or walls above ground, hollow. Hollow walls are drier and warmer because of the air space. No more material is needed in the hollow wall than in the solid wall; it is divided. Concrete is immensely strong and its resistance to crushing is so great that no account need be taken of this in any walls needed about the farm. Factory chimneys 350′ high are built with walls no more than 12″ thick at the base and 7″ thick above the first 100′.

Hollow walls may be made with an air space of 8″ or 10″ and the two walls each of a thickness of 3″ or 4″. These thin walls should be reinforced with iron or steel wires or rods laid at intervals of about 8″ or 12″ horizontally as the work proceeds, and if some such rods are put in vertically at intervals of 24″ it is all the better. This is called "reinforcing" and wonderfully increases the strength of the concrete. Wherever there is to be pressure against concrete walls and no backing is behind them this reinforcing should be remembered. For plain walls, as of a house or stable or poultry building where no special pressure is to be encountered, small wires, say No. 8, laid straight, will serve, and for walls where there is more pressure larger rods must be used. Refer to some of the numerous books on concrete construction and reinforcing for tables that give exactly the various sizes of rods needed for each class of work.

CONSTRUCTION OF HOLLOW WALLS.

There is little more material used in the hollow wall, and little more labor except in setting up the forms, and they are not difficult. The air space is most easily made a wide one, as then the inner forms are the more readily taken out. Building outer walls 3″ thick (which is ample) and an air space of about 10″ will give a wall apparently 16″ thick, which has a substantial effect, and is warm in winter. To accomplish this, studdings are set up in the usual manner, spaced 20″ apart if the planks of the forms are to be 2″ thick, and closer if thinner stuff is used. These studdings should be carefully plumbed, braced and tied together at the bottom with wires, and occasionally through the middle, to hold them absolutely in place. The tops should be held with a short board nailed across.

The collapsible inner form is made by setting up short studdings 2″x6″ (2″x4″ will serve, but are not so easily removed) which has one edge sharply beveled so that it may be twisted around and loosened without difficulty. These studdings hold apart the boards of the inner form. All wooden parts of this inner form should be of green material or else well saturated with water before using, else they may swell and hurt the work, besides being hard to loosen and take out. See *Fig. 385*.

Planking 2″x12″ is best for the inner form and it may be raised for each course. The two thin walls need to be tied together and this is variously accomplished. An easy way is by means of bits of large galvanized wire, about No. 2, with the ends turned over. These pieces of wire are laid across from one wall to the other beneath the plank of the form. They tie solidly and being cheap may be put in at intervals of about 24″. It is better to put in three sets of planking and about 36″ of this double wall before raising the inner form as a smoother outer face can thus be kept. In order to make the wall very strong and safe, vertical wires should be used in the thin walls which will effectually prevent any cracking, even by earthquake. Greater height than 36″ without raising up with this sort of form is not practicable. There is another bond sometimes used, and a good one: paving brick or any hard burned bricks. These must be long enough to reach across and rest for at least an inch of their length on each wall. They are of course imperishable and resist thrusts and hold together.

When the hollow wall has reached within 6″ of the top it may be bridged across with tiles, slate or sheet iron, taking care that the material does not cover the walls more than half way, and the finishing top should be made solid.

PUTTING IN DOOR AND WINDOW FRAMES.

The frames should be made before the wall is begun and they may be set in place as the work reaches the point where they are needed, letting the concrete come right against them; or, rough frames a little larger than the permanent ones may be put in and the permanent frames after the wall is finished. It is well to nail 1″x1″ vertical strips on the frames so placed as to become imbedded in the concrete which will hold them secure and make a close fit.

CONCRETE OR BLOCKS FOR WALLS.

A hollow concrete wall, constructed as outlined, of good rich concrete, will be warmer and drier and more durable than a wall of blocks as they are commonly made, since they are not often made rich enough or wet enough to make really first-class concrete. The cost of the hollow wall will probably be less than that of a wall laid up of blocks. The appearance may easily be better. A plain flat wall, slightly rough, is much to be preferred from the standpoint of beauty.

CONCRETE FOR CHIMNEY CAPS.

Caps for chimneys are best made of concrete. These are easily built in place. A form to fit the chimney should be built coming out about

3″ wider than the brick and the edges raising about 3″. At the flues clay tiling should project, or else galvanized iron cores, since wooden cores will swell and surely crack the cap before it is hard. Give the cap a slope to throw the water to the outside.

CONCRETE FOR PIERS OR FOUNDATION STONES.

One of the most convenient uses to which concrete may be put is for small piers to set under the posts of barns, stables or corncribs. These are molded in place in a fraction of the time required to place and bed natural stone, and the tops are readily leveled with much exactness. To make these piers the surface soil should be excavated to solid earth, digging a hole accurately of the size that the pier is desired, say 24″ square. Fill it with concrete to the level of the surface and from that height a tapering form like a truncated pyramid is used to the level desired. If the post resting on a pier is to be, say, 8″ x 8″, the top of the pier may be made of that size, or, allowing somewhat for inaccurate placing, 12″ x 12″ may be the top, and the bottom may be 16″ x 16″, with a uniform taper. In this concrete block should be molded a bolt, say of 3/4″ iron, about 8″ long, of which 6″ will be imbedded in the concrete and 2″ will project. A piece of 2″ joist of tough, durable wood may now be sawn to fit the top of the concrete block and a hole bored in it to admit the iron pin. Upon this the post will rest and to this block the post may be toe-nailed with spikes, thus making a very good attachment to the base. Or, if there is any chance of the post lifting off, a longer bolt may be used with head imbedded in the concrete and thread on its upper end. Thus, by cutting a slot in the post to admit of a nut the post may be solidly bolted to the base. Foundation blocks should always be made of rich concrete, say of 1 to 5 if gravel is used, or 1 to 3 if sand and 5 if crushed stone, or whatever has been found to make a strong, dense concrete with the material available.

CONCRETE FOR PORCH COLUMNS.

Columns for porches and porte-cocheres of country homes may be made of concrete with great economy of first cost and immense gain in durability and cost of repair. The molds for these may be cheaply constructed by sawing half circles from tough boards and nailing to the inner side of these segments pine strips about an inch square. With tapered columns these strips will be slightly tapered to make them fit. Bases, if turned, may be first molded in plaster of paris to make the forms, and capitals in the same manner. The columns should be cast standing on their bases, the two parts of the mold well wired together, since the pressure of wet concrete is very great at a height of 8′ or more. A rich mixture should be used rather wet, and well agitated with a slender stick to cause air bubbles to come to the surface. A core of steel is useful, though not indispensable, but there should be a

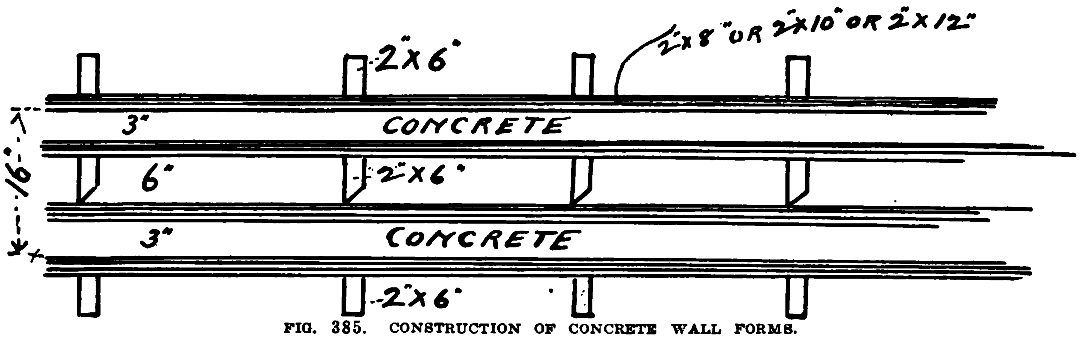


FIG. 385. CONSTRUCTION OF CONCRETE WALL FORMS.

34″ bolt inserted that will project through the top and engage the superincumbent woodwork.

These columns will not need much finishing after the forms are taken off; should there be a rough appearance it may be made smooth by this method. As soon as the forms are taken off and while there is yet considerable moisture in the columns moisten them more and when the water has sunk in so that it cannot be actually seen on the surface take the bare hand half full of cement and, beginning at the bottom, draw it carefully upward, letting what cement adhere that naturally does and wipe off all surplus. This fills all airholes and makes a smooth appearance with very little time or material. Porch columns may also be made square and this form looks exceedingly well; let them be of generous size, say for a one-story porch 18″ x 18″ and for a two-story porch 30″ x 30″.

CONCRETE FOR CORNCRIB FOUNDATIONS.

To make rat-proof corncrib foundations first mold blocks of concrete in the ground and set on them cylinders made of galvanized iron, about

8" in diameter at the top and 12" at the bottom and 24" long. If thought best this length may be reduced to 16" or 18", though absolute security from rats cannot be had with a much less height than 24". Fill these cylinders with rich concrete and when it is hard set the crib upon them. A ½" or ¾" rod running up through the bottom block and the middle of the cylinder will insure rigidity of union. See *Figs. 420* and *421*.

CONCRETE FOR FENCE POSTS.

With the price of lumber constantly increasing and the price of cement decreasing the time is near at hand when cement will be used for a great many things on the farm which are now considered either impossible or very doubtful.

The cement fence post is as yet in an experimental stage, and no generalization, therefore, can be made that would apply to all cases. The posts are usually made in some form of improvised mold, out of a mixture of 1 part of cement to from 4 to 7 parts of sand, the best ratio having not as yet been determined. All cement posts have some kind of reinforcement to keep them from breaking. This may be either wood, gas-pipe or wire, which is imbedded in the post. If wire is used there is usually one wire placed about one inch from either corner as the post is being made, the holes or cross-wires put in to fasten the fence wires or boards to the posts.

The post as well as all other cement work improves with age up to a certain limit and no posts should be used until six months after they have been made. From our observations so far we would say that concrete fence posts as now manufactured are necessarily very heavy, which makes them inconvenient to handle; quite brittle and sensitive to sudden jar, necessitating a high fence with posts much closer together than in case of good wooden posts, and lacking in best arrangement for fastening of wire and especially boards upon them when set up in the field.

We have tested some cement posts, very promising according to the recommendations given them by their makers. They were declared to be "stronger than wooden posts" and "lasting as the Pyramids of Egypt." Here are the results of actual tests:

Cement post No. 1—A post 3½" x 3¾" at lower and 2½" x 3" at the top end, 6' 6" long, reinforced with three pairs of twisted wire. Test 1—Post supported horizontally 9" from each end, and weight applied in middle, straining the two wires or the stronger side of post. Total weight, 701¾ pounds; total deflection, 15' 32"; breaking weight, 773¼ pounds.

Test 2—Post supported as above but strain applied on the one wire or the staple side of post. Total weight, 474¾ pounds; total deflection, 15' 16"; breaking weight, 544¾ pounds.

Test 3—Lower end of post fastened horizontally in clamp, and weights applied 3' 10" from support, straining the staple side of post. Total weight, 168¼ pounds; total deflection, 4¾"; breaking load, 178¼ pounds.

Test 4—Post fastened as in previous test, but weight dropped, straining the stronger side of post. Post cracked when 40 pounds were dropped 20". Cracks open ¼" when drop repeated.

A common round cedar post was tested, but it did not break at 395 pounds with deflection of only 2". However, by working out the formula for strength of different materials we would get the following results for different posts of wood of like dimensions as cement post No. 1, submitted to similar test as in 3: Breaking load of white ash post, 1,450 pounds; breaking load of white oak post, 1,340 pounds; breaking load of poplar post, 1,330 pounds; breaking load of white pine post, 1,000 pounds.

Cement post No. 2—A post 4" x 4" at lower and 3" x 3" at top end, 6' 6" long, reinforced by four pairs of twisted wire. Test 1—Post fastened horizontally in clamp and weights applied 3' 10" from support: (a) weight 83 pounds, cracks appear; weight 160 pounds, 8 distinct, 3 partial cracks; weight 197 pounds, 10 distinct, 3 partial cracks; weight 237 pounds, cracks open; weight 300 pounds, post breaks. (b) weight 230 pounds, breaks a post; (c) weight 345 pounds, breaks another post. This makes an average breaking strength of 292 pounds.

Test 2—Post fastened as above but weight dropped upon post 3' 10" from clamp: (a) weight 83 pounds, drop 15", post cracked; (b) weight 40 pounds, drop 2', post cracked; (c) weight 40 pounds, drop 1', post cracked. This makes an average of 52.6 pounds dropped 16.4", sufficient to crack the post.

Test 3—Cracked post (c) tested for breaking drop load. Weight 80 pounds, drop 1', 5 cracks; weight 80 pounds, drop 2', break at clamp. To fully realize the meaning of Test 1, let us see what a wooden post of like dimensions would do when submitted to similar test: Breaking load of white ash post, 2,230 pounds; breaking load of white oak post, 2,060 pounds; breaking load of poplar post, 1,890 pounds; breaking load of white pine post, 1,540 pounds.

These tests show that white pine is five times as strong as the cement posts tested for steady load, while for sudden jar there is simply no comparison.

We would very much like to know what is the actual pressure to which fence posts in the field are subjected and how often new posts are broken by animals running against them, as this is the only practical comparison between the strength of cement and wooden posts.

The foregoing tests should not discourage anyone who intends to make his own cement posts. If there is plenty of sand and gravel to be had nearby every farmer short of wood should be his own manufacturer of fence posts.

The question arises, Can a farmer manufacture for his own use a fence post which has been patented? If he has seen and has had explained to him a certain patented process of fence post construction and he deliberately goes to work and imitates this process he is liable for damages. However, there is nothing to hinder a farmer from making fence posts according to his own process without infringing on the rights of anyone, for it is their own peculiar method of making and reinforcing that some individuals have patented and in which they are protected by law.

Joseph E. Wing says: "I believe we have in cement a very hopeful material to replace the fast vanishing supply of wood. I regret that men

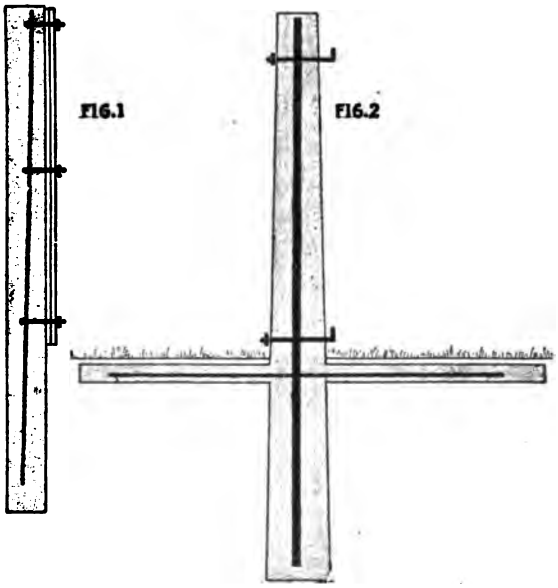


FIG. 386. REINFORCED CEMENT POST.

have tried to build concrete posts of exceedingly small size. In my opinion none should be less than 5″ x 5″ and it would not cost so very much to increase the size at the bottom to 6″ x 6″.

"*Fig. 386* (left side) represents a small post for attaching wire or boards. It is 5″ x 5″ and made in a plain wooden box form. Four feet of this box form will be open and when it is to be used a pine board through which three bolts have been passed and nuts put on them closes this opening, which will be in the bottom. The form lays with this board in the under side, the bolt heads projecting up into the form half way or more. Fill the form half full, then put in it an iron rod of some sort, either the specially corrugated bars made for the purpose of about ½″ diameter or a straight piece of wire about No. 0 size or larger. One can buy wire cut and straightened to any length at a very reasonable figure, and I do not know that it needs to be galvanized for this purpose.

"Lay in the metal, then finish filling the mould, smoothing off the top nicely; let it set 24 hours and very carefully remove the form, leaving it rest on the board without moving it. That will take for a post 7′ long 1 1-15 cubic feet of concrete, costing about 12 cents; say the metal costs 5 cents and the board 5 cents and the 3 bolts 3 cents, you have a cost for materials of 25 cents. The labor would cost about 3 cents, I suppose, and wear and tear of forms somewhat. One would need about 10 forms and take an hour a day to fill them; in a week or two he would accumulate quite a supply of posts.

"The forms would be held together by sawing a square notch in a 2″ x 10″ plank or by iron clamps. The metal should turn over half an inch at each end. Be sure that it is of good size, as in it lies the strength of the post. It is desirable to make posts that shall endure for centuries, for fence repairing is no small part of our work. After a post is moulded comes the care of it. It must be kept moist for 10 days by daily sprinkling. Water is a component part of concrete, and if ever it dries out before the chemical union takes place it will never get its due strength.

"But it is in the gate post that I have invented that I take especial pride. Dig the hole neatly and not larger than about 12″ in diameter but at least 3½′ deep. I think telephone men dig 4′. Take the earth clear away, as none of it will be needed. Dig a narrow trench, say 5″ wide and 8″ deep, and 6′ long across the hole, and another one in the transverse direction, so that the hole will be in the center of a cross.

"Right where these trenches join the large hole widen them an inch or two. Get a piece of old buggy axle, or about 7′ of 1½″ or 2″ pipe. If it is not quite long enough to come nearly to the top of the post and reach the bottom of the hole shovel in and tamp some concrete to put under it, though it should reach nearly to each end of the post. Set it up and tamp concrete about it, being sure to tamp well and that the concrete is well mixed and of good proportions, it being better to use too much cement than too little. When up to the trenches put 2½″ of concrete in them and lay down in each one a rod of say ½″ iron or twisted wire cable or a piece of old inch pipe, letting them run right across the center of the post; then go on filling till the top of the ground is reached and the trenches as well as the hole are full. Now set up the form, which may be of two boards, 1" x 12" and two 1" x 10", which will make a square post 10" x 10", or it may be a round form in halves.

"The hinges should be inserted in the soft cement and it is doubtless better that they should run clear through, as shown in *Fig. 386* (right side). Let the posts set for 30 days before you touch them. Concrete reaches nearly its maximum strength in 45 days. The fence posts if laid close together and covered with moist sand will cure out best; the sand may be wet down now and then.

"This post will cost very little more than a good wooden one and will absolutely last a century. It cannot possibly get away unless the bottom of the post is in soft ground; if in digging the hole you do not find hard earth at one depth go on until you do find it."

CONCRETE FOR FLOORS.

Concrete is an ideal flooring for porches, cellars, meat houses, wash houses, and summer kitchens. Porch floors may be laid either with or without filling in beneath them. If the filling is done the gravel or earth should be carefully tamped and solidified, else in settling it will leave the concrete unsupported and it may crack and drop out of level. A better concrete floor for porches is made by reinforcing the concrete and supporting it only on the walls. It may easily span 8' or 10' and if need be may span 12', though in porch work it is cheaper to build a very thin cross wall under porches as wide as 12', thus dividing the span in two.

To build a reinforced floor a temporary flooring of wood is laid down and over it is laid a network of steel rods or large wires which should be raised an inch so as to permit the concrete to cover them on the under side. The size and frequency of these rods must be proportioned to the width of span and probable load to carry. For spans of 8' a safe proportion of steel and concrete is to use 3/8" steel rods, spacing them 5 1/2" apart and having them imbedded about 3/4" in the concrete (of course on the under side) and the slab of concrete may be 4" thick. If it is thicker it will be somewhat stronger, but these proportions are recommended by engineers for a floor to bear a load of 50 pounds per square foot. For a stronger floor, carrying safely 125 pounds per square foot, the proportions should be a slab 5" thick, a 1/2" rod imbedded 1" and spaced 7 1/2" apart. This also for the 8' span. If wider spans than 8' are desired the builder had best consult some maker of reinforcing steel and learn the proportions.

To lay the floor, make a rich concrete, certainly richer than would be used in a wall, and spread it over the temporary flooring, having it rather wet so that it can readily be made to flow around the metal reinforcement. Tamp it gently with a broad-faced tamper. Lay it down and at once put on a top coat of about 1" or 1 1/2" of screened material, say of sharp sand 2 parts, cement 1. Trowel this to a smooth surface. The final troweling must be given just as the work sets, when with care a very smooth surface may be made. Do not remove the supporting boards until 30 days. Porch floors need not be blocked off if they are reinforced with metal, since the cracks, if any, will be small. To bring the work to a level while building it is well to set up boards on edge with the top edge at the level, or slightly below the level, of the required height of the floor. Then a straightedge may be drawn across the work, sawing it back and forth and leveling the concrete, removing any surplus. If this is done with the body of the work the finishing coat may be put on evenly and with care the same process of leveling may be done without the aid of the boards, which of course must be removed and their places filled as soon as their use is ended.

If porch floors are built resting on a filling of earth or gravel without reinforcement they should be laid in blocks. This is best accomplished by making partitions across the floor, using 1" boards, or heavier, and making squares of about 4'. Fill each alternate square, like the white spots in a checker board; let it set; then remove the wood and fill in the remaining spaces. To keep the concrete from adhering paper may be used to separate the blocks.

CONCRETE FOR CELLAR FLOORS.

Concrete floors in cellars may be laid directly upon the clay, if it is dry, and, if there is danger of water, cinders, gravel or broken stone may be laid down first and the concrete spread upon it. Cellar floors should have a slope to one side and a depression along that wall, forming a shallow ditch with grade running to a drain at the corner. A thickness of 2" or 3" is ample in a cellar floor and it need not be blocked off since it will hardly crack seriously. To get it to uniform surface use boards in putting it down as directed for porch floors. Cellar floors should be troweled smooth, and have a good top coat to resist wear.

BARN FLOORS.

Barn floors should always be of concrete where they may rest upon the ground, since they are cheaper than wood, and imperishable; besides they do not harbor vermin. Barn floors may be laid in squares as directed for porch floors, or all in one piece, which will be apt to crack somewhat. The cracks, while irregular, may not do any harm, and after they have opened to their maximum size may be filled with dry cement powder and wetted. Where teams are to stand upon floors they should be 5″ thick, and along driveways where heavy loads must be drawn they should be cut across in squares of about 6″, deeply marked so as to give horses a secure foothold.

CONCRETE FEEDING AND BARNYARD FLOORS.

Humphrey Jones of Ohio has built an economical barnyard floor by first enclosing the yard with a ditch in which tile is laid. The yard is then leveled and solidified and 2″ of concrete laid down. On this, while soft, is laid steel fencing of the square mesh woven variety, which serves as an excellent reinforcing material, and on this is laid 2″ more of concrete. Thus 4″ of concrete with no foundation but the natural earth serves to hold as perfectly as though it were very much heavier and not reinforced. Where the ditch comes he has made a thin concrete wall, depending from the edge, the idea being in part to prevent the entrance of water beneath the concrete and in part to prevent the edge being gradually broken off by driving over it in wet times. It should be borne in mind that a concrete floor well made of pretty rich cement laid comparatively thin is much to be preferred to a very thick one laid with poor concrete that may soon go to pieces from the effects of weather and natural wear.

MISTAKES IN CONCRETE FLOORING.

Sometimes the upper surfacing of concrete floors comes loose from the body of the work. This is usually the result of using too poor material below, or else of letting the lower body set too long before the top coat is put on, or else of not pressing the top coat down hard enough. It should be laid on as soon as possible after the bottom coat so that setting may proceed at the same time.

Some concrete floors are very slippery. This is the result of unnecessary troweling. It is indeed necessary to trowel the top coat, but if animals are to walk upon it without bedding it must not be left smooth. It may be roughened by drawing across it a coarse wooden comb, such as is used for currying horses, or by using a piece of notched steel like a coarse rip saw blade. Slippery floors may be corrected by cleaning them thoroughly, scraping a little, and sprinkling with water, then dusting well with cement, and roughening with a comb, or even with a very coarse brush.

CONCRETE FOR STABLE FLOORS.

Stable floors should be laid with a descent to permit them to drain to a common center, but for stalls the slant should not be excessive; 2″ in 8′ will suffice. They need not exceed 5″ in thickness and may be laid in one piece or in blocks. Drops for cow stables need not be more than 5″ and from the walk to the gutter may well be a simple slope instead of the gutter once commonly in use. (*Fig. 387.*)

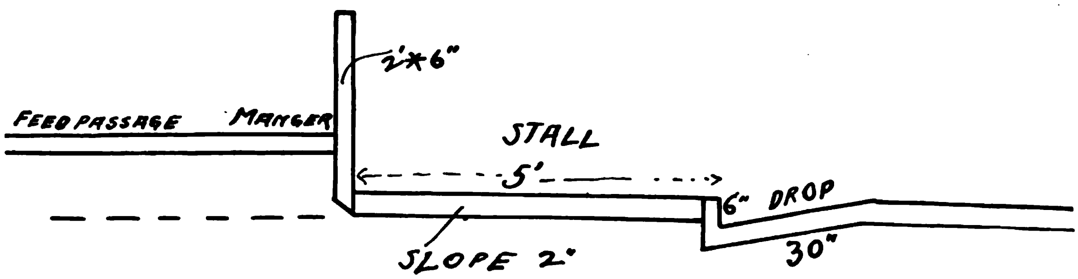


FIG. 387. CONCRETE STALL FLOOR (SECTION).

Mangers in many of the best cow barns are of concrete and are sometimes arranged so that water may be turned in them either for cleaning or for drinking purposes. This is hardly a desirable practice, however, since if a cow were diseased she might contaminate the entire row by means of the water flowing past her. The floor of the feed passage in front of the cows may well be of concrete, and there is no objection to the cows eating from the floor of this passage with no back to their manger, since cows pull material towards them, and any scattered forage may readily be pushed up to them and the manger may readily be swept out. The use of concrete in these instances is a great saving of dirt and prevents the ravages of rats and mice.

CONCRETE FOR HORSE STALLS.

Concrete is hardly so desirable for horse stalls as for cow stalls, yet it is far preferable to wood.

and unless hard clay is used there is nothing else available. Horse stalls should be kept well littered with straw or shredded corn stover when the only objection to it (its hardness) disappears. Horse stalls must not be left smooth and slippery, nor must cow stalls or walks. The problem of draining horse stalls is a vexing one; no blind or covered drain will keep open long and all such emit a fierce odor. Perhaps as good as any is a single trench about 3" deep and of the same width, or, better, only 2" wide. This of course must be cleaned out frequently, but that is easily done and there is no fear of its permanent stoppage, nor can a horse get his foot fast in it, or slip in it. This drain should lead to a manure pit where practicable and the liquids be absorbed by the dry parts of the manure. If sufficient absorbents are used there will not be much urine to drain away.

In putting down stable floors all posts must first be set. Posts of large iron pipe are now much in use; for horse stalls the pipe should be about 3" in diameter; for cows 2". If wood is used it may be set in the ground, concrete encasing it from the bottom to the surface; then if it decays another post may be slipped into the same socket.

CONCRETE FOR HOGHOUSES.

All first-class modern hoghouses make large use of concrete, both for floors of pens and alleys, for inside partitions and for troughs and outside yards for exercising. There is no objection to concrete in the hoghouse if the sleeping pens are kept well bedded and the walking surfaces are left rough enough to prevent slipping. Concrete partitions in hoghouses need not be more than 2" thick, but should be well reinforced with about No. 6 steel wire. The black wire serves as well as the galvanized since concrete is supposed to protect wire from rusting.

CONCRETE FOR WATERING TROUGHS.

Cement makes an ideal watering trough for all sorts of animals. It is indestructible, once rightly made, is easily cleaned, and has a tendency to keep the water pure and sweet. Small watering troughs with thin sides should be well reinforced; large ones need it less, but metal reinforcement adds strength to any form of concrete. To build a concrete watering trough that at the same time may serve in part as a storage tank, remove the loose surface earth for say 6", to a greater depth if it is not desired completely to drink the water out of the trough. With horses and cattle there is no harm to have a depth of water; with lambs it may be a different matter. It is safer to go down a foot or so with the foundation, but it is costly to fill up with concrete to the surface of the ground, and when permissible water is the cheapest filler of a tank.

Have ready a drain for the overflow. This should extend into the area of the tank. Have ready also the inlet to the tank. This may be by means of a pipe entering from the bottom and projecting above the level of the highest surface of water that will ever stand in the tank. The overflow is best managed thus: let the union coupling of a 2" pipe come at the level of the concrete floor, connecting below with the drain. Into this union screw a short length of pipe, so short that water will flow into its open end and down to the drain before it will overflow the sides of the tank. To empty the tank completely it is only necessary to unscrew this short pipe, when all the water will run away.

To build the form for a concrete tank is a simple matter. First build the outer form, which is a box as large as the tank is desired. A good size for a horse or cattle watering trough where some storage is also desired is 6' wide and 12' long, or it may be in square form, 8' x 8' or 6' x 6', or a longer or shorter to fit peculiar situations. The height may be 36". This form may be of inch lumber, well braced from the outside so that it cannot spread. After the 6" thickness of foundation or tank bottom is put in this form is set over it and an inner form within that. The inner form is not quite so easily made, since it should taper so as to be smaller at the bottom, much as a mill hopper tapers. Make it, if the outer form is 6' x 12' inside measure, to be 5' 2", outside measure at the top, and 11' 2" long, which will make the top edge of the tank wall 5" thick. The bottom of the inner form will be 4' wide, outside measure, and 10' long. This will make the bottom of the wall 12" thick, and this taper is needed to add strength of the walls when ice forms in the tank. It is wise to brace the inner form across from side to side. Then fill between these forms, laying in a course of wires about once in 6", carrying them around the corners. Do not use barbed wire unless it is some old wire that you wish to hide, since it is inconvenient to handle and holds no better in the concrete than smooth wire. Take out the inner form in 24 hours and wash the inside of the tank with cement and water as thick as cream. Let the outer form remain on for a week. Fill the tank with water when the cement wash is hard enough to bear it, say after 24 hours. The outside of the tank will hardly need any attention. Use good mixtures in tank building, say of cement and gravel 1 to 4 to 5.

Do not build water tanks near the approach of freezing weather, since frost may ruin them, even after they are set. They should have at least 30 days before being frozen.

BUILDING LARGE COMBINED TANKS.

There is a type of tank of large diameter and moderate height from which animals may drink that is economical to build and effective. It is best built upon a clay foundation, or on some soil that will become water-tight by puddling, since these tanks are often built with no concrete bottoms. They are best made circular, the size may be 20′, 30′ or more in diameter; the larger the more easily the forms are made. To build them drive a stake into the earth, put a nail in the top of it and with a string describe a circle the size of the required tank. Excavate a very narrow trench, down to solid earth, which may not need be more than 12″. Fill this trench with concrete. It need not be wider than 6″, but should be filled with good, rich stuff. To set up the form above, straight stakes as high as the top of the proposed tank may be set around the inner circle about 1′ to 3′ apart, depending on how small the circle is, and boards bent around and lightly nailed at the ends to make the inner form. In this form there will be no slope to the wall, but it will be built perpendicularly and dependence put in good reinforcement to prevent cracking. It is rather hard to build a sloping circular form and the steel required will not cost much more than the extra amount of concrete in a tapering wall.

When the inner circle is built set up around it boards 6″ wide opposite the stakes, to space the outer form, and about them bend the boards that make this form. These boards may be of ordinary 7/8″ stuff of the mills if the circle is large enough, or they may be run through the planer and brought down to 5/8″ if it is a circle of about 16′. To throw the boards in the water for 24 hours before using will greatly help their bending. Do not nail the boards of the outer form to the pieces separating the two forms, since these must be removed before concrete is put in —they may be lifted out gradually, as the wall rises, or taken out at once.

To hold the outer form together the ends of the boards may be spliced together by butting them against each other and nailing another short board over the joint, on the outside, of course, and the nails must either be driven from the inside of the board or else be too short to come into the space of the concrete. As there will be considerable pressure on this outer form it should be well fastened together and it is well to wire it to the stakes back of the inner form.

The circular forms are not difficult to make, but are hard to describe briefly. Strong wires about the outer form will prove useful. When the two hoops are done they will leave between them a space of 6″ which is to be filled with concrete. As the filling progresses lay in wires completely encircling the wall and lapping 36″, with the ends simply turned over at right angles. These wires may be of No. 4 size and put in 6″ apart as you come up. Black wire will serve as well as galvanized. To straighten this wire when it comes from the coil fasten one end to a tree or post and another end to a 12′ lever, the short end against another tree, and let a strong team pull against the wire, which will effectually take out its curling properties. Then with a bolt cutter cut it into lengths and put it in place as needed.

To finish this tank, remove the inner form carefully after a day or two and wash it with pure cement and water, as thick as cream; throw out all sod, loose earth and loam, and put into the tank a lot of pigs, little and big. Turn in water enough to make it muddy and feed them in there for a week or so. That will puddle the bottom perfectly, when it may be carefully cleaned with a shovel and the water turned in. An outlet pipe should be put in so that the tank may be emptied as are other tanks. This is the cheapest and most satisfactory manner of storing water in pasture, when fed by windmill.

A tank 30′ in diameter, holding 36″ of water, will take about 12 barrels of cement and 10 yards of coarse stuff. The wood of the forms may be used over and over if care is taken to pull the nails when taking apart. Nails in forms should always be left out enough so that a hammer can grasp them.

The bottom of such a tank should not freeze, else it may need puddling again. A concrete bottom may be put in at any time if it is ever desired.

SMALL CIRCULAR TANKS.

In building a small circular tank the form cannot well be bent to shape, and vertical pieces must be used, being arranged much as the staves are in a wooden tank. These may be held in the outer part of the form by wooden bands of 1/2″ stuff lightly nailed and the inner form may be set around a circle made by nailing wide boards together and with a string and pencil describing a circle on them, after which the saw or axe may trim them to shape.

Storage tanks are often desired of circular form and high enough to put water in the upper stories of barns or dwellings. Concrete storage tanks are made as high as 100′ for city use, and there are no engineering difficulties in their construction. They are built with thin walls, well reinforced with steel. In building these concrete storage tanks the concrete is no more than the shell for preventing leakage, the steel taking all stress of bursting pressure, and this important principle should be borne in mind by all who attempt to build concrete silos or tall storage tanks.

A good idea in building such a storage tank is to use the lower part of the tower for a milk room, toolhouse or meathouse, since the less the depth of water the easier the pressure is held. To accomplish this let us consider a storage tank, circular in form, 8′ in inside diameter and 20′ high. Begin by putting the foundation trench in solid earth; let the foundation be about 18″ wide, though the wall above ground need not be thicker than 6″. Erect a form to a height of say 10′, either by use of staves or upright boards held by circles, or use of curved steel forms, such as are now made for silo building. Build the wall to the height of 10′, leaving an opening for door and window if desired, but using a reinforcing wire of No. 6 size laid in horizontally at intervals of 12″ and vertical wires of the same size 24″ apart. At the height of 10′ lay a wooden floor across the space inside the walls and upon this floor a heap of moist sand, moulding it into the shape of a rather flat arch, say with a rise of 24″ at the center. This sand will hold the concrete for the roof of the lower story of the floor of the water tank quite as well as an expensive wooden form. It is essential to put a liberal amount of reinforcement about the wall at the point where the arch begins to spring, since it will thrust in each direction, so put here 4 wires of No. 4 size and across the arch put also a wire in the midst of the concrete, following the curve and crossing at the top, one wire at about each 12″, and other circling wires 12″ apart from the base of the arch to the crown. The arch need not be thicker than 6″. In it must be placed the pipes for inlet and outlet.

Upon this story the tank proper is built, also with walls 6″ thick, reinforced with one No. 4 wire for each 8″ of height near the bottom, decreasing to 12″ apart at the upper distance. The roof may be of wood, in which case bolts should be let into the concrete at the upper margin, threads up, to receive and hold the wooden plate; or, it may be of concrete, either a flat slab reinforced, or a cone-shaped roof or an arched form. In case wood is used it is made from inch boards, about 12″ wide and 7′ long; these boards are ripped diagonally from point to point and to make a roof are put with all points meeting at the same place, which makes a perfect one. Shingles should complete the wooden roof.

RUBBLE WORK FOR WALLS AND POSTS.

In many regions there are to be found an abundance of small round stones, from the size of a cocoanut to a small pumpkin. These make beautiful walls laid with concrete. The manner of using them is to build a form wide enough to receive the stones and leave a margin of about 4″ for concrete on one side. Then the stones are laid in place along the side of the form and concrete, rather rich and rather thin, is thrown

FIG. 388. CONCRETE RUBBLE WORK FOR GATE POSTS.

back of them. With care the stones need not be much stained with cement; the concrete will work in between the stones sufficiently to imbed them and hold them in place, and the result is a very cheap and attractive wall.

Gate posts may be built in this manner: simple boxes open at each side, made of four boards about 12" wide and 36" long, are laid upon a concrete foundation; stones are laid within these boxes, close to the wood, and when a course of them is laid the middle is filled with rich concrete thin enough to work out between the stones. A piece of iron reinforcement in the center will prove of value and if the farmer will search his scrap piles he will find ample stuff for this purpose at no outlay. Hinges should be very strong, very long, and laid in at the right place, since once the cement has set they cannot be changed. A latch holder of simple design may be laid in place also. As good a one as any is a simple flat bridging bar of iron with a notch in the middle of it to receive the latch, the ends turned far into the concrete. The latch strikes the slope of this iron and slides easily up until it drops into place and holds the gate. (See *Fig. 388.*)

CONCRETE FOR SILOS.

Concrete makes a good silo. It is air-tight and imperishable. It keeps silage perfectly and needs no attention when well built. It is not costly where materials are at hand and cement is not too dear. Thirty-five barrels of cement will build a concrete silo 30' high and 16' in diameter, inside measure.

Concrete silos are most economically built with thin walls, well reinforced. They are sometimes built with hollow walls in cold climates. The cheapest type of concrete silo, and one answering the purpose as well as any where the winters are not too cold, has a wall about 6" thick at the base and tapering to 4" thick at the top. Such a wall needs reinforcement. To use vertical wires of No. 4 gauge, one every 24", and horizontal wires of the same gauge, one every 8", will provide ample reinforcement.

There are several ways to erect concrete silos; 2" x 6" studdings may be set up on the foundation (which is a simple ring of concrete in a trench, about 12" wide and 18" deep) as though to build an ordinary wooden silo or tank. These studdings are held in place by bending about their inside thin strips of wood and nailing with 6-penny nails to hold them. This makes the inner form.

For the outer form set up studdings 36" apart and 5½" from the inner studdings at the bottom and 4½" at the top. These studdings are tied to the inner hoop by means of wires let through holes and twisted tight. No 12 wires are right. On the inside of these studdings are placed boards ½" thick, either of green lumber or stuff that has been previously soaked well to make them pliant. But one board is placed in at a time and the concrete filled back of it. Next a wire is put in, then another board. The wires are cut to be about 36" longer than the circumference of the silo and the ends turned square over. To take the curl out of heavy wire stretch with strong team and lever till near the breaking point; then it will lie straight and may be cut into lengths as desired. With silos larger than 16' in diameter or higher than 30' larger wires should be used than No. 4.

The concrete mixture should be a fairly rich one, say 1 barrel of cement to ¾ of a yard of gravel, or if broken stone is used the proportions should be 1 of cement, 2 of sharp sand and 4 of broken stone. To finish the silo a good plan is to let bolts project up and down the length of the door openings (which should have metal reinforcement around them, the wires attaching) and to these bolts fasten the chute for holding the ladder and for throwing down the silage. Let bolts also project from the sides, outwardly, near the top and 24" below, so that 8 short posts may be bolted in place to hold a cone-shaped roof raised up 24" above the edge. This gives light to the inside of the silo and allows the filling to proceed clear above the edge, thus giving chance to settle. A strip of canvas may be stretched around these posts at filling time. The plate is a hoop of the ½" stuff, used in four or five thicknesses, breaking joints. The roof is made with 2" x 12" planks, 14' long for a silo 16' in diameter, ripped diagonally through from corner to corner, put up with the points together, shingled and the peak covered with a galvanized cap.

After the wooden form is taken off the silo may be washed, inside and out, with pure cement and water as thick as cream and the inside coated with hot pitch which will effectually resist the acids of the corn. No floor other than the earth is desirable and the silo should not be put far into the ground.

There are also steel forms for silo building that are very convenient and economical, and silos are made from specially curved concrete blocks, made with grooves in their top surfaces, which grooves receive the wire reinforcement. Concrete block silos should be plastered after being laid with a plaster of cement, sharp sand 2 parts, and afterward pitched.

CEMENT FOR ROOFING.

Cement roof laid over wooden rafters has not generally proved satisfactory. The contraction of the wood, the inequalities of temperature, the settling of the roof, all serve to crack the roof and make it leak. The one feasible means of stopping these cracks is hot pitch and cement, mixed, the pitch not too stiff. However, cement shingles and tiles are now made that form admirable roofing and are certainly superior to shingles or slate, while costing but little more. As these must be made with patented machines we will not describe them here. It is well to remark, however, that these cement tiles may be colored with dry iron ore color mixed with the mortar of which they are made, so that they will very closely resemble the best tiles, and the coloring is imperishable.

CEMENT FOR HEARTHSTONES.

Cement makes admirable hearths for fireplaces and these withstand fire quite as well as the tiles that are ordinarily bought, and are if well made nearly or quite as beautiful, besides never cracking or scaling off as the tiles so often do. The writer has three of these hearths, all in use, one of them constantly, and exposed to a good deal of heat, and all are perfect after two years' use. They were made as follows: Fill a simple box where the hearth is to be with about 4" of concrete, not very rich, and upon it a top coat of about ½" of mortar mixed 1 to 2 of sand. This top coat should have mixed in it the dry color of iron ore. The hearths are troweled down very hard and smooth and then carefully marked into 2" squares so that they closely resemble red tiles and are usually taken for such.

CONCRETE FOR CHIMNEYS.

Concrete chimneys when made of porous blocks have gone almost at once to pieces through the destructive influence of coal smoke which contains sulphuric acid gas. Yet concrete chimneys are built of great size and height by manufacturers, their stacks having linings of clay. With good clay chimney linings there would seem to be no reason why concrete should not be used for chimney building for residences or other uses. It is no more liable to deterioration from smoke than is lime mortar with which bricks are laid and this is not operative anyway where water does not reach the work. Concrete chimneys should be made of well mixed and well proportioned material so as to be almost or quite without voids.

THE USE OF OUTSIDE PLASTERING.

To put plaster on outside walls with common laths one must have first a solid backing of some rough lumber; any dry stuff will serve, but pine is to be preferred, as it is not apt to warp. Space the laths out from the side of the building about ¾". Nail them on 1½" apart.

The best way to plaster the outside of buildings is to use common poultry netting, that of an inch mesh being best, although good results are had with coarser mesh. This woven wire comes in rolls. It is put over the wall of the building spaced ½" away; or, if a very warm wall is desired, ¾", and stretched tight. The best way to put it on is to unroll and hang it as wall paper is hung, fastening the top first, then one edge, then by using 6 or 8-penny nails, starting them slanting in the edge of the netting, it may be stretched sideways. This stuff cannot be stretched lengthways, but may easily be stretched taut sideways. It is kept away from the wall by the use of laths running vertically, 2' apart. Light staples 1" long hold it in place, and if it should pucker anywhere it is held down by a staple. Screws 1" long are used to hold it away from the building; the mesh wires are placed in the slot of the screws; the staple holds them there and a tap of the hammer drives it down right. The netting is put on rapidly and is cheap. Being galvanized it is very durable, especially when incased in plaster.

The plaster should be made of good fresh lime and sharp sand. It should be made up in large amount before the plastering is begun so that all colors will be alike. It should not be rich in lime, but should be made as though for mason's mortar. It is put on as over laths. It is best to apply two coats, the first barely hiding the wire and a thin coat over that before it is thoroughly dry. This will fill and hide all small cracks. When it is completed the wire is imbedded in the middle of the thickness of the plaster. It cannot crack; it cannot peel off, for the wire being firmly stapled to the wall holds it solidly in place. As time goes on and the wall gets wet and dry again the mortar becomes harder and harder until it is like stone. It is warm in winter and cool in summer.

There is yet another use for outside plaster. That is for covering outbuildings; poultry houses plastered outside and in are warm, sightly, easily kept free from vermin and cheap. There need be but one thickness of boards and the wire stretched over it on each side or common laths may be used for the inside. The cost of this sort of plastering is about double the cost of painting once. A better plaster is made of Portland cement one part, clean sand two parts. This hardens into a cement impervious to moisture.

CEMENT FLOOR IN HOGHOUSE.

Fig. 389 shows the cross section of a hoghouse 24' x 60' with a cement floor. The floor is made in two levels, 1' lower in the middle than at the sides. By this means a dry clean feeding floor in front and a dry clean sleeping floor back are insured, and a space in the middle to collect all droppings and moisture. Bedding should be used and absorbents. The trough should extend along the front and be of cement 10″ deep and the front by the trough should be hinged so as to open inwardly enough to lock

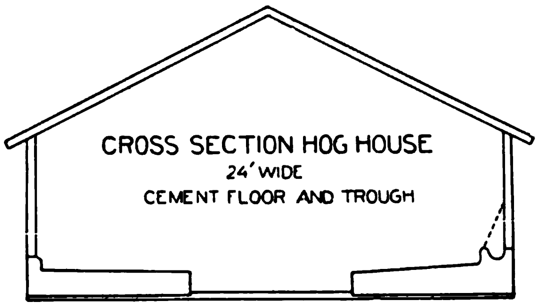


FIG. 389. CONCRETE FLOOR FOR HOGHOUSE.

at the front side of the trough, thus shutting the swine away from the trough while it is being cleaned and feed put in. The trough should be divided at intervals of about 16′ so that liquid feed cannot run away. The cement should extend upward 1′ to form the foundation wall and the superstructure of wood anchored to it by ¾″ bolts imbedded in the cement.

CONCRETE FLOOR FOR HOGHOUSE.

The bottom to receive concrete should be solid, so that it will not settle in holes nor out of the original level. It must be so that no water can stand under it, as it will freeze in winter and heave up the floor, of course cracking the concrete. It is best to remove a few inches of top soil and tamp well the surface that is to receive the cement. The general way is to excavate 8″ to 12″ and fill with gravel. But if the floor is protected from water getting under it the gravel is not necessary.

The best concrete is made from broken stone, gravel and coarse sand. Mix dry 13 parts gravel, 6 parts sand, 6 parts Portland cement; then, when thoroughly mixed, add water to make a stiff paste. Then take 27 parts broken stone, thoroughly drenched with water, so that all fine dust may be washed out, and mix the crushed stone with the other until all is incorporated with the cement.

In laying cement it is best to divide the floor into squares of 4′ or 5′ with 2″ x 4″ pieces firmly staked down. Fill every alternate square with the mortar well tamped down until the fine cement begins to come to the top. After it has stood a short time at least, but before it is dry, apply a finishing coat of ½″ or ¾″, made of 2 parts sifted sand to 1 part of cement, smoothing down with a trowel. After setting it so as to be fairly firm remove the 2″ x 4s″ and fill the other squares in the same way. If made in too large squares shrinkage cracks will occur. In laying cement walks or feeding floors outdoors the cracks marking the divisions or squares are cut clear through the cement, thus allowing for contraction and expansion.

To make concrete without the broken stone, coarse gravel may be used, but it will need more cement, say 6 or 7 parts of sand and gravel to 1 of cement. There seems to be no hard and fast rule as to this. Only as much should be mixed at one time as can be immediately used.

After completion the floor should be sprinkled daily with water, which is necessary to complete hardening of the concrete. It is best to leave the studding around the outside for a long while. Concrete will usually cost from a quarter to a half more than wood, but the concrete is for all time and is certainly more sanitary and easier to clean and keep clean.

CEMENT FEEDING FLOOR FOR HOGS.

A cement feeding floor for hogs may be built 12′ wide, as long as desired, with a slope of 1″ in 12″ and preferably with a drop at the lower side and a cement trough at the upper side. A cross section of the ideal feeding floor is shown in *Fig. 390.* Let the floor be in plain uninterrupted sunlight, as sun is a sure destroyer of disease germs.

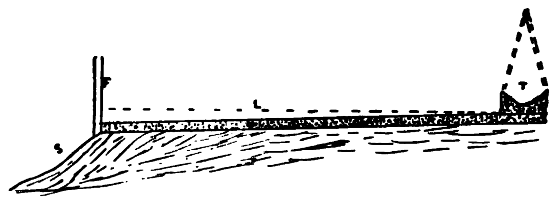


FIG. 390. CEMENT FEEDING FLOOR FOR HOGHOUSE.

In the cut *T* is the trough and over it is a section of swinging fence that will close it from the hogs while the slop or feed is put in; *L* is line of level; *F* fence of woven wire to prevent hogs from crowding each other over the bank; *S* slope over which cobs and manure descend.

CEMENT WATERING TROUGH.

Cement or concrete watering troughs are fast supplanting the fast-decaying and ever-ready-to-leak troughs. Of the former two types are shown in the accompanying illustrations. Fences, walls, floors, troughs and well coverings all decay. Therefore the coming of good cement at a low price is doubly welcome to the farmer. It seems now that he may do things so well that they will stay done through several generations and at slightly greater expense than the temporary makeshifts to which he has been accustomed.

To build a watering trough, remove the top soil down to where it is firm, say 8". Build a box the size of the outside of the trough, say 4' x 12' and 3' high. Make it strong to resist pressure when cement is rammed against it, setting stakes at the sides and tieing across the top. Put in the bottom a layer of concrete about 4" thick and through it insert a drain pipe, and an

FIG. 391. CEMENT WATERING TROUGH.

inlet pipe. Make the drain pipe 1½' with coupling, coming just flush with the floor of cement. Into this coupling screw a short standpipe, so that into this the overflow will discharge and when it is unscrewed the whole tank will be emptied. Make this short standpipe to screw in easily and keep the threads greased. (See *Figs. 391* and *392.*)

Do not try to fill up the tank with concrete high enough to allow stock to drink out all the water. Water is the cheapest material with which to fill the bottom of a trough. Make an inner form with sloping sides so that the wall

FIG. 392. CEMENT WATERING TROUGH.

will be 6" thick at the top and 16" thick at the bottom; put in place and fill with concrete and pound it down as hard as possible. Do this before the bottom has become thoroughly hard. When it has set a day or two take off the wood carefully and wash trough well with a mixture of equal parts pure cement and pure sand, using a fairly fine clean sand, or cement alone. Put it on with a whitewash brush. Sprinkle the work twice a day and when a little hard carefully fill it with water.

A CONCRETE SMOKEHOUSE.

Concrete is an excellent material with which to build smokehouses, since the walls are cool and have a tendency to prevent the heating of the meat by means of the smoke arising. Where it is possible the smoke pit should be a little distance away and the smoke allowed to enter through a little tunnel, which may be made of

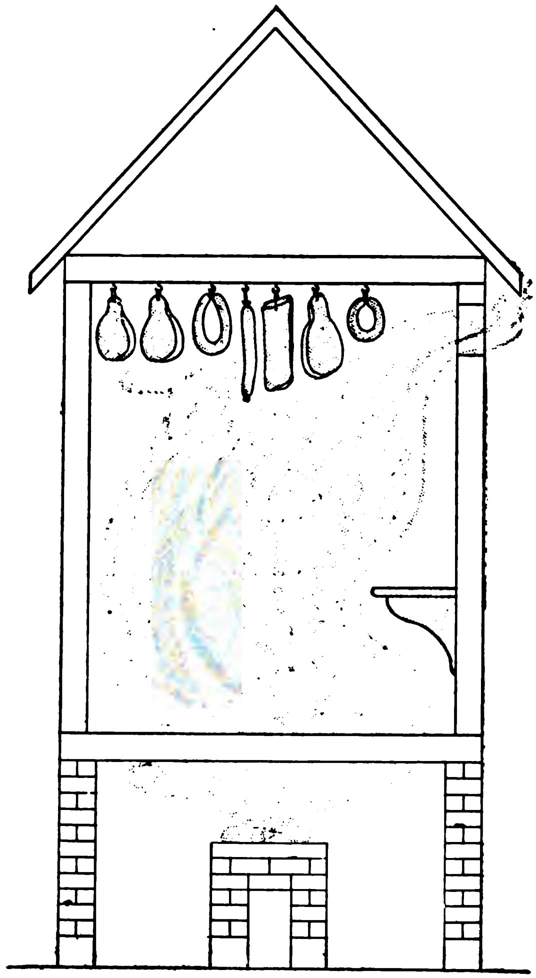


FIG. 393. CONCRETE SMOKEHOUSE.

an 8″ or 10″ tile. The concrete walls need not be more than 6″ thick and if desired the top may be formed cheaply of one slab of concrete, laid with a very little slant to carry off the drip. (*Fig. 393.*) In this slab should be imbedded a No. 1 wire about each 6″, running in both directions, which will prevent its cracking. The hooks to hang the meat should then be inserted in the concrete when it is formed. The meat bench should be of concrete also.

A CONCRETE WATER TANK.

An Ohio farmer contributes the following: "The problem of the water supply for the farm house and lawn may be solved in various ways. When one can have running water from a spring he is fortunate, and if his house sets too high for that he can often lift water by use of the hydraulic ram. Next comes the tank, to be filled by means of a pump or by gravity from the roof. This must always be the main reliance on farms in the level regions of the Middle West. And when tanks are considered there is choice between the elevated tank and the pneumatic or air service. We placed a steel pneumatic tank in the cellar and we fill this by pumping directly from a large underground cistern. It works admirably. We pump by hand, but there is objection to any system that involves human labor in pumping. Engines need care and time to start and stop them. Let us call the labor cost of pumping our tank $18 a year. The water is worth that and a great deal more. But it is very evident that if a pressure tank costs in labor $18 a year to fill, then it is worth while scheming how to get one filled for nothing. If it is possible to equip himself with an automatic tank-filling device a man can clearly afford to expend something like $300 more to accomplish it than what the air presure system would cost. Water in the best farming regions where water tanks are needed is often hard or filled with lime. For bathing one finds rainwater best.

"There is nothing new in this idea, but when elevated tanks have been made of wood or set on wooden towers they have usually proved troublesome. The one new thing is concrete. (See *Fig. 394.*) Rightly built, I believe it will prove perfect. At the old homestead stood an old stone building, about 10′ x 10′, once used for a dairy. Taking it as a foundation we erected on it a concrete tank a little more than 9′ in diameter, inside measure, and 8′ deep with walls 6″ thick. The tank has a capacity of a little more than 200 barrels; perhaps it is unnecessarily large, but we can use it for irrigation in dry seasons about the lawn and garden. The weight of this water will be 22½ tons, so it is evident that the structure must be strong. It must be well reinforced with steel rods laid in the concrete, both bottom and sides. To help those who may build from the ground up I estimate that it would take 18 yards of concrete, as many of gravel (or whatever material is used) and 24 barrels of cement to make a rich mixture. The cost of materials will be for 18 yards of gravel, 24 barrels of best cement, $48, and steel for reinforcing about $20.

"Thus there is a cash outlay for materials of something like $85, not counting the wood for the forms. We built the forms ourselves. It took eight men about 2½ days to fill the forms with concrete, including the time spent in hauling gravel. Thus the labor cost may be set down roughly at $40. The tank should be finished for about $150, counting use of wood for forms. One can hardly buy a good pressure tank and pump for less than that amount. And it must be remembered that pressure tanks are not storage tanks; one must have storage in addition. However, this tank would not be nearly high enough for some situations; there would need be an additional story between the lower room (designed for use as a small farm dairy room) and the tank room. This would not add very much to the cost, maybe about one-fifth more, since foundation, roof and floor would be the same in either case, and a floor of wood over the dairy would be sufficient. There might be ice stored over the dairy; in that case a concrete floor should be laid.

"In our situation we got elevation enough without going higher than 16′, and with this elevation we can fill the tank from the clean metal roof of a large barn standing about 200′ distant. The pipe leading the water across is 2″ in diameter, buried below frost and has in it a vent hole to empty it in winter time so that water may not stand to freeze in the vertical stem. We made some blunders, and I would suggest that a good handy carpenter put up the forms; he will be surer to get things plumb and square. Let me emphasize that studding for forms should be no farther apart than 24″ where inch lumber is used, and that it is better to use seasoned pine studding that will keep straight and that all boards should be run through a planer and sized. They receive no great injury in use and can often be borrowed, or hired, from the dealer in lumber. Wire together well; the wet concrete will press hard in every direction when it is put in forms. It takes, of course, two sets of studding; they will be put opposite and well wired together. The outer wooden shell of wall is first put up, high enough to lay the lower walls, and the concrete floor (the studding may go clear up), then the

FIG. 394. CONCRETE WATER TANK.

reinforcing irons must go in. Here is need of a little professional skill and care. One can get the engineers employed by manufacturers of metal reinforcement to specify exactly what reinforcement is needed and how it shall be put in, and that is the right thing to do.

"The principle of metal reinforcement is that the steel bars be put as near the outside of the wall as they can be and be well covered with concrete; within ¾" is right. Briefly, the tank is made a network of bars, spaced 4" apart in both directions on the bottom, and the bars ½" diameter. If plain steel bars are used their ends should be turned at a square turn. About the side bars are spaced first 4" apart; then, after 24" height, they are 5" for 24" more; then 6" the rest of the way; and the vertical bars about 20" apart to which the horizontal ones are tied with small wires, this to hold them in place. We were careful to wire our cage well together, to see that it was within ¾" of the wooden form, yet touching it nowhere, then we put in our floor of concrete, having first all the pipes in place that would be needed in it, and then we let this floor harden enough so that the rest of the form could be put in, then sprinkled well with pure cement where the wall rested on the floor and put up the rest of the wall. We made the mixture both rich and wet, so that no tamping was needed, and only a little agitation with sticks to cause air bubbles to rise out was given it. The proportions we used with our gravel, naturally well filled with clean sand, were 1 of cement to 4½ of gravel, wet enough to pour from buckets into the form. This wet rich mixture is needed in a reinforced wall; it coats perfectly each bit of steel and preserves it. We made the roof flat, sloping a bit toward the middle so that rain will flow in, projecting 30" on each side and 4" thick, reinforced, and of course for the projecting part the reinforcement goes on the top surface, just hidden. The water that falls from the sky to this roof will fill the tank almost exactly once a year, of normal rainfall.

"The dairy room will have cement milk trough, will always be cool in summer, and we think will not freeze in winter, with that mass of water above it. We can supplement the work of the roof in water storage by the windmill if we need to do so."

CONCRETE BLOCKS FOR HOUSES.

A Colorado farmer says that to make good cement blocks it is necessary to have a mixer, and if a down-face machine is used the operator should have three different batches of concrete

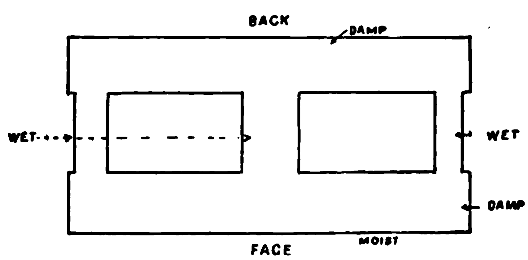


FIG. 395. CONCRETE BLOCKS FOR HOUSES.

on the tables at all times. First, use a fine sand and cement mixed in the proportion of 2 parts sand and 1 part cement for the face. This should be simply moistened with clean water so it will not adhere to the face plate. Cover the face plate with about ½" of this material, then add a coarser mixture of damp concrete and tamp lightly. Then throw the cores into place and use a mixture of concrete as wet as possible and yet that will stand up, this mixture to be used at both sides of and between the cores. This should be tamped more than the first that was placed in the mold. Now add enough of the second kind used to complete the block. This should be tamped quite hard. Now smooth off the back of the block and remove it from the machine.

The object of making the center parts of the block very wet is to check the moisture, as that part of the block will be more dense and less porous than the parts immediately adjoining it, and gives the dead air space a chance to absorb the moisture.

As to the size of block that is the best an 8" x 8" x 16" is very good or an 8" x 9" x 18" is good. Try to get the length of the blocks to be an exact multiple of the width and they will handle easier. After the blocks have been removed from the machine they should be carried away to where they will not be interfered with for 24 hours. It is an easy matter to crack a block simply by jarring the board on which it is placed, as might be done by walking on the board.

When the blocks are about 12 hours old as soon as they begin to show a light color they should be sprinkled with clean water. They may be taken off the pallets when they are 24 to 36 hours old. They should be piled not more than three high the first day they are removed from the pallets and sprinkled three times a day for five days. Alternate drying and wetting add to the strength of the blocks, provided they are not allowed to remain entirely dry for more than 12 hours. After five days they may be stacked in the yard and watered with clean water once a day for 10 days, and two or three weeks after they are ready to be placed in a wall.

Fig. 395 shows the type of block here discussed. Any desired face can be formed on this block when being made. Use nothing but Portland cement in making blocks, as the natural cement will not stand in air.

CONCRETE WATERING PLACES.

A concrete storage tank for water, with an arrangement of separate drinking places for swine and sheep that will not freeze, these watering places all fed from the storage tank, and somewhat widely separated from each other, may be constructed as follows (see *Fig. 396*).

Let the tank be a good-sized one, round or square. In building it if a section of cast iron pipe about 10" in diameter can be secured and passed through it and at one end connected with a vertical flue or pipe it will be wise. A little fire can be built in this pipe and the chill taken off the water; besides the warmer the tank water is kept the less danger of the watering places freezing. Beside the storage tank, or at some convenient spot, must be a small tank to have float valve and be connected with all the watering places. These of course must all be on the same level. This small tank may be protected by a heap of straw or manure so that frost will not affect it at all. Whenever an animal takes a mouthful of water from a drinking place the water is lowered in this secondary tank and at once a fresh supply comes in from the main

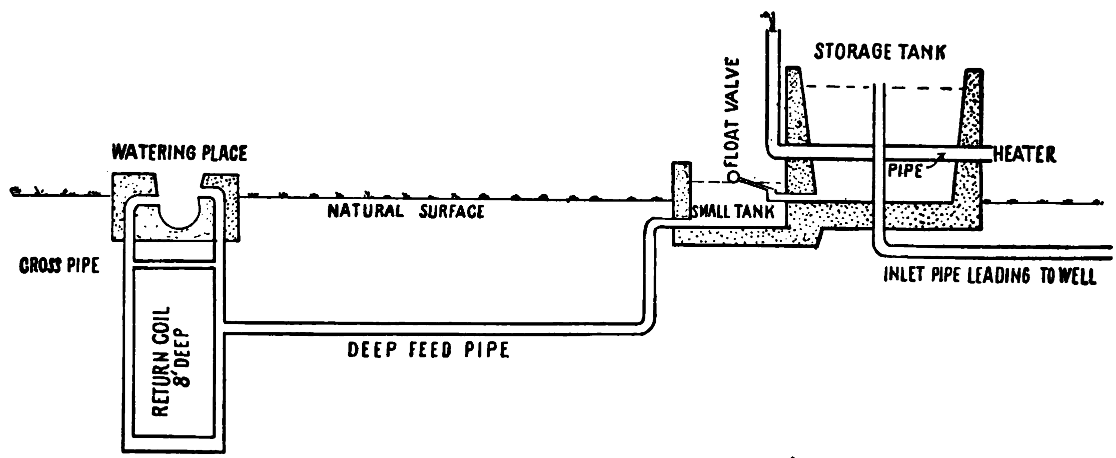


FIG. 396. CONCRETE WATERING PLACES.

tank. Perhaps it is impossible to construct individual drinking places so that they will not sometimes freeze a little at night when not in use. They may be protected with hinged wooden covers that will help greatly. Lay the pipes supplying them very deep. Something may be done to prevent frost reaching far down the pipes by providing a return to make the water circulate; the idea is that one or the other of the vertical pipes will have in it a colder column of water, and there will immediately set up a circulation, which will continue steadily as long as there is cooling going on, or heating either. Thus the water will never freeze lower down than the cross pipe in the loop. It would be well, if the digging is not too hard, to put these loops down at least 8′ in the earth. Then if there is at the bottom a bit of large cast pipe, say 4″, into which the vertical pipes are screwed, all the better, since the circulation will be better. This arrangement will not freeze lower than the cross in the pipe till the whole earth freezes up. If litter is placed around the drinking bowl, and it is covered at night, it will be well-nigh frost-proof. Care must be observed in these drinking fountains that sediment does not enter the pipes; the bowl may be deep, with chance for sediment to collect below the orifices of the pipes. The illustration shows the coil or return pipes both reaching to the bowl, one higher than the other, and with also a connecting cross below. This lower cross should be of smaller pipe than the vertical, perhaps 1¼″ for the main pipes and 1″ for the cross. Then there will always be water circulating, even though the fountain should freeze, which it will not be apt to do. And keep the bowl cleaned out. A brass screen at the end of each pipe would be good. If the bowl is a foot deeper than the pipes all the safer.

BUILDING A CEMENT TANK.

Fig. 396a shows a cross section of a square cement water tank for cattle. The walls penetrate the earth only till they reach a firm foundation and the bottom rests on the earth.

The walls are 36″ high and 6″ thick at top and 16″ at base. The bottom is 4″ thick, though it may well be thicker where it joins the walls, so as to strengthen them somewhat. Reinforce this tank well with steel rods spaced 12″ apart about the wall, placed as shown in the illustration—these rods 36″ long and ¼″ in diameter. At the top imbed close to the outer edge rods 24′ long, bent around each corner and their ends lapping. This reinforcing is imperatively needed in so large a tank, especially when built in square form. The bottom has no especial need of reinforcing, though a few rods through it will tend to prevent its cracking. They should bend up at the ends and reach nearly to the top of the wall.

To build this tank is an extremely simple matter. One makes a box for the outer form, leveling it at the top and digs a trench for the

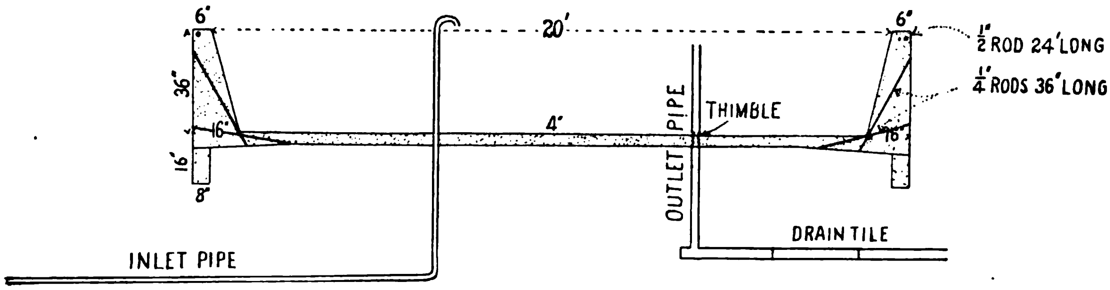


FIG. 396a. BUILDING A CEMENT TANK.

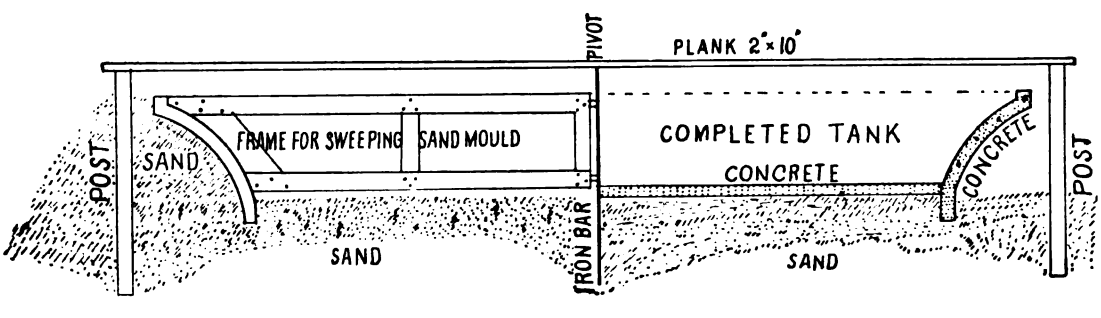


FIG. 396b. BUILDING A CEMENT TANK.

foundation; it need be no more than 8" wide and perhaps 16" deep, then puts in his concrete floor and on it the box for inner form; then the walls, and all of it should be put in on the same day. Make a rich mixture, rather wet, so that it will pour, and keep it agitated well with sticks as it is poured in so as to work all air bubbles to the surface. Take off the inner form in 24 hours and paint the inside with a wash of cement and water, thick as gravy.

The inlet and outlet pipes must be put in before the tank is built, the inlet pipe reaching just above the water line and if it has a curving piece or "return" put on it all the better. The outlet pipe should be at least 2" in diameter and have a thimble set in the concrete bottom. Grease the threads well so that it will be easy to screw in and out. Water overflows over the top edge of this pipe and runs down into the tile provided, or it is screwed out and the whole tank is emptied.

Fig. 396b shows a tank that is easily and cheaply made if one has sand in one's neighborhood to use for a form. To make this form set up a piece of stiff pipe, or an iron bar, *P*, in the center of where it is desired to build the tank. In line with it and outside the proposed tank set two posts, across them a strong plank; this stiffens up the pivot. Now we need a frame for sweeping around and making the mold. Four boards nailed together, one of them a wide one hollowed a little to make a neat curve as shown on the left hand side of *Fig. 396b,* makes this frame. Now pile up sand around the circle and wet it and pack it with the shovel, then swing the frame about and let it scrape off the sand till there is a complete circle molded in the sand pile. Then we are ready to put in concrete. No inner form is needed; as the concrete is put in, sand is thrown against it to hold it in place, after it has been fairly well placed with the trowel. Use moist concrete but not too wet to be held in place.

After the sand mold is ready then clean out the trench (it had better be dug at the beginning) and fill it with concrete. If one wishes to make the outer surface of this tank absolutely smooth and fine do it in this manner: Screen some coarse sand and mix with cement, 1 to 2; do not wet it. Spread it over the sand mold in its dry state about 1" thick, pressing it down hard (not hard enough to disturb the packed sand). Use the frame and sweep this if desired simply shortening the frame 1". When this dry cement and sand are in place moisten them with a fine sprinkler, or the wet sand may give it enough moisture to make it set. Then put in the bottom, reinforcing it somewhat, say a 1/4" rod each 16" in two directions, and then the walls, about 6" thick and for each 12" of vertical height lay in a big wire or 1/4" rod bent to fit. As the concrete is placed and smoothed in the inside, pressing it hard against the form, throw up a little sand against it to hold it up. At the top edge place a rod 1/2" in diameter bent to shape; it need not be continuous; short rods hooked together will serve.

This sand mold is built in less time than the square mold and requires no lumber. It makes a stronger and more beautiful tank. With good gravel mix 1 1/4 barrels of cement with each yard of gravel, or if stone and sand are used, mix 1 cement, 2 sand, 5 stone. For hogs make near by, but not too near, a smaller tank, connecting the two with an underground pipe. Do not have the hogs near enough to the large tank so that they will get hurt by cattle and horses.

A CIRCULAR CONCRETE TANK.

Fig. 397 illustrates a good circular concrete watering tank that is described as follows: "This tank holds enough water to use for a week or more. Building the form of a circular watering tank is often rather difficult and costly. The form usually costs more than the concrete that it molds. In this tank the form costs nothing but a little labor, and that very much less than would have been required for a wooden form. The tank was molded in sand. The sand was afterwards used for other purposes, so that really it cost nothing but the placement. We began the tank by digging a narrow circular trench to come just under the wall, the circle 10' in diameter. This trench was dug down to firm clay, and was intended merely to make sure that the tank had good support so that it could not settle unevenly. The earth from the trench was thrown out to make backing for the sand mold. Pipes were put in for inlet and outlet, and there seems but one right way to put in these pipes. The inlet pipe should enter through the bottom and rise a little way above the level of the water when the tank is filled. We used 2" pipe, which is most satisfactory when water runs with no pressure, this tank being filled by gravity from the overflow of other watering places in the sheep yards.

"Placing the outlet pipe is seldom done just right. There should be a tile drain leading away, and in the bottom of the tank a 2" pipe union just flush with the surface, on the under side of this union a pipe joining the tile and on the upper side a short piece of 2" pipe reaching up to the height that you wish the water to stand in the tank. Thus when it is filled the surplus water overflows into this pipe and discharges into the tile drain. When it is desired to clean the tank the pipe is unscrewed from the union and all the water rushes out into the drain. Thus the pipe makes both plug and overflow. After the pipes were ready and the trench dug the next step was to erect a perpendicular bar at the center of the proposed tank. This forms the pivot for sweeping the mold. While we did not think of it in time the inlet pipe might well be used for this purpose, piecing it out temporarily to make it tall enough. It must be exactly vertical, and supported at the upper end, as there will be put against it quite a bit of stress in forming the mold. We placed a 2" x 8" plank across the site, supporting it by posts at each end, well braced; this held the upper end of our pivot, or axle. On this pivot we fastened laid up. As the concrete was mixed fairly wet (not sloppy) the walls would not quite lay up without support, and sand was shoveled against the fresh concrete on the inside as fast as it was laid up. At intervals reinforcement of heavy wire was laid in, encircling the tank, and this was made epecially strong at the top rim. The thickness of concrete was about 5" except at the top, where it was made 7".

"After it had set for a day the sand was taken out from the inside and the surface smoothed up and washed with pure cement and water, thick as cream. After ten days the sand was taken away from the outside and the tank was complete. Six teams can water at one time without disturbing one another. A given amount of cement will go farther used in this way than in any other form that we know. There should

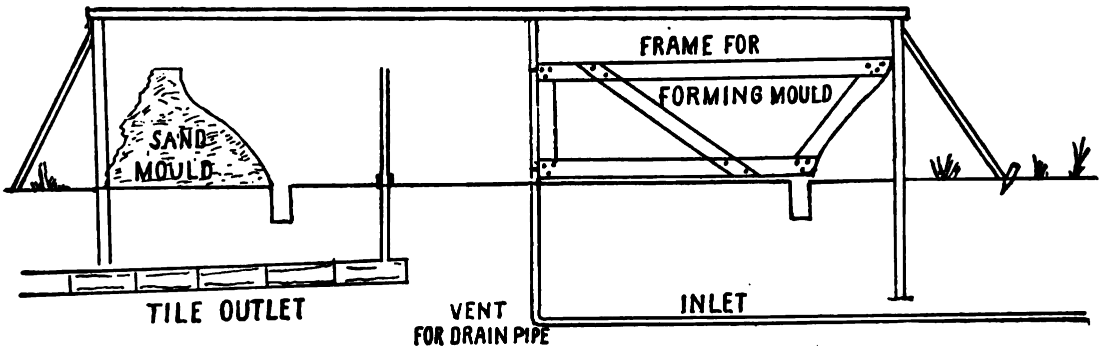


FIG. 397. CIRCULAR CONCRETE TANK.

with loops of wire a frame of three boards swinging about freely about the center, and this was to form the sand into shape for the mold. As curves are as easily made in such form as straight lines we made the outer board curved, though to have made it straight and inclined would have been as well, and a little easier done. It is not well to try to make a tank of this sort with vertical walls since it is so much easier to make the form with sloping walls, and is also easier to lay on the concrete. Damp sand was then piled up about the circumference of the circle and packed hard as it was laid up, the form being revolved about from time to time to make the sand lie at the right place, and to scrape off the surplus where it was piled too far in. In a short time the mold was complete, and was as exactly round and true as a china saucer, which it resembled. Next the loose sand was shoveled out from the bottom, the trench cleaned out, and concrete put in. The bottom was well reinforced with scrap iron (a good place to get rid of it), so that it could not crack, the trench filled at the same time, then the walls be a curved return on the upper end of the inlet pipe merely to prevent sportive boys throwing pebbles down it."

A FARM TANK.

The builder of the cement watering tank shown in *Fig. 398* thus describes it: "My tank is 6' wide at bottom and 10' at top and is 26" deep. It required but four barrels of cement to build it, with three tons of crushed stone. We reinforced it well as we built it, with very heavy wire. It has now gone safely through two winters and I think will be everlasting. I used a tank heater part of the time. Being saucer-shaped it cannot well burst from freezing.

"To build such a tank bank up about for the outer form with earth and sand. This may easily be made into nice regular form by use of a wide board fastened at one end to a bar thrust in the ground and shaped at the other end to form the mold. This board revolving about will make the form exactly regular and correct. The earth or sand should, of course,

FIG. 398. FARM TANK OF CONCRETE.

be fine and backed nicely. We covered this earth form with burlap and then with building paper and laid the concrete directly on it. The paper dried on the concrete and made a nice covering for the outside. No inner form was needed, as we used the concrete fairly stiff, as wet, however, as it would stand up at the desired slope. We made the thickness about 6", putting in the bottom first, and then the sides in regular courses, laying in plenty of wires as we went along. We washed it inside with pure cement when it was set. There was only one piece of wood needed

FIG. 399. OUTSIDE PLASTERING OF A FARM COTTAGE.

in this form; the board and the time in doing the work was less than would have been had we built a form of wood.''

BUILDING CONCRETE HOUSE WALLS.

How may a form be built to construct hollow walls of concrete?

It is not a difficult problem, so the inner air space is large enough to permit comfortable working. The design (*Fig. 400*) shows how a wall may be readily built of two walls, each 3" thick, and an air space between them of 10". The only trick is to get out the plank of the inner form, and this is readily done when the inner studding of 2" x 6" is beveled so that it may readily be twisted to loosen the planking. It should not be struck but gently and evenly twisted, when it will release the planking. The ties across the wall are best made of vitrified paving brick, if they can be gotten 12" or 14" long; if they cannot be had of that length the inner form may be narrower. Wires, which should be galvanized, hold the outer studding together; these wires are cut and remain imbedded in the wall. If no paving bricks are to be had good hard-burned drain tiles may make the connection between the two walls, or short pieces of iron rods, or even very heavy galvanized wires, say about No. 1 size, cut and the ends bent over. Such a wall is built up a few feet at a time and allowed to set and harden somewhat before the inner forms are taken out and raised up. It will prove cold and damp-resistant. The inner surface will be plastered; the outer surface may be simply roughened a little with a tool

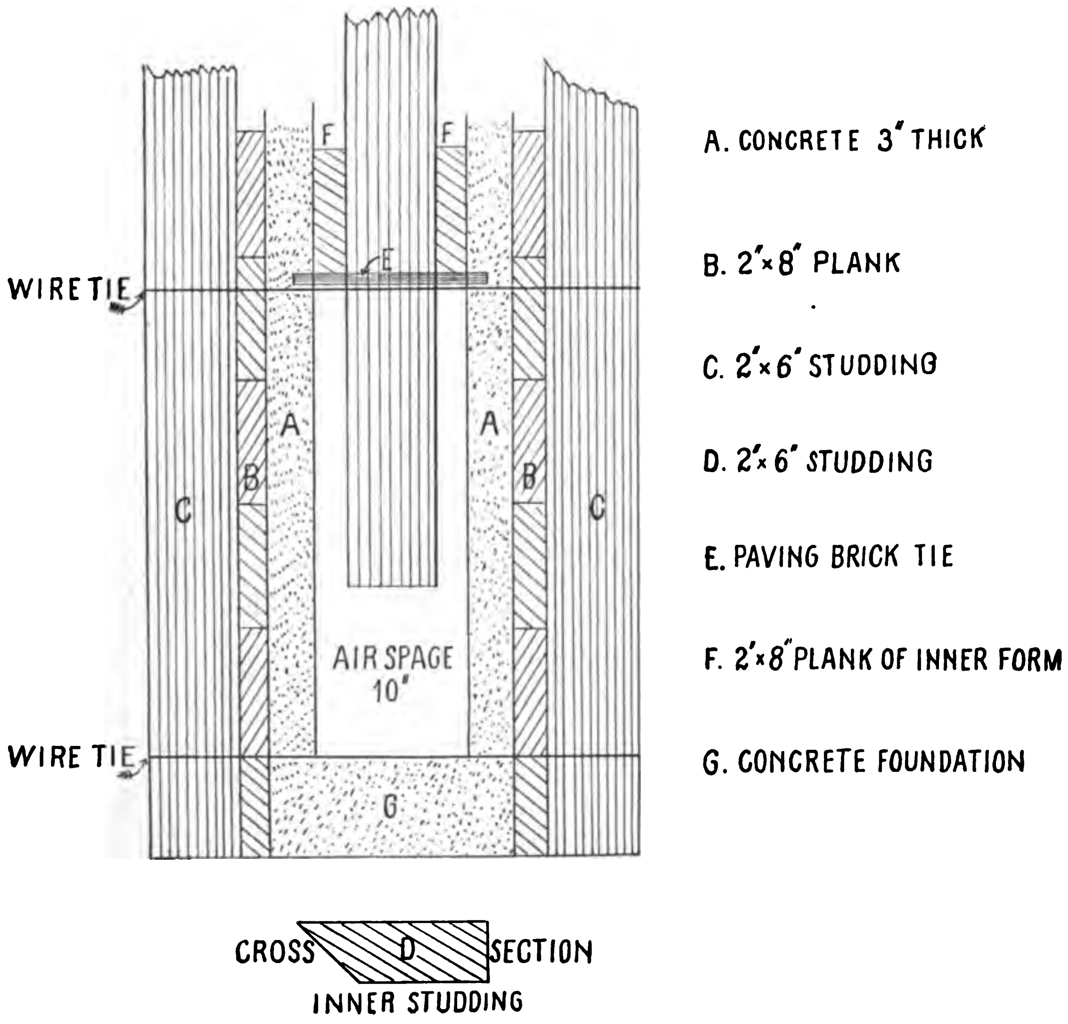


FIG. 400. BUILDING CONCRETE HOUSE WALLS.

made for that purpose or washed with the proper acid to make it rough and of uniform surface, or it may also be plastered, though this does not usually give so pleasing a surface as the rough one.

At the top and bottom the walls will be hollow. The two walls are bridged over for the top, tiles or slate being used, taking care that they do not cover more than about 1" of the wall at the inner side.

MISCELLANEOUS.

SILOS.

LOCATION OF A SILO.

When possible the silo should be located in the feeding barn, since it not only brings the cost of building within the reach of every one who is really in need of a silo, but greatly facilitates the handling of the silage when feeding it out. Depth in a silo is always preferable to breadth, so that in the case of basement barns it is advisable to let the silo reach from the top of the barn posts to the ground floor of the basement; a door or opening can then be made from the silo directly into the basement where the silage is to be fed. The next best location is adjoining the feeding stable. In most dairy stables the cows are stanchioned in two long rows facing each other, and whenever it is possible it should be arranged so that the silo can be entered from the end of this feeding alley. A wooden track can be laid along the center of the feed-way and into the silo, upon which a low-wheeled car can be operated to distribute the feed. If the silo building is located entirely separate it should be planned to load the silage into a cart, which can be driven into the feeding barn, thus delivering the silage with little labor directly to the stock. The idea of convenience should not be lost sight of, for by exercising a little thought and judgment the labor of waiting on the stock through the long feeding season can be greatly reduced.

FILLING SILOS.

The cost of putting corn into the silo depends largely on the advantage taken of all the little devices that are calculated to lighten and reduce the labor of harvesting and drawing to the silo. By the use of the corn binder for cutting in the field and conveniently equipped wagons for hauling there will be no more hard work connected with securing the fodder for filling the silo than there would be in harvesting a clover or grass crop. Many farms are supplied with low-wheeled wagons or trucks. A very simple and practical way of equipping the ordinary high-wheeled farm wagon is shown in *Fig. 401.* This rack is made of 2" x 8" plank, 16' long, one end of each being placed on top of the forward bolster; the other ends pass under the rear axle and are chained or bolted up tight to it; these two pieces make the foundation of the rack. The wagon is coupled out as far as the planks will allow. On top of the plank are placed four cross-pieces, equally distant from each other, as shown in the figure. These cross-pieces are 2"x4" and should be about 7' long; upon these are laid inch boards parallel with the wagon. The load is of course placed wholly in front of the rear wheels, but the rack is sufficiently large and low enough to enable a man to put on a ton of green corn from the ground without having to climb up on the load or hand it to a second person to deposit.

While it is true that silage cut fine may pack somewhat closer than that cut long, it is doubtful whether there is any material gain in the operation; by cutting fine more of the inner parts of the stalks are exposed to the air, and perhaps more fermentation induced than with longer cuts. There is nothing gained by cutting fodder fine instead of coarse, provided stock eats it equally well in both cases; the gain in cutting, which is often very great, comes mainly from getting consumed that which would otherwise be wasted. In the case of silage, there being no necessity for cutting the fodder in order to have it eaten, the length of the cut appears to turn upon somewhat closer packing on the one side and extra expense of fine cutting on the other. With ample power and a modern feed-cutter a silo can be filled in about half the time taken by old methods.

When corn has reached the proper stage of maturity it is not necessary that it be wilted before putting into the silo in order to make the so-called sweet silage; only the immature fodder needs wilting; such should be wilted from about 24 to 48 hours, if possible, before putting into the silo. Varieties that mature, if left until the ears begin to glaze, can be put into the silo immediately after being cut with satisfactory results, provided there is no outside moisture on the corn as it goes into the silo; nor is it necessary to suspend operations every other day in order to let the silage in the silo reach a certain temperature before filling can be continued. If the corn is sufficiently mature, and is put into the silo without rain or dew, there need be no fears about the quality of the silage, whether put in slowly or rapidly. There is a limit to putting dry or excessively wilted corn into the silo beyond which we dare not go. When the corn has lost enough water to cause the leaves to rustle and break in handling it does not pack closely enough in the silo to exclude the air, and on opening the pit it will be found that the silage is fire-fanged and permeated all through with a white mold. There is another reason why the corn should not be allowed to become so dry even if there were no trouble about its keeping in the silo: when dry corn is put into the silo we have lost the succulent quality of the silage that makes it especially desirable. Having once commenced to fill the silo the work can be crowded right along by observing the conditions mentioned. In case of an accident or break-down it will do no harm to suspend work for a day or two, but if left longer than this the silage to a depth of two or three inches usually begins to mold. When filling is completed a foot and one-half of chaffed straw, marsh hay or cornstalks will make a sufficient covering. The use of weights is now obsolete. The silo should be examined daily for a couple of weeks and the covering

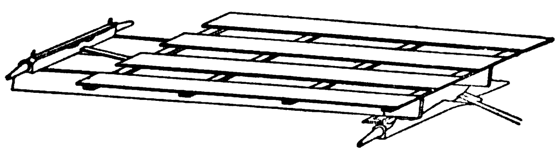


FIG. 401. RACK FOR DRAWING FODDER CORN.

pressed down until the settling has ceased.

The question is often asked if one crop can be placed on top of another in the silo, provided that the first has only partially filled it. Most certainly; if one crop, as clover, for example, only partly fills the silo, when the corn crop has matured the covering of the clover can be removed or left on, as desired, and the other crop placed on top of it. By filling at different times much more can be got into the silo than if a single crop is placed therein by rapid filling. Even with the slow filling, silage settles considerably after the silo is closed up; with very rapid filling it may settle as much as two-fifths, or even one-half. Under any system it is well to allow two or three days' settling at the last and to fill up the silo again so as to get in all the feed possible.

AN ILLINOIS SILO.

The well-known dairyman, H. B. Gurler, of DeKalb County, Ill., thus describes several types of silos and their construction: My first silo was built about 25 years ago. It was rectangular in form, 20′ deep and sheeted inside the studding with a single sheeting of first-class match ⅞″ pine. A few years later I built another silo with three compartments and double-sheeted the inside walls, using paper between the two courses of lumber. In about seven years these double walls began to show decay and at the end of ten years I was compelled to tear them out and put round silos in their place. A double wooden wall is the last kind of a silo I would build if I were to build another, as the moisture gets between the two layers of wood and does not dry, causing decay, and the walls are decayed beyond usefulness in a few years. If one will persist in using wood let it be of but one thickness and of a quality that will be sound and make as near an air-tight wall as possible.

Five years ago I built my first round cement silos, building three that season. The following year I built one 38′ in diameter, which I consider too large, as I am compelled to feed about 200 head of cattle when it is opened to keep ahead of decay. If I am feeding less than that number there is danger of the silage being exposed so long that decay will begin and then trouble begins, especially if it is being fed to cows in milk. Twenty feet in diameter is a convenient size and I would not build with my present knowledge any larger in diameter, but build as deep as I could conveniently in our prairie country. (See *Fig. 402.*) Three of mine are 38′ deep and three are 24′ deep. I prefer the deeper ones. With five years' experience I am confident that the round cement silo is the most economical kind to build that I know anything about. The cement preserves the silage and also preserves the wood, as it prevents moisture from reaching the wood from the silage. In case the cement cracks (I have had very little trouble in that way) go over it with a wash of cement the same as a cistern is repaired when it cracks. I find this to fill all cracks perfectly, so that one would not know that there had ever been cracks. A cement silo cannot be built as cheaply as a wood one if the first cost alone is

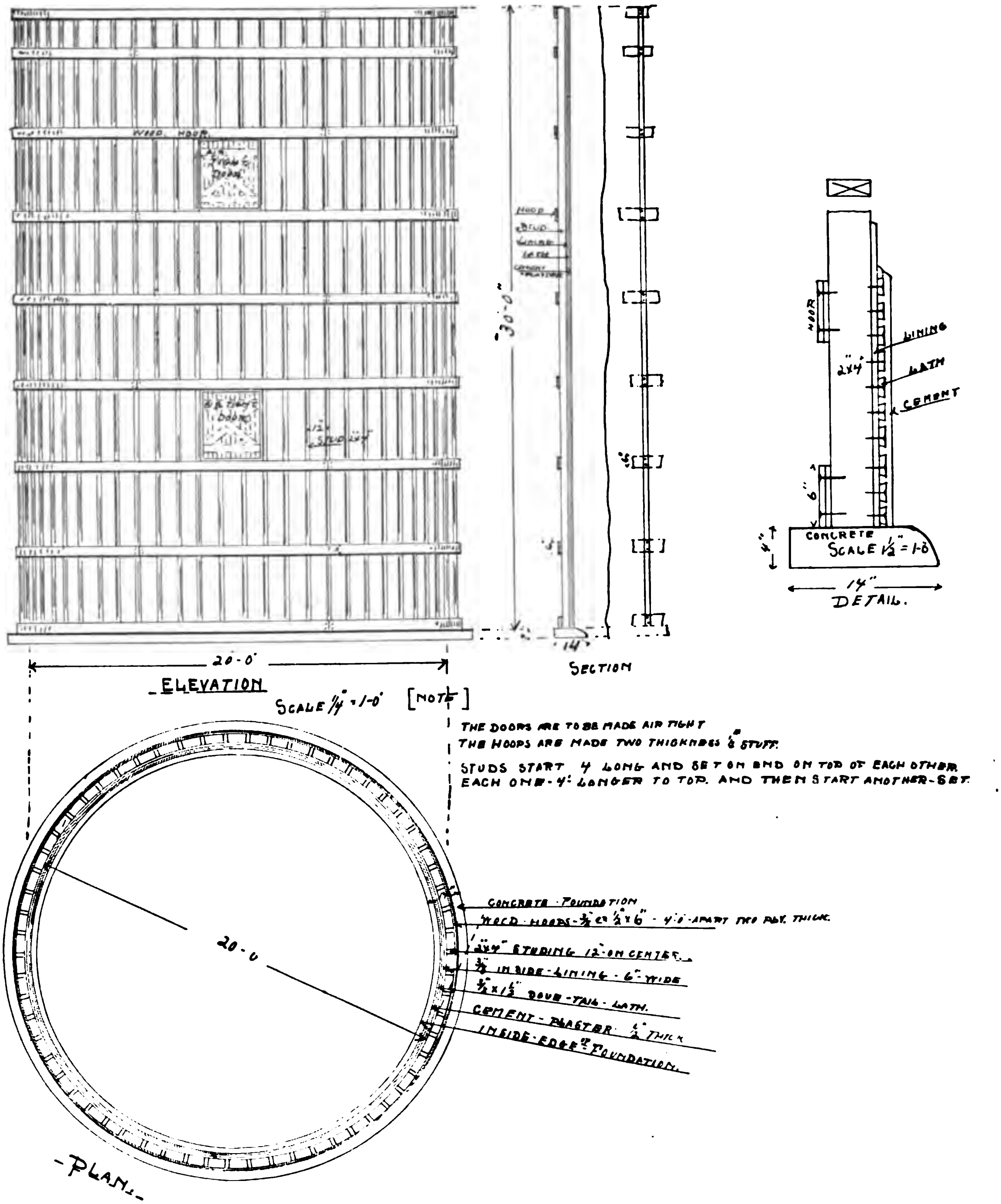


FIG. 402. CONSTRUCTION AND TYPE OF ILLINOIS SILO.

considered, but if the matter of durability is taken into consideration I fully believe that they are the most economical to build. I believe my cement silos can be kept in perfect condition for 50 years at the simple expense of once in about three years giving them a coating of cement wash. This we do as we fill them, applying as high as we can reach from the ground and when we have them filled nearly to this point put the wash on to another section and so on to the top.

The silo that I built in 1898 on which I put no roof cost me 12½ cents per square foot of surface wall. To illustrate: A silo 20' in diameter is 63' in circumference, and if 38' deep or high it has 2,400 surface feet, which at 12½ cents per foot would cost $300, and it would hold 250 tons. Some would figure it to hold 300 tons. This does not include the cost of a roof, which after three years' experience I am confident is more a matter of convenience than of necessity. I do not believe it adds a dollar to the value of the contents of a silo. I do know that the roof is very much in the way when we reach the top in filling, as a man 6' tall is constantly bumping his head against the roof.

My silos all have clay floors and the silage keeps as well on clay as on cement. If you need to keep the rats out cement the bottom. The foundation may be of stone, brick or cement (grout) to a proper distance above ground. I used 2" x 4" studding, 12 in centers, but I am certain that they might have been put 15 to 16 in centers just as well, as all the object of the studding is to hold the lumber together, as there no lateral pressure can reach the studding unless the lumber sheeting is first pulled in two by the pressure, and the pressure required to break this circular sheeting is something surprising. The inside sheeting was secured by taking 6" fencing and having it resawed, making the material a little less than ½" thick. On this were put laths made from the same material, the laths being made with beveled edges so that when nailed onto the sheeting horizontally the same as the sheeting is put on we have a dove-tailed joint between the laths to receive the cement, preventing its loosening until it is broken. The patent grooved laths might be used, but they cannot be sprung to a 20' circle.

The first three circular silos that I built were put in a row and enclosed with a frame building like a barn. This obviated the need of sheeting outside the studding. Not being certain that I had sufficient resistance to the lateral pressure in the inside sheeting, laths and cement, I put wooden hoops outside the studding, using the same material that I did for the inside sheeting, putting it on double and breaking joints. I learned that I could secure more resistance for the money in wood than I could in any form of iron hoops and where protected from the weather they were all right. For outside sheeting I used in one case the same material that was used for sheeting inside. This acts as weather-boarding and also helps to resist the lateral pressure. For the cement work use none but the best (I used the Portland), and mix it one part cement and two parts clean sand. Be careful not to have any clay or loam in it.

A SILO OF WOOD AND CEMENT.

According to Joseph E. Wing this is the cheapest and perhaps the most economical silo yet devised. He thus explains the method of construction:

Begin by digging a trench as narrow as you can with your post hole diggers and 3' deep, widening it at the bottom. This trench will be circular, of the diameter you wish your silo—12', 14' or 16'. I would not build wider than 16' with this form of construction. Fill the trench with good cement concrete, ramming it hard, and extend it up above ground 2'. It should be made 8" thick above ground. To build this make a form of thin boards bent in a circle like a cheese box. Make the top of the concrete exactly level. Procure common rough barn siding or fencing; for a silo of small diameter 6" fencing will be good; for a wide silo the stuff may be wider. Make two hoops of boards ½" x 6", 5" larger than the inside circle of the concrete foundation. Treble the ½" boards, breaking joints. Lay these hoops on the wall and take a piece of siding, set it up inside the circle and nail fast, seeing that it is vertical. Set up four of these boards about the wall, then plumb them carefully and brace them, raising up the other circle and nail it at the top. If you wish to go higher let the upper hoop extend above the top of the boards 3". It will then serve to catch the lower ends of the second set of boards. Now nail on all the boards, siding as though siding a barn. Nail barrel staves lightly at the middle to hold in place. Leave an open strip 3' wide where the doors will come. You now have a big barrel made of 1" boards and nothing whatever yet to give strength or tightness.

The bottom of the lower door should be 7' up from the ground; side up to that point. At the side of the doors, on the inside, nail 2" x 6" studding, flat-ways, directly to the boards to strengthen them there and make a finish. Provide stuff ½" or ¾" thick, 3" wide, and begin to put it horizontally around the outside of silo, spacing 3" apart. Nail it well and break joints. On this shingle the wall. Let the stuff go across the doors and be especially careful to select good material there and to place it judiciously. Doors need not be closer than 4' to each other. It is easy to lift silage 2' and then to dig down 2' to a lower door. It will add to the strength to make them 6' between.

If one length of the boards cannot be obtained set up another set on top of the first. It is just as well to do this in any case. A silo should be at least 30′ deep. You may use 16′ stuff for bottom set and 14′ for the top. That with the wall gives a 32′ silo. Run a few strips of strap iron up the siding to hold the two sections together in a cyclone. When all is stripped with the ½″ x 3″ stuff you have a wall that cannot be rent asunder. The tensile strength of wood is enormous. Cheap elm or green oak will bend easily and make good material for this stripping.

Lath the inside with common plastering laths but space them 1″ apart. Nail a row of them right around, then another row right on top of the first, breaking joints and allowing the second lath to project above the under one ¼″, thus giving a secure hold for the plaster. These plastering laths alone would hold the silo from spreading. Plaster with best Portland cement into which sufficient fibrous gypsum has been mixed to make it adhesive. Now and then whitewash it with pure cement after being used or coat it with pitch to preserve it from the acid of the silage. Bevel the 2″ x 6″s that form the door jambs to receive the doors.

This silo has had tests in Michigan and elsewhere and has enthusiastic adherents. It should endure for many years and has the advantage of the stave silo in that it will never blow down nor collapse. In roofing it at the top bend around and nail five thicknesses of the ½″ stuff to make a plate. Get 2″ x 12″ plank long enough for rafters and rip them diagonally from corner to corner. This should be done in a mill, where it is done very rapidly. Set them up with points together and toe-nail together, then shingle. This makes a slightly conical roof. Make it steep; it looks better and enables you to blow a mound of silage. Leave the earthen floor.

THE WING CEMENT SILO.

This silo, built by Joseph E. Wing, has a wall 6″ thick at the base thinning to 4″ at top. It is 16′ in diameter and 30′ high. (See *Fig. 403.*)

Mr. Wing thus tells how it is built: We bought a quantity of 2″ x 7″ hemlock staves to form the inner core of the form. In erecting this core we nail a ½″ strip 6″ wide horizontally about the staves on the inside as we set them up; this keeps them in place and is easily torn off when taking down the wood. The staves we beveled slightly as silo staves are beveled. I think now that to have grooved them and put in the grooves short metal tongues at three or four points along the length so that they would have been unable to move against each other would have been wise; they could have been set up more rapidly. We set them up much as you would set up any wooden silo, a 16′ length first, using a wooden hoop 2″ x 6″ built of ½″ stuff as a form to build against, this hoop being on the inside of the silo. Each stave was spiked to this hoop; when the lower section was finished the spikes were withdrawn and the hoop raised up for the second form.

The outer wall of the form was of ½″ oak stuff, 8″ wide, the boards running about the silo horizontally and held in place by 2″ x 4″ studding set about 2″ apart. To hold these studding at the right distance from the inner core they were wired in three places with No. 12 wire, boring through the staves of the inner form for this and passing the wires through these holes and fastening by letting the loop pass about a big nail. The wires we learned should be twisted to get the slack all out of them. They pass through the wall and are left in.

In beginning we dug a circular trench 2′ deep, widening it at the bottom to give a good

FIG. 403. WING CEMENT SILO.

bearing and filling it first. The concrete was raised by means of a pole derrick, which should be about 6′ higher than the silo is designed. This derrick is easily revolved and is guyed in four or six directions with long and heavy guy wires. Scaffolding is carried up as you go. Concrete mortar is lifted up by horse-power, swung in place rapidly and deposited in the forms with shovels. After one knows how, silos may be very rapidly built in this manner. Our men were all our regular farm laborers. We think this silo will be a permanent thing.

The thinness of the walls forbids putting much if any dependence in their strength to resist bursting. The bursting pressure of silage at 30′ depth is 330 pounds per square foot, according to King. If your silo is 16′ in diameter it must therefore have strength to resist 2,640 pounds pressure for each foot in height. As you go up the pressure decreases, of course. Concrete should have a tensile strength of about 200 to 500 pounds per square inch. We imbed wires or rods directly in the mortar to hold the strain. Iron hoops designed to hold wooden silos may be put in. Wire is rather cheaper and more easily handled. Get No. 00 wire. It is hard to handle, so reel it out across the field and rig a lever of a 6″ sapling about 20′ long and put a team on it across a stump and stretch it till it lies straight. Then cut it into lengths long enough to reach around the silo and 6′ longer. At each board lay in a wire or two before you put in cement, wrap the ends about each other and turn them back; the cement will not let them slip when it is hard. These encircling wires should be in the middle of the thickness of the wall, so insert upright wires in the wall about 3′ apart; they will also prevent cracks and will hold the horizontal wires in place. No. 00 wire has a tensile strength of about 7,000 pounds. If the silo is to be 30′ deep begin by putting one at the ground level, then up 8″ put in another and at each 8″ board. This is a little stronger than is absolutely needed, but I do like a thing to be safe and wire is not very costly. It will not rust in the cement. At the doors, which need not be closer to each other than 6′ and should not be nearer the ground than 7′, place upright rods 1″ in diameter on each side and loop the wires about them. Across the bottom and top of the doors pass similar iron 5′ long with the ends turned up 2″ and curving as the curve of the wall.

We mixed our concrete at a strength of one barrel of cement to a yard of gravel. It seems to be very hard. We washed the wall with a brush with a wash of nearly pure cement, water and a little sand. We put a roof on, as the silo may hold silage until summer time some years and roofs are not very costly. The floor is of clay, which it seems is better than anything else. It is not excavated at all. The pole may be sawed in sections and thrown out of the window or left in the silo until it is fed out and sawed off then.

If you are building of a different dimension remember the rule for calculating the pressure on your walls is to assume the normal pressure at a depth of 30′ to be 330 pounds per square foot and to multiply this by one-half the diameter of your silo wall. Be sure you put in enough and put no dependence in the cement for resisting bursting strain. The thin wall is very much cheaper than the thick one and just as good, if the steel is there.

The oak stuff that makes the outside of the form warps and cannot readily be used again for silo building, though it is useful in a hundred other ways; the inner shell is practically uninjured by the use made of it.

All concrete work should be moderately wet down, never made sloppy, and rammed hard in the mould until moisture rises on top. If it is made very wet it is nearly ruined. It should not be wet until just as it is ready to use.

I think a 4″ wall is right and just as good as one 18″ thick, barring possible freezing. I insist that abundant steel must be used and advise coating the inside with hot pitch to make it acid and air-proof.

It is not necessary to use a complete form for the entire silo. We set up first a 16′ length of inner staves, afterward another 16′ length on these, thus needing as much timber for this inner form as is needed to build a complete wooden silo. We now think this a mistake. These staves can as well be in 8′ lengths and after two sets are up the lower set is well taken away and moved up, next the second set moved up, thus proceeding until the silo is tall enough. These staves should be all accurately fitted together before work is begun. There should be three dowels or pins in each stave and holes exactly corresponding on the other side. These dowels should be made of ¼″ steel. They should fit tightly on the one side and the holes to engage them should be large enough to allow them to enter and remove easily. Thus equipped the staves are very rapidly set up, as each one supports the one next to it, and the dowels prevent them crowding in when the concrete is stamped behind them. A set of these staves will last for many years. The first year's use of this silo disclosed less than 10 pounds of spoiled silage.

A SILO OF CONCRETE BLOCKS.

A silo built of concrete blocks has been designed by Joseph E. Wing. He says the blocks are easy to make and will lay without mortar under them or at the ends and make an air-tight and water-tight job. There will be no need for a skilled mason in laying them. They are made just right in length and curve to make the wall, and where windows come they can be sawed in two or shorter ones made to fit the openings. Joints are broken just as in any stonework and the effect is pleasing.

The block is made in a wooden mold, and after being set the mold is taken off and the block hardened before being used, as any artificial stone blocks are made. It consists of two pieces, each 2″ thick, 8″ high and of convenient length, say 3′. These pieces are curved to fit the desired diameter of the silo and are spaced 2″ from each other. They are held together by

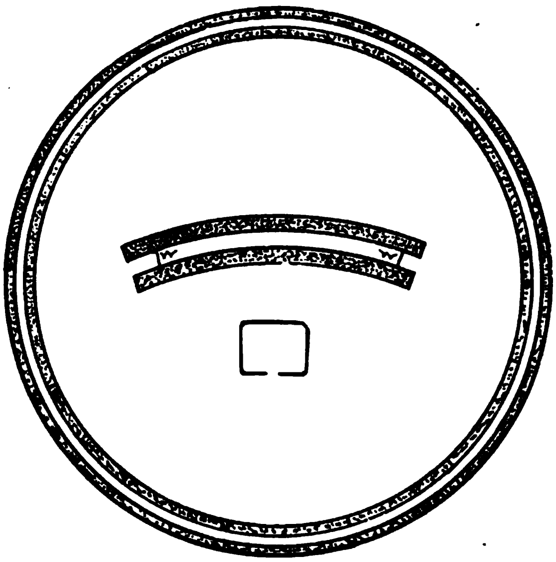


FIG. 404. SILO OF CONCRETE BLOCKS (CROSS-SECTION).

square loops of steel wire, large size, such as No. 4. This wire is bent in a form into the desired shape and two pieces are put in each block. Being very large stiff wire the blocks keep their position exactly when made even, though they do not at any part touch each other. This forms a stone block 6″ wide (it may be made 8″ if desired) and with a hollow clear through its length of 2″. These blocks may also be easily made in two parts; in one part is molded two bolts 6″ from each end; they are bolts 1/4″ x 7″. In the inner block, the mate, two holes corresponding with these bolts would be molded with a 1/4″ depression in the inner surface of the block. After they were hard the two parts would be fitted together, nuts put on, the depression making the nut flush with the inside of the wall, when the double block laid in the wall and the channel filled as described. Afterward the projecting bolt ends would be smoothly clipped off. The bolts would not show on the outside at all. This block would present no difficulties in manufacture whatever, and when once completed the two original blocks and the core would be inseparably united. The foundation is made below ground in a narrow trench in which ordinary concrete is rammed. Level it and lay the first course of hollow blocks. Fill the channel with rather thin concrete, lay in a No. 4 wire to hold the wall from spreading and lay the next course, breaking the joints carefully. Again fill the channel with cement, lay down another wire and another layer of blocks and so on up to the windows. At the windows (and the lower one should be up 7′ and the next one up 6′ higher) one can fit in a good wooden frame against which to build, and there should be iron rods run up vertically through the channel to make it extra solid there, while the wires will loop about these rods and their tops and bottoms be fastened together, so that there will be no danger of the silo bursting at this point. There should be abundant steel put into this wall, so that all bursting strains would be resisted by the concrete. Reference to the diagram (*Fig. 404*) will make plain the idea. The section of silo shows a course of blocks laid with the continuous channel open and ready to be filled with cement. It is actually a form of concrete and is left there when filled instead of being taken away as a wooden form would be. The block construction is clearly shown and the bit of heavy wire bent into shape to be inserted in the form and built into the block to hold the parallel sides in place. This idea, by the way, is applicable to straight walls for houses or any kind of buildings.

The wood mold is made with a curve to fit the silo and of any convenient length, as 3′, and as wide as the wall is thick, say 6″. A depth of 8″ will lay very well. Clamps hold the bottom of the mold to the ends and sides. A curved wooden block 2″ thick fills the central portion of the mold to make the hollow in the stone; and this block must be made a trifle tapering to be readily taken out and in three parts, divided vertically, so that the cross wires will not hold it. These cross wires are held in place by the central block and cement poured in and gently rammed about them.

In making these cement stones gravel is not used, but coarse sand instead. In erecting a silo after this manner only scaffolding timber would be needed and the scaffold would be inside the silo, though hoisting would be by pole and der-

FIG. 405. COMBINATION CEMENT SILO (ELEVATION).

rick, as in any silo, the arm simply swinging material over the wall to the scaffold.

Silage has a bursting pressure at a depth of 30′ of 330 pounds per square foot. At 20′ depth the pressure is 220 pounds. To calculate the bursting pressure per vertical foot in a round

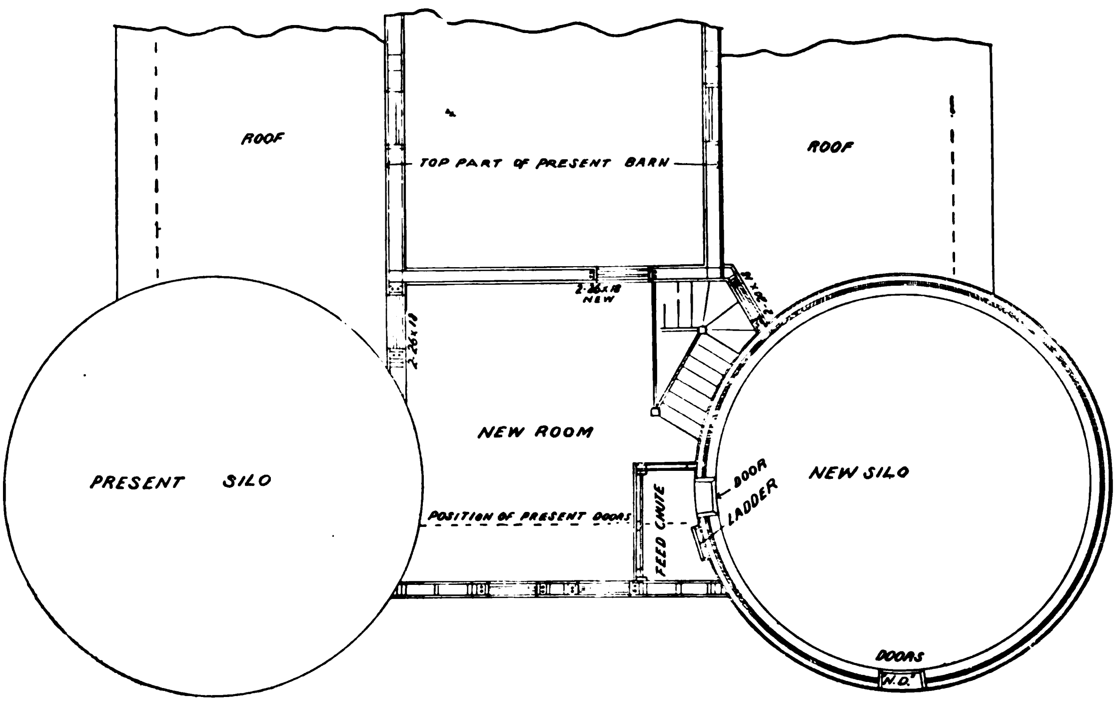


FIG. 406. COMBINATION CEMENT SILO (UPPER PLAN).

silo multiply the pressure per square foot by half the diameter of the silo. Thus in a 16′ silo 30′ deep the bursting-stress at the bottom is 8 x 330=2,640 pounds for the vertical foot, decreasing as you get higher.

COMBINATION CEMENT SILO.

In *Figs. 405* to *410* are presented complete plans for double silo for dairy barn built in DuPage County, Illinois. Further comment is unnecessary owing to complete architect's plans being shown.

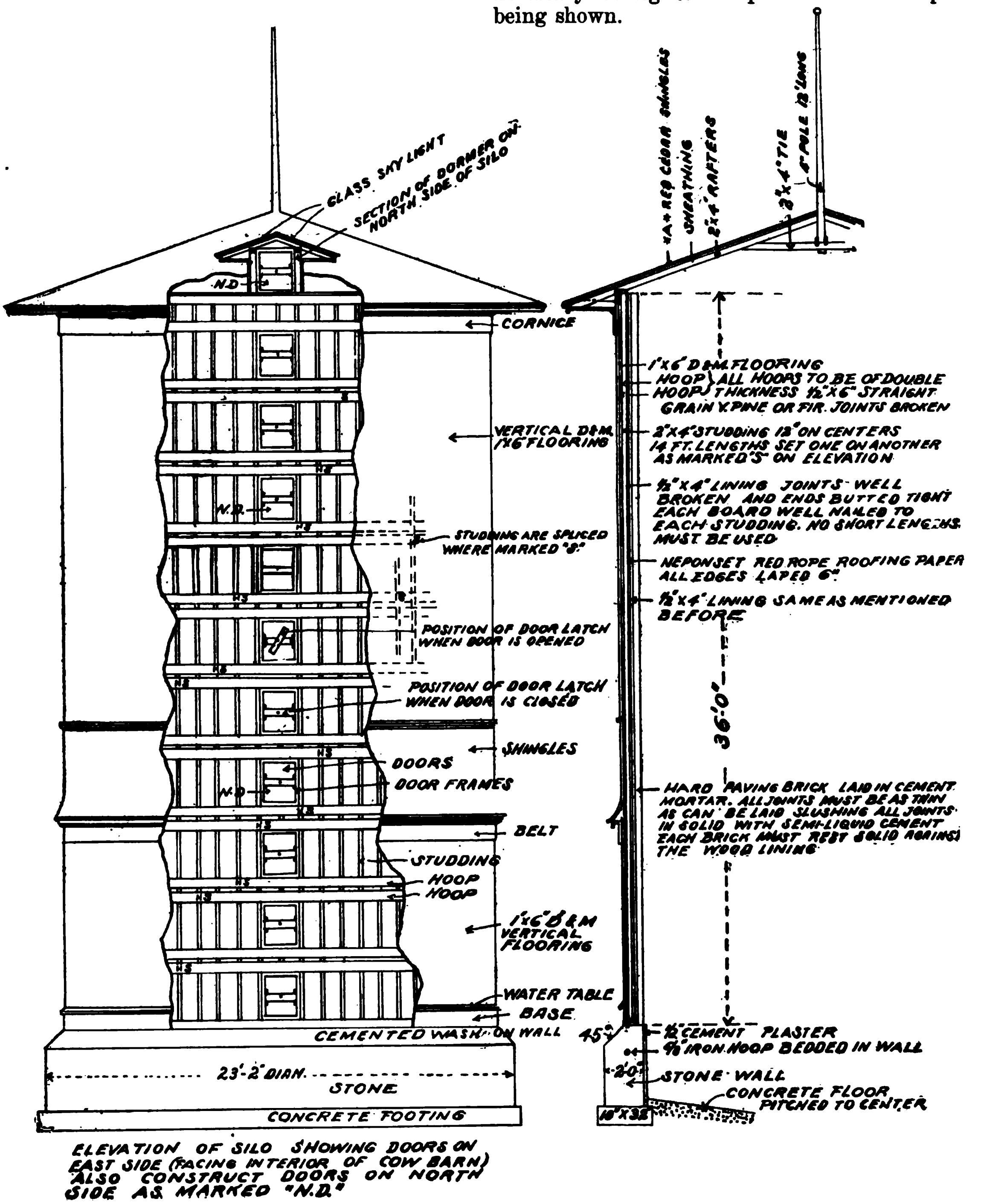


FIG. 407. COMBINATION CEMENT SILO (ELEVATION IN DETAIL).

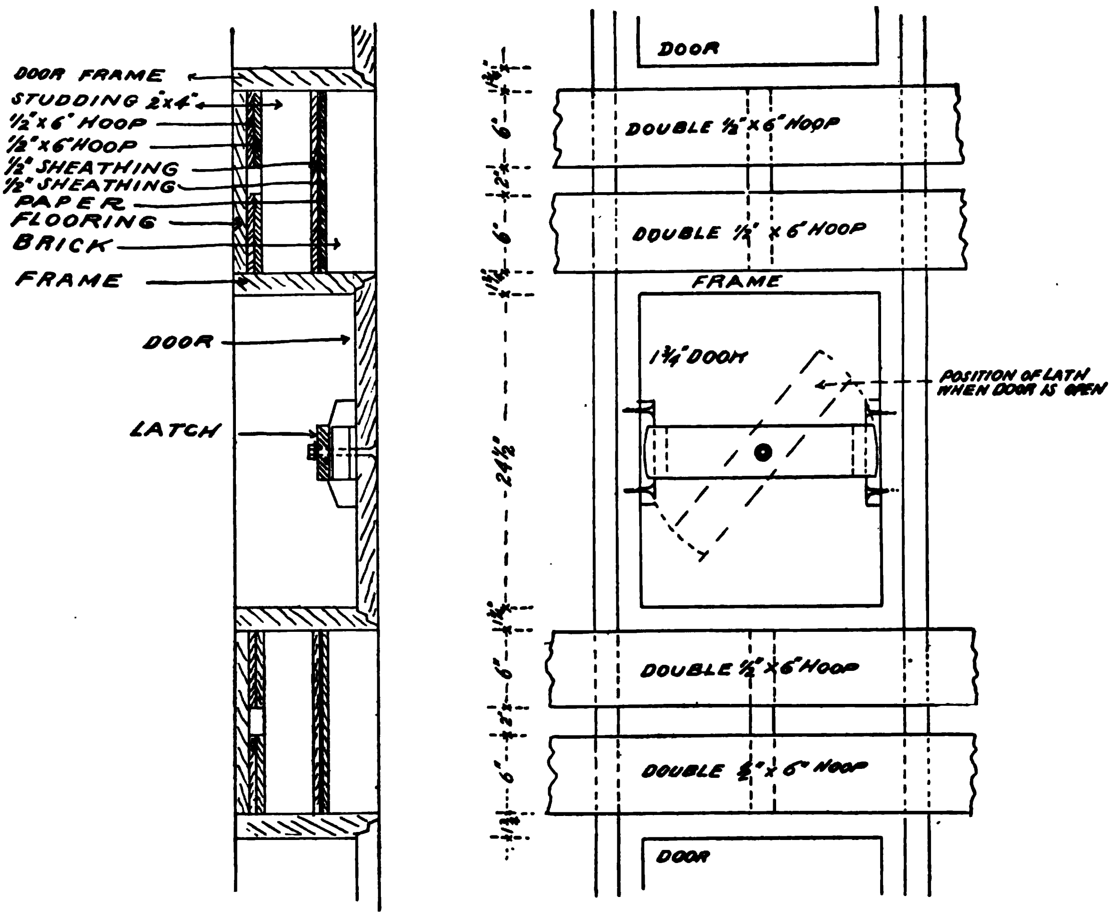


FIG. 408. COMBINATION CEMENT SILO (DETAIL OF DOOR CONSTRUCTION).

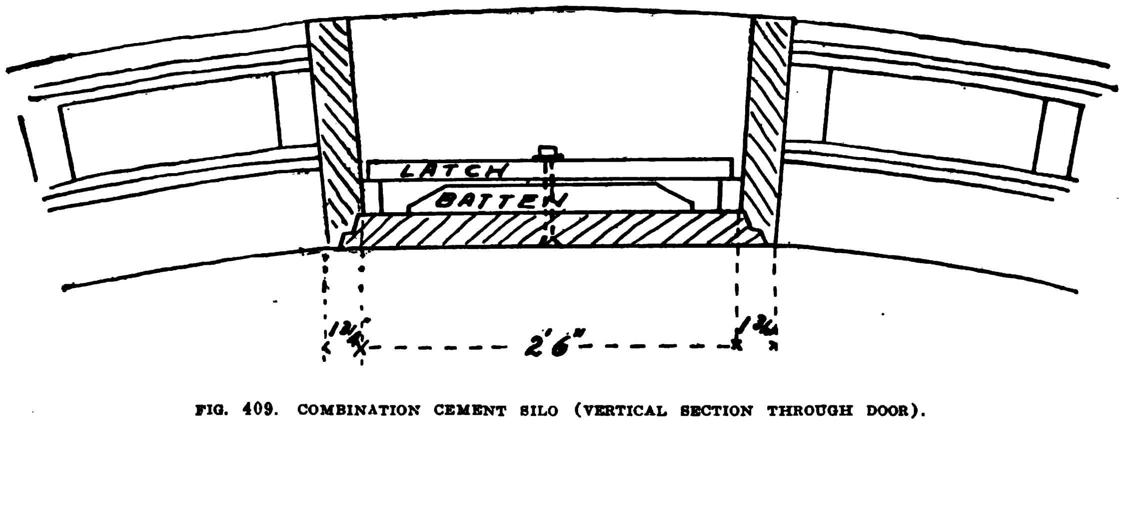


FIG. 409. COMBINATION CEMENT SILO (VERTICAL SECTION THROUGH DOOR).

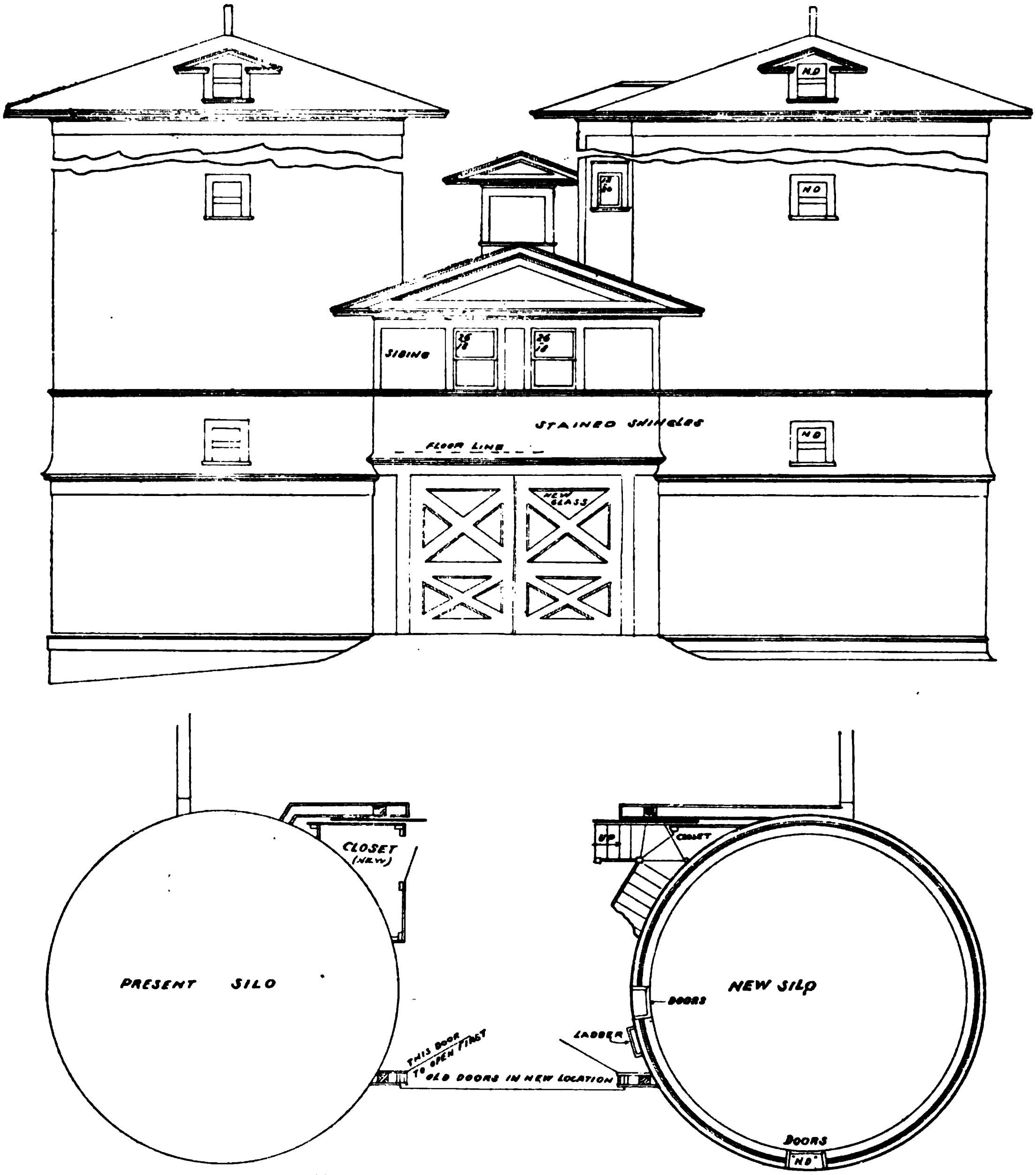


FIG. 410. COMBINATION CEMENT SILO (GENERAL PLAN).

CRIBS, GRANARIES AND WORKSHOPS.

Perhaps the cheapest building for a crib or granary is square, of capacity enough for the grain produce on the farm. But as corn is stored when not entirely dry it can be cured better in narrow cribs. On this theory are designed two cribs set parallel under one roof and 12′ apart. (*Fig. 412.*) This gives a driveway of sufficient size to store reaper, mower and all implements of the farm if necessary to store them here. If this driveway should be used for implement room care should be taken not to let any of the tools or implements come near enough to the sides of the crib to give rats a chance to gnaw their way in.

The cribs are each 6′ x 36′ at the bottom and 8′ x 36′ at the top. The object of this is to give the sides of the cribs an outward slope, which serves two or three valuable purposes. First, it prevents rats climbing up the sides; second, it prevents rain driving into corn, and third, makes it easier scooping corn from wagon. Rats will climb up the perpendicular sides of a crib to an open window or even to the top of the crib. To prevent their going over top of crib place a board extending 6" over the edge of the ties and plate to which the slats are nailed. The windows must not be left open after the corn is put in.

The bottom of each crib is 6" x 36" and rests on stone foundation 3' in ground. (*Fig. 411.*) The sills are 8" x 10" by 36', and the joists are

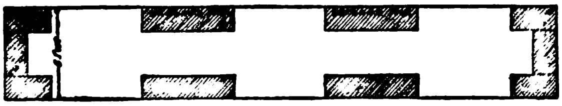


FIG. 411. TYPE OF CORNCRIB.

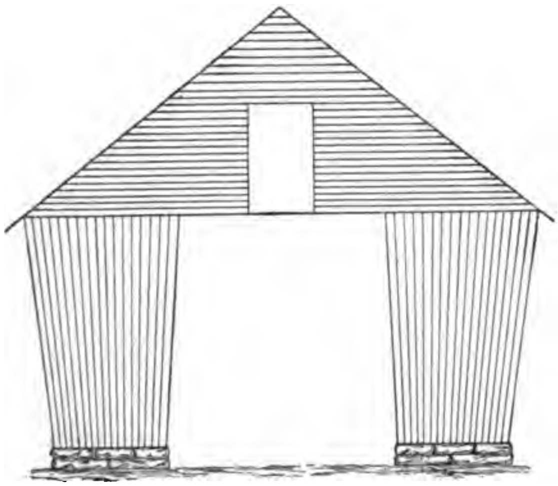


FIG. 412. TYPE OF CORNCRIB (ELEVATION).

2" x 10" by 6'. The sills rest on the stone piers 18" thick 1½' above ground. This gives thorough ventilation.

There are three windows on each side of driveway for receiving corn when the cribs are filled. These windows are 4' x 4' and are fastened by a strong wooden button. After the crib is filled to middle of these windows the corn is thrown over the top. With top of crib 8' x 36' there can be stored after the crib proper is full to the square one-third more corn.

The framework consists of three bents 12' each. The space over the driveway out 12' at each end is floored over and gives roof for several hundred bushels of corn or 1,000 bushels of wheat. This crib and granary are absolutely rat-proof if the doors and windows are not left open longer than when used to put in or take out corn, and if one is careful not to set boards or tools against the cribs for resting places for rats to gnaw their way in.

The slats on the outside and inside of the cribs are oak, 3" x 1¼" and ½" apart. Care should be taken not to use any slats with sappy or wavy edges.

It will be noticed that the size of the ties may seem heavy, but the fact is they are not too heavy, nor are the posts too heavy to prevent springing when the crib is loaded. The rafters are pine 2" x 6" and the sheathing is fencing 1" x 6"; the gables are weather-boarded with poplar. The posts are 12' long, 6" x 8". Ties are 12' long, 4" x 8", three to a post. There are four ties 6" x 6" 26' long which are tenoned into the outside posts and receive in a mortise the inside posts. This makes the inside of each crib one foot lower than the plate on which the rafters rest and makes it easier to fill the crib. If the crop is heavy set a board on edge, making the inside of crib as high as the outside. The driveway is closed by sliding doors, which when locked makes a safe store for the corn crop. The narrow slatted cribs have also perpendicular ventilators placed in front of each receiving window where corn is likely to pack and mold if at any place in the crib. These ventilators extend from floor to roof.

While the narrow crib is needed in moist eastern climates, farther west this crib may very well be widened to 8' or even 10' at the bottom. It is worthy of note that when pine lumber must be used and rat-proofing is desired it may be secured by lining the inside of the crib with wire netting of about ½" mesh. This is not expensive.

BUILDING A 2,000-BUSHEL CORNCRIB.

In building a corncrib that will hold, say, 2,000 bushels of corn, with a driveway between the two parts of the crib, it is important to know where the crib is to be built. A crib for Nebraska is usually 8' wide and sometimes 10' or 12'. Such a crib in Ohio would spoil much corn in humid seasons. Cribs in Illinois are often 8' wide. Cribs in New York are seldom more than 4' wide. In Ohio they are from 5' te 6'. A bushel of corn occupies about two cubic feet of space. Therefore a crib 6' wide, inside measure, 8' deep, and 40' long will hold about 1,000 bushels. Thus a double crib with driveway between will hold 2,000 bushels (see *Figs. 413* and *414*).

Let the driveway be 10' wide or 12' if it is desired to shelter occasional loads of hay. Let the posts be set on small, neat concrete piers and be 24' high to the sills, and well tinned with galvanized iron so that mice and rats cannot

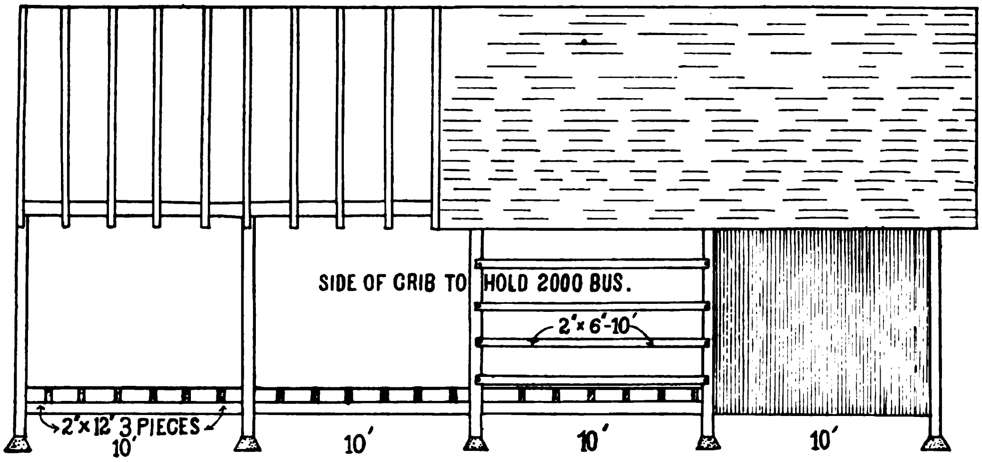


FIG. 413. CORNCRIB TO HOLD 2,000 BUSHELS (ELEVATION).

pass up them to enter the crib. Let the frame be strongly built of joist construction, the sills of three parts of 2" x 12" stuff, thoroughly spiked together and let in between the parts of the built-up posts, which are of 2" x 8" stuff, in three parts. Small cross sills of 2" x 8" stuff enable the floor to be laid lengthwise of the building. Nail girts are of 2" x 6", spiked well, or, better, bolted on, and the covering 1" x 4" stuff put on vertically and spaced with 1/4" cracks to permit air to pass through. The floor may also be left a little open to admit air, which will prevent mold in the corn. Let the crib be well braced in all directions and set apart from other buildings.

The following improvement of the crib (*Figs. 413* and *414*) has been suggested: "The timbers are so arranged and so thoroughly spiked together that they form a perfect brace, and most of the weight being on the inside wall does not settle out of place. The leaning walls make unloading of corn much more easy while the scoop boxes are arranged that three or more men may load at once when hauling to market. These boxes may also be used for self-feeders if so desired. Note the cross section (*Fig. 415*). Below, the timbers are all 2' apart and it should be sided with drop siding or shiplap put on horizontally. The cribs are 6' wide at the bottom with the walls leaning 3', the driveway being 12' wide. The collar beams tie the building together and also support the inside walls. The sills, if pillars are used, should be solid 8" x 8"; or if solid foundation 2" x 8" joists could be used. The windows should be about 10' apart and in two sets; the first set should not be more than 6' to 7' above the floor, while the second should be at the top and and directly between the lower set. The scoop boxes should be hung 8" below the floor and should be 18" wide with an 8' board on front; a space of 18" should be left not slatted for corn to roll out into boxes. The

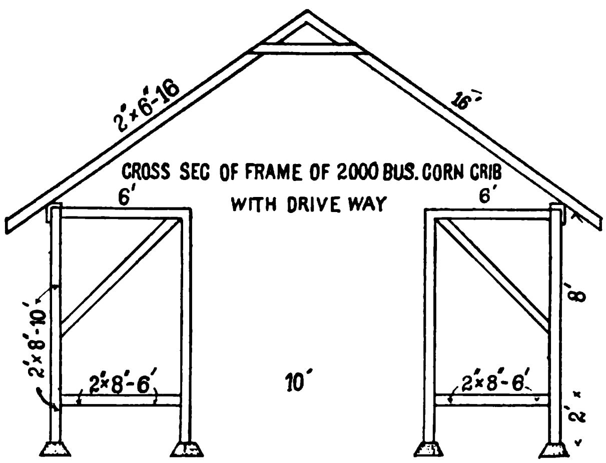


FIG. 414. CORNCRIB TO HOLD 2,000 BUSHELS.

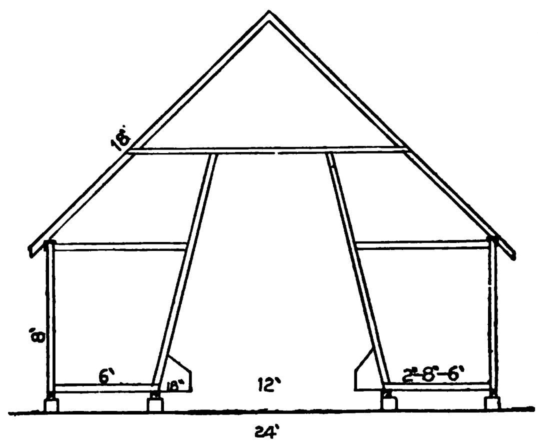


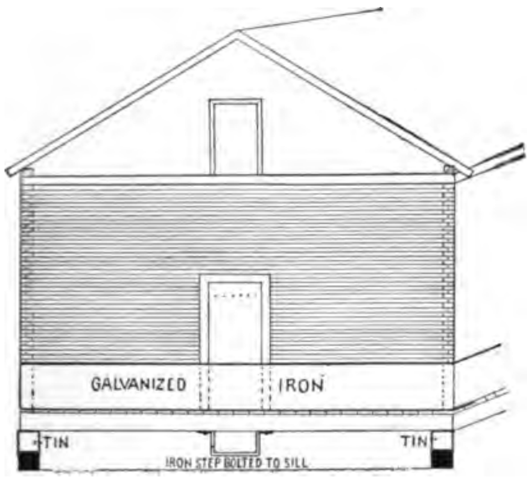
FIG. 415. IMPROVED CORNCRIB FOR 2,000 BUSHELS.

lids should be cut in sections 6′ long for convenience in handling. The diagram shows a roof ½ pitch. A track 24′ long, just level with the eaves, will allow two 6′ doors to roll just out of the way. Each crib holds 1,200 bushels. Ventilators made of 2″ x 8″ timbers should be put in the outside walls near the bottom of the crib, so the air may pass through the corn. It will aid greatly in curing the corn."

Some builders would side (*Fig. 415*) with vertical siding about 4″ width, leaving ¼″ air cracks. Hemlock for siding is rat-proof. This crib might be set on concrete blocks molded in galvanized iron forms, say round, of 12″ diameter, and that would make it rat-proof, if nothing were ever leaned against it for rats to climb.

A RAT-PROOF CORNCRIB.

The crib shown in *Fig. 416* has been in use four years. The builder thus describes it: "I have 8″ square blocks, upper corners knocked



RAT PROOF CRIB

FIG. 416. RAT-PROOF CORNCRIB (ELEVATION).

off and a 50-pound lard can inverted over them. I use on the block a 4″ x 10″ sill, with 2″ flooring laid tight. I run a band of galvanized iron 2′ in width all around, as an extra precaution, outside on walls and bottom of door. The view shows the step to the crib door."

A COMBINED CORNCRIB AND GRANARY.

Five thousand bushels of corn require approximately 10,000 cubic feet. A farm crib for that amount of corn may be made 6′ wide and 100′ long. To hold 5,000 bushels will take two cribs of this size. They are placed parallel and 10′ apart and over the space under the roof, by making it half pitch, we find room for bins in a space 12′ by 100′ and averaging 6′ high—sufficient to store 5,000 bushels of either oats or corn, with space in the center for elevator. Being so long this could be economically filled by using a carrier in the peak of the roof. The ground plan (*Fig. 417*) shows but one section

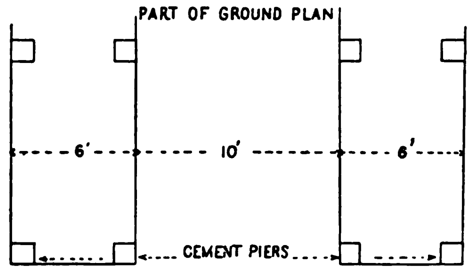


FIG. 417. COMBINED CORNCRIB AND GRANARY.

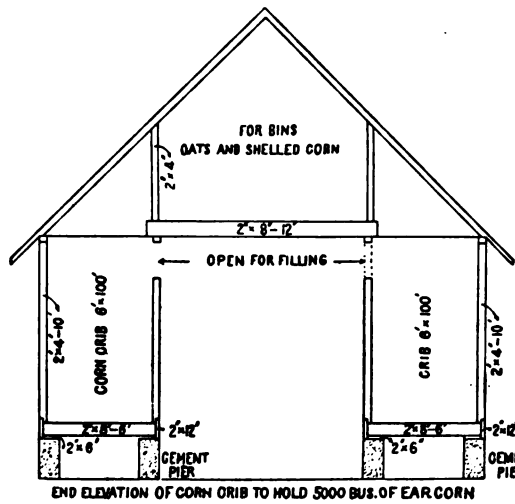


FIG. 418. COMBINED CORNCRIB AND GRANARY.

with concrete piers 10′ apart. The cross elevation shows these piers to be 12″ square and 2′ above ground. To keep out rats it would be well to use a galvanized form for these piers and fill with the cement mortar. On these can be erected a joist or plank frame as indicated or a heavy mortised frame. The only drawback to its use for other purposes is the chance for rats to secure entrance. A space of 18″ or 20″ at the top of the cribs on the inside should be left unsided for throwing in corn.

ANOTHER PLAN FOR A CORNCRIB.

In *Fig. 419* is shown a corncrib which the owner considers an improvement on *Fig. 418.* He says: "The plan in *Fig. 418* covers too much ground, consequently requires too much floor space and too much roof. The modern way is to build high. Therefore, if I were to build a crib to hold 5,000 bushels of corn I would build it 16′ to square, 8′ cribs on both head over driveway. The building would be 25′ x 48′ with a

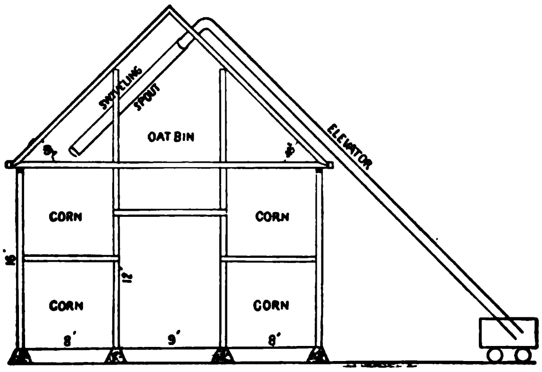


FIG. 419. ANOTHER CORNCRIB IDEA.

square pitch roof, and I would use an elevator or grain dump outside of building over the roof, discharging the grain through the middle of the roof and spouting it in the inside to either side or the middle. I have such an outfit and I can fill the entire building by one setting of elevator. My crib will hold 5,000 bushels of corn and 3,000 bushels of oats, and has a neat appearance. By building high we save work in shelling, as corn will roll down and does not need to be shoveled.''

A ROUND AND RAT-PROOF CORNCRIB.

It used to seem that it did not much matter how one stored corn. It was cheap stuff anyway and you know that rats got a toll of it and you did not worry if the weather took another toll. Then corn was so common, so plentiful. Nowadays all this is changed. Corn is worth double what it was a few years ago. And since we have learned to care well for our seed corn and to look attentively at each ear as we husk it we love it more. Therefore we no longer like to see it wasted or to think of rats nesting in the cribs.

There is need on many a farm of a crib to store corn for some months, to be used late in the season.

The size of the crib must be governed by the condition of green corn when it is cribbed. In Ohio it is not safe to have a mass of corn more than 6′ in diameter. The crib shown in *Fig. 420* is about 12′ in diameter, in the center of which is an airshaft to ventilate. Have the tinner make eight lengths of pipe of galvanized sheet iron. These to be 12″ in diameter at the large end and 8″ at the small end, 24″ long. There is another similar pipe 12″ at the small end and 16″ at the large end. These are the supports of the crib and are to be filled with concrete.

Dig a hole about 24″ square where the center of the crib will come. A circle is drawn around this about 10′ in diameter and eight other holes are dug about it. These are for the foundation of the crib. Fill all these holes with concrete. It is made of gravel six parts, cement one part. Level these bases. While yet the concrete in the holes is soft set on these bases galvanized pipe forms, small end up, and fill them with concrete, made a little richer than that of the underground part. Level the tops of them all. Thus you have one pier, the large one, in the center, surrounded by eight smaller ones each equi-distant from the center and so placed as to divide the circle into eight parts. *Fig. 421.*

Should anyone build one of these cribs with such a foundation in the fall he should as soon as the concrete is in bank around the piers with

FIG. 420. ROUND RAT-PROOF CORNCRIB.

manure to protect from frost. When the concrete is hard in the galvanized iron forms it will support the crib admirably, and any one of these small piers would support ten such cribs without danger. And the smooth iron will forever resist the climbing of rats and mice. No weight can be put safely on them for ten days, so you may set temporary posts to set your crib on, if you are in a hurry. The photograph shows crib setting on these temporary posts.

Next take a joist 2″ x 10″ and 12′ long and set it across the foundation. At right angles to it place and spike another, or rather two others, each 5′ 11″ long, thus making a square X of your foundation. Then put in between them intersecting 2″ x 10″ joists that will reach handy, only oak is best because it is most durable. Drive a circle of stakes solidly into the ground of exactly the same size in diameter as the radiating spokes. Place these stakes about 12″ apart. Bend around them green ½″ wood and tack it lightly to the stakes for a beginning. When one course is around lay on another, breaking joints and nail it with short nails, say 4s. Then a third layer of wood, and longer nails. Then the fourth layer, and nail well with nails that just about reach through. You can make one of these hoops in an hour, the five in half a day easily, and that is all the framing there is to be done. Absolutely no mortising, no posts, nothing but floor, hoops, siding and roof.

FIG. 421. ROUND RAT-PROOF CORNCRIB (CONSTRUCTION).

out to the same lengths as those already in place. These rest on the remaining foundation piers or posts. Now you have in place eight. Cut trimmers of 2″ x 10″ stuff and spike them in place between these floor joists, for such they are, tying all together. And to make the floor amply solid insert other spoke-like radiating joists between those already in, only the additional ones need not be larger than 2″ x 6″.

Next we must have five circular girts. These we will build of ½″ stuff, 4″ wide. Green stuff is best, oak or elm or beech or whatever is

Put one of these hoops over the ends of the floor joists. They need not be cut off till the hoop is in place, and it is well to leave the lower part of the joist project 2″ to hold the weight of the hoop. The hoop comes just to the level of the tops of the floor joists. Spike it in place, then lay your floor, and lay it with large open cracks. Now you are ready to "raise."

Placing the hoops exactly over each other, with a square mark down on each hoop where the eight ends of the 2″ x 10″ joists come so that you can nail right there the supporting pieces as you raise them up. Siding had better be of 1" x 4" stuff 12' long. You will not want the crib that high, but you may put the roof up that high, or nearly.

The crib in the illustration has the longest pieces of siding cut 11' 6" long. Cut eight of these pieces to begin with, and see that they are good ones, not weak. Mark on these pieces where the hoops are to come. Space between them 29"; that will bring the hoops equally distant apart. Nail up these eight pieces of siding, putting each one opposite a leg of the crib. Plumb them as you erect them carefully. Brace them so that they cannot get out of plumb. Now cut some short pieces of 1" x 4s", each piece 29" long, to help support the hoops as you raise. Get four or five men and lift bodily all the hoops, place the props under them and nail the bottommost one in place. Lift again and nail the second one. Thus proceed till all are nailed up in place, the top hoop ½" above the top of the supporting 1" x 4s". This is so that the roof boards will not encounter the end of the board.

Now side up with 1" x 4" siding, spaced at least ¼" apart, and wider if of dry stuff, letting the siding reach to the top of the hoop next the highest one. One can throw corn over this loop, and also leave a window below it on two sides so all the corn will not need to be lifted so high. Put two nails in each piece of siding. Then use some ½" stuff and cut diagonal braces and fit in from hoop to hoop, clear up from the floor to the top of the siding. Of course before the siding is put on carefully plumb the crib. Let about three or four pieces of siding go clear up to the top hoop at each "corner." And set under this top hoop a short 2" x 4", resting on the hoop below, so that the weight will not all be upborne by nails.

Now all ready for roof. Take 1" x 12" boards, 10' long—1" x 10" will serve, or narrower, if need be. Have the mill man rip them carefully from one corner to the other, diagonally, so that each board makes two pointed pieces, like wedges. Mark from the wide end (having carefully sawed them to length) 24". You will need to set up a round pole in the middle of the crib to help you get started setting up the roof. Lay a scaffold across the crib on which to stand; put up four of these roof boards, on the opposite sides; nail them to the hoop (the plate) at the mark of 24". Let the ends rest against the pole. You cannot quite make these roof boards fill the middle, but no matter. Now begin and nail them all on, following right around, nailing the broad butt to the hoop at the mark, and the tops together and midway you may use short pieces of 1" x 4" to tie them together, nailing down into the block. Toe-nail them, too. When you get around to one of the temporary roof boards take it off and make it fit. Do not worry about the roof "not coming out"; there will be left a hole from 4" to 12" wide at the top.

You may need to rip the last board to make it fit. Now put a nail in the top of the pole (better sharpen it) and tie a string to that nail and with a pencil line the roof for shingles. Line as high as you can reach, each line clear around and 5" above the other, and lay the shingles with tops to lines. You will have to use a sharp knife and trim the shingles a little to make them lay. When you shingle up as high as you can reach put up a roof scaffold. The best way is to have some of the ½" stuff and bend it right around as though you were making a hoop and double it and nail it together, encircling the roof. That is safe and quickly made. Take out the pole and finish the peak with a cone made of galvanized iron. It need not be riveted together. Get your tinner to cut you a circle about 24" or 30" in diameter and to take out of it a little V on one side and you can bend it to fit the roof exactly.

Two men, after the foundation is in, will build about two of these cribs in a week. They hold a little more than 500 bushels of ear corn. Put up a 24" airshaft in the middle of each crib; do not floor beneath that. Bend hoop stuff and make battens for doors just as hoops were made, only with a smaller circle, so if it straightens a little it will yet be curved enough.

Following is a bill of material: 8 galvanized iron cylinders, 24" long, 12" diameter at base, 8" at top, put together with seam, no solder needed. 1 similar iron 16" at base, 12" at top. 4 pieces 2" x 10" and 12' long. 4 pieces 2" x 6" and 12' long. 108 pieces 1" x 4" and 12' long for siding. 70 pieces ½" x 4" and 12' long for hoops. 100 feet 1" x 4" for flooring. 250 feet of 1" x 10" or 1" x 12" ripped diagonally, 10' long, for roof. 1,500 shingles 5" to the weather.

A TWO-STORY DOUBLE CORNCRIB.

The double crib with two stories and two driveways shown in *Fig. 422* is about 30' wide, each crib being about 10' wide and 20' deep and 60' long. Built of these dimensions it will hold about 7,000 bushels of corn on each side of the driveway, but on most western farms it will be built 12' wide rather than 10', which

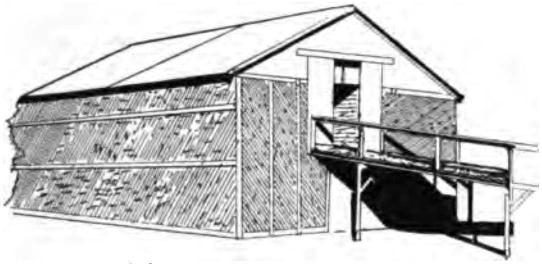


FIG. 422. TWO-STORY DOUBLE CORNCRIB.

will considerably increase the capacity, without adding materially to the expense.

TOOLHOUSE AND WORKSHOP.

A model toolhouse should be of generous size, so that machines may be put away without much labor; it should be as easy to unhitch in the shed as out of doors, else men will be apt to leave machines out. The shed illustrated in *Figs. 423* and *424* is merely a great umbrella with posts one way 30′ apart, the

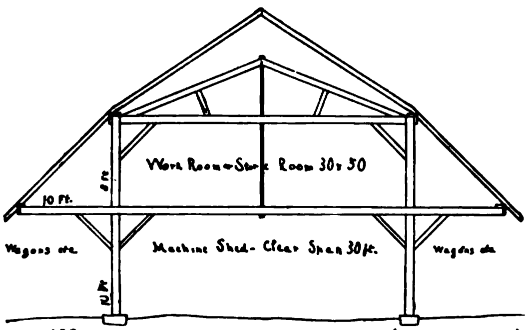


FIG. 423. TOOLHOUSE AND WORKSHOP (FRAMEWORK).

FIG. 424. TOOLHOUSE AND WORKSHOP (ELEVATION).

other way 12′ or 16′, no side to it at all, so that there is nothing in the way of driving into it at any point. Putting the main machinery in the inner parts leaves the overhanging roof 10′ wide for wagons and as it is 10′ high there is no difficulty in driving under to unhitch. Buggies may be sheltered on the shady side, and if it is feared that snow would drift into them one or two sides may be boarded up. This is not designed for a house for fine carriages, which should of course have a tight dust-proof building.

The work-room above will hold a lot of smaller tools, be a good place in which to mend harness, make gates, repair machinery or store seed grain. By putting the truss above it with an inch truss-rod coming down to the cross-beam there is given a clear span of 30′ in the shed below. The whole thing is built in joint construction, posts 2″ x 8″, in two pieces, built up solid below the cross-beam, this made of three pieces of 2″ x 12″, spaced 2″ apart, box plates of 2″x10″, bridge truss of 6″x6″, rafters of 2″ x 4″ or 2″ x 6″, according to whether they are ever to hold much weight.

The work-room should have a bridge stairway wide enough and sloping enough to take up a vehicle if necessary for repairs or painting. This may be in any bent that is most convenient. The floor may be of hard earth or cement; the posts to rest on stone pillars. Put on a shingle roof that will not be too hot in summer. If there is too much room in this upper story finish off a room for an extra hand to use now and then.

A CONVENIENT TOOLSHED.

It is difficult to keep things in their places unless one has provided places for them. On any ordinary farm there is a great collection of machinery, wagons, plows, harrows, drills, rakes, mowers, binders and what not, which are generally supposed to be stored on the barn floor or in odd corners of other buildings. Too often they are left out under the sky. Yet it is not difficult to keep them sheltered and in a place where they will be convenient of access, not in the way and easily put in their places. *Fig. 425* shows such a building. It has no sides but is simply a roof of pyramid shape, projecting on each side 10′

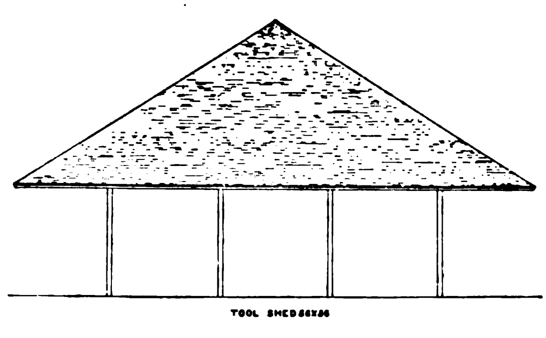


FIG. 425. CONVENIENT TOOLSHED.

beyond the posts, being 56′ square over all. Under these projecting eaves the farm wagons may stand and in the middle spaces the machinery may be stored. Any machine may be driven to any part, as there is nothing to interfere with driving through in any direction. There is much satisfaction in storing machines in a building by themselves; they are not in the way, nor are they in danger of injury from contact of animals or wagons. There is no danger of fire in such a building as this. Protection from sun and rain alone is needed. The posts are 6″ x 6″, set on stone; the roof is of shingles.

STORING SHREDDED FODDER.

In this day of progressive and improved farming we find the farmer pondering over many subjects which until recently did not trouble him. One of these is a satisfactory way of

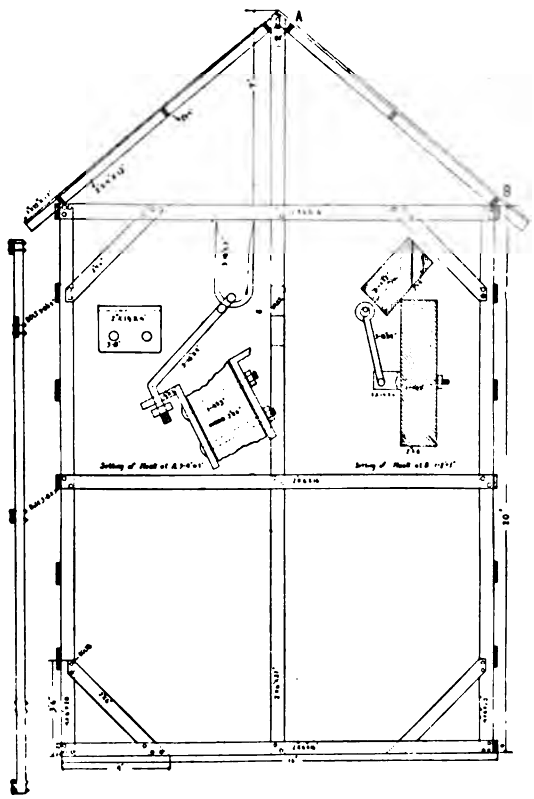


FIG. 426. SHED FOR STORING SHREDDED FODDER.

handling shredded fodder economically. For years past more or less corn has been cut and shredded, but the amount is proportionately small in comparison to the thousands of acres left to stand in the field and spoil by exposure. However, more and more is being cut each year and now many farmers are debating whether it would not be best to grow less hay and cut more corn for roughage. Undoubtedly the greatest drawback to this is the inconvenience of storing and feeding. The whole stalks are a nuisance anywhere you find them—in the feed rack, in the manure, or in the field. Also a smaller part of fodder is eaten when fed whole.

Experienced men generally admit that shredding is profitable if the fodder can be well kept in storing, but here is where the trouble comes.

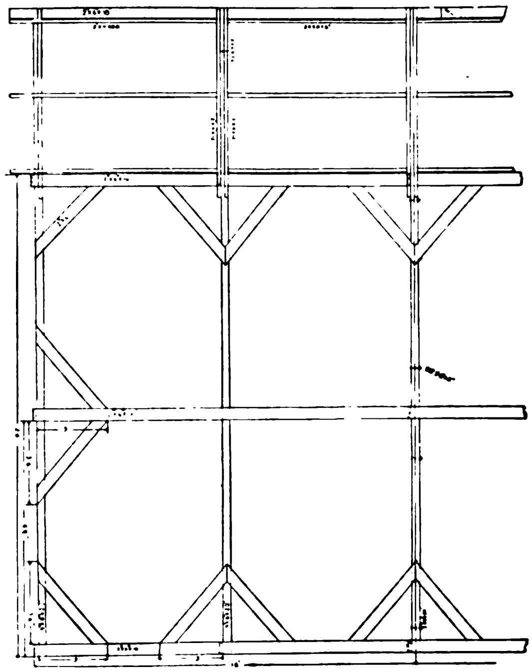


FIG. 427. SHED FOR STORING SHREDDED FODDER (FRAME).

When put in a tight barn, even if only slightly damp, it will become mouldy and dusty, and it is too much trouble to handle in stack. No entirely satisfactory way of storing is in general use. Even if well kept it is hard to get out of a hay loft. On the whole it is usually best to feed outside. In fact, on most farms it is necessary to feed the larger part of the roughage in the feedlot.

Figs. 426 and *427* give an idea of a shed designed for this purpose. It is constructed in sections and is portable. Thus it may be placed anywhere around the feedlot and taken out of the way in the spring or moved to a different place. A rack should be built the full length so that fodder can be rolled directly into it as fed. It may be built any length in multiples of 16′, and the fodder may also be shredded directly into it and the roof removed so as to fill and tramp clear to the top. It is merely a frame structure with no boards on ends or sides.

Fodder stored in this way will keep far better than when put into a tight barn and is much easier put in and taken out to feed. Also the waste or unused portion serves a valuable purpose by retaining liquid manure.

As may be seen from the drawing the shed can be easily taken down so as to move on a wagon, or by merely removing eight or ten bolts it may be sided anywhere. When put together it is as strong as if nailed and stationary.

The upright posts should be placed on small stones to avoid decay which would result if set on the ground. The roof is of grooved roofing boards and may be removed in sections and easily replaced. By means of hooks, as shown at *A* and *B*, it is prevented from being blown away by the wind.

A shed of this kind is easily built and the cost is also comparatively small. This of course may be somewhat lessened by doing away with all bolts if one is sure that he will not want to move it. This shed 16' wide, 20' high, and 48' long will hold 400 tons. The cost for material and labor is $88.30. The shed will last for a number of years.

MACHINE SHED FOR SMALL FARM.

Fig. 428 shows a machine shed to contain two mowers, one binder, one seeder, one disc harrow, one corn planter, a drag, a roller, a steel harrow, a fanning mill, two corn cultivators with wheels, four one-horse cultivators, two wagons, and a manure spreader. These may be nicely stored in a shed 40' wide and about 40' long, or longer if the builder can afford it. This will mean mere packing away, not that the tools may be driven in and unhitched from each evening. If that is desired a narrow building, say 24' wide and 60' or 72' long, will be needed. In some way the long building is best. It may have sliding doors along its whole length on the back side and on the south side may be left open; the ends may be closed. The construction should be simple, the location dry or filled a foot or so with clay (no other door is needed), as few posts as may be and a roof wide and low enough to shut out sun. Storage under the roof for small tools may be had and even a work-room up there is easy to construct. By spacing the posts 16' apart two rows of machinery may be put in each space. It would be well, however, to make two spaces of 18' so that wagons could with ease be driven in side by side. This would make necessary strong plates and good braces. Galvanized steel should be used for the roof.

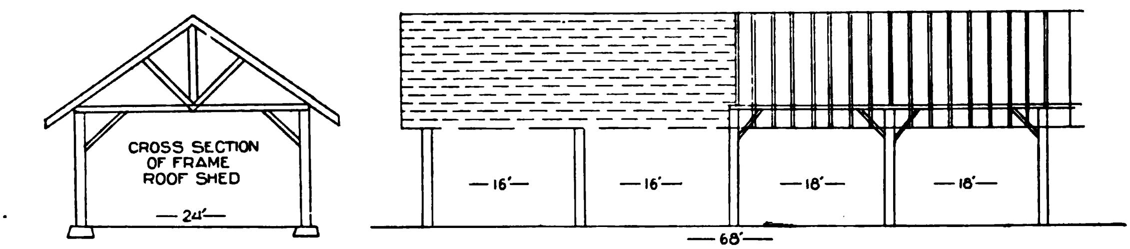


FIG. 428. MACHINE SHED FOR SMALL FARM.

PLAN FOR A ROOT CELLAR.

Dig a hole 18' x 20', 5' 4" deep (*Fig. 429*). On the floor of the cellar hole build a solid concrete wall (*Fig. 430*). First erect a box wall about 1' high and 16' x 18' outside measure. This will allow a space of 1' between the box wall and the cellar wall as shown herein. This will make a concrete wall 1' in thickness. Brace the box wall firmly by means of two or three 2" x 6" studding. Fill in the first course of concrete until it is about flush with the top of the box, leaving the surface rough to form a good bond with the next course added. When the first course has had sufficient time to harden the box wall can be raised about a foot and the second course of concrete applied.

Make the wall 6' 4" high so as to allow 4" for a concrete floor and 6' as the distance from the surface of the floor to the bottom of the plate. As the concrete wall is to project about a foot above the ground it is necessary to build two sides to box wall, forming the mold for the concrete. This outside course of boards will have to be made 18' x 20' inside measure, or the size of the cellar hole, so as to continue the wall upright. The wall should be continued above the ground to prevent the access of water.

Good concrete for wall can be made by mixing 5 parts of gravel, 3 parts of sharp sand and 1 part of good Portland cement. These constituents are well mixed by shoveling over five times or until they show a thorough intermingling, after which sufficient water must be added to form a thin mortar. When well mixed shovel the whole into the 12" space or boxing. Make the floor of concrete 4" thick and in blocks about 3' square.

Use 2" x 8" material in the construction of the sill. Make a 2" x 8" notch or recess at each end of the 18' joists which will allow them to rest on both the sill and the wall. Place the joists 4' apart and use 12' 2" x 6" scantlings for rafters, placing them 2' apart. This will give the roof about one-third pitch. Nail the ceiling on top of the joists before putting on the roof, using tongued and grooved 1" material.

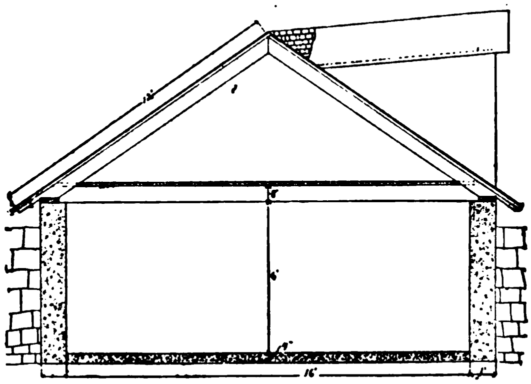


FIG. 429. ROOT CELLAR (SIDE ELEVATION).

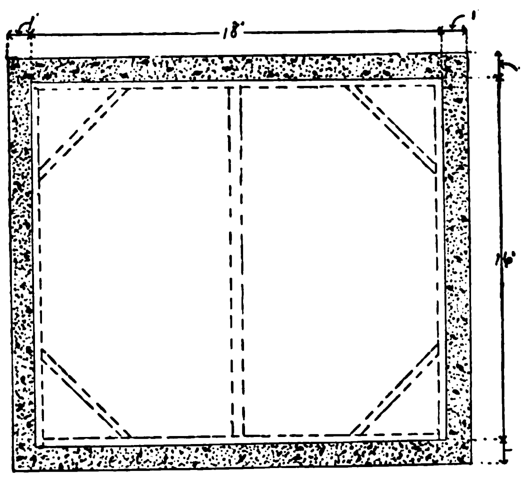


FIG. 430. ROOT CELLAR (GROUND AND WALLS).

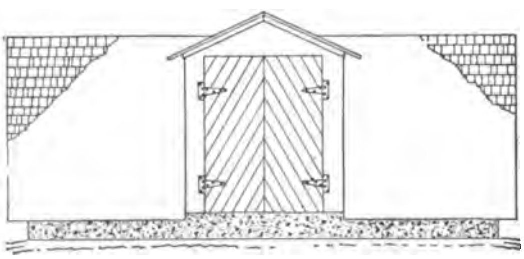


FIG. 431. ROOT CELLAR (FRONT ELEVATION).

For the roof (*Fig. 429*) use 1" roofing boards placed close together. Cover this with two thicknesses of roofing paper and lay the shingles 4½" to the weather. Make the entrance in the middle of one side through a gable door about 4½' by 6½'. Have the gable 6' wide and 6½' to eaves. Provide a double inside door hinged parallel with the roof where the latter joins the gable. During severe weather the space between the doors can be partially filled with chaff or straw. Put in two ventilating shafts 6" square and running from about 6" above the floor to a point above the peak of the roof. Have the lower 12" of these ventilation tubes perforated with at least a dozen ¾" holes.

Place 6" or more of thoroughly dry chaff on top of the ceiling, as this makes an excellent non-conductor of heat. Cover the ground for about 4' around the building with 1' to 1½' of horse manure and cover the whole building with two or three loads of straw for the winter. This cellar will have a capacity of 1,000 bushels and be capable of withstanding low temperatures.

FRAME FOR HAY BARN.

A frame for a hay barn having nothing in the way inside is shown in *Fig. 432*. The posts may be of solid timber, 8" x 8" or else built up of 2" x 8" stuff. Set on concrete blocks, good ones, and bolt each post solidly to the concrete blocks, then no windstorm can disturb your

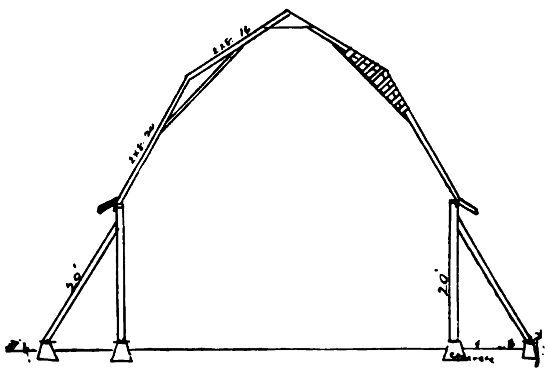


FIG. 432. FRAME FOR HAY BARN.

barn. The outside braces cover over carefully with galvanized iron on three sides; leave bottom open, else they will decay and iron will rust. There may be a floor, or a simple scaffolding of poles under the hay, to let air under. The braces will not look bad and will be absolutely out of the way. You can place bents 16' apart. Have several transverse driveways through the barn.

JOIST FRAME HAY BARRACKS.

Where hay is to be stored under roof and no stock to be provided for, this simple frame (*Fig. 433*), which is easily made of 2″ stuff, or of part round poles if desired, commends itself as being simple, strong and cheap. There should be braces running the long way of the building at the same angle shown in the cut to protect against winds. The artist fails to show all the detail of the curb roof, which must be tied

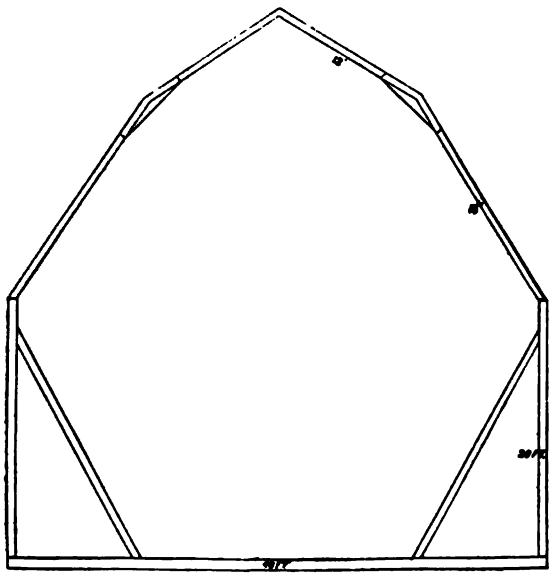


FIG. 433. JOIST FRAME HAY BARRACKS.

together by collar beams at the peak and effectually tied at the angles of the rafters. Reference to roofs of barns shown in more detail will explain the roof and how the plates are put on.

FEED RACKS AND TROUGHS.

A PRACTICAL FEED RACK FOR SHEEP.

Cheapness, simplicity and effectiveness are the three strong points of this rack. *Fig. 434* shows the construction. The end pieces are of 2″ x 4″ pine, the bottom boards are of 1″ x 12″ and the top boards are set at an angle and leave a wide opening through which the hay descends and plenty of room for the sheep to thrust their heads in to eat. This form of rack gives the animals easy access to every bit of the feed and prevents any waste of consequence, for when sheep can thrust their heads in they let them remain there and eat without drawing the hay out and trampling it under foot. In general this rack is built without a bottom, though if it is desired to feed grain in it there may be provided a tight bottom, putting it about midway of the bottom board. It is better to provide separate troughs for feeding grain.

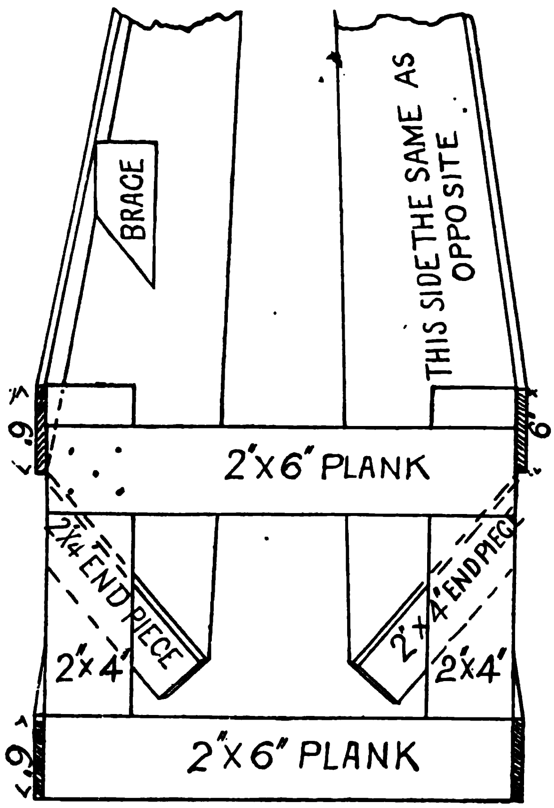


FIG. 434. PRACTICAL FEED RACK FOR SHEEP.

A SELF-FEEDING MANGER AND STALL.

This stall-manger plan can be used in nearly any form of building. The stalls being only 3′ to 3′ 4″, as may be preferred, in width and coming out 2′ from the manger, the front edge of stall being perpendicular as shown in *Fig. 435,* there is no danger of animals getting hemmed in or injured in any way.

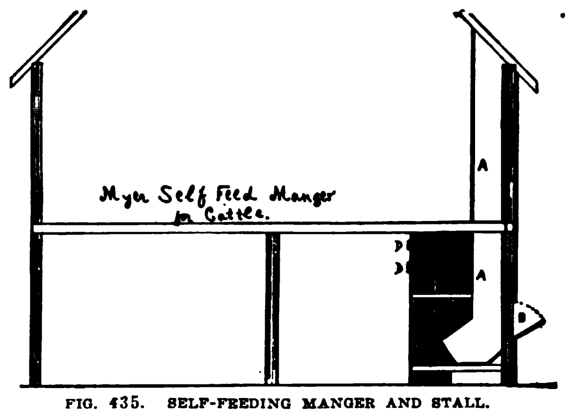


FIG. 435. SELF-FEEDING MANGER AND STALL.

On the outside of the building above the top of the manger there is an opening in the siding for feeding silage, ground grain, bran, cottonseed meal and the like. This is closed by a shutter turning up or down as desired. The stalls should be braced from near the end of the 2″ x 4″ support of the manger to near the middle of manger and closed between the brace and side of the stall so that stock cannot get their feet fastened. *Fig. 435* is thus described: *A, A,* hay chute 2′ wide, continuous with building. *B,* outer door to feed silage or grain of any sort without disturbing cattle; rack hung out from siding may carry car to distribute silage. *C,* wooden partitions between stalls; partitions 36″ to 42″ between centers, 44″ from hay chute to outside of partition; outer piece of partition should be 2″ x 6″ firmly fastened to stub-post set in ground. *D,* two boards 1″ x 6″ to brace the upper part of partitions.

A COLORADO SHEEP-FEEDING RACK.

In Colorado self-feeders are very popular in feeding hay to sheep. A self-feeder saves time and feed. Although the representation given

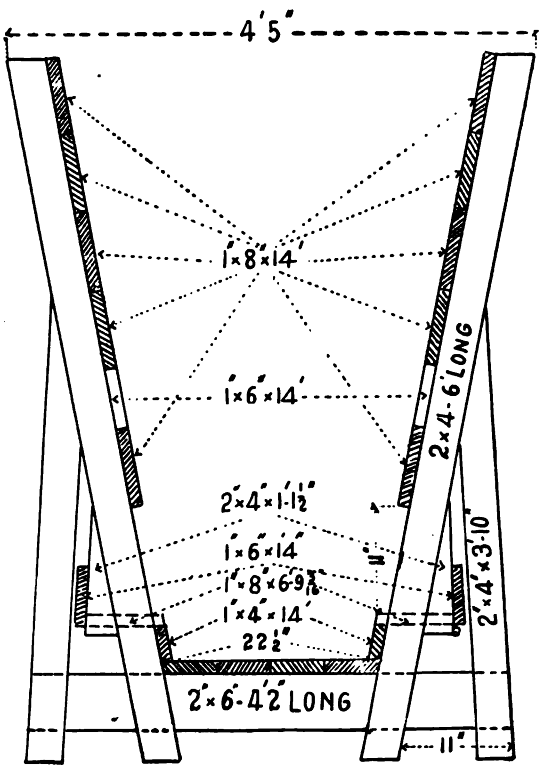


FIG. 436. COLORADO SHEEP-FEEDING RACK.

here (*Fig. 438*) may involve a little more outlay for material than some hay racks, it is counted very economical, because it prevents much waste accompanying the use of most devices while sheep are eating. When panels are used usually one linear foot per sheep is allowed. With this feeder 4″ per sheep is ample space.

HAY RACK AND FEEDER FOR SHEEP.

The simple hay rack shown in *Fig. 437* is used in feeding in silage, grain or hay, or all three together at one time. The main thing is to

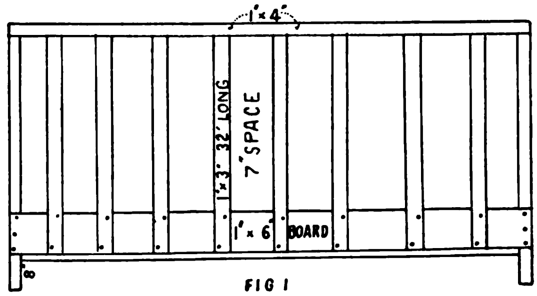


FIG. 437. HAY RACK AND FEEDER FOR SHEEP.

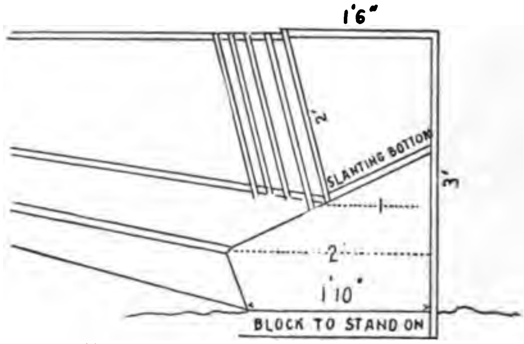


FIG. 438. HAY RACK AND FEEDER FOR SHEEP.

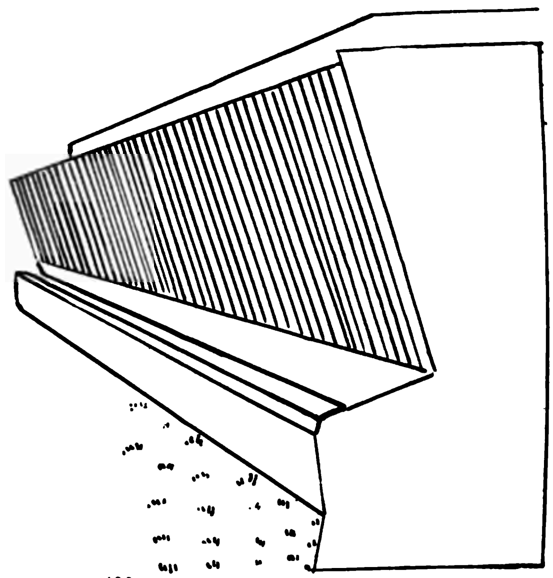


FIG. 439. HAY RACK AND FEEDER FOR SHEEP.

have it so made that the sheep or lamb can readily thrust its head clear in and hold it there while it eats. The spaces should not be so open that small sheep or large lambs can get in with their feet. The type is adapted to the use of mature sheep and lambs past 5 months old. It is substantially a flat-bottomed feed trough 24" wide and tight bottom, a hay rack above and attached to it. It is easily and cheaply built and effective. If the ewes have young lambs at their sides a different rack is advisable; one with slats closer together is best.

Figs. 438 and *439* show a combination feeder in use on Fillmore Farms, Tranquillity Farms, and other good sheep farms. There is probably nothing better for ewes with lambs. The specifications are: trough, 6" wide at bottom, 14" at top of slant. The trough is 7" high at the front and 11" at back. The slats are 2" wide, 1" thick, rounded, spaced 3" apart. The frame is 2' x 3'. The rack may be made in any length and placed so as to divide spaces. *Fig. 439* shows the rack complete.

TROUGHS AND SHEDS FOR 500 LAMBS.

In providing troughs sufficient to accommodate western lambs simultaneously one should have 24 troughs, each 16' long. The troughs should be placed 8' apart to allow the lambs

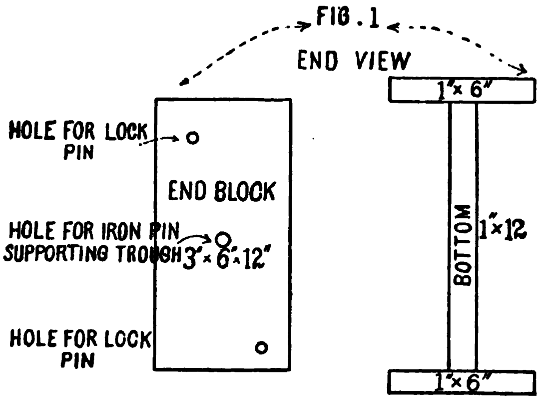


FIG. 440. TROUGHS AND SHEDS FOR 500 LAMBS.

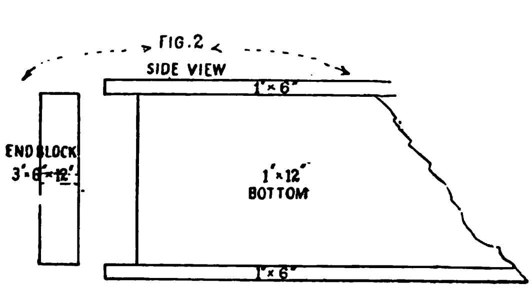


FIG. 441. TROUGHS AND SHEDS FOR 500 LAMBS.

ample freedom in getting to their feed quickly. In making troughs it is important to avoid the mistake sometimes made by nailing the end pieces of troughs to inch side-boards. A very satisfactory trough is represented in *Figs. 440* to *443.*

Figs. 440 and *441* represent a trough on edge, giving respectively an end view and a side view,

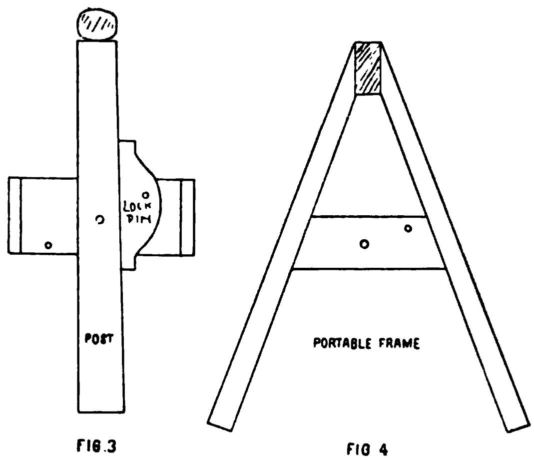


FIG. 442. TROUGHS AND SHEDS FOR 500 LAMBS.

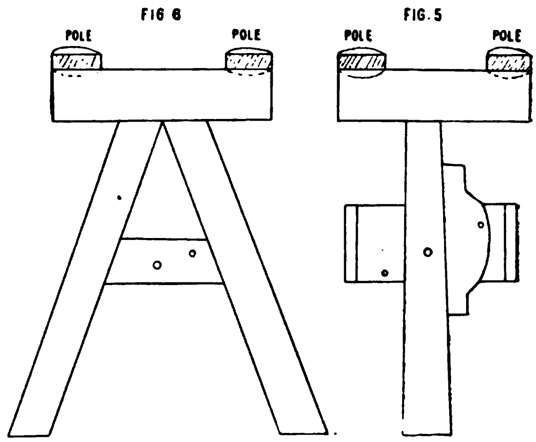


FIG. 443. TROUGHS AND SHEDS FOR 500 LAMBS.

with end block removed. Details: bottom 1" x 12"; sideboards 1" x 6"; end block 3" x 6" x 12"; hole for iron pin supporting trough; holes for lock pin. These reversible troughs may be hung upon posts set in the ground with 2" block with hole for lock pin, nailed to side of post, as shown in *Fig. 442.* Trough should be hung 14" or 15" above the ground. In either case poles should be provided above troughs to prevent sheep jumping over troughs.

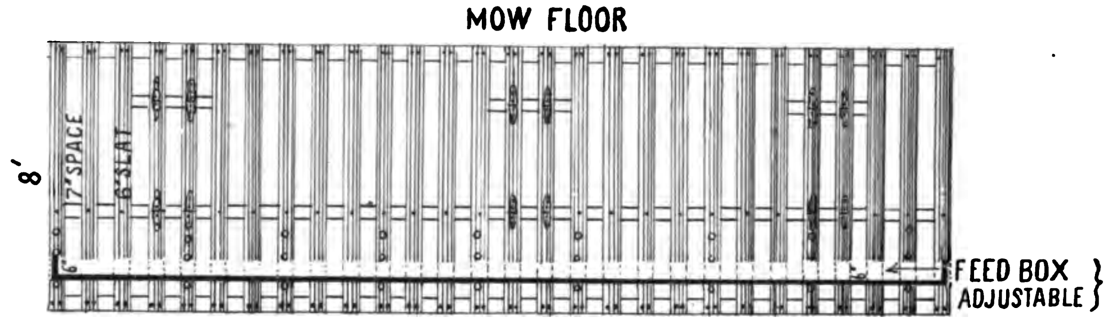
A still more effective means of preventing sheep from standing with their front feet in troughs—a habit very delightful to them in muddy weather—may be secured by using two poles over each trough, one over each side, as shown in *Fig. 443.*

If panels are used in feeding hay, 1′ per head should be allowed. Panels should have an 8″ space for lambs to feed through, between a 12″ bottom board and a 6″ board next above. A second 6″ board at the top may be spaced 6″ or 8″ above the middle board. If self-feeders are used in feeding hay 4″ per head will be sufficient.

GENERAL-PURPOSE SHEEP RACK.

A sheep rack for feeding fodder, hay or grain, to have a tight bottom, be set against the back wall of a barn and extend up to the mow floor so that one can feed corn fodder from the mow with but one handling, is shown in *Fig. 444.* Let the rack be 18″ wide and composed of 1″ x 6″ boards set vertically and spaced 7″ apart. Let the grain trough be a simple box 16″ wide, inside measure, and 6″ deep, and made to fit closely but not tightly between the front of the rack and the side of the barn. Do not fasten the feed box in place. Provide holes through the vertical boards and corresponding holes at the back to the siding of the barn and thrust ¾″ iron rods through under the box to hold it up. Then as manure accumulates in the shed the feed box will be raised and the rods thrust in higher holes.

The vertical 1″ x 6″ boards will go to the loft, but a part of them will need to be cut and hinged so that they may be let down, or raised up, for the purpose of reaching in and taking out the coarser refuse parts of the cornstalks. The wide spaces between slats allow sheep to thrust their heads clear in and they eat with less waste than when they must pull the forage out and trample it under feet.



LONGITUDINAL SECTION

FIG. 444. GENERAL-PURPOSE SHEEP RACK.

SELF-FEEDER FOR CATTLE.

Herewith is a diagram (*Fig. 445*) of a self-feeder for cattle that can be built on posts or built on runners of 4″ x 8″ pieces, so that it can be moved more easily. The troughs should be 2′ wide and have a space of 1½″ at the bottom of feeder for the corn to run out into the troughs. The 2″ x 4″ pieces on the side should be 8′ apart at the top and 4′ at the bottom, so the sides will be slanting.

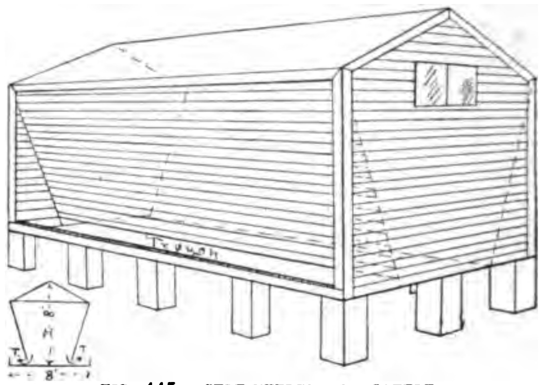


FIG. 445. SELF-FEEDER FOR CATTLE.

SELF-FEEDERS FOR OPEN LOTS.

The self-feeder for cattle shown in *Fig. 446* is for an open feedlot or pasture. When cattle are made to put their heads through spaces like this to eat their food much outside waste is saved. The dimensions of this feeder are about right for cattle weighing, say, 1,000 pounds. In making it use bolts freely.

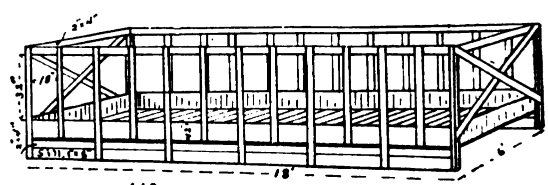


FIG. 446. SELF-FEEDER FOR OPEN LOTS.

SHEEP RACK AT IOWA EXPERIMENT STATION.

The sheep rack shown in *Fig. 447* has been used with satisfaction at the Iowa Experiment Station. The rack is 8′ long, 18″ wide and 38″ high. This size is found convenient for small pens, but any size may be used to suit the requirements. Economy of time and material may be gained by making the rack a little wider and feeding from both sides. *Fig. 447* gives a side view of the rack as used for feeding hay, also an end view, showing operation of grain trough and explaining method of construction.

The bottom of the rack (*C*) is 14″ from the ground floor. The front is boarded tight from *A* to *B*, a distance of 14″ and slopes inward, making *B* 4″ inside of the perpendicular line *A C*. A 3″ strip extends across the front joining on to the bottom to prevent the chaff and seeds from being worked out. The space from *C* to *B* (8″) gives the sheep access to the hay, and is separated into 3″ spaces by narrow cleats, as shown on left. The grain is fed in a trough consisting of two boards joined together, as shown in end view, one being 6″ and the other 12″ in width and both of the same length as the rack. The trough is attached by hinges to the front of the rack at a point midway between *A* and *C* and can be lowered for grain feeding and fastened up out of the way when the grain is eaten, as shown in *Fig. 447.* All lumber used should be planed on one side at least and the grain trough should be planed on both sides. The hayrack of itself is a good one and gives good satisfaction used alone. The grain feeding attachment is easily and cheaply made, occupies no room when not in use and makes the rack complete.

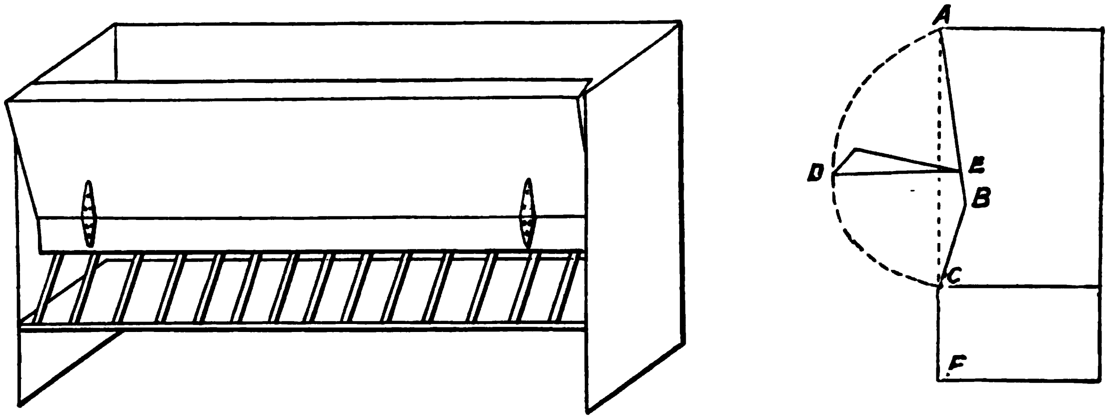


FIG. 447. SHEEP RACK AT IOWA EXPERIMENT STATION.

CORN FODDER RACK FOR CATTLE.

The plan shown in *Fig. 448* for a rack for out-of-door feeding combines strength, economy of lumber, protection from hogs and very little waste of fodder, while it is also easily raised as the stalks accumulate or moved entirely to another place. For material, elm, oak or any other tough native lumber will do better than pine; in fact, one would need 4″ x 4s″ of pine to stand the strain as posts where 2″ x 4s″ of elm or oak will do as well. Some 4¼″ machine bolts are also needed. *Fig. 448* shows part of one side of the rack, indicating how the panels are joined together and bolted to the posts, and how each post is braced to the one opposite, the post on the opposite side being shown in perspective with dotted lines to indicate the position of parts that are hidden from view.

In making, cut 2″ x 4s″ into 6′ or 8′ lengths for posts; 6′ will do if the rack is used only a portion of the season; if used in one place the whole season make 8′ posts. These posts will stand on top of the ground, one at each corner of the rack and at intervals of about 8′ along the sides. Using 1″ stuff for ties and braces, nail a 5′ board across the top of each pair of posts, thus making the rack 5′ wide and brace the posts well. It makes a stronger rack to put the braces at the bottom, but if the rack will need to be moved to a new place during the winter it is better to brace at the top so that the posts can be pulled up out of the stalks. Leave the 4″ faces of the posts toward the sides of the rack. With the posts all made up into bents of two each, prop one pair up vertically for an end and bolt on the top rails—long 2″ x 4s″—one at each side of the rack at a height of 4½′. Each bent is raised in turn and bolted to this top rail and where two lengths of top rail join they may be either lapped at a post with one long bolt or the post set far enough from the lap so that a 4½" bolt will do at the post and another at the splice. This allows all bolts to be of one size but takes more of them. All holes should be bored big enough so that the bolts may be slipped in and out with the fingers.

About 12" to 15" in length of rack or 2' to 2½' of perimeter should be allowed for each steer. The bottom rail is bolted on at 2½' from the ground, making even joints with the rail above. Next nail on 1" x 28" slats vertically from top to bottom rail on the outside of the rack, and near the ends of each panel and at intervals of 4' or 5' between put 4½' slats reaching from top rail to ground. Below the bottom rail slip in two 12" boards between the posts and the long shafts and nail them to the

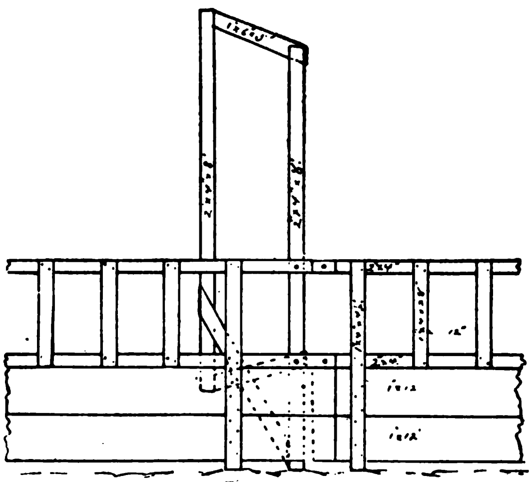


FIG. 448. CORN FODDER RACK FOR CATTLE.

slats but not to the posts. These boards should be the same length as the rails so that the separation into panels is complete.

Now an important thing is the spacing of the slats. For horned cattle they should be at least 2' apart; for dehorned cattle 12" in the clear is the best distance, and where necessary in order to make the spacing even they may be put as close as 11". In a rack without slats the stalks are easily pulled out under the feet; in fact, the common way of eating is to take an ear or a bite of leaves and back out from the rack to eat it, letting the stalk with whatever feed may be left on it drop to the ground. Then again the steers form the babit of rooting the stalks aside with a swinging motion of the head which sends them out of the rack if there are no slats to prevent it. Of course with horned cattle the slats cannot be put close enough together to be the most effective in preventing waste; or some of the steers cannot get their heads in, or else once in are caught and get badly scratched up by the other steers unless they can pull off a slat. With dehorned steers and slats put close they form the habit of standing with the head inside the rack while they eat rather than bump it against the slats in backing out with each mouthful; thus almost none of the feed is pulled out under the feet, and the steers work the fodder over thoroughly in the rack, leaving the coarsest parts of the stalks to be thrown out before the next feed is thrown in.

With this sort of rack hogs can be allowed to run with cattle all the time and thus clean up after them much more thoroughly than if run in alternate lots a day behind the cattle.

When the stalks accumulate about a foot deep around the rack so that it is a little low for the steers and likely to rub the tops of their necks bare, and so the hogs begin trying to climb in it, bore holes in the posts a foot above the others and raise the rack a panel at a time and bolt it on again. There are no cracks in the lower part of the panels for stalks to work through and bind it down, and even if things are frozen so that racks made in solid, independent, 16' sections with ends attached could not be pried up through the stalks, these light panels can easily be pried up one at a time. There is no particular need of moving it to a new place each time, for the manure from the stalks is better to be piled deep, and the steers will leave very little scattered corn inside the rack. This corn will not rot till after spring opens and at that time the rack can be thrown open and the hogs allowed to clean it up. The panels can then be put under shelter until the rack is needed again for feeding purposes

ANOTHER GOOD SHEEP-FEEDING RACK.

Into the rack shown in *Fig. 449* hay falls to the sheep as they eat it and they do not nose

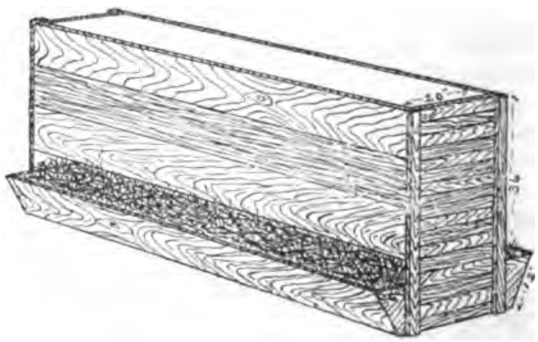


FIG. 449. ANOTHER GOOD SHEEP FEEDING RACK.

it all over, and lambs may run there without being on top of the hay all the time. This rack is to a certain extent a self-feeder, and though it is not recommended to feed sheep in any other way than what they will eat at one time it is an advantage to have a little hay left for the weaker ones. They waste very little hay with this rack and as it has no bottom it can be raised and then moved by one man. The frame is made of 2" x 6"s edgewise; for the block at the bottom saw 2" x 6s" diagonally; nail 12" board along the bottom lengthwise, then take three 10" boards and nail up the front; set the bottom 10" level with the 12" or about 1" higher; make the rack with a frame about every 4', omitting cross-piece except at the center, and this is not necessary unless the rack is to be moved about. For rack to feed only one side make 18" between studs. The sides may be made separate and set against light posts. Do not nail, but wire so they can be raised.

A HAY SELF-FEEDER.

This is a combined feeder and windbreak. The hay should in any event be covered, and a little additional roof covers the cattle as well. A cross-section of the feeder is shown in *Fig.*

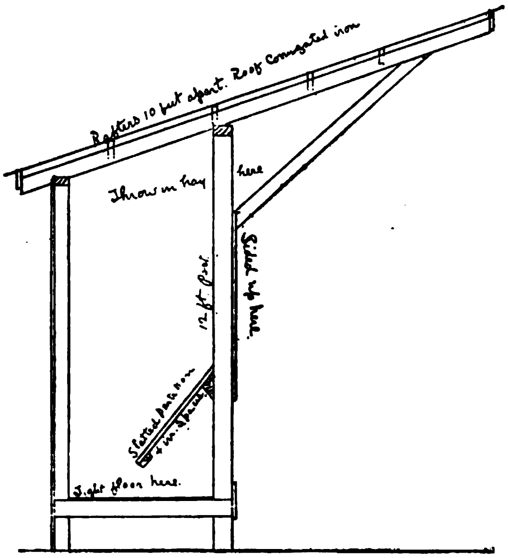


FIG. 450. HAY SELF-FEEDER.

450. Corn or bran or any ground feed may also be fed in the bottom on the tight floor. The posts are set in the ground. Galvanized steel corrugated roofing is used. Such a feeder and windbreak along the cold side of the yard would be useful on many a farm to hold bright straw, shredded fodder or hay.

COMBINED HAY AND GRAIN RACK.

The cross-section of this rack, shown in *Fig. 451*, explains its construction. It is a corn box, very strongly made to resist the pushing of big cattle, with added hay slots spaced 4" apart to

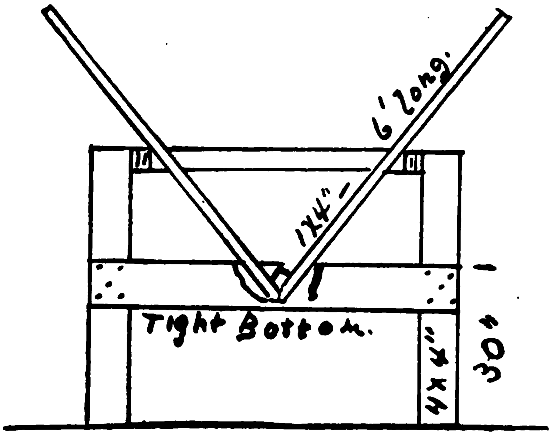


FIG. 451. COMBINED HAY AND GRAIN RACK.

hold hay. What is pulled through mostly drops in the boxes and is consumed or may be thrown back into the rack. The tight bottom admits of the feeding of any kind of grain.

SELF-FEEDER IN HORSE'S FEED-BOX.

Fig. 452 shows a self-feeder to be built in the feed-box of each horse at the end farthest from the horse. It stops the "hogging" of the feed and the waste of grain by slobbering, insures better mastication, and less grain fed this way

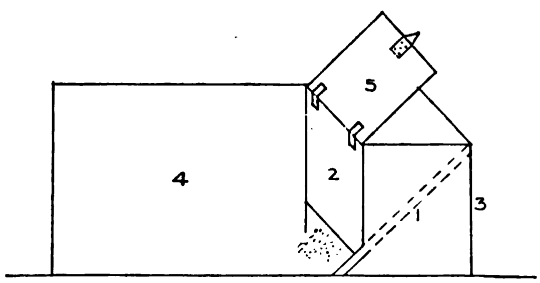


FIG. 452. SELF-FEEDER IN HORSE'S FEED-BOX.

will give as good results as more fed the old way.

The hopper can be made to hold any desired amount. Ear corn and mash can be fed in the remainder of the feed-box. The front wall should be made with slight backward slope. Explanatory: 1. Shoulder of chute; should be extended an inch beyond. 2. Front wall of feeder. 3. Back wall of original feed-box. 4. Side of feed-box. 5. Lid of feeder.

CATTLE YARD AND SELF-FEEDER FOR HAY.

The feeding of cattle in open yards is commonly practiced, yet shelter pays well. Small yards too are recommended and they may be paved to advantage. (See *Fig. 453.*)

The hay feeder of which a cross-section is shown in *Fig. 454* holds two loads of hay which is all eaten without waste. Corn boxes

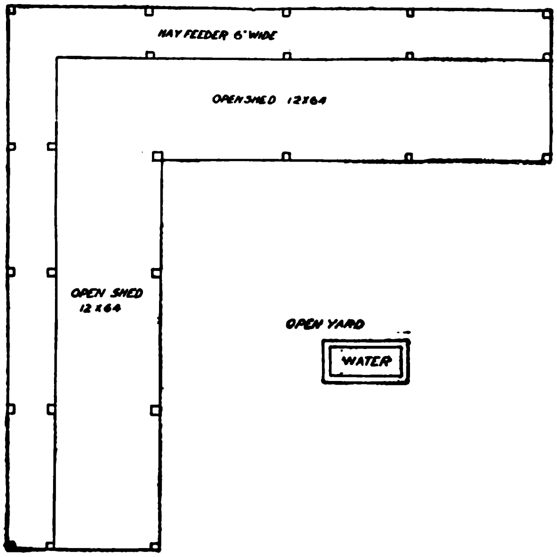


FIG. 453. CATTLE YARD AND SELF-FEEDER FOR HAY.

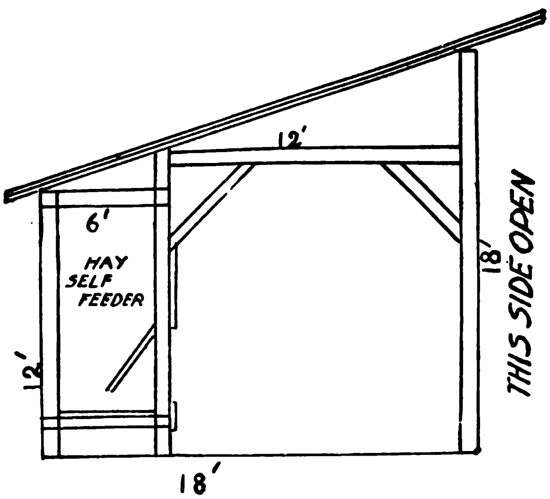


FIG. 454. CATTLE YARD AND SELF-FEEDER FOR HAY.

are set under the roof, leaving room to drive between them and the hay feeder. The yard need not be more than large enough to complete the square, then all manure is saved and less litter needed to keep it dry.

SHEEP FEEDING RACK AND TROUGH.

The accompanying illustrations (*Figs. 455* to *457*) are of a self-feeding hay rack and invertible sheep feeding trough, representing types now commonly found in use in the sheep feeding section of Colorado. Years of experience

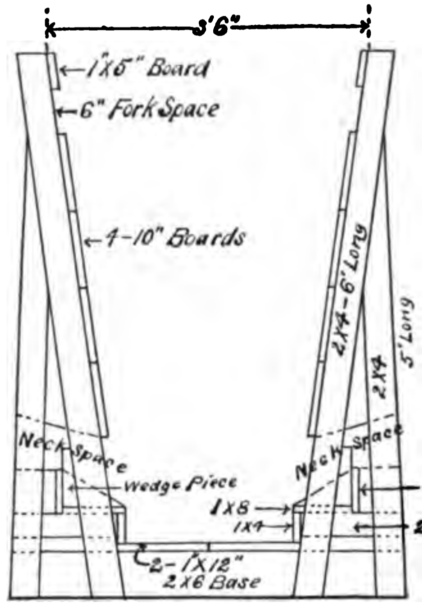


FIG. 455. SHEEP FEEDING RACK AND TROUGH.

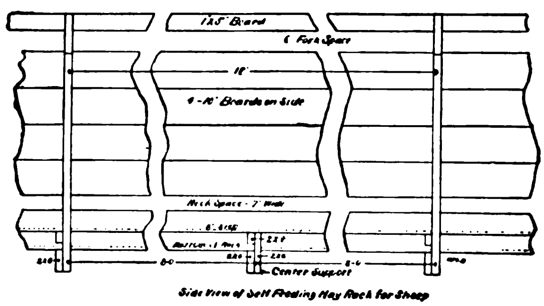


FIG. 456. SHEEP FEEDING RACK AND TROUGH.

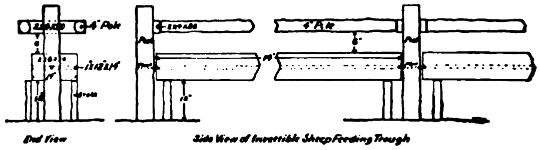


FIG. 457. SHEEP FEEDING RACK AND TROUGH.

have led the feeders of that section to adopt these types of feeding devices. The construction of the hay rack is such as to save all the hay. Experiments conducted by the feeders themselves have proved that there is a saving of 25 per cent in the amount of hay fed in one of these racks as compared to any other form of rack used in that section.

The bottom of the rack is of tight construction. The neck space is just wide enough to admit the sheep's head, and does not permit it to pull out hay and waste it. The hay settles in the rack and needs very little pushing down. The grain trough being double or reversible makes it possible always to have clean feeding conditions. It is found far superior to the single upright trough and is but slightly more expensive.

BUILDING A HAY SHED.

In building a hay shed 30′ long by 26′ wide and 24′ to the plates, in which a fork is to be used, the plan (*Fig. 463*) shows how to brace and support the room to admit passage of hay-forks from the end. The rafters are 2″ x 6″, 18′ long. It is an open shed.

FIG. 460. SELF-FEEDER FOR MIXED FEEDS.

FIG. 458. CORNBELT SHED FOR HAY FEEDING.

FIG. 459. WISCONSIN SELF-FEEDER FOR SHEEP.

FIG. 461. A PORTABLE FEED RACK.

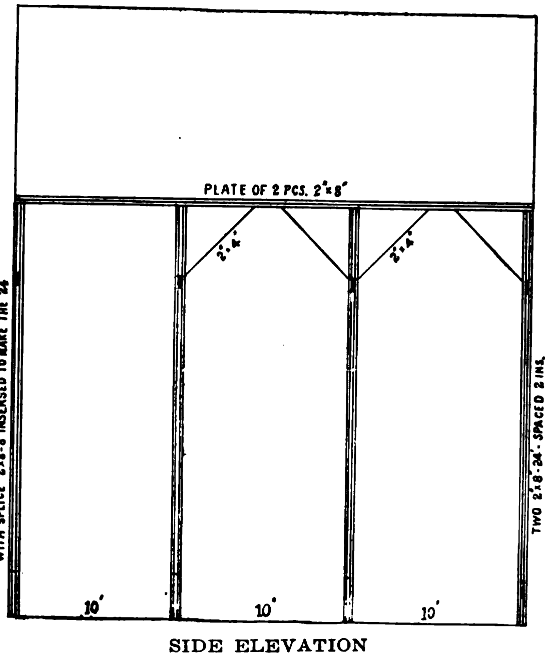


FIG. 462. HAY SHED (FRAME).

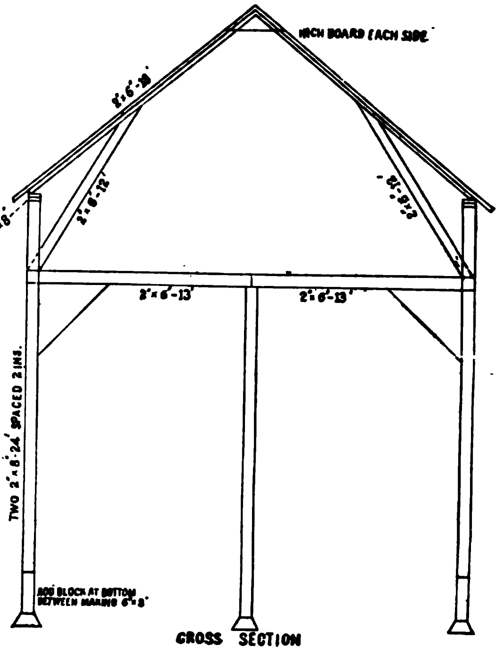


FIG. 463. HAY SHED (CROSS-SECTION).

Every bent must be tied at the 20′ height and then the brace to the rafters at the place where ties enter posts will be safe with a short collar beam of inch boards to each pair of rafters to which the track is fastened. The building should be well braced as indicated, as otherwise it would be liable to blow down when empty. Whether sided or not it had best have some ties on the outside posts.

GOOD IDEA IN FEED RACKS.

The cuts *Figs. 464* and *465* are self-explanatory. By hitching a team on one end of this unique rack it can be moved very easily. The

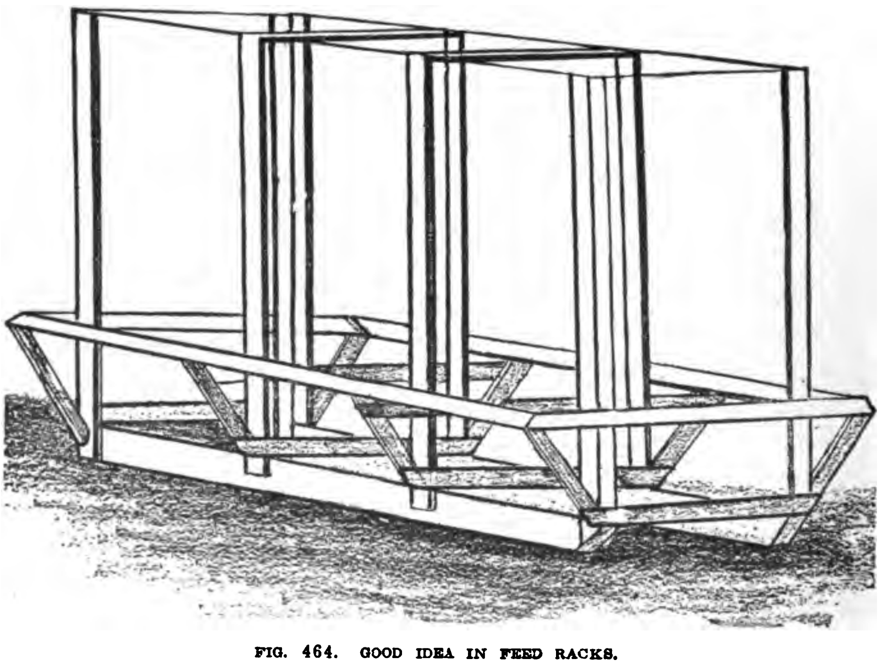


FIG. 464. GOOD IDEA IN FEED RACKS.

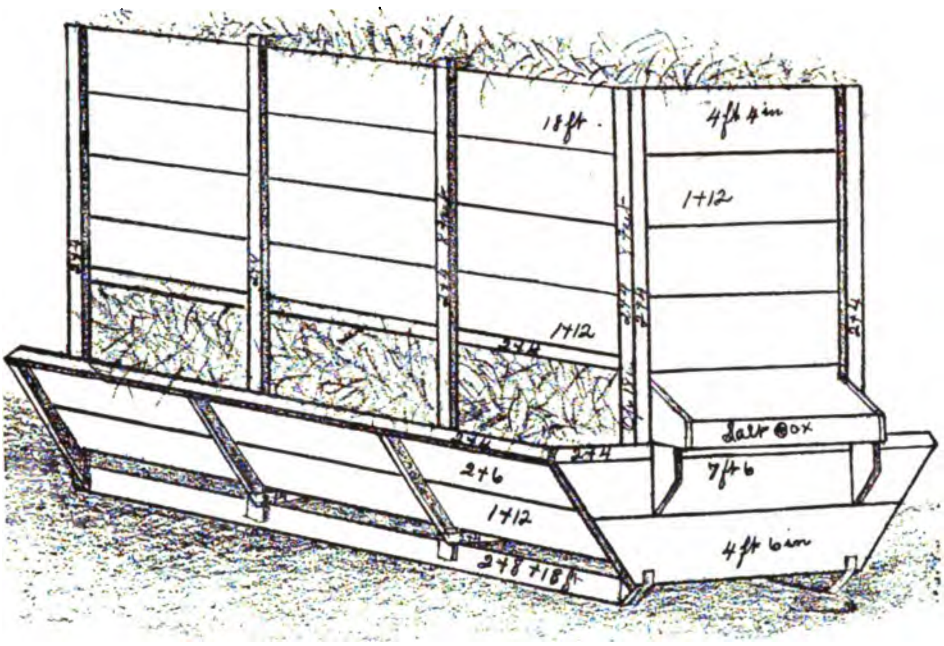


FIG. 465. GOOD IDEA IN FEED RACKS.

18′ ark holds 1,000 pounds of hay or one ton of sorghum. The frame-work is made mostly out of 2″ x 4″s except the runners, which are 2″ x 6″.

FARM FENCES.

There is nothing on the farm that adds more to the appearance of the place than a good fence. There may be some choice as to the kind of fence one would want to use but there is no choice as to the way it should be built. Every fence should be carefully built; it will last longer and increase actual value of the farm. The late Jeremiah M. Rusk said: "Show me the farmer's fence and I will tell you the kind of farmer he is."

Fences have been used in one form or other ever since men engaged in the pursuit of stock raising. In ancient times the sheep were sometimes corralled in enclosures made of tenting. Afterwards came the stone fence, the picket fence and the zigzag rail fence that are now relics of the past.

The three kinds of fences that are in general use today are the board fence, the barbed-wire fence and the woven wire fence. Barbed-wire has been used quite extensively, but it is no doubt nearing its end of service, since at the present time the woven wire fence either alone or in combination with the barbed wire is coming more and more into use. The woven wire is proving to be a very substantial fence and one best suited for ordinary farm fields.

FENCE POSTS.

Corresponding to the foundation of a building are the posts, which are necessary in the construction of all fences. The cost as compared with the durability of the post is the thing to be considered when making the selection of posts.

Of the wood posts red cedar gives the best service. Good cedar posts cost from 15 to 20 cents apiece. While oak posts are cheaper they are shorter lived than cedar and are disagreeable to work with because they are so hard. In parts of the country where stone can be quarried, stone posts are often used. They cost from 25 to 50 cents and are very heavy to handle, but when once in the ground they are there to stay.

Wooden fence posts are becoming more and more scarce as the timber of the country is cut, and the price is constantly increasing. A substitute for wooden posts is now being introduced in the form of cement posts. It is the same material used in concrete sidewalks. The claims made for these posts are that they surpass in smoothness of wear and freedom of cleavage by frost or breaking by blows, as in the case of building stones. The posts are also claimed to be fire, rot, frost and rust-proof, much stronger than wood and to improve instead of degenerate with age. There are several different patterns of these posts on the market. The weight of the posts is against long shipments, but a farmer can make his own posts with the least possible outlay. One or two molds and a level piece of ground covered with sand 2" or 3" thick comprise the necessary machinery.

The molds made of cypress will cost about $3 each and those made of pine will cost about half as much. One style of these posts is 4½" square at the ground line and tapers on three sides to 3" square at the top and 3½" square at the bottom, and also makes a small truss of the four wires which run lengthwise through the post. The post can be made any length desired, a 6' post weighing about 50 pounds when cured. The approximate cost is about as follows: 1½ pounds No. 8 wire at $1.80 per cwt., 2.7 cents, and 8 pounds cement at 60 cents per cwt., 4.8 cents (gravel and labor not included in the cost) would be per 6' post 7.5 cents. A 6½' post at this rate would cost 8.25 cents.

Small holes are molded through the post parallel to the fence and in the direction which the fence runs. Through these holes a short wire is run and wrapped around the wire of the fence at each side of the post; in the same way boards can be attached. The posts are claimed to be very strong. No. 8 wire is capable of holding a weight of 1,800 pounds. With four of them in the post it makes it almost indestructible. Also the holes through the posts are behind the front wires so that should the cement be knocked off in front the wire would still hold.

The posts are composed of three parts sand and one part of cement mixed thoroughly dry first and then wet enough to pound into the mold without becoming sloppy. Enough of the wet mixture is placed in the mold to make about 1½" in depth. Then it is pounded down. Two of the long wires with hooks on each end are placed in lengthwise with the cross wires to make the holes through which the tie wires pass. Next fill the mold to within 1" of the top, place in two more longitudinal wires and tamp. Fill up the mold a little more than level and tamp again; smooth off and turn the post out on the wet sand floor to cure. They are molded face downward, and a groove runs through the center of the face in which can be placed a wire for lightning arrester. Keep posts moist for four days by sprinkling.

BUILDING CONCRETE CORNER POSTS.

Fig. 466 is thus described: "The post form is made in two sections of No. 18 galvanized iron, and when joined forms a cylinder. A cleat on one edge of each section holds them in place and three iron rings of ¼" x 1" tire iron hold the sections together. The top ring is solid; the other two are hinged and fasten with a wedge-shaped pin. In one edge of one section at the proper place have two holes for hinge pins, also two ½" holes 10" apart for an iron staple as a catch for the gate latch. Dig holes 4' deep, about 12" in diameter and use metal for reinforcement. Fill the hole with concrete, then place the form on and continue putting in hinge pins or gate catches. Use a barrel of cement to a yard of gravel and what sand the gravel needs. Work down the side of the form with a thin light tamp. Take the form off the next day

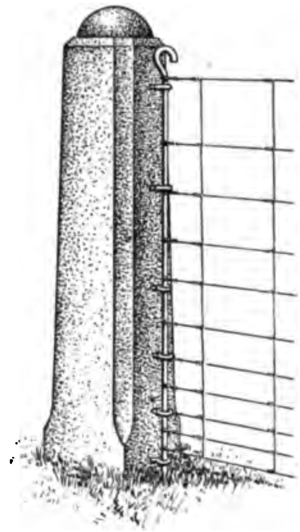


FIG. 466. CONCRETE CORNER POST.

carefully and paint at once with pure cement mixed with water to the consistency of thick paint. The brace form is made of two sections, as shown, held apart by a 2" x 6" and together by four bolts. Two eyebolts (⅝) against post and 6 pins ½" with eye at one end form holes for bringing wire through, and after stretching one simple twist over the wire will hold tight. Have a piece of iron 5" long welded across the end of the hinge screw hook and have the catches made in the form of an *E* with the center stem left out. It requires from ⅝ to ¾ of a yard of gravel to build one post and brace. Part of the brace form is hinged about the center so it will turn down until the lower half is filled. Make the foundation for brace about 18" deep and width of spade. In putting in the top hinge pin allow for settling by lowering outside end about ⅜".

TYPE OF CEMENT ANCHOR POST.

Fig. 467 is of a cement anchor post built in the ground 4½′ deep. It is about 12″ square at the base and 10″ at the top, with corners taken off. Insert six eyes into the post at the time of building. Into these eyes insert a ⅝″ rod or

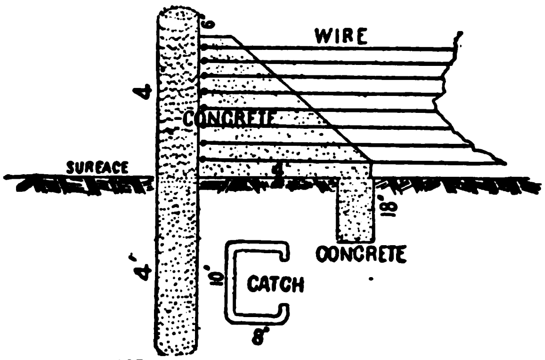


FIG. 467. TYPE OF CEMENT ANCHOR POST.

gas pipe, and attach wires to the rod. The post is braced by cross arms, under ground. This attachment is neat and can be easily adjusted or removed. No brace is needed. This post is as cheap as a wooden post, provided one makes the post himself, which anyone can do, after the form is built. After the form is removed, brush the post with some pure cement mixed to a consistency of cream.

SETTING FENCE POSTS.

Next to the material is the manner of setting the posts. In building a fence it must be remembered that the end posts are the mainstay of the whole fence. These should be about 3″ greater in diameter and about 2′ longer than the intermediate posts. The hole for the end posts should be at least 4′ deep, if 5′ is to be above the ground, and should be 3′ square. In the side of the wooden post toward the end of the fence and about 7″ from the bottom end of the post a piece 2″ x 6″ and 30″ long should be spiked and fastened into a notch in the post cut for it. If for a corner another piece should be fastened above it and at right angles to the first. About 10′ from the end post in line with the fence another post about the same size should be set at the same depth. About a foot from the top of the end post and to a few inches above the ground on the other should be extended diagonally a wooden brace 4″ x 4″, being fitted into notches cut in the posts. Another brace of twisted wire should extend from near the top of the brace post to the bottom of the end post. The intermediate posts should be about 7′ long and 4″ to 6″ in diameter and should be placed 2½′ or 3′ in the ground and about a rod apart. All posts must be in perfect line from top to bottom, otherwise the tension will pull some of the staples. The wire should always be fastened on the side of the posts toward the field where the stock is kept.

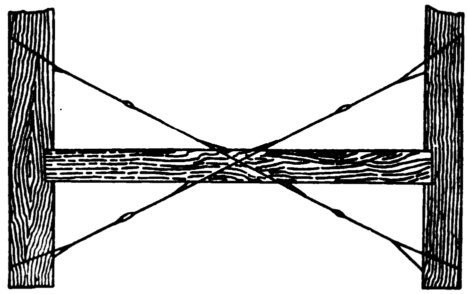


FIG. 468. SETTING FENCE POSTS.

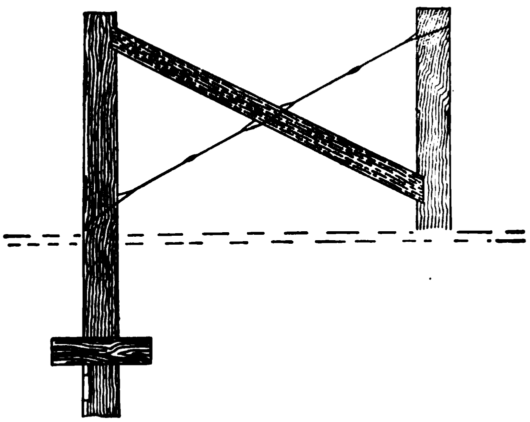


FIG. 469. SETTING FENCE POSTS.

Figs. 468 and *469* show the two very popular methods of bracing end or corner posts.

Figs. 470, 471 and *472* show cuts of woven wire fences constructed from galvanized wire. These fences are very serviceable and are suffi-

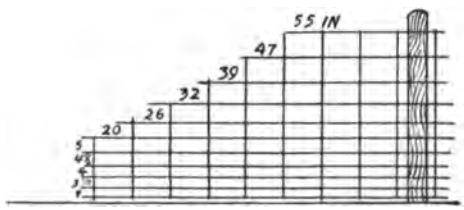


FIG. 470. TYPE OF WIRE FENCE.

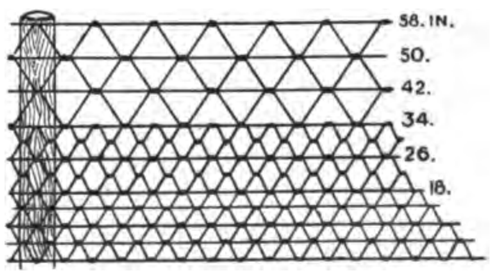


FIG. 471. TYPE OF WIRE FENCE.

ciently strong, and woven in a manner to enclose cattle, horses, sheep or hogs. Some farmers prefer a combination fence as shown in *Figs. 473* and *475*. This is a good kind of fence for a hog pasture and will turn any kind of

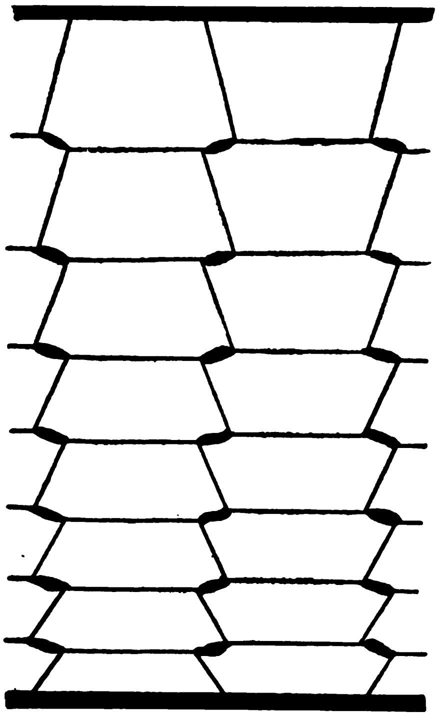


FIG. 472. WOVEN WIRE FENCING.

stock. In *Fig. 473* is shown a combination woven and barbed-wire fence. This makes a cheaper fence than an all-woven one of the same height, since the 26″ space covered by the three barbed-wires does not cost as much as woven wire 26″ high. Even with an all-woven wire fence it is often advisable to have a barbed-wire on top, so horses will not reach over and bend down the wire on top of the woven wire.

The old-fashioned board fence is rapidly going out of use and is now only seen around yards and short stretches near buildings where it is often better than wire. One hundred rods of the old board fence would cost $85 for the boards alone. It takes twice as many posts and is much more tedious to build, since the posts have to be set in such a manner as to let the boards meet. This kind of fence completed would cost about $1.20 per rod. This puts it out of competition with the woven wire fence, since the best 54″ woven wire fence can be purchased for 65 cents or less per rod and is more sightly and serviceable.

Fig. 476 shows a strong hurdle fence composed entirely of ordinary fence boards. The triangular frames which serve as posts are each of two pieces of 1″ boards crossed and braced as shown in *Fig. 476*. The panels are 16′ long, each composed of four boards; in setting up the fence each triangular frame supports the ends of the panels. The upper and lower board of each panel interlock with the frame, as shown in *Fig. 476*, making a very strong fence. This is a very handy fence for fencing temporary pastures and is often used to divide a pasture from tilled land.

Fig. 477 is a windbreak and is used to inclose the barnyard or feed-lot. The fence is generally 8′ high, but some prefer 6′. The boards should be on the side next to the feed-lot so that the stock by rubbing cannot knock the boards off. Although primarily this fence is a windbreak it is very valuable in that it hides the manure piles and general disorder of the feed-lot.

FIG. 474.

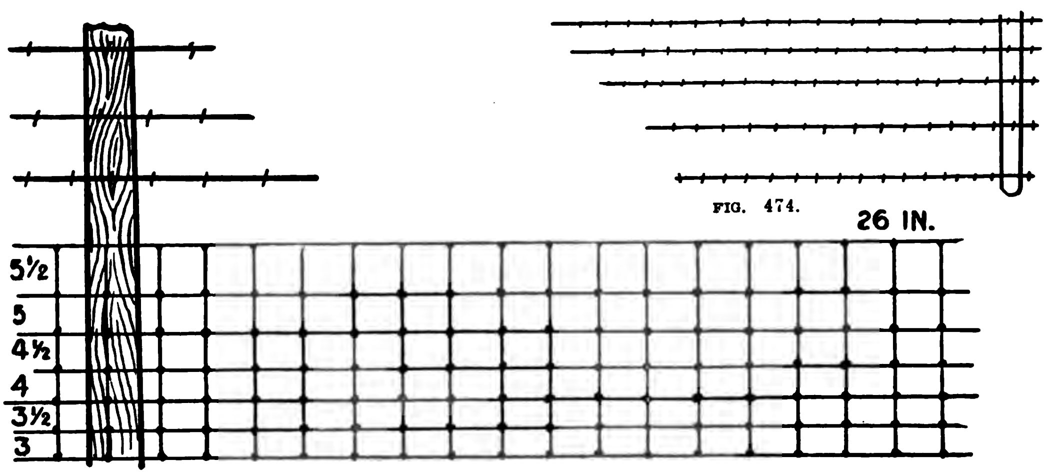


FIG. 473. COMBINATION WOVEN WIRE AND BARBED-WIRE FENCE.

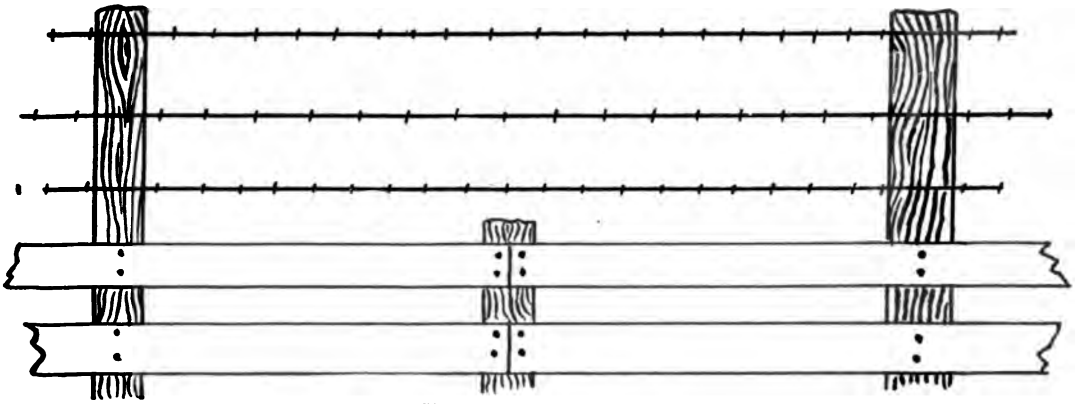


FIG. 475. WIRE AND BOARD FENCE.

Fig. 478 represents another style, a very neat farm fence, rather preferable to the old straight fence. It saves one board to each length and by nailing on the two upper boards as shown in the

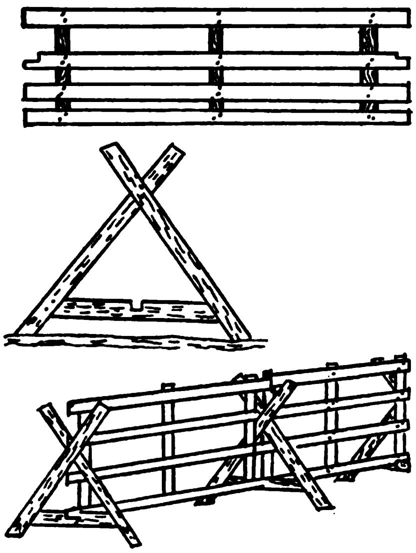


FIG. 476. STRONG HURDLES.

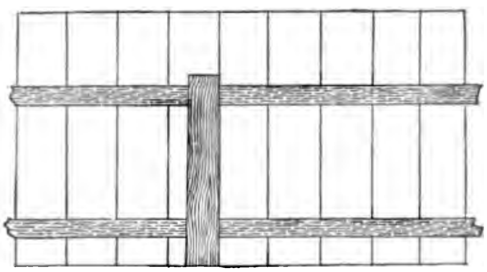


FIG. 477. WINDBREAK.

illustration great additional strength is given. These boards not only act as braces but as ties also, and a fence built on well-set posts and

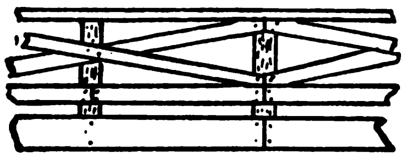


FIG. 478. FARM FENCE.

thoroughly nailed will never sag or get out of line until the posts rot off.

STONE ANCHOR WALLS FOR FENCE.

Mrs. Virginia C. Meredith of Indiana submits the accompanying photographs that illustrate stone-anchor walls used with wire fence. These walls are built of boulders laid in cement; they are 8′ long, 2′ wide, 4′ 6″ above ground and 3′ under ground. In building them it was the intention to get something that would endure, that would stand plumb and at the same time be not unsightly. The expense is greater than that of putting in the best red cedar posts and braces, but on the other hand there is every reason to think that these walls will not only stand plumb but that they will last indefinitely. On a home farm it is worth while to make permanent improvements. To make the holes through which the wires pass (see *Fig. 480*) the stonemason in building laid gas pipe on a level at the required distances apart and before the cement hardened withdrew the pipe.

The fence shown in the picture is of four barbed wires, the top one being 50″ from the ground; the bottom one is 16″ from the ground. The fence is an outside one and is intended to inclose cattle and horses upon a permanent pasture. To fence an entire farm for hogs seems a needless expense. The wire is fastened only at the two ends at the anchor walls. It is fastened, after passing through the holes, to a stretcher or ratchet by means of which it may be stretched as tight as desired. Between the end stone anchor

FIG. 479. STONE ANCHOR WALLS FOR FENCE.

walls small red cedar posts are set 50′ apart or less, according to the surface of the ground. Upon the cedar posts are iron insulators through which the wires pass but are not fastened. Between the cedar posts the wires are held in place by steel stays at distances of about 10′. In a short line of fence, 100 rods or less, the wire is attached to the ratchet or stretcher at one end only while at the other end it is wrapped around a vertical piece of gas pipe, as may be plainly

FIG. 480. STONE ANCHOR WALLS FOR FENCE.

seen in the anchor walls at the gateway (*Fig. 479*).

Three things are necessary to a good fence—strength, elasticity and light weight. By using barbed wire one gets the very great advantage of the cable in stretching as well as extra strength, while by using but four wires one certainly secures a fence of light weight. The barb itself on a tight wire is a harmless but effective warning to cattle and horses to let the fence alone. Barbed wire, used after this plan of not stapling it to the post, is elastic enough to withstand any ordinary shock, such as a falling tree, because the force of the impact is distributed along the entire line of fence between the end anchor-walls.

A gate is always a source of weakness to a fence and a cause of care to the farm owner. The stone posts to which the gate is hung (*Fig. 479*) are 2′ 6″ square. The hinges as well as the latch piece were set in the cement as the posts were being built.

Mrs. Meredith says: "We are greatly indebted to the pure breeds for animals with little of the scrub propensity for jumping fences, consequently a fence 4′ 2″ high is ample safeguard for the stock usually kept on a farm. I have used a fence of the style here described for more than twenty years and with entire satisfaction. We seem not yet to have learned how to build farm fences. A ride through any section of the country reveals a succession of poor fences constructed after the vagaries of each particular owner. Hardly ever does one find a fence that stands plumb. With plank fences the great weight inevitably forces them to lean; with woven wire fences, in many cases, the wire used is so light and so poorly galvanized that in a short time it yields to the rubbing of stock and shows holes or else is borne to the ground. The usual barbed-wire fence seems to inspire in its owner a disinclination to replace a staple or mend a broken wire. The very best fence ever constructed was an old-time split rail Virginia worm fence; it would stand plumb and would turn hogs as well as horses, but it is a luxury of the past, too expensive for modern farm economy."

A CONVENIENT PORTABLE FENCE.

It is often desirable to have a fence that may be quickly erected and as quickly removed. The fence shown in *Fig. 482* is very cheap, strong and convenient. It is built of pine, 1″ x 6″ for the bottom rail and 1″ x 4″ for the top rails. The braces that hold it upright are 2″ x 4″ and the base or cross piece is 2″ x 6″. The base is notched 2″ and the bottom boards notched as much, which makes a secure lock. This fence is easily made and is erected when needed as fast as the panels and braces can be taken from the wagon. As the base piece of the brace is apt to decay first it might well be made of oak and if set on two bricks or small flat stones it

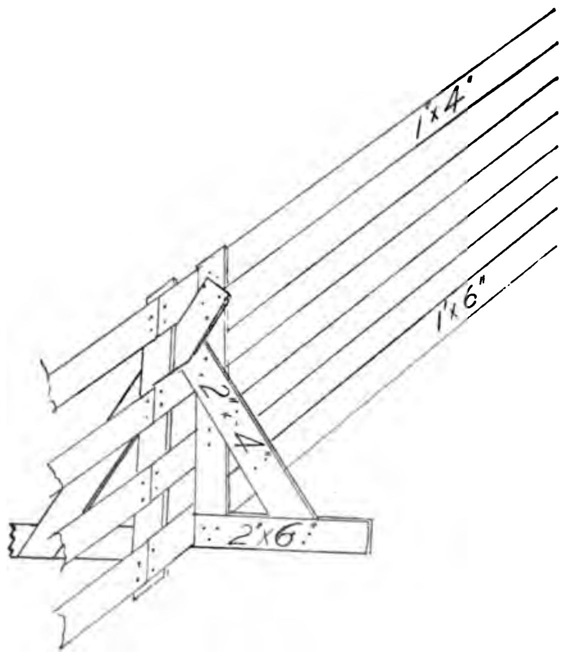


FIG. 482. CONVENIENT PORTABLE FENCE.

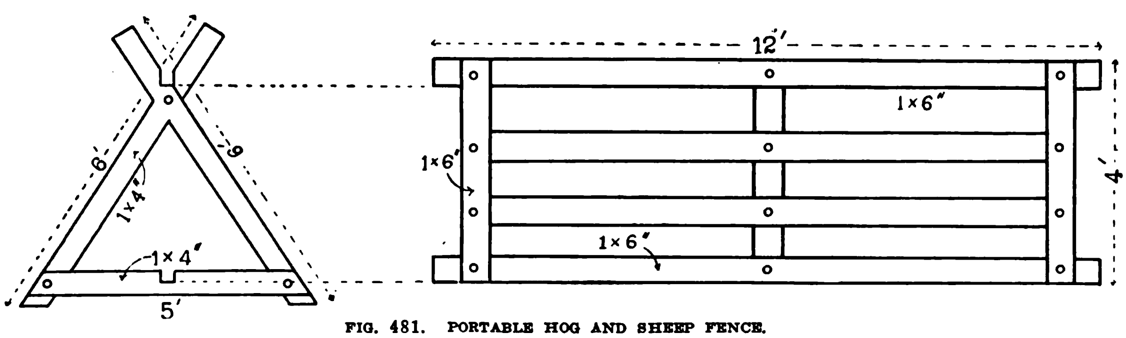


FIG. 481. PORTABLE HOG AND SHEEP FENCE.

would be less affected by moisture of the soil. These panels must not be too long or they will warp out of shape, 12′ being long enough. Pine is better than oak because of the warping tendency of most hard woods.

PORTABLE HOG AND SHEEP FENCING

The cut (*Fig. 481*) shows a good type of a portable hog and sheep fence. It should be built of good material that will not warp nor rot readily. Put together with long wire nails, clinched, painted or treated with a wood preservative it will endure for years and form a ready means of enclosing a patch of rape or clover pasture.

ANOTHER GOOD PORTABLE HOG AND SHEEP FENCE.

The panels in the portable hog fence shown in *Fig. 483* are made of 4″ fencing, 14′ long, with 6″ spaces between the boards—thus making a fence 3′ high by allowing the cleats to project 2″. If the fence is to be used for pigs the lower space may be reduced to 4″ and the

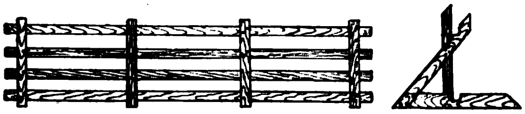


FIG. 483. PORTABLE HOG AND SHEEP FENCE.

upper one increased to 8″. This makes a better division for all purposes. The fence is held in place by triangular frames, as indicated in the drawing. The ends of the panels overlap about 6″ and fit into notches for the top and bottom boards. The brace should be on the outside of the lot. This style of fence is very satisfactory for sheep and will serve the purpose of a temporary fence for hogs, though it is sometimes necessary to stake it at the braces.

Another portable fence (see *Fig. 484*) is thus described:

The panels are made of 6″ pine fencing 12′

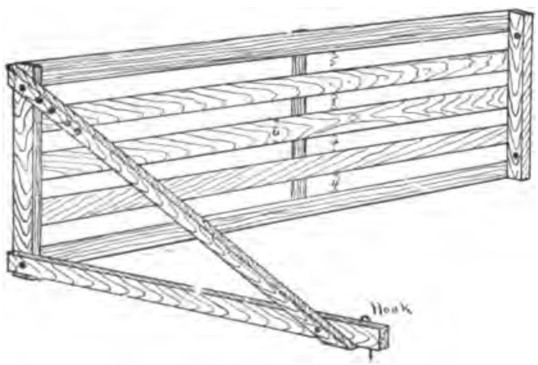


FIG. 484. ANOTHER PORTABLE FENCE.

long with 4″ and 5″ spaces between the boards, as shown in the illustration. This makes a fence 4′ high. The planks are nailed at each end to a 2″ x 4″ scantling 4′ long, which has two holes 1″ in diameter for the purpose of putting the fence together, with a brace between the panels, as shown. In the center of each panel is a brace made of 4″ fencing. The main braces are made of the same; they are 6′ long; the top brace is bolted to the other at the ground. The extra holes in the upper brace are to regulate the position of the fence on a hillside. The braces may be put on either side; they are usually put both ways. Iron pins 18″ long, with an "f" hook at one end, are used by driving into the ground with the hook over the brace. Wooden pins are used to hold the fence together, running through the braces.

HURDLES FOR SHEEP.

Fig. 485 shows hurdle made of four 4″ strips about 12′ or 14′ in length with upright strips of the same material well nailed and clinched. Eight-inch spaces between the strips and two-

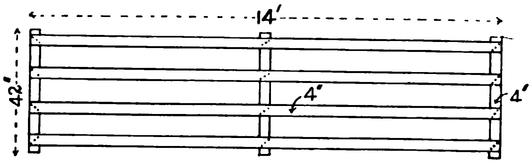


FIG. 485. HURDLE FOR SHEEP.

inch projection of the uprights give a hurdle 42″ high when set up.

Fig. 486 is a short-hinged hurdle that gives satisfaction in making small pens in the barn. These are four or five feet long, and joined together at the ends with strong hinges. These can be set up in a corner of shed or barn half

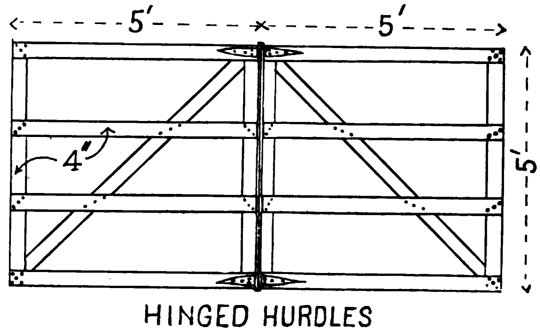


FIG. 486. HINGED HURDLES.

open, thus forming a pen 4′ x 4′ or 5′ x 5′ as the case may be. (See *Fig. 487*.) Another pair makes a second pen and so on. These are very handy at lambing time.

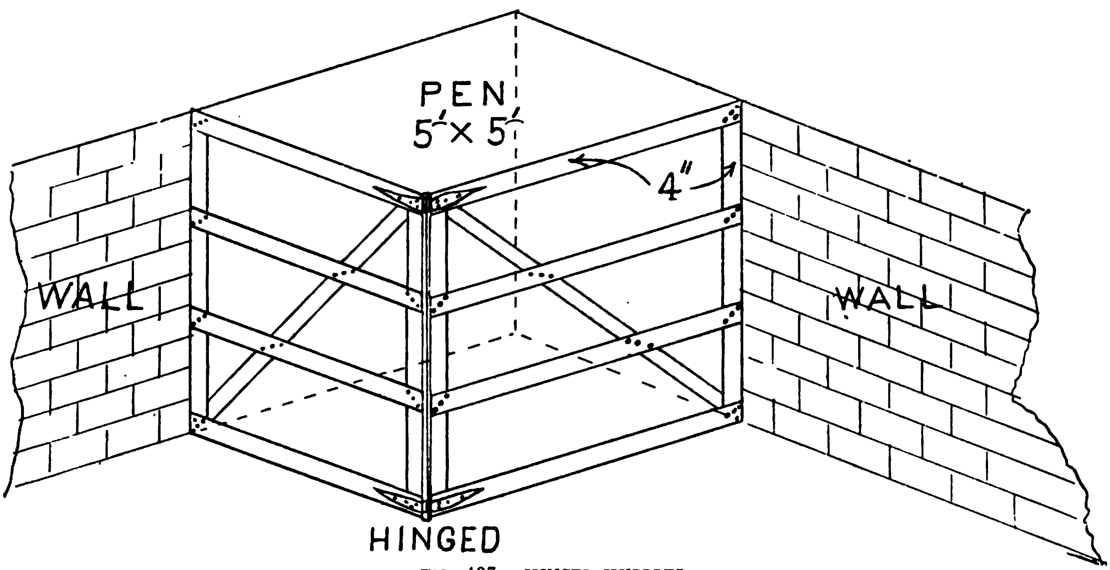


FIG. 487. HINGED HURDLES.

ENGLISH HURDLES FOR SHEEP.

English hurdles for sheep are made so light that the shepherd can move them on his back. The drawing (*Fig. 488*) is of a good hurdle made of hardwood $1\frac{1}{2}$" x 2" 4' long; sharpen one end; band the other end with a strip of hoop iron so it cannot split, or wrap it a few turns tight with No. 12 wire; put on four bars of light straight wood, pine is best; these bars

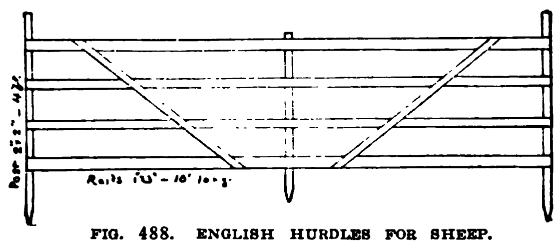


FIG. 488. ENGLISH HURDLES FOR SHEEP.

are 1" x 3" and 10' long. There must be a bar to make holes in the ground for inserting the posts, which then get a tap or two with the sledge to make them solid. A metal band slips over and holds the tops together. Heavy wire will serve or light wire for that matter.

BRACING A WIRE FENCE.

The general principle of bracing a wire fence is shown in *Fig. 489*. This brace is a rod of $\frac{3}{4}$" iron, nutted and threaded at each end, passing through a 3' length of 6" x 6" stuff. If the iron rod is not at hand a cable of six twisted wires may be used. This brace is cheap—will hold the post down instead of pulling or pushing it up. It also is immovable and frost or wet does not affect it. It is not generally desirable, however, to have a brace extending out beyond the end of the fence. When it is not desirable to have such a brace the difficulty is obviated by the brace shown in *Fig. 490*. Take

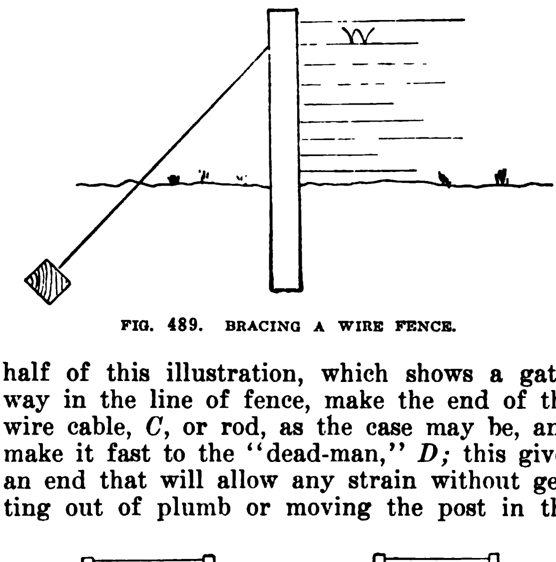


FIG. 489. BRACING A WIRE FENCE.

half of this illustration, which shows a gateway in the line of fence, make the end of the wire cable, *C*, or rod, as the case may be, and make it fast to the "dead-man," *D;* this gives an end that will allow any strain without getting out of plumb or moving the post in the

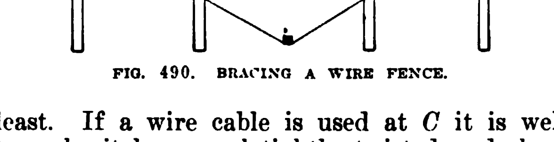


FIG. 490. BRACING A WIRE FENCE.

least. If a wire cable is used at *C* it is well to make it large and tightly twisted and short enough to make the posts *B* incline towards one another at the top a very little before the wire is strained, so that when all the slack is out they will be perpendicular. With an iron rod nutted at the upper end this is not necessary, for any obliquity can be remedied by a few turns with the wrench. When a gateway in the line of fence is required the plan shown in *Fig. 490* has been found very satisfactory. The cable or rod passes under the block *D*, which should be a good durable stick of oak, 6″ x 6″ and about 4′ long. The fence will not lift it.

Fig. 491 illustrates the bracing of a post when it is desired that no brace should appear to view,

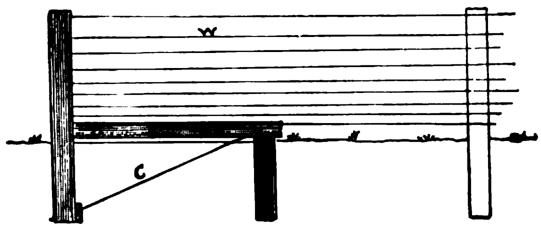


FIG. 491. BRACING A WIRE FENCE.

as in the case of a lawn or yard fence. *C* is a rod of ¾″ iron passing through the lower end of the post and the end of the brace, *B*. There is also a block of 2″ x 6″ on the front of the end of the post to keep it from moving forward or lifting up. The short post is not fastened to the brace, which merely rests on it. Braced in this manner the post will remain perpendicular unless strain is brought on it sufficient to bend it. It should be of 8″ x 6″ stuff. The brace *B* should be of 6″ x 6″ stuff and about 6′ long.

A GOOD CHEAP FENCE.

L. N. Bonham, of Butler County, O., a few years ago contributed the subjoined article to THE BREEDER'S GAZETTE: I have completed 110 rods of wire fence that has every appearance of giving good service. We have in the township more than 40 varieties of wire and wood fences, but few of them combine cheapness and efficiency enough to commend them. The farm was originally refenced with good locust posts and the best pine fencing for the majority of road and field fences. I used the old fence material found on the farm for slat fences, which have done good service, as some of them are good yet and will last several years longer.

I have always claimed that the well-made fence is the most economical. The wire fence I describe replaces a division fence that was built from the second grade of lumber and posts. I bought lumber and posts by the carload, and as I hauled the lumber and posts to the farm I sorted each into three grades. This was on the theory that a fence, like a chain, is no stronger than its weakest link.

It does not pay to put sappy or cross-knotted boards into the same panel with strong, sound lumber. The lines of fence built with the three different grades of posts and boards are lasting in proportion to the quality of material used. The fence made of third-grade boards and posts had to be repaired several years ago and was later removed. I am now replacing division fences. I hope the wire fence will last as long as did my third-grade pine and locust fence. The posts I have used in the wire fence are made from old locust trees which the borers had damaged, so the posts are not first class and would not do for a board fence, even if I could get as good fencing as I purchased 25 years ago.

The new fence has a post every rod set 36″ in the ground. There are 10 strands of No. 10 galvanized wire, each double and twisted into a cable as the fence is made. For stays between the posts I have a crimped No. 9 wire that is put in every 15″ as the weaving progresses, and these stays are gripped by the cable so firmly that neither cables nor stays can be displaced without force enough to break one or both. The fence is hog-tight and bull strong. In the line of 110 rods I have three anchor posts 9′ long (butt cuts of whiteoak) squared to 12″ above ground. They are set 5′ in the ground and braced and anchored as shown in *Fig. 492*. *A*

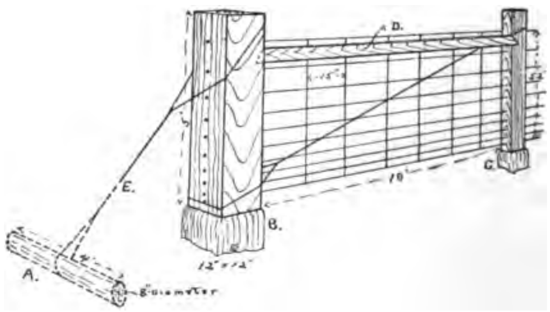


FIG. 492. BRACING A POST.

is an oak timber buried horizontally 3′ under ground and at right angles with the fence. Around the middle of this "dead man" are four strands of No. 9 galvanized wire *E* that pass around the anchor post *B* and are twisted into a cable. Another cable of the same size and material passes around anchor post *B* near the ground and post *C* near the top. After the brace is put in place this cable is twisted tight enough to hold the second post firmly against it. Each end of the line of fence has the same arrangement of anchor posts, braces and cables, and in the middle of the line (55 rods from each end) is another anchor post similarly braced, except the cable is attached to an extra strong fence post instead of a "dead man."

The anchor posts are painted with oil and mineral paint and the tops covered with tin painted on both sides. The wires pass through the center of the anchor posts to ratchets. I think the twisted strands of wire will be less affected by changes of temperature than plain wire. I had the fence built in hot weather in preference to freezing or cold weather, as my experience is that wire and slat or paling fences keep in place better when put together in dry, hot weather than when built early in the spring or late in the fall.

I see many failures in wire fences from lack of well-constructed anchor posts and stays and from placing the posts too far apart and not deep enough. The most common form of bracing is to set one end of the brace near the top of the anchor post and at the foot of the next post in the line, and it is no uncommon sight to see the anchor post rise enough during the first winter to ruin the fence. I can no longer afford board fences. Wire fences have many objections, but their cheapness, neatness as well as ease of construction and keeping clean commend them. Before setting this fence I plowed a headland 10′ wide, harrowed it well and sowed grass and clover seed. Such a fencerow is free from weeds, furnishes good pasture and gives increased height and better drainage to the fence.

PRESERVING POSTS.

Tarring or painting the outside of a fence post that is full of sap may keep surface water out of the post, but that assumes that the foreign water is the cause of decay. It is doubtless one cause, but the sap and insects that enter for the sap are another means of destruction of posts. To prevent injury by the sap and insects the creosoting of timber was invented. Saturating timber with creosote coagulates the albumen and excludes the air and acts as a preventive of insects, ferments or fungi. To make the creosote most effective the timber is put into a bath of superheated steam and then treated with creosote. The process is only partially effective. While it prevents largely the injury from fungi and insects the timber is made brittle and in some varieties of wood this brittleness is so extreme as to lessen its value in the ratio of lessened strength. The process costs about 15 cents per railroad tie or half that for a fence post.

A well-seasoned post might be benefited by soaking in tar if the seasoning has been thorough enough to dry out the sap. Tarring tends to exclude moisture and to prevent insect attacks, but among the many devices for preserving timber the use of creosote or corrosive sublimate, the latter process called kyanizing, seems to give most satisfactory results. Their value is based on their action on the albumen, as that is the element in vegetable bodies that soonest decays or starts ferment.

CONSUMPTION OF WOODEN FENCE POSTS.

The annual production of fence posts in the regular logging camps of the country is 8,715,661. It has been estimated that upwards of 1,000,000,000 posts are set each year. Timber of the required quality is produced in the Middle West by hardy catalpa, black locust and Osage orange.

Catalpa makes an excellent growth on deep, porous, fertile soil, but only on such soil. Five or 6″ posts should be ready to cut in about 10 years. Under ordinary conditions, locust should produce fence material in 15 years.

Osage orange is being extensively planted for hedges and windbreaks, from which a considerable yield of fence posts may be obtained. It makes satisfactory growth on dry soils and reaches post size in from 15 to 20 years.

Several other species, such as white willow, European larch, Russian mulberry and red cedar are also being grown with good results, but none of them is better fitted to supply fence posts than those first named.

FARM GATES.

Every fence must have its gate. Where gates are opened and shut several times every day it is very important that the gate move easily and quickly. There are two gates that are in common use. The first is the common board gate which slides part way open on two wooden pegs before it swings. The second is the hinge gate. The first has the advantage of being easier on the posts. There is also an iron gate manufactured on the same principles, but instead of sliding it is provided with rollers. The hinge gate is quickly and easily swung. The greatest trouble is in keeping the gate posts in position so that the end of the gate will not drag. If the ground is not firm the post hole should be tamped full of small rocks against the back side of the post at the bottom of the hole and another at the top of the front side.

A still better way is to set a permanent gate post in cement. Gates are sometimes hung so that the top hinge is set back about 2″ so as to raise the gate as it swings open. If the swinging end of the gate is set on a block when the gate is open or shut, the strain on the gate post will be greatly relieved. The board gate of course is the cheapest.

Of the iron gates the prices on 14′ gates are from $8 to $9, according to height. There are several forms of patent opening gates on the market costing more. Some of them are quite satisfactory, though none of them meets all the requirements.

Fig. 493 illustrates a gate that is horse-high, bull-strong and pig-tight, besides being light and

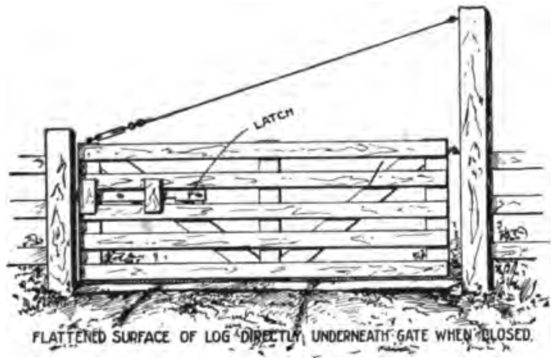


FIG. 493. PRACTICAL FARM GATE.

easily opened and closed. It swings both ways, hangs on common iron hinges and an iron cable fastened from the outermost end to the swinging post. This cable may be tightened as the gate sags by means of a turn buckle. When the gate is closed it stands 2″ above a sill; the sill is made by imbedding a log, flattened on the upper-side, directly underneath the gate. The imbedded log is not level with the surrounding ground but is raised several inches and the

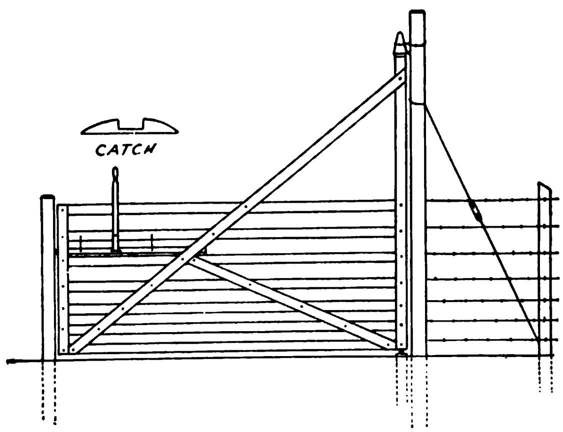


FIG. 494. GATE HUNG TO SWING CLEAR.

ground leveled off to a gentle slope so as to make the approach to the sill gradual. This makes the gate swing more than half a foot above the ground when opening or closing and it can clearly be seen that this would help considerably to make easy the use of the gate during heavy snows. The latch is simply a sliding 4″ stick with notches cut in it so as to keep the latch in place when open or closed.

Fig. 494 shows a farm gate that is hung to swing clear in and out and is constructed of the best yellow pine or hardwood. The advantage claimed for it is that it swings clear either in or out, is easily opened by one on horseback from either side, is self-fastening and does not sag.

The materials necessary in construction include one post 8″ x 8″ and 15′ long; one post 6″ x 6″ and 8′ long, one piece 4″ x 4″ and 10′ long, main standard; seven pieces 1″ x 4″ and 14′ long, horizontal strips; two pieces 1″ x 3″ and 17′ long, braces; two pieces 1″ x 4″ and 6′ long, end standards; one piece 1″ x 3″ and 4′ long, latch; one piece 1″ x 2″ and 3½′ long, handle bar; one piece of ½″ galvanized rod 3′ long; three pounds 10-penny wire nails and 20′ of wire for another brace.

The latch is hung with No. 24 copper wire, swings clear and has no friction. The lower end of the handle bar passes through a staple 4″ wide driven through the latch. The catch is made of 2″x3″ hardwood 8″ long and is gained in flush on post. The gate rests on a 6″ x 6″ block set 2′ in the ground. Fit the thimble skein over the top of the main standard, bend ½″ rod as shown and staple to the post. In the bottom of the standard insert an iron pin 4″ long to fit in a hole in the bottom block.

A gate that gives general satisfaction is constructed as follows: Set two posts 20′ apart, take a piece of strong timber 20′ long, mortise and tenon down on top of the posts and bore a 2″ hole in the center of the cross-piece. The gate posts should be high enough to allow a load of hay to pass under this cross-piece without the latter dragging off the driver; take two pieces of iron 2′ or 3′ long (an old wagon tire will do), drill three holes in each piece large enough to receive a ⅝″ bolt, hammer one end of one piece round to go through the 2″ hole in the cross-piece overhead and hammer one end of the other piece of iron to an abrupt bevel to fit into an iron socket near the ground, which is the axis or pivot upon which the gate is to turn. Take two 2″ x 4″ scantling, bore three holes in the irons, put the irons between the holes in each end of each one to match the scantling and bolt securely; leave enough of the iron projecting to go through the hole in the cross-piece, as shown in *Fig. 496,* and enough projecting at the other end to go into the socket near the ground. We now have up the two gate posts, the cross-girder and upright pivotal piece

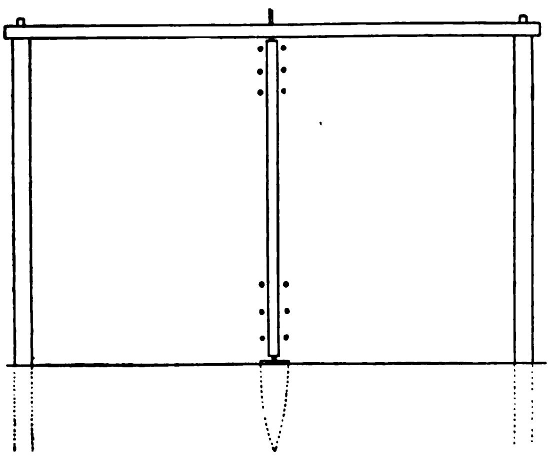


FIG. 495. NEW TYPE OF GATE.

upon which the gate is to turn. (*Fig. 495.*) The gate may be built to suit one's personal taste. When completed there are two gates or two driveways 10′ wide when the gate is open, so that two teams may pass through the gate at the same time.

Fig. 496 shows the gate closed. In the framework 2″ x 4″s are used and the upright or picket pieces are 1″ x 4″; the latch is 3′ long

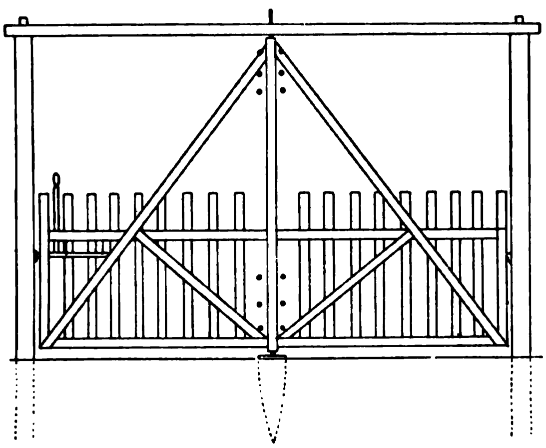


FIG 496. NEW TYPE OF GATE (CLOSED).

made of an old buggy tire fastened to the gate at the distal end with a loose bolt, having a hole in it 6″ from the end next to the gate post; one end of a small rope is passed through the hole in the latch and the other end of the rope through a hole in the lower end of the lever and a latch receiver on each post beveled on both sides makes it a self-latcher when the gate is opened from either side or turned round and round either way; it will latch every time the latch comes to either post. One can ride up to the gate, pull down the lever, push the gate open, ride through, swing his horse half round and close the gate behind or push it forward until the latch catches in the receiver at the opposite post.

The post for a farm gate is an all-important thing. A good, strong, immovable post helps to keep the gate in shape. Where practicable, permanent posts of cement are recommended, with 3′ below the surface. As to the gate shown in *Fig. 497,* an iron runs through the post 6″ from the ground and another 4′ above this. These rods project far enough from the posts

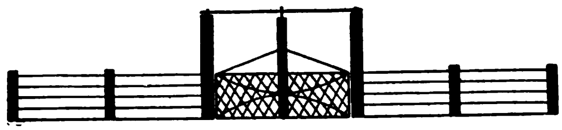


FIG. 497. POSTS FOR A GATE.

with bolt holes through the ends to form butts for hinges on one side and on the other to screw on a piece of timber, to which the fence is attached. This gives a permanent and immovable post, both for gate and fence. The posts have square sockets in the upper end, in which can be inserted wooden posts to construct an arch over the gate if so desired. The posts are not less than 15′ apart on the inside and are connected by a beam overhead 8′ from the ground.

The gate is not less than 15′ wide, and, instead of being hung on hinges in the ordinary way, it revolves on a center post. This gives two spaces 7½′ wide when the gate is open, amply wide for all ordinary farm purposes. The gate being light can easily be lifted out of its holdings for heavy machinery and wagons of hay to pass. The upper beam can also be removed for the higher loads. The gate itself is thus constructed: Four slats 16′ long, 1″ thick and 4″ wide; two pieces of scantling 4′ long, 4′ wide and 2″ thick. For a 15′ gate saw one foot off two of the slats and bolt them on the ends of the scantling with 4″ bolts running down into the stile. The other two slats are used as bent braces in such a way as to form two arches bolted together in the middle. Weave the wire of No. 9 and No. 15 and while it is still tight nail it fast to the framework. This makes a light, strong gate through which no pig can squeeze and which will defy larger stock.

The framework is made fast to the revolving post with three bolts with hooked ends. These are put under the top and bottom slats and the center of the brace boards, going entirely through the revolving post. This post has an iron spur at each end and a good ring fitted over the end to keep it from splitting out. The bottom spur is 1½" long and the top one 3". The bottom revolves on a cedar or locust post in the ground flush with the surface, and the top one in a hole in the cross-beam. The top one is long enough to allow the bottom to be lifted out of socket when necessary. The weight of the gate will keep it in place.

To keep the gate from sagging put wooden braces from each end up to the center post or twist in a doubled No. 9 wire, which perhaps is better. In this way are secured two short, strong gates in one that cannot possibly sag. There are no hinges to be getting out of order. Use lag bolts freely of various sizes. When used for spurs to the revolving post, screw them up as close as required and then cut off the heads. This gives a good tight pin.

The gate can be constructed at a moderate cost for materials. It can be built by anyone who is handy with tools for a very small amount. When the gate is put in place it looks neat and gives satisfaction.

The gate illustrated in *Fig. 498* is 5' high and 11' wide. It requires eight 16' boards.

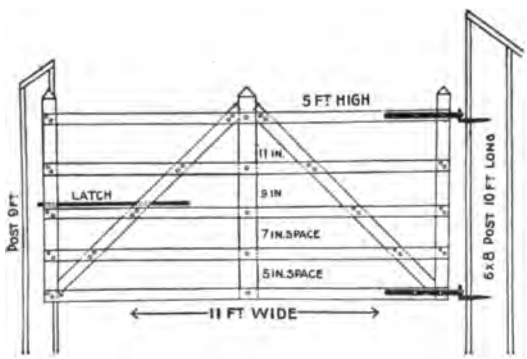


FIG. 498. A POPULAR FARM GATE.

Hard pine, dressed on two sides and 5" wide has given satisfaction. A child can open and close it. Properly put up and with posts braced there is no sag or twisting out of shape. One of these gates made from rough pine fencing has been swinging about 20 years and is still good, and has been opened and closed as often as 20 times daily.

The latch is placed in the gate between the brace boards, which are double, one on each side of gate, as also are the end and center pieces. Use two bolts in each board as shown in the cut. It holds the gate in place better than when one bolt is used. Forty-eight 3½" x ⅜" bolts are required. The cost is about $8 for painting, building and lumber.

The type of gate shown in *Fig. 499* for pastures and fields may be 12' to 14' by 4½' high.

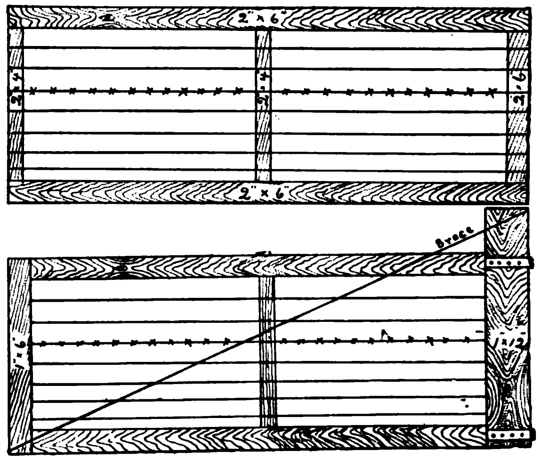


FIG. 499. AN INEXPENSIVE TYPE OF GATE.

Make a frame of five pieces, two 2" x 4" and one 2" x 6", as shown in illustration. Cut as many pieces of No. 9 wire as are desired about 2' longer than twice the length of the gate; fasten the ends of the wire to 2" x 6" after passing around the out end. Creases should be cut in the 2" x 4" and 2" x 6" pieces just deep enough to imbed the wire. The wires being in place, nail two 1" x 12" pieces 5½' long, one on each side of the 2" x 6" end piece, forming a strong gate head to which to attach hinges; the 18" extending above the top of the gate, receiving one end of the brace or supporting wire, as seen in *Fig. 499,* makes the support more effectual. Over the 2" x 4"s at the opposite end nail a 1" x 6". Next twist the wires evenly until all are drawn tight, but not too tight, else they will warp the frame.

To prevent stock from rubbing against the gate some farmers use barbed wire in place of No. 9 smooth just above the center and sometimes put on cross wires, doubling them and twisting between the horizontal wires, thus holding the latter in place and preventing pigs from squeezing through. The number of horizontal wires used will depend on the kind of stock fenced against. The brace or supporting wire is last put on and should be twisted till it holds the outer end of gate at its proper position. If the gate sags at any time one or two twists will bring it up. This is a strong, neat gate that anyone can make, and if the parts of the wood that will not be accessible after the gate is finished are well painted or coated with hot tar before putting together and all exposed parts kept well painted afterward it will be a gate for a lifetime.

The drawing (*Fig. 500*) shows a farm gate 10½′ long and 5′ high. The material used may be 1″ x 4″ hard pine or oak, dressed on both sides. Paint the pieces before putting the gate together. Use five upright pieces, two at each end and one in the middle. On the side with

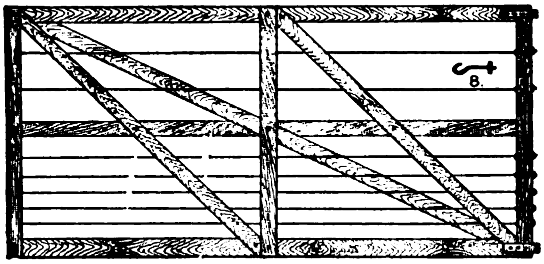


FIG. 500. A PLANK FARM GATE.

the middle pieces use two short braces and on the other side a long brace. If this is done the gate will never sag. Use as many boards in this gate as desired. The fewer boards the lighter the gate will be and the less the wind will catch it. Use No. 9 wire. Wrap each end around the head of the gate, running it back to the heel, where it is cut off and fastened to a ⅜″ bolt, which has had the head part bent into the shape of a hook *B* in the illustration. Run the bolt through the two upright pieces at the heel of the gate. Tightening up the nuts on the bolts will stretch the wires. Staple each wire to each piece of wood that it crosses. Do not drive the staples in tight.

The most important thing is the hanging of the gate. Many farmers contend that all gates should be made to open both ways. This will save many runaways besides being much more convenient. Use strap and screw hinges. When boring holes in the gate post for the screws begin on the corner of the post and bore toward the opposite corner. Fasten the hinges on the side of the gate that will permit of its opening both ways.

The plan of a gate that can be instantly adjusted to any height to swing over snowdrifts or set high enough to allow sheep or pigs to pass beneath it and restrain cattle or horses is indicated in the drawing.

This gate may be made of light, stiff material, good pine being commonly employed. The planks may be 1¼″ x 4″, and any length up to 12′. It is all put together with ⅜″ car-

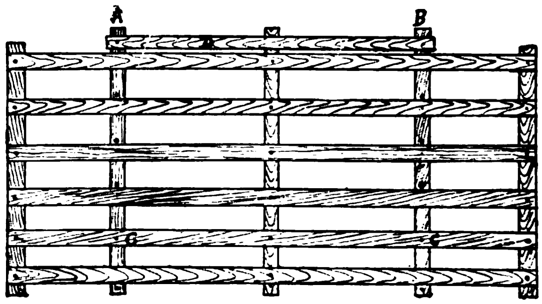


FIG. 501. ADJUSTABLE FARM GATE.

riage bolts. *Fig. 501* shows the gate with holes bored and half the upright pieces in place. It will be noted that the braces *A B* are bolted through the rail next the bottom at *C,* and the other bolts merely pass through the braces either above or below the rails, as shown in the drawing. The connecting pieces *D* must be just ¾″

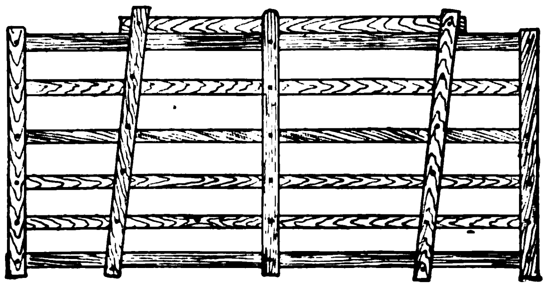


FIG. 502. ADJUSTABLE FARM GATE.

above the top rail when the braces are vertical, as in *Fig. 501.*

Fig. 502 shows the gate completed and the braces pushed back to hold it square. These braces must be put on loosely enough so that they will work easily back and forward, and washers should be put between the braces and rail at *C.*

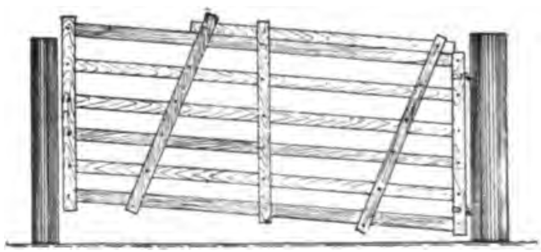


FIG. 503. ADJUSTABLE FARM GATE.

Fig. 502 shows how the gate is raised up and the braces pushed back to hold it to allow pigs to run under it. It may be raised much higher than this if desired. By pulling the brace forward the end of the gate drops to the ground and this serves to keep it open when desired. The hinges are common strap and screw hinges, the strap around as shown in *Fig. 503* and bolted to the vertical pieces.

Fig. 504 shows a gate that has been used constantly for the last 30 years. Probably the best material out of which to make it is seasoned white oak or black walnut. Use fencing boards 1″ thick, 6″ wide and 12′ long, and for an ordinary gate five planks high is enough. Bolt the gate together with ¼″ bolts and washers; leave the upright boards where the hinges are fastened 6″ wide and the other uprights and braces 3″ wide, which is strong enough and much lighter. Let the braces into the uprights, top and bottom, ¼″. The posts should be 10′ long for a five-plank gate. Cut the tops slanting like a roof and nail on a short board for top. The bottom of the posts should go into the ground 4′ deep in a hole made large enough to contain a yard of small broken stone or bats well rammed in from bottom to top mixed with the dirt or clay. Set the posts 12′ 4″ apart, 2″ at each end of the gate space. Set the gate 4″ off the ground, level on top, and leave 2″ at the top so as to make it open upward and hang shut when not fastened. Make the hinges of heavy wagon-tire iron, four ⅜″ bolts to each.

FIG. 504. A STRONG GATE.

Fig. 505 shows a gate that is made of common fence boards generally 16′ long fastened together with wire nails clinched, then hung on a cleat between two posts set close together. One of the posts should reach up about 2′ above the gate with pivot for the level to turn on. No matter what the heft of the gate is when finished the lever can be weighted until a small child can open or shut the gate with ease. This gate swings only one way.

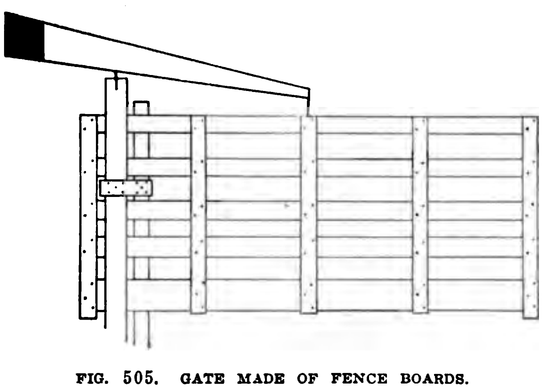


FIG. 505. GATE MADE OF FENCE BOARDS.

Fig. 506 shows a gate that never sags. When made of walnut or any other hard wood and bolted together it will last indefinitely. Gates of this type put up ten years ago and made of black walnut 1″ x 4″ are good today and swing clear of the ground. A post to which to fasten the gate when open will be found convenient, for when properly hung the gate will not stand open unless held.

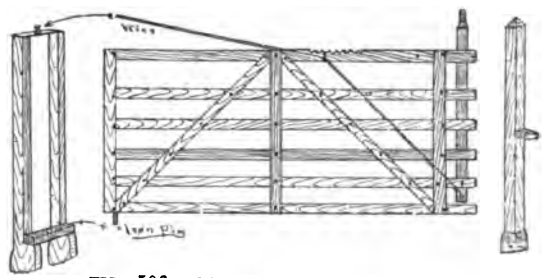


FIG. 506. GATE THAT DOES NOT SAG.

The art of hanging a farm gate is not generally understood, and this is the reason why so many gates have their "noses" in the ground. It is useless to say that the hanging post must be well secured, for if a man does not care enough about the working of his gate to secure the post, a gate with its nose in the ground is good enough for him.

Fig. 507 shows a gate braced, hung and latched as a Virginia farmer has been successfully using it for 25 years. A gate hung and latched like this is easily opened on horseback and one need not look back to see if it is going to latch. At *N* are notches 2½″ or 3″ apart in the top slat for a bolt in the top of the braces to rest in; this allows the gate to be adjusted

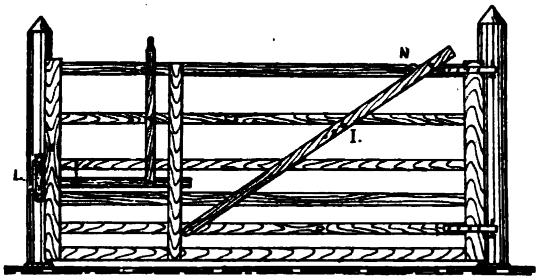


FIG. 507. HANGING A GATE.

as desired. At *I* is a safe-pine, to prevent hogs from raising the gate. At *L* two strong pins are put in the post with a 1½″ or 2″ auger, with a 1″ x 8″ x 15″ board nailed on as shown, with the side next to the gate dressed. The inner edge of the board is about 1″ from the gate and just far enough from the post for the latch to pass behind it freely; the outer edge of the board should be at such an angle from the gate as will cause the latch to strike it near the outer edge; this causes the latch to swing back and glide in easily.

Fig. 508 explains how the gate is hung to insure self-shutting. The posts are leaned from the gate about 3″; this causes the gate to rise

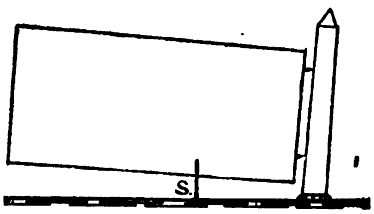


FIG. 508. HOW A GATE IS HUNG.

as it is opened and to descend as it is shut. The gate comes down to the proper place when shut. To make this plan of hanging plain, if the gate stands east and west when shut and points south when open the posts should lean north; the more they lean the higher the gate will rise when open and the more heft it will have on going shut. Posts should stand plumb east and west. To obtain the same result in hanging gates to trees or posts already set which are plumb the bottom hook in the post should extend about 3″ further from the post than the top one. Hooks must be put inside of the post as in *Fig. 507.* At *S* in *Fig. 508* is the stake behind to prevent the gate from opening around further than is necessary. The second and top slats should not be less than 1″ x 6″, the braces 1″ x 4″. On several gates illustrated in this book the bottom hinge is shown to be on the bottom slat. This will cause it to rot loose quicker than if it were higher. In several instances the braces are shown to extend to the bottom, which will cause them to give way earlier from decay.

Fig. 509 shows how by placing a stick of timber a little below the surface of the ground solidly from one post to the other the gate is

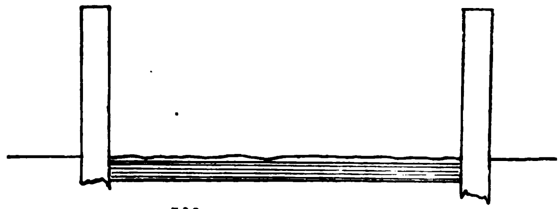


FIG. 509. HOW A GATE IS HUNG.

prevented from sagging down with the weight of the outer end, and the post must keep its upright position. It is not necessary that the sleeper should reach clear to the second post, although it is better. The earth will hold it if it is 6′ long. At right angles to this sleeper put another in the direction that the gate is to open and the post will never sag in that direction either.

Fig. 510 shows a good strong gate that may be very quickly nailed together and it is rigid and retains its shape well with age and hard usage. The two short braces make a better and

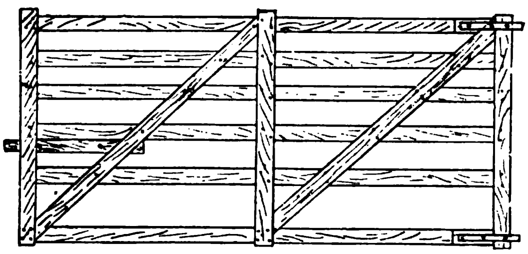


FIG. 510. A GATE EASY TO MAKE.

stiffer gate than one long one would. Good pine, 1″ x 4″, will answer for this gate, and about 12-penny nails to put it together so that they may clinch well will serve as well as bolts.

Fig. 511 shows a gate with a wire brace. When there is much snow to obstruct gates it is sometimes desirable to raise them high enough to allow them to swing over the drifts. The wire looping around the gate and not fastened except at the upper corner may be slipped down as the gate is raised to hold the outer end at any angle. The wire brace should not come so low when the gate is square as drawn; when slipped down to position shown the gate should be in

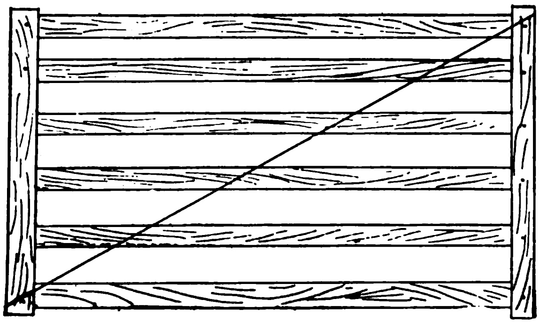


FIG. 511. GATE WITH WIRE BRACE.

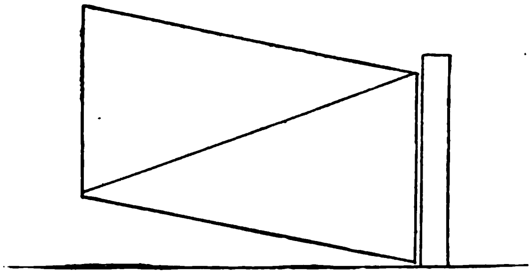


FIG. 512. GATE WITH WIRE BRACE.

the same shape as *Fig. 512.* This gate must be bolted together, one bolt at each intersection.

Fig. 513 shows a very strong and durable gate, neat-looking and adapted to use along roadsides where a neat gate is desirable. It is not expensive to construct. The frame is of good pine, 2″ x 4″, except the heel post, which is 4″ x 4″.

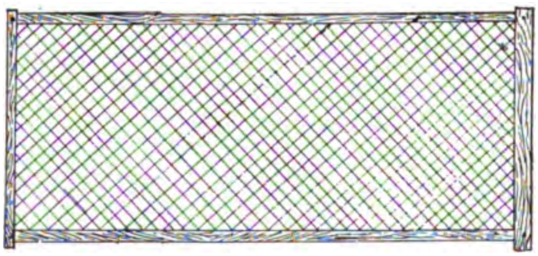


FIG. 513. WOVEN WIRE GATE.

On this frame, which is mortised together, is stretched and stapled some sort of woven wire fencing that will not be injured by hard usage. There are a number of varieties of wire fencing that may be made right on the frame as wanted. Large, strong hinges with screw bolts to go into the post a good distance are advised for any kind of gate.

Fig. 514 illustrates a form of gate that is in extensive use in many localities. It is a 12′ gate. From upright *A* to upright *B* is 8′ and from upright *B* to *C* is 4′. The cut also shows a form of home-made spring latch which will be found very useful, especially when one wants to open the gate from on horseback. 1, of course, is the latch handle working on a bolt

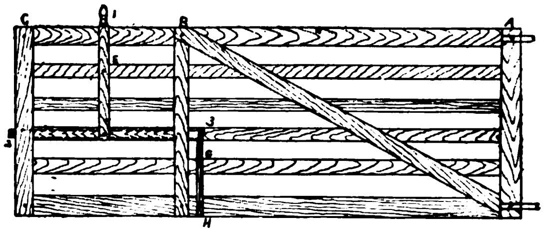


FIG. 514. GATE WITH LATCH.

at *E;* 2 is the latch proper; 3 is the latch spring fastened at *H* and *G* with the upper end bolted to the end of the latch.

The gate illustrated in *Fig. 515* is made of 3″ strips 1¼″ at one end and ¾″ at the other.

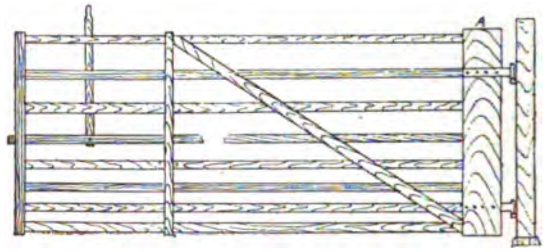


FIG. 515. LIGHT FARM GATE.

A is made of 12″ plank 1″ thick. The strips are nailed onto *A*. The ordinary hinge is used. The top hinge is on one side and the bottom hinge on the other side. The gate is hung plumb. The bottom hinge must be put on the side where the gate is to open. Make the gate, put on the hinges and then plumb it. Mark where to bore holes in the post while the gate is standing propped up against the post. Any one can make and hang such a gate.

A type of gate used a great deal in the south and shown in *Fig. 516* usually is made of oak timber and lasts remarkably well. It is light and strong. The post *A* is set 3′ in the ground. *F* shows a section of the post where the latch

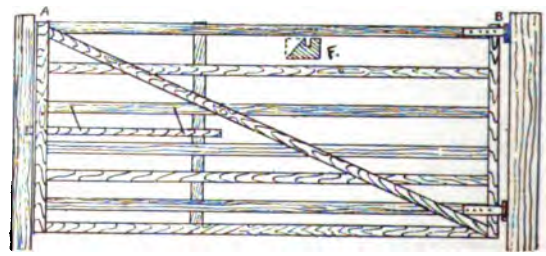


FIG. 516. GATE USED IN THE SOUTH.

strikes it. The latch slips into the mortise after it is pushed back by sliding on the bevel. The post *B* is set 4′ in ground. The latch is suspended by two pieces of No. 10 wire and the whole gate is made of 1″ x 3″ oak strips. Nos. 8 and 10 wire nails clinched across the grain may be used. They hold as well as bolts.

A Tennessee farm gate is presented in *Fig. 517*. It is light, cheap and durable. It can be made as tall or as low as may be desired by

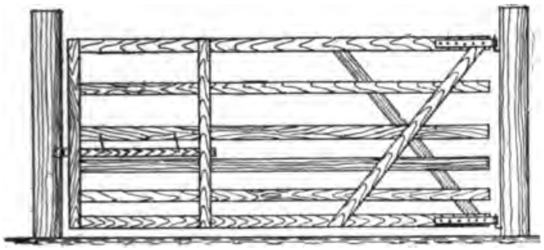


FIG. 517. TENNESSEE FARM GATE.

using many or few horizontal bars. The drawing shows six bars which cut 1″ x 4″ and properly spaced make the gate just 5′ high.

The Minnesota farm gate shown in *Fig. 518* will stand a great deal of rough usage. It is made of four 2″ x 6″ planks (hard pine preferred), 6″ apart, making it 42″ in width, and four 1″ x 6″ cross pieces. All are nailed together, and also bolted by 5″ x 3/8″ bolts except the rear-end groove wheel, which is fastened on by a 6″ x 1/2″ bolt. A 6″ pulley can be used for the groove wheel. The front bottom wheel

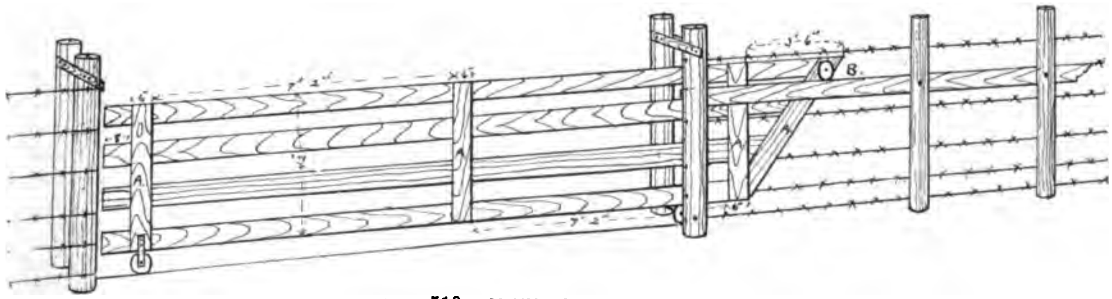


FIG. 518. MINNESOTA FARM GATE.

is a 6″ band wheel taken from any old machine. It is bolted to the gate with strap-iron by 6″ x 1/2″ bolts. The cross pieces are on both sides of the planks. At the bottom of two rear posts is a roller for the gate to slide or roll in between. The upper rear groove wheel *B* rolls on a beaded 2″ x 6″ plank which can be fastened on the wire or board fence, or else on the side of a barn or shed by bolts or nails. The top length of the gate is 20′; bottom length 16′ 6″; height from ground 48″. It is an easy gate to open.

A GATE OF WIRE.

The wood used in building a wire gate should be of the best and most durable sort. If it could be boiled in linseed oil, or soaked in creosote, to prevent decay, it would be well. Making

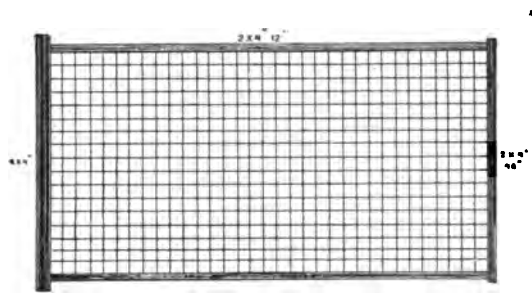


FIG. 519. GATE OF WIRE.

a wire gate is much more labor than making one all of wood. Wire gates are light and handy, however, and look well. They are not well adapted to the hardest use. The gate illustrated in *Fig. 519* is mortised together; it should be very neatly done, and the wire put in as shown, spaced 4″ to 6″ apart. The wires are put through the wood and clinched. At the intersections they are locked together. Use the washer device.

BRACES FOR FARM GATES.

The arrows in the accompanying illustration (*Fig. 520*) show two braces added to the usual farm gate which materially increase its strength. These can be conveniently put on old gates or new and will prevent gates from warping or sagging.

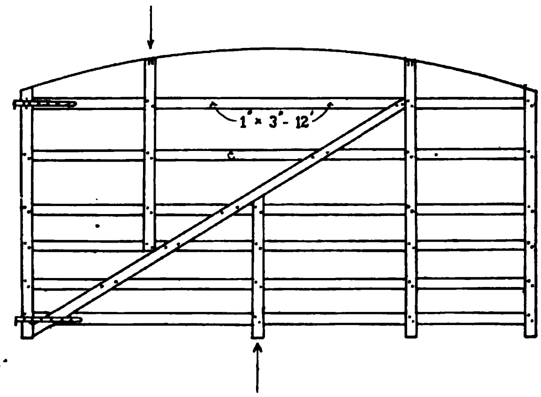


FIG. 520. BRACES FOR GATES.

Manufacturers find that a better and cheaper gate can be made with nails than bolts. Some use 1" x 3" 12' slats and nail from both sides. Two good hands can make from 10 to 12 nailed gates per day and if made from good timber and painted white they will last longer than bolted gates.

An Ohio farmer gives his views as follows on farm gates: We have just finished overhauling our gates which have had for ten years the rough handling of tenants. We find the gates hung with hinges made by our blacksmith with straps 2' long and hooks long enough to go through the posts, and with screw taps on the end all swing clear, although made and hung many years ago. On the other hand, all gates hung with straps and hooks that screw into the posts 5" to 6" are loose and gates sagged and several of the hooks are out and lost. The latter straps and screw-hooks with bolts are furnished at hardware stores. They do well for a few years, but are not so cheap in the long run or so satisfactory as the heavier blacksmith-made hinges. The latter are seldom used now by farmers. The ready-made hinges are neat and handy, but fail to give satisfactory service as a rule.

We have three styles of gates. The cheapest is placed where not often used and not along the highway or near the houses and barns. Our common slide gate is made 12' long and 4' high. We use pine fencing boards 6" wide and 12' long, of good quality, free from coarse knots. Six boards are required for a gate five boards high. The spaces between boards, beginning at the top, are 9", 7" and 3" respectively. The sixth board, cut into three pieces 4' long, makes the battens. One end batten is set back 6" from the end of the gate; the other is set flush with the end, and the third batten is in the middle of the gate. The gate is put together with eight-penny wire nails, clinched. We set two posts with sides 1½" apart to receive the end of the gate up to the batten. We next set a post 15" in from the other end of the gate and another on the side to which the gate is to open and nearer to the end of the gate, so as to allow the gate to come around at right angles to the line of the fence. The gate is to be supported on two cross strips nailed to the two posts. The upper strips should be 6" wide, coming under the top board, and the lower strip 3" wide, coming under the second board from the bottom, so that the gate is 3" from the ground. Two strips of the same kind should be put on the other posts, so as to carry the gate in line with the fence. If these bottom strips are 3" wide, scant, they will fill the bottom space at each end of the gate and prevent hogs from lifting it. If now a 1" hole is bored in the third board of the gate so a pin can pass through it and between the two heel posts the gate cannot be moved out of place until the pin is removed.

This kind of a slip gate is very convenient for division fences where there is not frequent passing through. The posts used with this gate need not be heavy. We find round posts, too light for board fence, do admirably if straight enough. The gate will last longer if the posts are set as directed and there is only space enough between the posts to allow the gate to pass freely and not have much play when closed. It is a cheap device, easily made, handier than bars or slip gaps and will last 10 to 15 years with reasonable care. We have never seen a sliding gate that was equal to a hinged gate properly made and well hung. It is miserable economy to go to the expense for material for a gate and then neglect to put it together in a substantial manner, or to hang it with too light hinges to posts poorly set or too light to carry the gate.

We have several swinging gates that were made fifteen years ago and are good for several years to come. Occasionally we find one of these gates with a broken board or stem. It is but a small task to loosen the screw bolts and put in a new piece and the life of the gate is prolonged and it does its work satisfactorily. It is very poor economy to neglect the gates when they drag or are not in condition to turn stock. Neglect to keep gates in repair is even more expensive and dangerous than to neglect fences. Either entails loss to stock and induces bad habits that are troublesome and costly in the end. The swinging gates are 12' long by 52" high. This is 4" higher than a common board or paling fence. It is better to have the gate higher than the fence, as stock will naturally try to get out at the gates before they will try the fence. The gate yields to the pressure more than the fence, and if a little higher than the fence the animals are less apt to reach over and press against it. To straighten the top board we have a strip 3″ x 1″ nailed to the top. This stiffens the top board and covers the ends of the battens so the weather does not check the ends nor rot wood around the bolts.

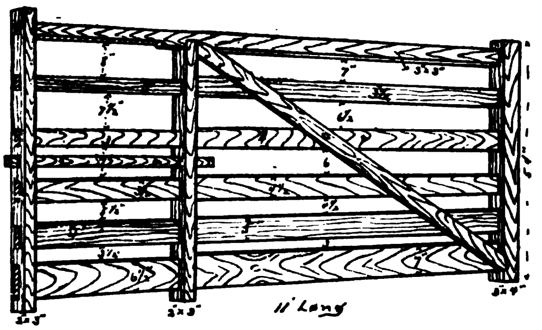


FIG. 521. OHIO FARM GATE.

The swing gates are made of 6″ fencing of good quality put together with bolts 3½″ x ⅜″, with washers under the tops. Ours are five boards high and the spaces between the boards beginning at the top are 8½″, 6″, 4½″ and 3″, respectively. The design is the same as shown in *Fig. 521* having the one long brace from the lower corner of the end to which the hinges are attached to the upper end of an upright 4′ from the swinging end. It pays to make the joints of the brace neat and true and even to paint the ends of the brace and battens to prevent decay. The lumber should be fairly well seasoned and bolts well drawn up. There is little danger of getting the hinges too heavy, but much danger of getting them too light. We find that where the bolt nearest the hook is ⅜″ or less it breaks before any other part of the gate. The most of the hinges found in the stores take too small bolts. If the heel bolts hold and the hooks that screw into the post do not fail such a gate will last longer than the average fence. The gate is lighter if made with the brace and front battens 3″ x 1″, and we find they do not give out. The slide-latch is 3″ x 1″, sides planed to move freely. It enters a slot or mortise in the post. The mortise should be 5″ long and 2″ deep and a full inch wide to admit the latch freely, yet without much play. A handy man can make and hang this gate in less than half a day.

We have another style of gate for along the highway and near the barn, the grove, the carriage-house and other places where appearances count something. The illustration (*Fig. 521*) shows this gate. Gates of this style have been painted every four years and those on the highway and grove and near the carriage-house are sound and swing as clear as they did 25 years ago, and have not cost a cent for repairs except paint. The posts the gates are hung to are white-oak, 9′ long, butt cuts, squared to 10″ at the saw-mill half the length and left under cover a year to dry out and not crack. The posts were set 4′ in the ground and are all good for many years yet. The tops of the posts are painted and covered with tin painted on both sides. Such gates and posts are a soild comfort, and considering the service and satisfaction given they are not more expensive than some of the cheaper sorts that have given their owners no satisfaction and been an endless annoyance. In the building of farm gates and fences that are to protect our crops and live stock and make life endurable and less of a burden it pays to build thoroughly well.

AN ENTRANCE GATE.

The gate illustrated (*Fig. 522*) is simple, very strong, sightly and durable. The top and

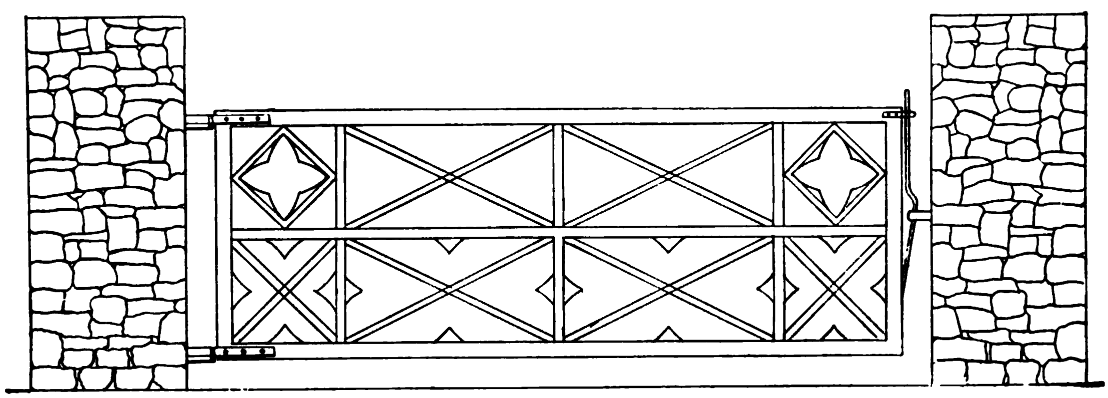


FIG. 522. ENTRANCE GATE WITH COBBLESTONE POSTS.

bottom rails should be of 2" x 3" stuff, of some durable timber not given to warping. The design is from the Island of Jersey and it is interesting to study it in detail. It is the work of an engineer as well as of an artist. There is not an unnecessary bit of wood about it; the bracing is admirable, and even the little triangular bits of wood serve to keep the dogs from jumping through the openings. When the gate is made stain it with oil and burnt umber, afterwards oil it with boiled linseed oil.

GATE POSTS OF COBBLE STONES.

Gate posts made of cobble stones are common in Southern California. They are laid up without much mortar showing. About 2½ barrels of Portland cement will do the work.

The first step in building them is to dig a hole as though for a moderately large wooden post, about 4' deep. The posts themselves are 30" square, but it is unnecessary to carry this size clear down and there is a saving of expense to make the bottom of the hole smaller. When the hole is dug, set up in it an old buggy axle or a piece of 2" pipe, any convenient piece of iron for a reinforcing core. About this core throw concrete material and tamp it solid. When within 18" of the surface have a trench dug transversely through the center of the post, 6' long, and fill it half full of concrete, then lay down any old or new iron rod in the center of it, or a twisted wire cable, and fill it up with more concrete to within 6" of the top of the ground. It may be covered over with sand or gravel. This will become an integral part of the post, and effectually prevent its moving to the right or the left, backwards or forwards. Have the hole 30" square, dug down to solid earth, and putting down a layer of concrete lay upon it the first square of cobble stones. When they are in, the space between them may be filled with the least desirable specimens, and concrete poured over them and tamped to make it fill all interstices. Make the concreting mortar rather thin so that it will readily fill all the voids between the stones, and rather rich so that it will adhere strongly.

When the surface of the ground is reached you need a box of inch boards, about 8" high and 30" square on the inside, a form to guide you in laying the stones and to prevent their being pressed out by the concrete. Fill this box around the outer edge with selected stones, throw bad sorts in the inside, and fill it again with cementing mortar. Then add another box, and so on until the desired height is reached, not forgetting to lay in the hinges at the right time, and the piece for the latch in the opposite post. The hinges should be made of very heavy stuff and be inserted at least 18" into the cement, and turned over at the ends, then they will never come loose or give trouble.

It is not necessary to put in any cement on the outside of the stones, so that most of them do not show that they are laid in cement, though it should be pushed in well between them, so that each stone has half its surface in contact with the cement and is held in an iron grip.

Stone walls may be readily made by this plan, a simple box to hold the cobble stones, which may line one side or both, being used. If it is for a house wall it is well to leave the inner side smooth, for the cellar surface, the cobble stones to appear only outside. There are regions where these water-worn small stones are very plentiful, and used in this way they are a real economy. (See *Fig. 522.*)

A GOOD LATCH FOR FARM GATES.

The latch shown in *Figs. 523* and *524* is made of a piece of 1" or ¾" round iron with a thread

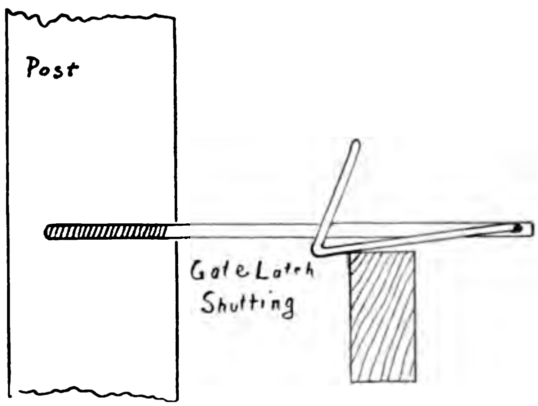


FIG. 523. TYPE OF GATE LATCH.

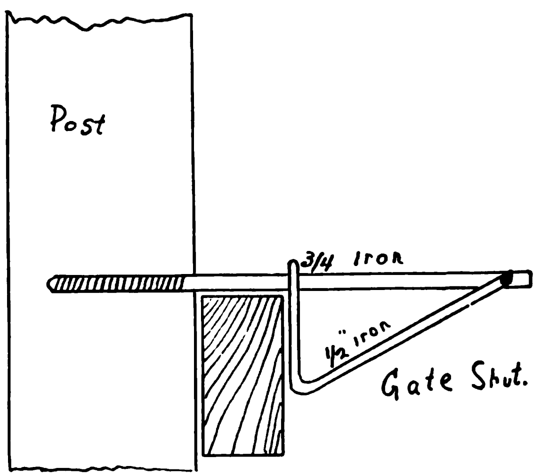


FIG. 524. TYPE OF GATE LATCH (GATE CLOSED).

cut on one end so that it may be screwed into the post and a 5/8" hole drilled through the other end in which is passed a piece of 1/2" iron, or a little larger, which is welded into a ring and then bent into the shape shown in *Fig. 524.* This is screwed into the post and the wooden latch or one of the gate boards extends out to engage it on the under side. A little loop of wire about the raising part of the latch keeps it from flying clear over when struck hard by the gate, or a pin may be thrust through the stem and the latch. A blacksmith can make one of these latches in a quarter of an hour.

A FARM GATE LATCH.

The farm gate latch shown in *Fig. 525* works easily and automatically. The illustration shows both sides of the gate and the large wooden catch

FIG. 525. FARM GATE LATCH.

that is attached to the post. This should be of durable hardwood and well painted, then it will always be smooth and will work easily.

A FARM GATE HINGE.

The cut, *Fig. 526*, is of a hinge which, if applied, will keep a gate shut without a latch and permit it to swing either way. The gate must be short enough so as to swing past the post. When the gate is opened it will be farther from the ground at the swing end than at the post. When there is snow on the ground it will rise over it instead of pushing it back. No. 1 is the hinge part for the post; No. 2, hinge part for gate. The distance between the lugs (*AA*) is 5". The greater this distance the higher the end of the gate will rise as it opens. The shanks (*DD*) of hinge parts Nos. 1 and 2 are driven into the post and gate, respectively. When the

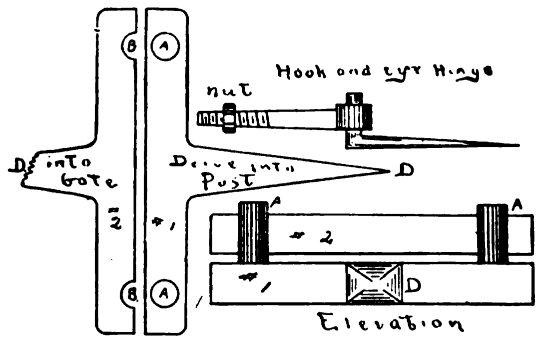


FIG. 526. FARM GATE HINGE.

gate is hung the sockets (*BB*) bear against the lugs (*AA*), one or the other of the lugs acting as the pivot, according to the direction in which the gate is opened. *Fig. 526* gives the position of Nos. 1 and 2 when viewed from the post end, *D* being the shank which is driven into the post. A hook-and-eye hinge is used at the top of the gate. The nut on the shank of this hinge is used in adjusting the gate so as to hang level.

BUILDING A PORTABLE FENCE.

Portable fences are useful in many situations —for making temporary hog lots, for pasturing off clover and for hurdling sheep. There are many forms, but probably nothing better than the simple designs shown in *Figs. 527* to *529*. *Fig. 527* shows a panel 12' long and 4' high, made of 5 boards 1" x 6" and 12' long. One of these boards is cut into short lengths and holds the panel together. It will be noted how the top and bottom boards extend out about 6"; this is to let them rest upon the "horse" that will hold them. The horse is made of two pieces 1" x 4" 6' long; if stuff can be gotten 1½" thick by 4" wide all the better, and a bottom piece 1" x 4" that is 5' long. Three bolts hold the horse together. Notches are cut to receive the panel. This fence is very rapidly erected and having a base 5' wide it is not easily upset,

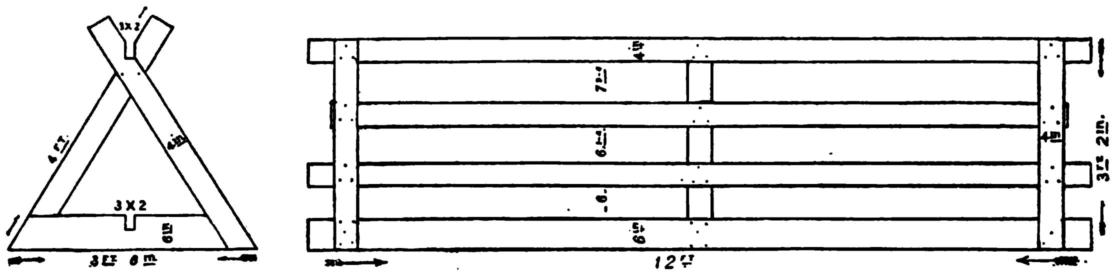


FIG. 527. BUILDING A PORTABLE FENCE.

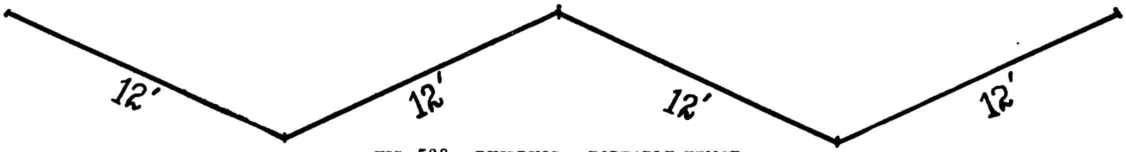


FIG. 528. BUILDING A PORTABLE FENCE.

though it is sometimes staked down by driving small stakes on one side of the feet of the horse and driving a nail through. *Fig. 529* shows another type of portable fence, rather more rigid than the first. *Fig. 528* shows how it is erected into a fence, by setting the panels in a slight zigzag. In the cut it shows a spread of 5′

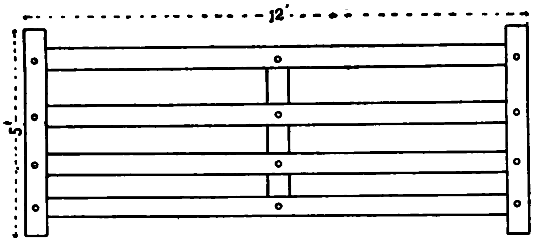


FIG. 529. ANOTHER TYPE OF PORTABLE FENCE.

and a length of panel of 12′. The tops and bottoms are held together at the ends by means of loops of strong wire. This also is very rapidly erected and serves a good purpose. Portable fences should be made of the best of wood or else thoroughly soaked in linseed oil or creosoted.

A PORTABLE PICKET FENCE.

Fig. 530 is of a portable picket worm fence. The rails should be 2″ x 3″ or 2″ x 4″ and the length the builder desires the panel. A 10′ panel should have a 4′ worm when built on a straight line. The thickness, width and length of the pickets can be made to suit the builder. The rails should be shouldered on ends, as shown, so the end of one panel will slip into the end of the other and not allowed to lie on the top of the other, so hogs cannot raise the end of one panel off the end of the other and thus make an opening in the fence. The laps on the ends of the rails should be about 2½″ long and have holes bored in them to admit a 20d nail easily, so when moving the fence they will not be hard to get out. The pickets should be nailed as close to the end of rails as possible, so as to make no large cracks where the panels join. A panel 3′ high with the end pickets long enough to stretch a barbed wire on top of each panel makes a light fence on which wire will not have much effect. One advantage of this fence is that one can open it at any place desired to go through by simply pulling out two nails.

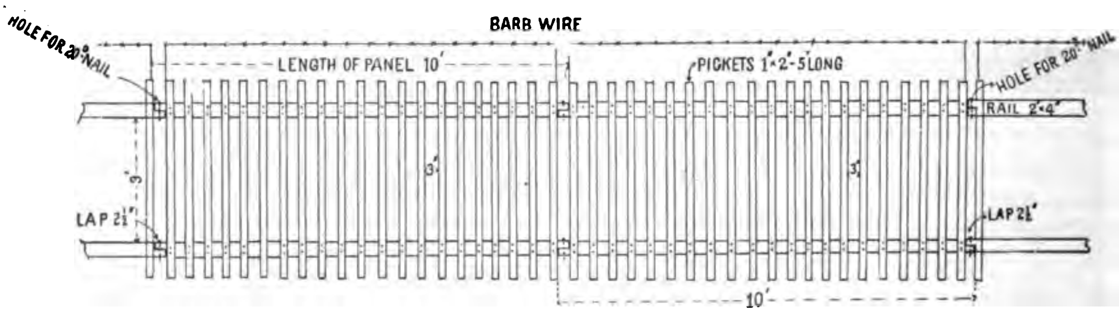


FIG. 530. PORTABLE PICKET FENCE.

DIPPING TANK CONSTRUCTION.

It behooves every stock owner to see that his animals are free from skin parasites. Young stock especially should receive attention in this matter. The cold rains, sleet and snow of winter are new experiences to many of them and even if they are in perfect condition and free from parasites the winter months tax their vitality severely. Matters will be much worse if lice, fleas, mites and ticks are robbing the young animals of the nourishment they need. Lousy animals may pull through the winter, but the setback which they receive from the combined effects of parasites and cold stormy weather seriously impairs their usefulness.

As a means of correcting this condition, dipping is a question that stockmen can well afford to think about. It was not many years ago that sheep were the only animals supposed to require dipping, and the very suggestion of dipping hogs or cattle would have been ridiculed. Why such a sentiment should exist concerning the dipping of hogs and cattle is not clear. The latter animals suffer just as much from parasites as sheep do. Fortunately this prejudice is disappearing. Dipping is now recognized as the easiest and most satisfactory treatment of mange and other skin diseases of cattle, and the best swine breeders of the country regard dipping as essential to their success. No domestic animal can thrive while it is being tormented by lice, and the food it eats is being stolen by myriads of parasites. No manner of combating skin parasites and diseases is equal to that of submerging the animal affected in a fluid capable of destroying the pests; that is, dipping.

Of course it is essential that the fluid used should not be injurious to the animal itself. Spraying or scrubbing or dusting with insect powders or greasing with lard and sulphur will furnish some relief to animals infested with parasites, but there is nothing equal to a swim in a good penetrating dip. The selection of an efficient dip is essential; that is, one that will destroy unfailingly the parasites and at the same time have no bad effect upon the skin and hair or fleece. Coaltar carbolic dips are being recognized as the most satisfactory preparations, since they come nearest meeting these requirements. They are death to lice and mites and other vermin, and at the same time their effect upon the skin and hair is stimulating and invigorating, rather than otherwise.

The tank problem is one which puzzles many farmers. The galvanized iron tank fills a long-felt want for a light durable tank, without leaks and is easily transported from place to place. Tanks of this description are manufactured in the large cities and are becoming popular throughout the country. Many regard a galvanized iron tank as rather too expensive, especially where high freight charges must be added to original cost. Many farmers would prefer to construct a tank from materials that may be obtained close at home, working at the job at odd times and thus utilizing time which would otherwise be of little value. For this reason many will be glad to get plans and specifications for home-made tanks. Here is a plan for a tank made of lumber. The material should not cost more than $4 or $5. The directions are given for a tank of the following dimensions with the idea that they may be varied to suit the convenience of each particular case:

Length 8′; depth 4′; width (at bottom) 16″; width (at top) 20″; capacity about 360 gallons. These dimensions may easily be varied to suit the builder. A bottom width of 12″ or 14″ is wide enough for ordinary purposes; 6′ is long enough for the smaller animals, but we prefer an 8′ length, and 10′ is desirable for the larger animals.

The side pieces are of 2″ x 4″ material, 4′, 4″ in length. Make ten of these and mortise them into the sills (which are also of 2″ x 4″ material, 24″ long) in the manner shown in *Fig.*

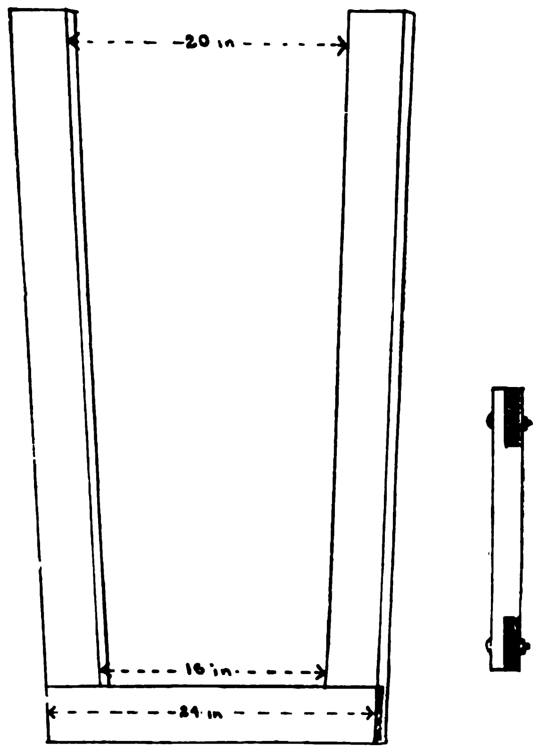


FIG. 531. DIPPING TANK (SHAPE OF FRAME).

531, which is a view from below. *Fig. 531* will give a good idea of one of the U-shaped frames. Set these five frames upon a smooth level surface, 2′ apart, and secure by temporary support. Be sure that all are upright and true, then begin laying the sides. The sides and ends are of 7/8″ tongued flooring. The sides are laid first. Plane the tongue from one piece of flooring and place this upon edge on the sills, planed edge down. There should be a small projection beyond each end-post; when the sides are finished these ends are sawed off, leaving a smooth planed surface for the end boards to cover. Paint the tongue and groove of each board as it is laid.

After laying a few boards on one side build the other side to an equal height. The bottom can now be laid much more conveniently than if this is postponed until the sides are entirely enclosed. For the bottom use two 8′ planks. Bevel one side of each to the angle of the sides, put the planks in place and draw down with bolts through the sills. The bolts used in the middle sill should be about 2″ longer than the others for the purpose of attaching the ladder, which is described later. The crack between the two bottom planks should be covered with a thin strip of batting or other light material. *Fig. 532* illustrates the appearance of the tank at this stage, except that one side is entirely boarded up. The sides are now finished and the projecting ends sawed off. Much depends on this job. If done properly the end boards when nailed securely will make a water-tight joint. Give the entire box a good coat of paint inside and outside.

A cement tank is easily and cheaply constructed and is very durable. It has the disadvantage of not being portable, but otherwise is a very satisfactory tank. Select a rather high, well-drained spot where the earth is firm. If the selection can be such that a drain pipe can be laid from the bottom of the tank to the surface of the ground some distance away so much the better. Dig a pit of the following dimensions: Length (at top) 10′; length (at bottom) 5′; width (at bottom) 23″; width (at top) 28″; depth 4′. (See *Fig. 533.*) Smooth the

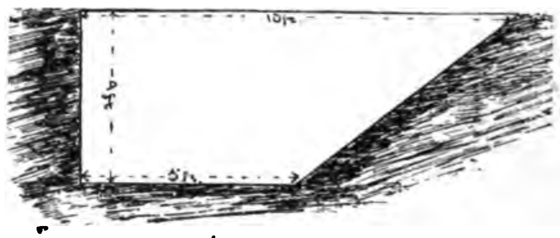


FIG. 533. DIPPING TANK (SIDE VIEW).

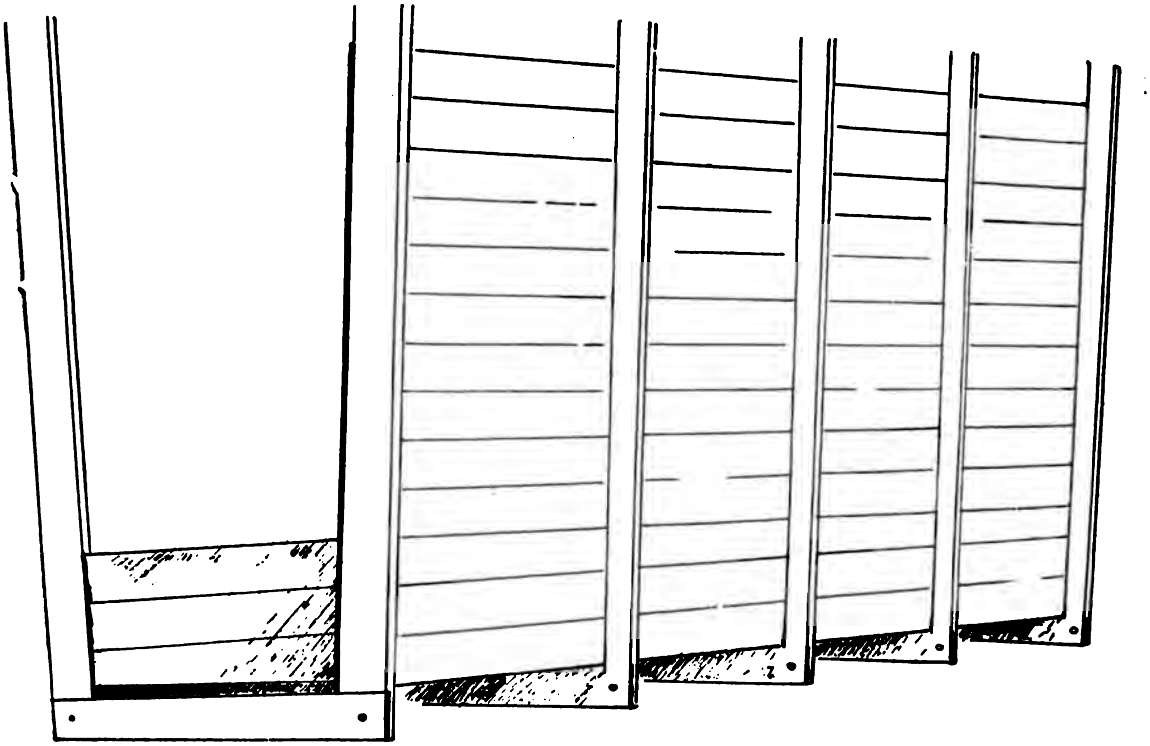


FIG. 532. DIPPING TANK SHOWING CONSTRUCTION.

sides of this pit and at the bottom place a 2″ layer of cinders, gravel or other material and tamp until firm.

Make a frame of rough lumber 4″ shorter and 8″ narrower than the pit. This frame will then have the following dimensions: Length (at top) 9′, 8″; length (at bottom) 4′, 8″; width (at bottom) 15″; width (at top) 20″; depth 4′. This frame has no floor at the bottom or on the slant end. Place the frame in the pit as indicated in *Fig. 534*. This frame is of use only in

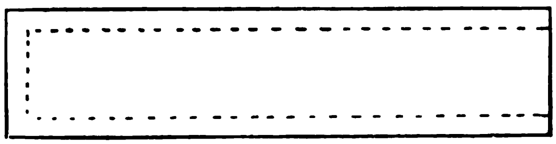


FIG. 534. DIPPING TANK (PIT).

constructing the side walls and the vertical end wall. The bottom and slant end are laid after the frame is removed.

Mix good Portland cement with coarse sand and gravel at the rate of one part cement to six parts sand. Such a tank will require from 350 to 400 pounds of cement and something like a ton of gravel and sand mixed. Fill in the sides and straight end with cement, tamping well as the filling is done. Allow plenty of time for the cement to set. Two weeks is not too long; if the ground is damp a longer time should be given. The pit should be covered by means of a tent or water-tight roof of some kind during this period, in order that chance showers may not interfere with the setting of the cement.

After the sides and one end are hard, remove the frame and lay the bottom and slant end with a trowel. In the angle where the bottom of the tank joins the slant end, two bolts should be embedded in the cement. The ends should project at least 2″ above the surface of the cement. These are for the attachment of a ladder to assist the animals in getting out of the tank. Round the joints where the sides join the bottom. If this is done properly and carefully there will be no danger of leakage. When the bottom is set the tank is ready for use.

A CATTLE DIPPING VAT.

The plan of the cattle-dipping plant illustrated in *Figs. 535* and *536*, is one that has been used in Nebraska by Richards & Comstock since they built their first dipping tank, about seven years ago, since which time they have made some slight alterations, but practically are using today the same vats used before.

The dipping plant is thus described by the builders: At the entrance of the vat is a trap, as shown in the illustration, swinging on a pivot, and when a steer goes onto this trap it would tip up and precipitate the animal into the vat. We found that this was not satisfactory, so changed this trap to a slight incline, covering the incline with a piece of sheet steel 8′ in length. The incline is made with a drop of 8″ or 10″ in 6′; by wetting it before the cattle go onto it, it becomes very slippery and acts as a toboggan slide, so that when they go out on this incline they slide off into the vat, completely submerging themselves, as the solution in the vat is about 6′ deep.

This vat is made from 2″ yellow pine, the vat itself being set in the ground about 6′ or 8′. The ribs to hold the sides, as well as the bottom, are 4″ x 4s″ placed about 4′ apart and bolted both at the top and bottom so as to form a complete band around the tank.

We have one vat in which about 200,000 head of cattle have been dipped and the only part requiring any repairs is the incline where the cattle come out of the vat, and the dripping pen floor.

The planks are beveled on the edges and the cracks packed with oakum, which makes a tighter joint than if they were tongued and grooved. The cost of one of these plants without boiler will average from $175 to $250, according to the material, labor and point at which it is constructed.

We have a man stand on the top of the vat with a pole arranged with an iron fork to go over the neck so as to crowd the steer under a second time, so that in swimming the length of the vat the animal is completely submerged twice.

Originally we used entirely cold preparations, but from careful observation as well as thorough tests we find that it should be used hot, so we have installed 12-horsepower boilers at all of our plants to heat the solution to a temperature of 105°. This we do by placing the boiler as close to the dipping vat as possible, then running a steam pipe, generally 1¼″ size, down into the corner of the vat by the entrance, then along the bottom of the tank at one edge, and perforating the pipe with ⅛″ holes about 18″ apart and leaving the end of the steam pipe open, so that the steam is forced out from the pipe all along. We find that this keeps the temperature of the dip the same throughout the entire length of the vat.

There is no doubt that any dip that is really effective will kill germs and parasites much quicker if heated than when cold. Laboratory tests that one chemist reported to us show that the parasites were killed instantly in a solution at a temperature of 105°, while at a temperature of 32° after five minutes' immersion they still showed signs of life. When put in sperm culture after having been immersed for five minutes in a cold solution about 25 per cent of them still retained life. This shows beyond any doubt that the hot application is the proper one to use.

Many have erroneously believed that one dipping of an animal afflicted with lice or itch would be sufficient. This is not true. The egg which is laid by the parasite does not hatch out for some time, generally from seven to ten days, and any preparation that is strong enough to kill these eggs would be very disastrous to the animal, so that they require a second dipping from eight to eleven days after the first. This is effective with any good preparation provided the animals dipped have been kept in a pen, yard or pasture where there has been no infection, as the dipping of cattle is not a preventive, but simply a cure, and after dipping if they go to a

FIG. 536. CATTLE DIPPING VAT IN USE.

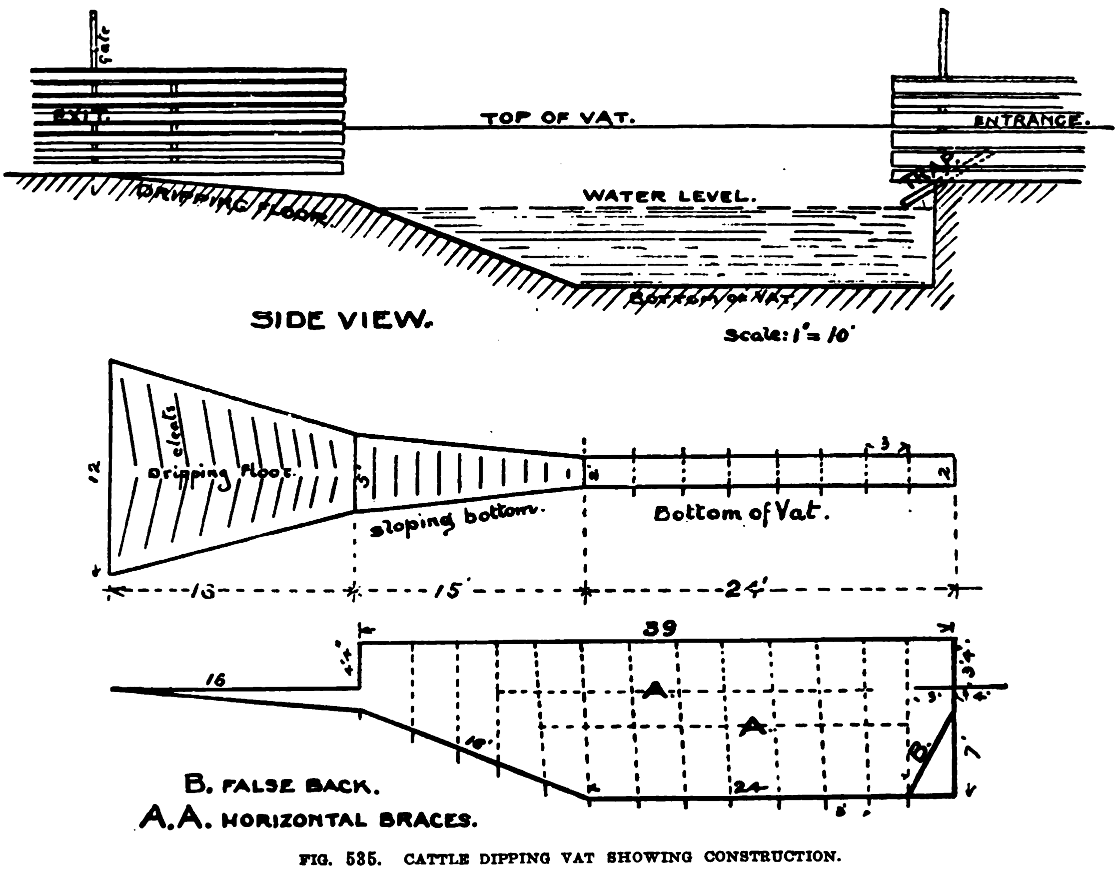


FIG. 535. CATTLE DIPPING VAT SHOWING CONSTRUCTION.

post, shed or windmill tower or any similar thing or even lie down where the post or ground is infected they are very liable to become infected again.

Those who have been most successful in exterminating this trouble from their herds have adopted a system of dipping every week or ten days each animal that shows any indication of it until it is completely eradicated from the herd.

After dipping seven years we are pleased to say that we consider it an unqualified success, which every herdsman will have to adopt.

We dip all our cattle once a year to insure their being free from trouble. No new purchases are allowed to go onto our ranch until after they have been dipped.

A DIPPING VAT FOR SHEEP.

The strongest argument for the dipping of sheep lies in the fact that it is the best way of freeing them from external parasites. Sheep are very frequently troubled with red lice, which can hardly be seen, and yet they cause the sheep unlimited annoyance. Dipping will completely destroy them. Ticks cause the farm flocks of this country untold annoyance and for these dipping is thoroughly effective. Ticks and red lice do more damage than sheepmen are aware of, because the evidences of the annoyance which they give the sheep are not so marked as in some other troubles, but they are none the less a severe check to their well-doing. Dipping followed faithfully each year will completely remove the baneful results from the presence of these parasites. For the eradication of scab dipping stands first among remedial measures.

While the destruction of these pests is usually the mainly accepted argument for dipping, yet there are others that, grouped together, make a more favorable endorsement of the operation. Among these may be briefly mentioned cleansing the skin, cleansing the wool, and particularly encouraging the growth of the latter. To get the fullest returns in these directions the dipping should be done twice each year—in the spring shortly after shearing and again in the fall, just before the advent of winter.

Shortly after shearing it is an advantage to dip the flock thoroughly so as to cleanse the skin. This not only adds to the thrift of the sheep and the lambs, but in both instances it favors the secretion of yolk, and this means the growth of a sound, live, uncotted fleece. Not only is the growth of wool better from it, but it adds directly to the function of the fleece as a protection to the sheep. The fleece of a sheep that has been dipped is more likely to remain intact throughout the season, as there is no cause for the sheep rubbing or otherwise breaking the compactness of it. Another advantage that seems to follow dipping at this time is that it seems to lessen the tendency of the sheep to lose its wool in spots too early in the season. When the fleece is clean and healthy it seems to continue growing longer and the wool does not peel in patches. Dipping in the fall is more for the purpose of removing from the fleece such foreign matter as may have been gathered during the summer and also freeing it from any of the parasites that prove such an annoyance during the winter season. Even under the best conditions the fleece is likely to become filled more or less with sand and other foreign matter which, during the winter, would produce such irritation as to cause the sheep to rub against sharp surfaces and destroy the compactness of the fleece.

By dipping sheep late in the fall, when the ground is frozen, and then keeping them away from the strawstacks and feeding them in racks that prevent the chaff from falling into the wool, it is possible to put a clip on the spring market just as clean as if the sheep had been washed just previous to being shorn.

It is hard to measure the damage that is done to the fleece alone, to say nothing of the thrift of the sheep, by overlooking dipping in the fall. It is quite common to see sheep in the ordinary flocks of the country with fleeces badly broken by rubbing under wagons, or some such means, through their endeavors to get rid of the irritation of the dirt that was left in the fleece. Such fleeces are likely to become cotted, especially if the sheep have not been dipped in the spring. Neglect of spring dipping is apt to result in a decreased secretion of yolk, a condition which favors cotting. A fiber of wool is covered with scales that overlap each other much like the shingles on a roof. To keep these scales down and to prevent them from warping just as shingles would do there must be a liberal supply of yolk in the fleece. If this yolk is not secreted, owing to the unthrifty condition of the skin, the scales rise and the fibers become so matted they finally reach what is known as a cotted condition.

The fleece of a sheep that has not been dipped, also one that is dirty or discolored, sells for 3 or 4 cents per pound less in the Chicago market than the fleece of a sheep that has been cleaned by dipping. These are facts that may be verified every spring. It is said that the benefits of dipping applied to a single fleece would pay for the dipping of more than a dozen sheep.

While the foregoing applies especially to breeding flocks, there are just as forcible reasons for dipping feeders. In feeding sheep it is of prime importance to reach as rapidly as possible that sappy and thrifty condition which is conducive to good gains. Dipping will hasten this and also remove the risk of unlimited losses through an outbreak of scab. It is good policy to take it for granted that the feeders are in need of a dipping rather than wait for the evidence of it which usually comes when the sheep should go to market.

Dipping being so necessary it follows that it will pay to arrange for a dipping vat especially for this purpose. The cost of this is sometimes used as an argument against it, but this may be easily overcome by a number of farmers in a community combining and building a dipping vat for the use of all. It would be easy to drive the sheep to this plant and the ease with which they may be dipped would result in a considerable saving of labor.

The dipping vat (*Fig. 537*) which is herewith described cost about $50 and could be built much more cheaply with some study as to the more economical use of material. There is one feature about this vat which is not wholly satisfactory, and that is due to the fact that

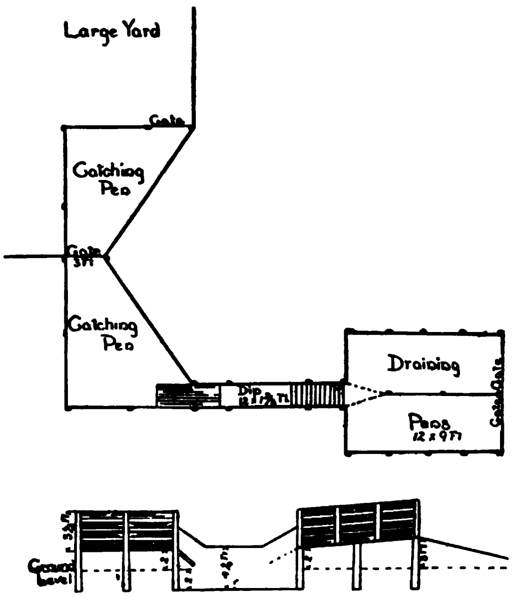


FIG. 537. DIPPING VAT FOR SHEEP.

the planks used in making the vat are not as durable as they should be. Iron tanks which are manufactured would be much more satisfactory on that account. An ordinary wooden vat well painted will last several years, but in making a vat of this kind it would be better to put a little extra money in it so as to make it more durable.

The ground plan (*Fig. 537*) readily explains the general arrangement. The only point to which attention may be called in the construction of the yards is that there are no corners for the sheep to be crowded in, consequently they move along as freely as required. Each catching pen is exactly the same size as each of the draining pens, consequently they hold the same number of sheep. By taking these dimensions it is easy to run the sheep into the vat in groups just sufficient to fill each of the draining pens desired. The gates between the catching pens are sliding so that the sheep may readily pass through from one to the other. The second catching pen, or the one nearest the dipping pen, is floored, as this tends to keep the feet of the sheep clean just before they enter the dip. The dipping vat is 12′ long, 4½′ deep, 20″ wide at the top end and 6″ wide at the bottom.

The vat holds about 125 pails of water with the dip required to give the fluid the needed strength. It is sufficient to dip about 125 sheep. This is allowing more fluid than is generally stated to be sufficient, but it is better to use this amount and thereby clean the fleeces thoroughly. This amount may be used in dipping sheep that have their fleeces about half grown. If the dipping is done shortly after shearing much less dip will be required.

For the comfort of the sheep it is advisable to choose a day that is not too warm, and care should be observed also in driving the sheep and penning them in that they do not become overheated. In passing them through the dip haste should be avoided. They should be allowed to remain as long as possible in the draining-pens. This is better for the sheep, saves dip and lessens the danger of poisoning afterwards. There have been cases where the sheep have died through eating grass on which they have been allowed to run before they have become thoroughly dry. Then if the sheep are turned out too hurriedly from the draining-pens and the sun is very warm it will dry out the fleece and add to its harshness.

This dipping vat is best for a flock of about 200 sheep. For a larger number it would be preferable to make the vat longer so that more dip could be put in and more sheep run through. It is easy, however, to dip as many as 500 sheep with this vat, but more thorough dipping can be given by having the vat considerably longer. In that case the yards and draining-pens should be enlarged so that the sheep could be run through in larger groups. It would seem that for dipping sheep on an extensive scale it would be an advantage to have the vat double, so that the sheep could turn when they got to the end and swim back and go out near the point of starting. This long swim would cleanse the fleece thoroughly.

For a farm flock a small dipping plant of this kind is admirably adapted, but it would be a more economical arrangement for several to combine and make a plant for this purpose.

A CEMENT TANK AT THE MINNESOTA COLLEGE.

In 1903 a cement dipping tank was built at the University Farm. The location chosen was at the end of the piggery, close enough that the wall could be used in place of a fence on one side. The alley of the piggery is used for a catching pen and a hurdle or loose door completes the run from catching pen to tank. The cover of the tank answers for the floor of the dripping pen. Hurdles set up around this floor readily form a dripping pen large enough for a small flock of sheep.

In excavating for the tank, the dirt was removed accurately so that the tank would be true and level when finished. The sides of the tank were built up about 9″ above the level of the ground by using brick discarded from the hog-house walls when that was built. (See *Fig. 538.*) Small stones would answer as well when at hand. The object in building it up 9″ above the ground level was to provide good drainage away from the tank and to keep surface water from flowing into it. The earth shoveled out of the hole was graded up back of this 4″ brick wall to the top of the tank. This hole when finished and ready for cementing was 3′ wide and 13′ 3″ long at the top; at the bottom, 13½″ wide by 6′ 6″ long; depth of the hole from level of ground, 3′ 3″. When finished, the dimensions were 2′ 6″ wide and 12′ 2″ long on top; 10″ wide and 6′ 2″ long on the bottom.

The tank is large enough to dip yearling cattle successfully. For sheep and hogs alone, the dimensions could be modified to advantage—15′ on top and 2′ 6″ in width would be preferable for outside dimensions, giving when finished a tank 14′ by 2′ and 3′ 9″ deep.

Reasonable accuracy was observed in plastering the cement to insure a good piece of work and to have the tank true. The work was done by two young men without experience in handling cement, in about 10 hours, after hauling the sand and cement and getting the tools together. The tank has now stood through three winters and is better than when built.

DIPPING SHEEP ON THE FARM.

A successful sheep breeder furnishes the following description of the concrete dipping tank shown in *Fig. 539:* "Our old dipping vat was of wood. It had a cage that was lowered into the vat by a windlass, and the lambs were then drawn out and drained. It was very hard to use and by no means easy on the lambs. We constructed one of concrete, and it suits almost perfectly. The tank is a small one, 4′ long on the bottom, 14′ on top, 4′ deep, 18″ wide at top and 6″ at bottom. Therein is our one mistake; it is too narrow at the bottom. Widen it to 12″ at the bottom, leaving the top 18″ and it will be perfect. As it is, now and then a very wide lamb finds it too narrow when

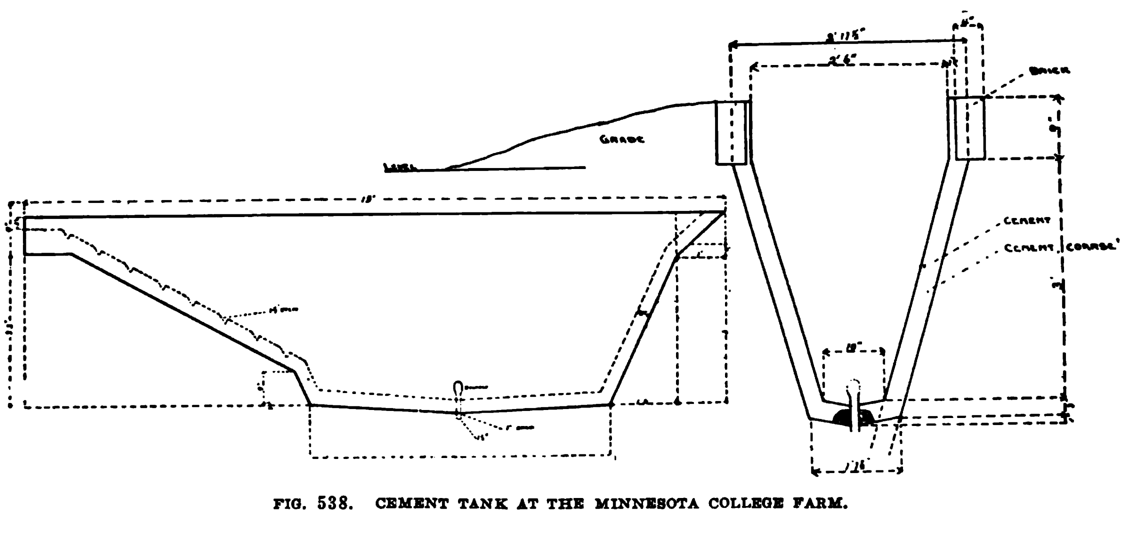


FIG. 538. CEMENT TANK AT THE MINNESOTA COLLEGE FARM.

the dip is used out so that it is low in the tank. Such a tank is not costly. Ours took about 3½ barrels of cement and two days' time to build, counting the work of excavation and form construction. It will last practically forever.

"Unfortunately we did not at the time build a concrete draining pen, but used the old wooden one which is 3' wide and 12' long. This is altogether insufficient for rapid dipping. We will next construct a draining pen about 12' square, divided by a fence into two parts. The sheep will drain on one side while the other is filling. Unless sheep are thoroughly drained dipping is a costly operation. Even a well-drained lamb of large size will take away a gallon of dip in his wool. If he goes out too soon he may take out three gallons. We learned that dipping with this new tank is mainly a matter of heating water and mixing dip. The mere act of dipping the sheep is not serious. One or two men catch the lambs and drop them into the vat. We learned that a proper drop was rather head first, like a diver's posture, thus they disappear and come up completely immersed. They swim across and walk easily up the incline and into the draining pen. Some that are dazed by the unusual shock of immersion in the dip bath may need a little help to pass out. Three or four men are enough to work the plant to its utmost. Two can do it very nicely, if not too many are to be dipped in a day. We took two days, choosing sunny ones, and put through about 1,400, getting started about 9 o'clock in the morning and ceasing at 4. We used a coaltar dip, mixing it 1 to 50. We kept the water hot and softened it with concentrated lye. When we put in the new concrete draining pen we will likely put in also an arch of concrete to hold two large kettles for heating water. Nearby is our concrete supply tank, filled by wind-power. The diagrams show the very simple tank quite clearly. The gentle incline is easy to walk up. It should be rough at bottom and had better have transverse grooves. The draining pen should slope about 6" in 12' toward the tank; 12' x 12' will be large enough. Since a pen 6' x 12' will drain 50 lambs by the time another pen is full they will be pretty dry. With this simple cheap plant four men can readily dip 1,000 lambs in a day."

WAGON RACK AND STANCHION.

The plan illustrated in *Figs. 540* and *541* is of a cattle and hog rack. As a cattle rack it will hold the most unruly and strongest cow or bull in such a position that it cannot do any damage to itself, the driver or the wagon. The dimensions are as follows: Use 1" lumber for rack 3' high and 12' long; the top board is 9' 8" long, lower board 12' long; there is a 6" space between boards. The upright side pieces or slats are all made of hardwood. Slats *A*, *B* and *D* are 3" wide; slat *C* 1' wide; all double. Slat *E* is single, placed outside, 3" wide, 2½' long. Slat *F* is also single, placed inside, 2" wide and 16"

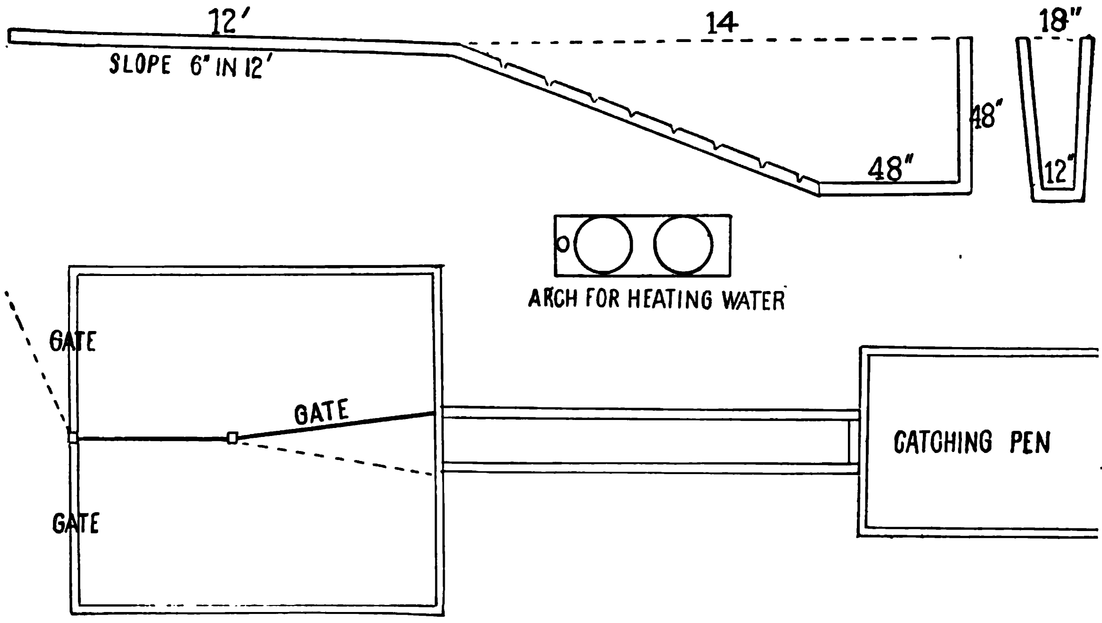


FIG. 639. OUTFIT FOR DIPPING SHEEP ON THE FARM.

long; this slat is to rest on top edge of wagon-box to hold front endgate when used as a hog rack. Slats are spaced apart as shown in *Fig. 541*. The cut-out board *G*, for placing on the wagon seat, is slid in between double-slat *D* and bolted to slats *E* and *F*. Nailed near the top on the inside of rack and in front of slat *C* is a hardwood block (*H*) ½″ x 18″; it is used to prevent the stanchion from being pulled down backward. Ordinary endgates and end rods are used for the rack in either end.

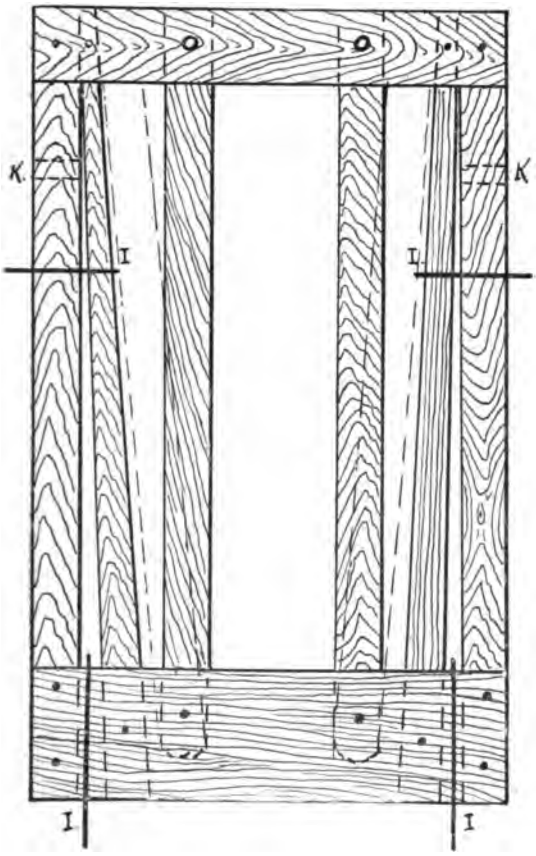


FIG. 540. WAGON RACK AND STANCHION.

The movable stanchion (*Fig. 540*) is made 5′ high and 3′ wide or inside width of wagon-box. Cross-pieces at the top and bottom are double; bottom ones are of 10″ planks and top ones are of 6″ planks. The uprights are 2″ x 4″. The two middle uprights are movable sideways at the top to open the stanchion and are locked by sticking in ordinary iron pins between them. For hauling cattle after the rack is on the wagon place the stanchion crossways between the racks in the wagon-box in front of block *H*. Bolt it down with hook bolts (*I*), running the bolts through the bottom of the wagon-box and wagon-box crosspiece underneath. Next bolt it sideways onto the rack with hook bolts at *J*. Hook bolts are ½″ thick, 12″ long with 3″ hooks, threaded plentifully. To prevent the stanchion from being pushed down forward use two stout braces running upwards diagonally from the bottom of front end of wagon-box to front of stanchion against brace block at about point *K* (*Fig. 540*). For ugly and dangerous animals tie their heads downward, running the ropes through the bottom of the wagon-box.

DEVICE FOR A THREE-HORSE HITCH.

The three-horse hitch shown in *Fig. 542* has proved satisfactory for hauling heavy loads on an ordinary wagon. *A* is an ordinary wagon tongue; *B* is a piece of wagon tire 4″ or 5″ wide

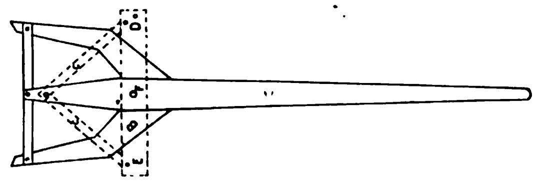


FIG. 542. DEVICE FOR THREE-HORSE HITCH.

and about 20″ long with a hole at *F* to correspond in size with the hole in the tongue. *C C* are strong iron straps fastened to the back end of the tongue with a bolt and also to *B* with

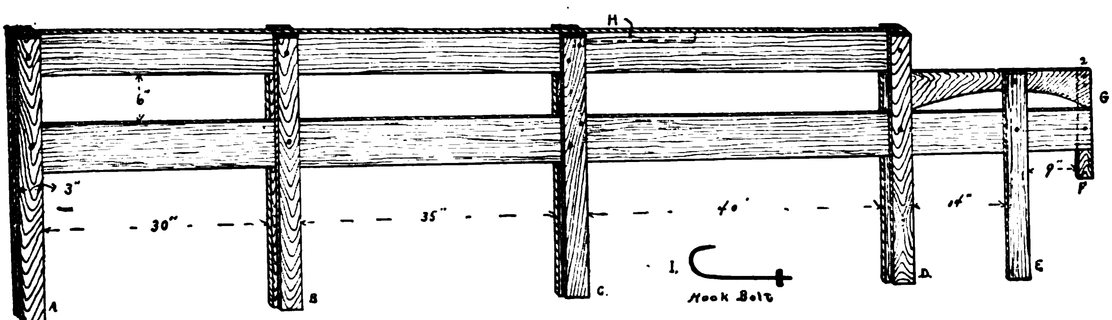


FIG. 541. WAGON RACK AND STANCHION (SHOWING THE RACK).

strong rivets. Drill holes through *B* and the straps *C* at *E* and *D,* making them 8″ from the hole *F*. Countersink the hole *F* and have an iron pin to go through *B* and *A,* with the head made to fit and not project any above *B*. Put a hammer strap on one of the straps *C*. Now cut the evener as long as will work between the wheels of the wagon, and divide it in the ordinary way; place it on the plate *B* and fasten at either *E* or *D,* as you may desire, using a bolt and hammer strap; use singletrees about 30″ long and a doubletree to correspond.

By working the evener at *E* or *D* the middle horse is placed far enough to one side that the tongue does not interfere with it in any way. There is no side draft to speak of, and the plate *B* keeps the evener balanced nicely and up to its place at all times. Use an ordinary neckyoke on the two horses next the tongue and arrange lines on the third horse any convenient way. The scheme is all right; but one has to get to one side to hitch or else use an evener so long that it will not work between the wheels. Take off the three-horse evener and take out the pin in the plate and it is ready for an ordinary two-horse doubletree.

FOUR HORSES WITH TWO REINS.

In order to work four horses abreast with two lines it is necessary to have two checks to each line, the main line, of course, running to outside bridle rings of outside horse. Check designated as No. 1 (*Fig. 543*) connects with outside of each inside horse's bridle ring. Check No. 2 crosses between the two center horses, as is usual in driving only two horses. Outside horses are checked back with short reins to rings in the hames of inside horses, thus crossing check No. 1. A cheap experiment with rope will reveal the merits or demerits of this method.

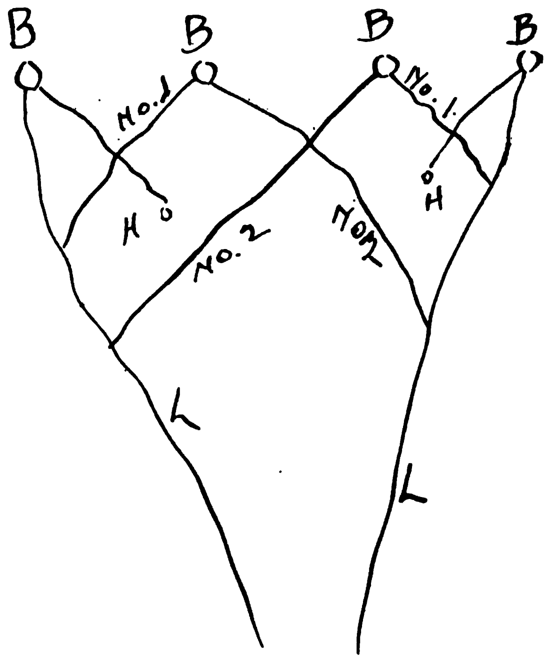


FIG. 543. FOUR HORSES WITH TWO REINS.

AN EVENER FOR FIVE HORSES.

Fig. 544 is of an evener for five horses on a gang plow, with two as the lead team. Make the evener of ash or oak 2″ x 5″ and 20″ long from clevis to clevis, giving the lead team the 12″ end and the 8″ end for wheelers. Fasten an old neckyoke ring or something similar to the end of the tongue and run a log chain through this to *A* on the evener, using light whiffletrees for the lead team.

It is desirable to use a three-horse evener for the wheelers; have a hole for the clevis in the center of the evener and the center horse will pull against the outside ones. Such an evener may be bought at any implement house. The clevis connecting this three-horse evener with the 20″ evener at *C* should be a solid piece double

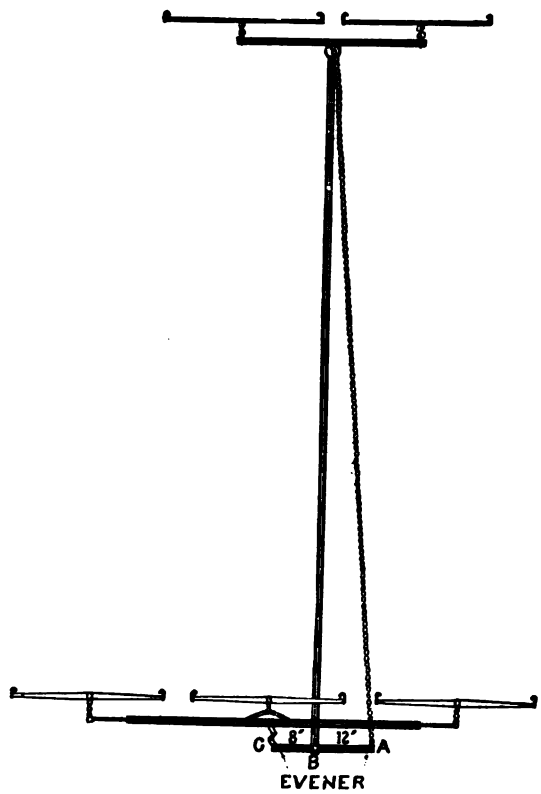


FIG. 544. EVENER FOR FIVE HORSES.

clevis which will hold the three-horse evener in place and not interfere with the chain.

If horses weigh less than 1,400 pounds each it will pay to use five horses on a gang plow. Another method of using five horses with two in the lead is as follows: Make an evener 5′ long, giving the outside wheeler 4′, and 1′ for the two teams that work against each other with chain and pulley.

FIVE HORSES ABREAST ON A PLOW.

Fig. 545 shows an evener to hitch five horses abreast on a gang plow. It also shows how to adjust the reins on such a hitch.

A THREE AND FOUR-HORSE HITCH.

The accompanying sketch (*Fig. 546*) shows a convenient arrangement for making a three and

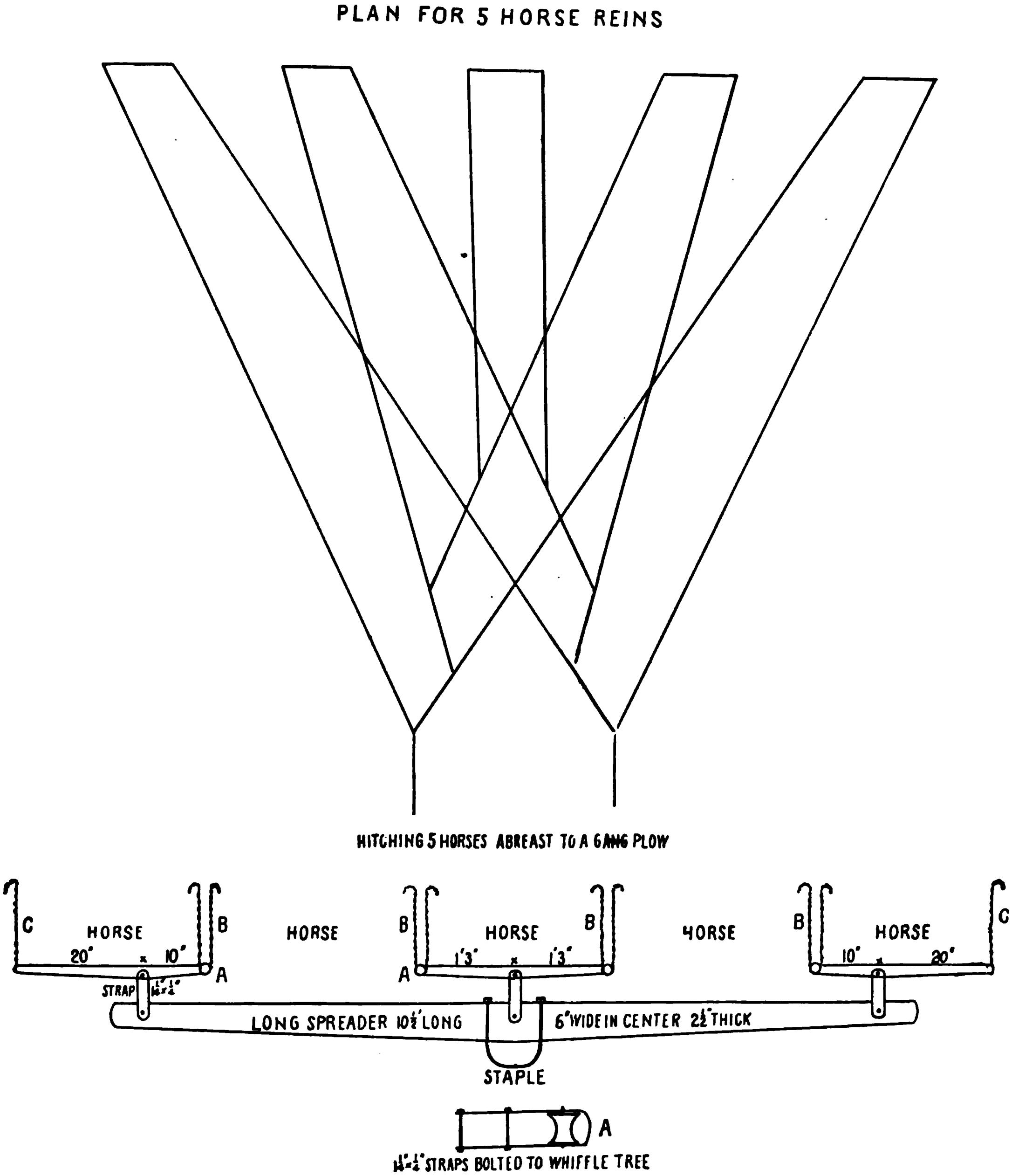


FIG. 545. DRIVING FIVE HORSES ABREAST ON A PLOW.

four-horse hitch. Change can be made in a few moments by taking off the singletree indicated by dotted lines and attaching a doubletree to tongue about 3′ forward from doubletree by a rod or a wire. If it is desired to bring the team closer to the tongue this can be done by boring

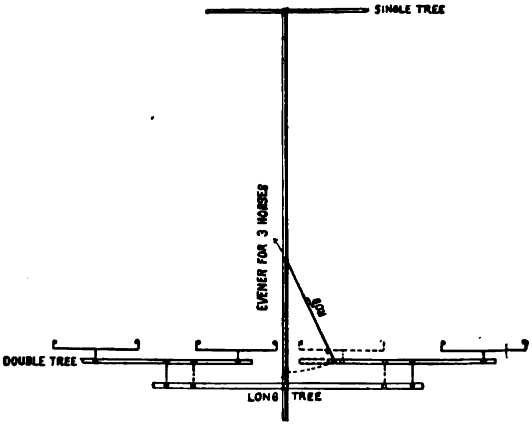


FIG. 546. THREE AND FOUR-HORSE HITCH.

extra holes in the long tree, as indicated by arrows and dotted lines. This arrangement makes a perfect evener for three horses and can be made in a few moments.

A FOUR-HORSE HITCH.

A simple way of working four horses abreast is shown in *Fig. 547*. It explains itself. The straps are from one bit to another.

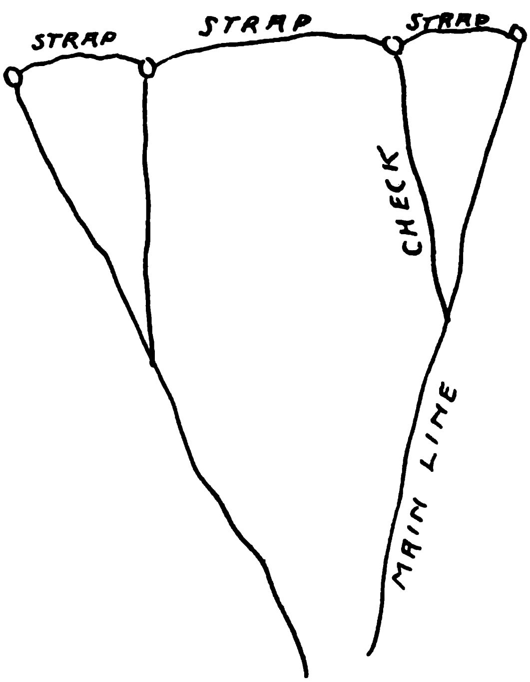


FIG. 547. FOUR-HORSE HITCH.

MULTIPLE HITCHES.

A method for working four horses to a gang plow is shown in *Figs. 548* and *549*.

Let *A*, *B*, *C* and *D* represent the four horses; *C* and *D* are placed on the pole *P* and hitched the same as two horses would be to a wagon. Then take the hitch-rein *J* on *B*'s bridle, run

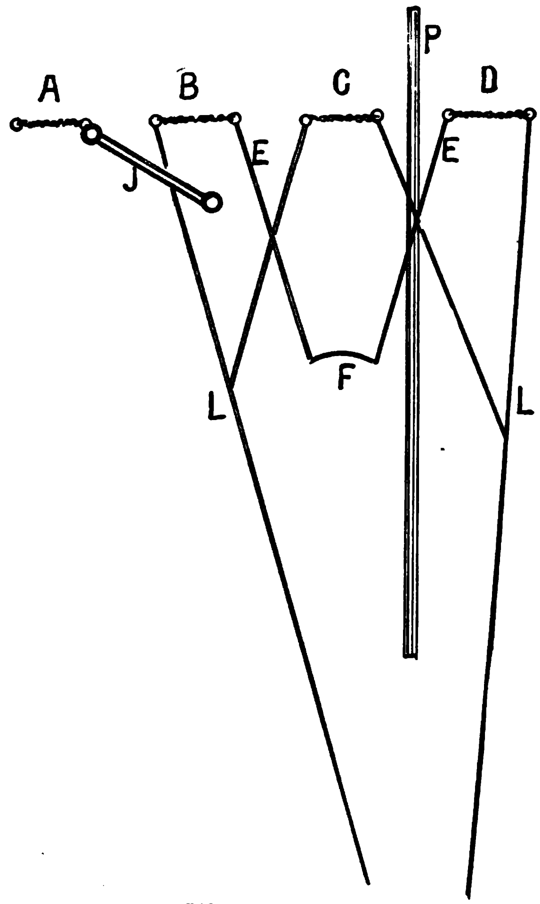


FIG. 548. MULTIPLE HITCH.

it to the ring in *E* and *C*'s hames and back to *B*'s bit and tie. Then do the same with *A*'s hitch-rein—that is, run *A*'s hitch-rein to *B*'s hame ring *E* and back to *A*'s bit and tie. Let them be tied so *A* and *B* can walk the proper distance from *C*. They are now hitched so as to be turned to the right. So they may be turned to the left, take a line and fasten to the near side of *A* and *B*'s bit, then the four horses may readily be turned either to the right or left. About the only use for the third line (on *A* and *B*) is in turning corners about quitting time, as they are liable to want to go towards the barn. Tie a loop in the third line big enough to slip over the arm and then one has two lines to handle. A good way to use only two lines is shown in *Fig. 548.*

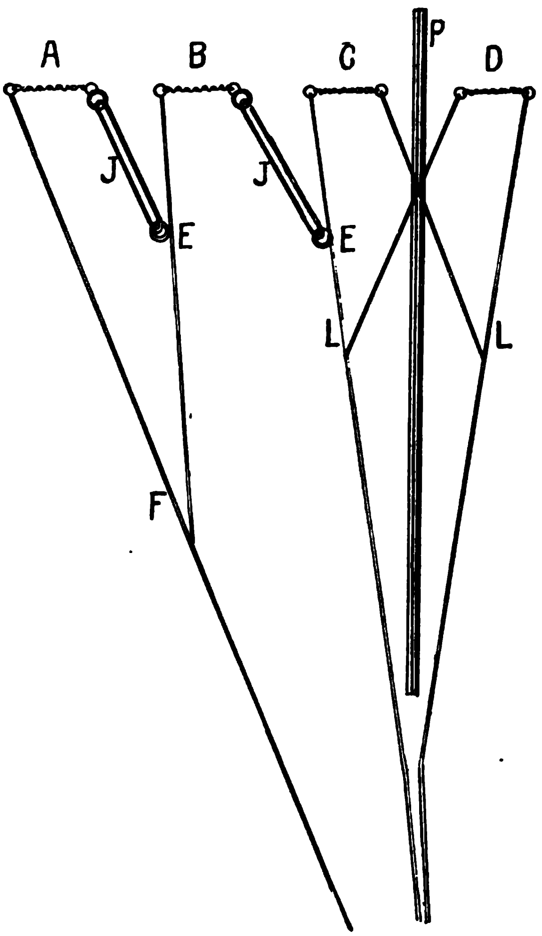


FIG. 549. MULTIPLE HITCH AND THREE REINS.

Let *A, B, C* and *D* represent the four horses as in *Fig. 548. C* and *D* will be on the pole. Fasten line *L* to right side of bits of *C* and *D* and left side of bits of *B* and *C*. Then take hitch-rein *E* on *D's* bit and tie to backband *F* of *C*'s harness, where the traces pass through. This is to keep *D* from getting too far to right or too far ahead. Take *B*'s hitch-rein *E* and tie to *C* at *F* same as *D*. This is a good way to drive three horses. To drive the fourth horse fasten a jockey stick *J* (a piece of wood about 3½′ long with a snap on each end) to *A*'s bit and *B*'s harness—in the buckle at the bottom of the hames is a good place. The four can now be turned either to right or left.

Another multiple hitch is shown in *Fig. 550.* No. 1 is the clevis on the end of the plow beam. No. 2 is the beams. No. 3 is clevis fastening. No. 4 is the equalizer that is made of a heavy piece of wagon tire 15″ long with a hole in each

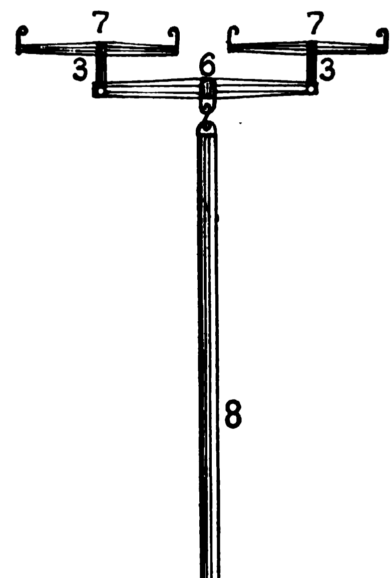
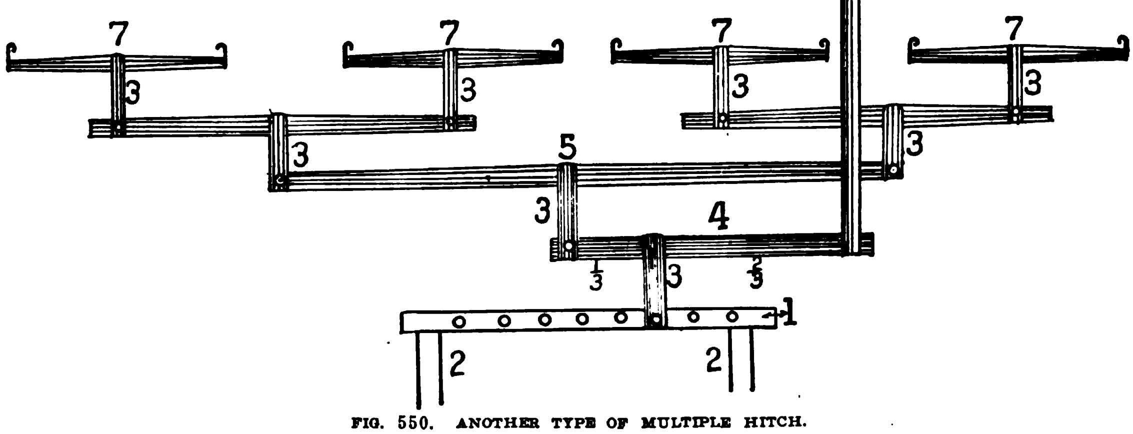
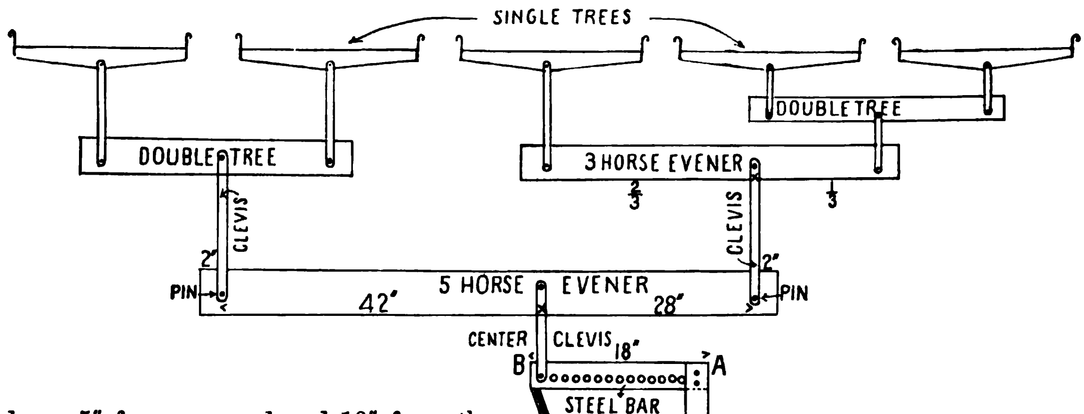



FIG. 550. ANOTHER TYPE OF MULTIPLE HITCH.



end and one 5" from one end and 10" from the other; this gives one-third of the length to the four horses, two-thirds to the two horses ahead. This lays down flat, the long end next to the furrow wheel and under the tongue and next to the furrow horse. No. 5 is a four-horse doubletree. No. 6 is a two-horse doubletree. No. 7 is a singletree and No. 8 is a rod or a chain running from No. 4 to No. 6 ahead of the four horses. This works just as well for five horses by changing No. 4 to two-fifths or three-fifths of the length and putting a three-horse evener instead of a four-horse, or No. 5.

In a six-horse hitch one may drive with 4 lines—the furrow horse and the third from the furrow as if there were only three horses and use the lines on the two outside ones, then tie the fourth one to the bit of the third with a hitch rein over his back and tie this to the fork of the third horse's lines. Then the two lines from the lead horses make four lines in all, but a good boy can drive them after a few rounds.

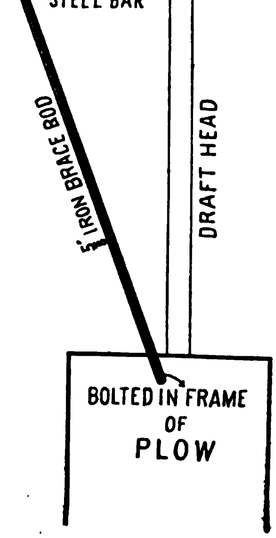


FIG. 551. DEVICE FOR FIVE HORSES ON A GANG PLOW.

THE FIFTH HORSE ON A GANG PLOW.

In making an evener for five horses (*Fig. 551*), get a bar of steel 18" long and 3/4" thick; drill 12 or 14 5/8" holes in a row down the center; bolt one end of this bar firmly to the draft head of the plow, where you have been attaching the evener. To the other end of the bar fasten a strong brace that goes back and bolts onto the main frame of the plow. This is what is called an extension draft head. By shifting the hitch from one hole to another one will soon find which hole is wanted to pull from to make the plow cut as wished and keep the off-horse in the furrow.

As to the five-horse evener, get a good piece

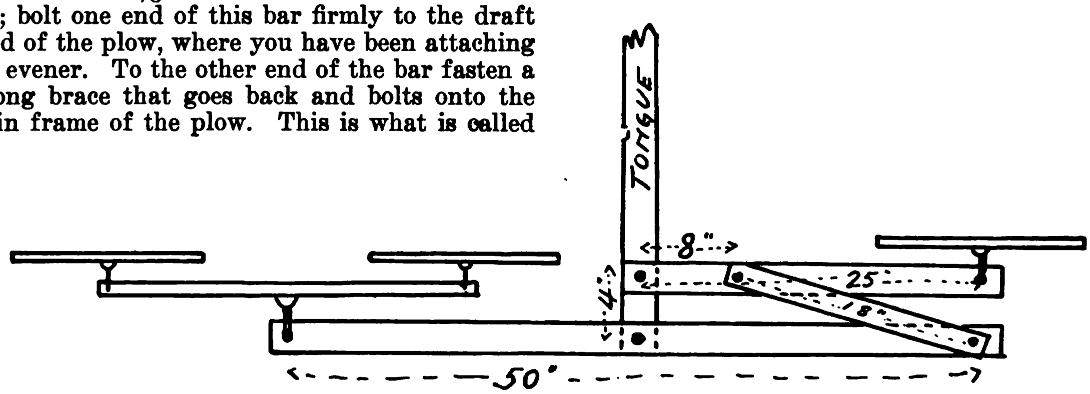


FIG. 552. THREE-HORSE DOUBLETREE.

of white oak 2″ x 6″ x 74″ long; 2″ from each end, and the same distance from back edge, bore ⅝″ holes for the clevis pins; these will be just 70″ apart. Now, 2″ from the front edge and 28″ from one hole and 42″ from the other, bore holes for (so-called) center clevis, which attaches the evener to the bar of extension draft head. To the short end of this five-horse evener fasten a three-horse evener, and singletree; to the other end attach an ordinary two-horse doubletree and two singletrees. The horse on the extreme left is the fifth horse. Fasten him to the fourth horse with a jockey stick and coupling strap.

A THREE-HORSE DOUBLETREE.

The sketch (*Fig. 552*) is of a three-horse doubletree to work with a tongue. It is simple, easy to make and gives satisfaction. The drawing explains itself.

HITCHING FOUR HORSES ABREAST.

The sketch (*Fig. 553*) shows how to drive four horses with a pair of common check lines. This arrangement will work equally well with three,

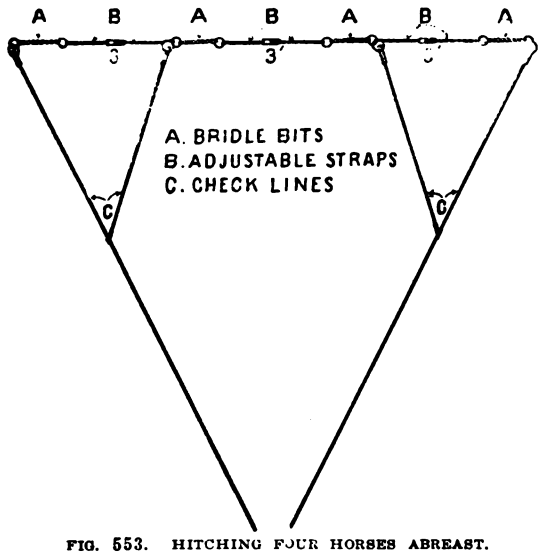


FIG. 553. HITCHING FOUR HORSES ABREAST.

four, five or six horses. The adjustable straps should have a snap on each end and a buckle in the middle.

A VIRGINIA HOGPEN FRONT.

The drawing (*Fig. 554*) is of a pigpen front. Posts are shown at each end and constitute a part of the fence. *A* is 1″ x 6″ top-board of gate, and extends across posts. *B B B* are 1″ x 6″ uprights and should be on the inside. *C C C C C* are 1″ x 6″. *D* is a small prop to hold the gate back while feed is put in. *E* is a 1″ x 2″ cleat nailed on front of post to keep *A* in place, cut with slope on back side as shown at *E*, so that *A* may have free play when the gate is pushed

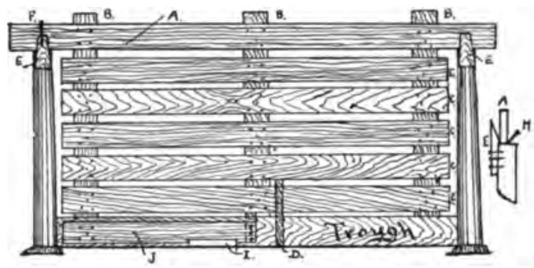


FIG. 554. VIRGINIA HOGPEN (FRONT).

back. *F* at left top is a strip of steel roofing nailed down to posts and across *A* to keep pigs from hoisting the gate. *H* is a spike driven in the post behind *A* to keep the gate in place. *I* shows a section of a board which should extend the full length of trough and stand 2″ above the trough. This board is used only in front to keep the gate from going forward. The half-length board *J* at left bottom is omitted in building the gate. It is only added in the cut to show how the gate appears when dropped ready for pigs to eat. The gate should be hung about 1″ forward at top. This will insure it to drop in place when the prop is removed.

BREEDING BOX FOR SWINE.

The dimensions of the box (*Fig. 555*) are: length, 5′ 6″, width 2′ and height 3′. The length of the short box, which may be made by moving the end board *j* into the slot *k*, is 3′ 6″. The corner posts are 2″ x 4″ scantling and the sides 1″ x 4″ strips; *a a a* are joists for nailing the floor to; *b b* extra boards to which the joists are nailed to stiffen the sides of the box; *c c* are boar supports which hold the boar's weight during service. The one on the left is stationary, while the one on the right is adjustable to the size of the sow and should fit up tight against her side; *d* is a piece used to adjust the right-hand support; *e* is a pin which holds the support in place; *f* is a strip to hold *d* in the groove or mortise; the *g*'s (of which there are six) are pieces that hold the supports solid and are 13″ in length; *h* is a wooden screw to hold the front end of the adjustable support in place; *i* is a ⅞″ rod which is placed behind the sow to keep her from backing out of the box; *j* is a movable end board which is used to adjust the box to different length sows. When long sows are to be bred the board is placed in the end of the box, as shown in the diagram, and when the short

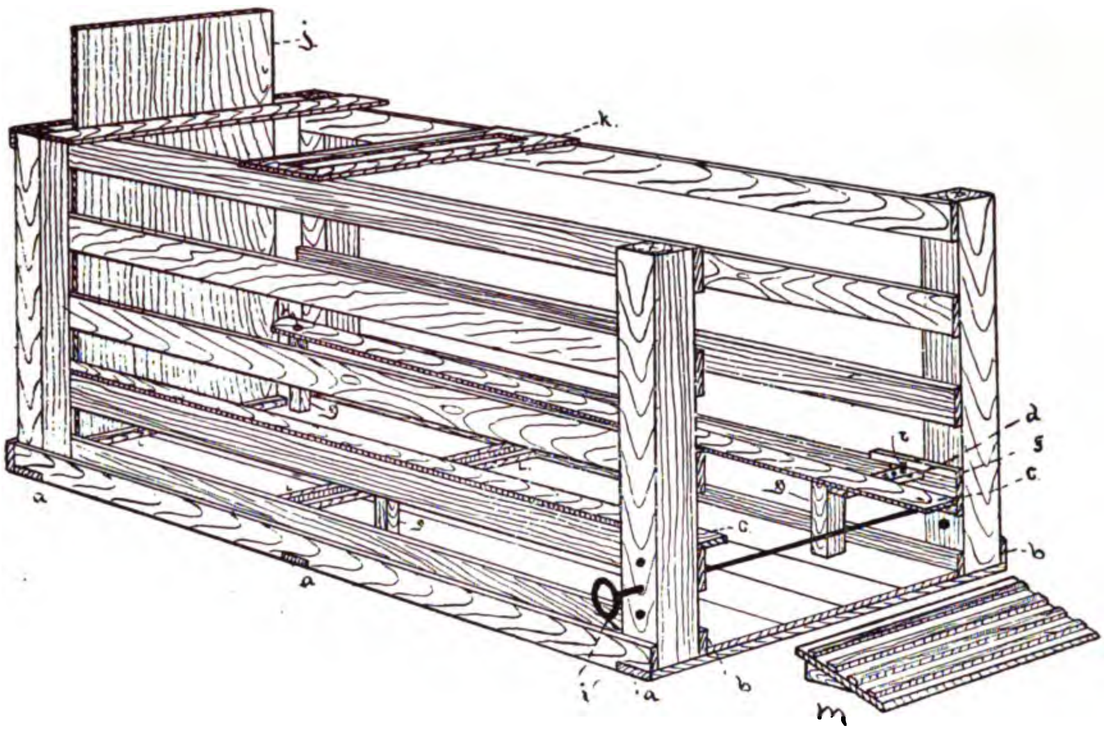


FIG. 555. BREEDING BOX FOR SWINE (SHOWING CONSTRUCTION).

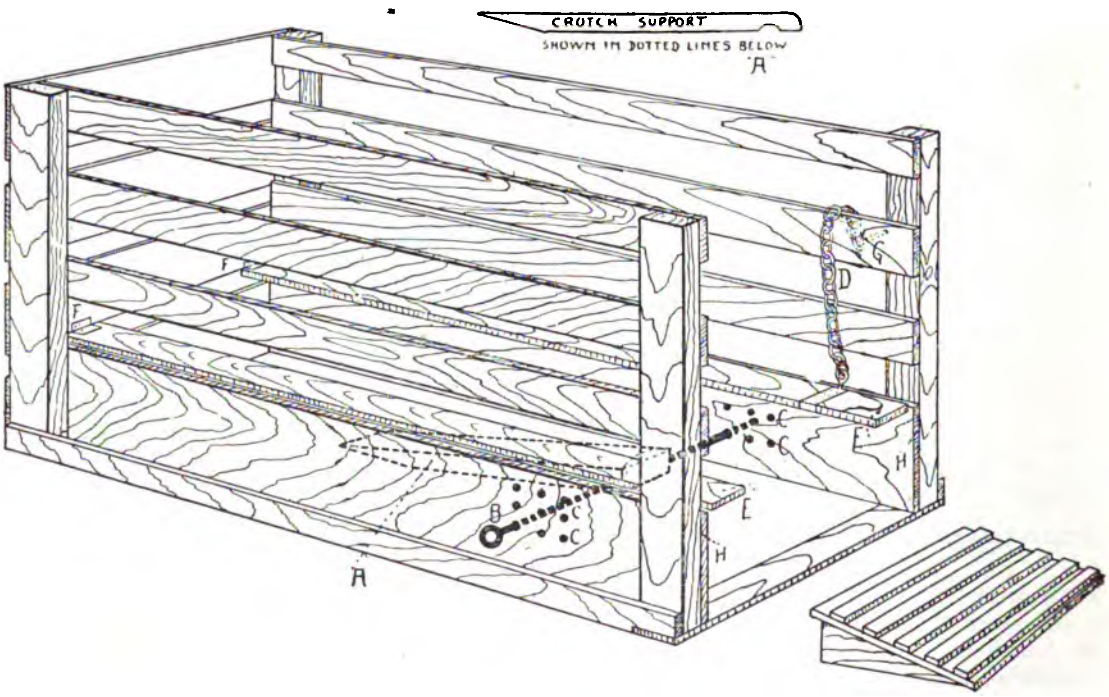


FIG. 556. BREEDING CRATE FOR SWINE (IMPROVED TYPE).

sows are bred the board is removed and placed in the slotted board *k*. *L L* are cleats which hold the bottom end of the board *j* in place; *m* is a platform used to raise a small boar high enough to serve a large sow.

IMPROVED HOG BREEDING CRATE.

Fig. 555 shows a type of breeding crate that has been used for many years. *Fig. 556* shows an improved type. Instead of the adjustment for long and short sows being handled from the front of the crate that end is made stationary. Put in lower side boards 10" high, through which holes are bored at convenient intervals *C C C C C C* to admit the iron rod *B,* which should pass close under the hams of the sow just above the hocks. The proper hole to use is determined by the size of the sow. A crotch support *A* is added with a notch in it which passes between the sow's hind legs and rests on the retaining rod, as shown. This is 2" x 4" x 3' long, and the upper edges are rounded off smooth, so as not to injure the sow. The side supports for the boar *E* are made adjustable by hinging to one of the cross slats in front and are raised or lowered from the back by means of a chain *O* which passes over the top of side board, and fastens to a pin or heavy nail *G*. Put a chain on for each support. Two 4" boards, 6" apart, should be nailed over the top of the crate above where sow's head comes to prevent her from climbing out.

An Indiana swine breeder, commenting on *Fig. 556*, says: "I submit a sketch (*Fig. 557*) of a breeding crate I make and use very successfully, and it costs so little any farmer using a large boar should make and use one. I always use a wood rod to hold the sow in the crate (a piece of broken fork or hoe handle answers), as an iron rod is apt to injure the boar, should he drop down, especially in very cold weather. I think this crate more convenient than the one

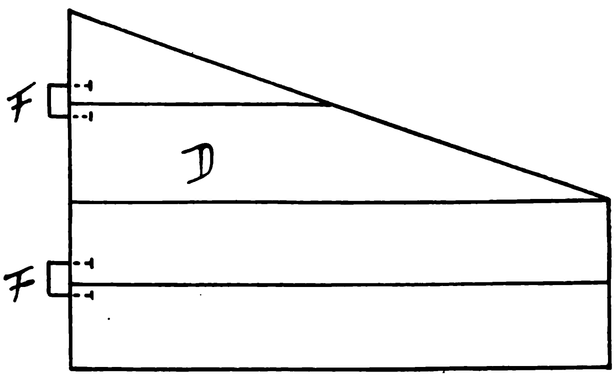


FIG. 558. SECTION OF FIG. 557.

shown in *Fig. 556*. Following are the specifications: *A* is the bottom, 4' 6" x 30". *B* is the rear end, 3' high. *C* is a stationary side showing foot rest 4" wide and 2" thick to hold weight of boar. It is raised 18" at the rear and 17" in front, rounded off at the front for easy access. *D* is a movable side, duplicate of the other, with staples *F* to hold it at different

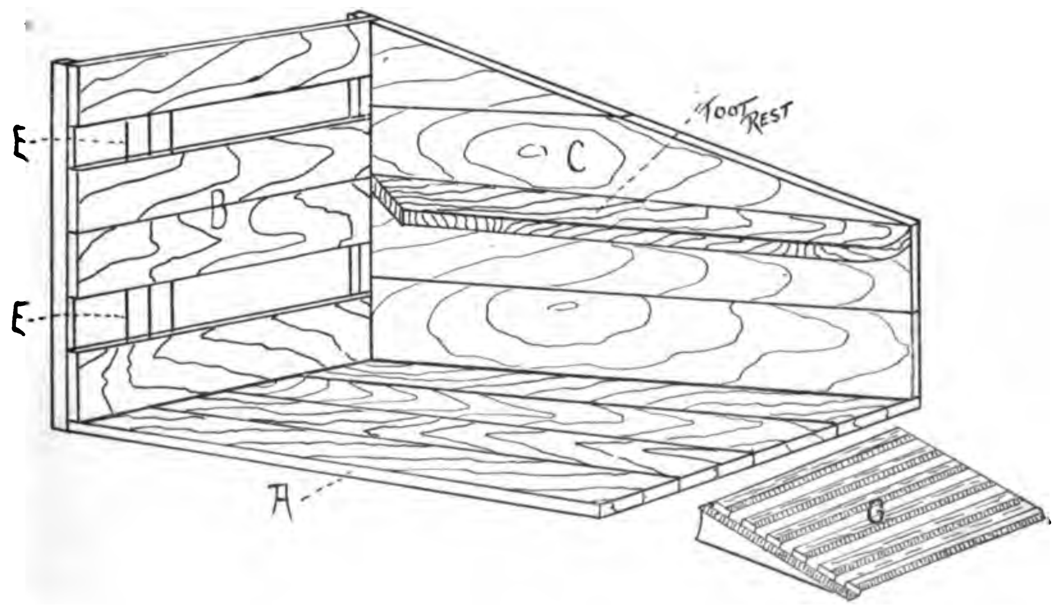


FIG. 557. ANOTHER IMPROVED TYPE OF BREEDING CRATE FOR SWINE.

spaces in notches *E E*. *G* is an adjustable platform for raising or lowering the boar. Movable sides must always fit against the sow when she is in, but widen out at the front to admit her. The crate should be set against a fence or a wall and near a gate to the boar's lot so that when he gets down he turns right into the gate. Use hurdle (a light low panel) to drive the sow in."

BREAKING A HALTER PULLER.

The two cuts (*Fig. 559*) show how to break a halter-pulling horse. First take a ⅜" rope 18′ or 20′ long, double it in the middle, put under the tail, cross it on the back, put the ends through the halter nosepiece and tie to a firm post or manger. Then go in front of horse and with your hat or something that will scare him make him pull back. After a few attempts he will stop and you cannot make him pull on the rope. He may forget it, so it is best to carry a rope and when you tie him on the street tie him in this way. It is a good way to break a colt to lead and to stand tied. If a colt is disposed to be stubborn, use the rope, tying him to the hame ring of a good steady horse and lead him around in that way. He may kick a few times, but will soon come to time. Another way is to run the halter rope through a ring on a post or a manger, and tie the end to the front foot.

Another method is thus explained: "Get a ½" rope 14′ long, make a lasso or sliploop at one end. Put a surcingle on the horse, also a

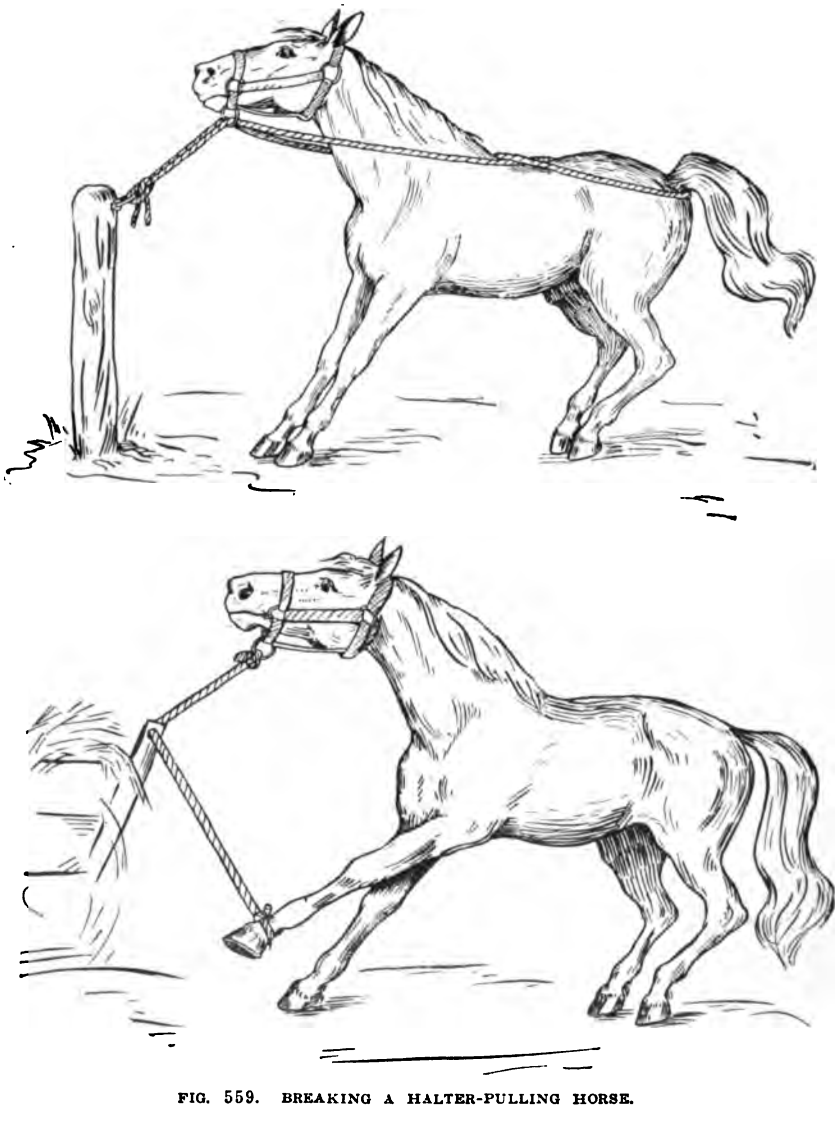


FIG. 559. BREAKING A HALTER-PULLING HORSE.

halter without any lead strap; place the horse in a narrow stall with the sliploop around his body at the flanks with a knot under the belly, and bring the loose end forward over the surcingle, between the front legs, up through the ring of the halter, down through the tie-hole in the manger without tying and back to the ring in the halter and tie there. This pulls on the halter and on the loin, and a horse can stand very little there. Get in front of him and make him pull back a few times until he will not try to pull back any more, and then your horse is broken of this dangerous habit.

MAKING A ROPE HALTER.

The accompanying illustration (*Fig. 560*) shows how to make a simple rope halter. All that is required to make it is a piece of rope and a marlin spike. First decide on the length of the nosepiece. Then splice a loop in one end of it as shown. Next at the spot marked for the other end of this piece raise one strand of the rope and push the end without the loop in it through, knotting as shown, then draw tight, leaving the second loop, which is also shown. Run the free end of the rope up over the head, through the spliced loop which comes on the off side, and then below the chin and through the knotted loop on the near side. This halter will fit any kind of a head and may be changed to suit by loosening the knotted loop and shortening the nosepiece. This halter may also be made by forming the loops by wrapping them into shape with twine, but halters so made are not so satisfactory as the kind shown for the reason that twine wears out after awhile. Still for those who cannot splice a loop into the end of the rope the wrapping scheme must serve.

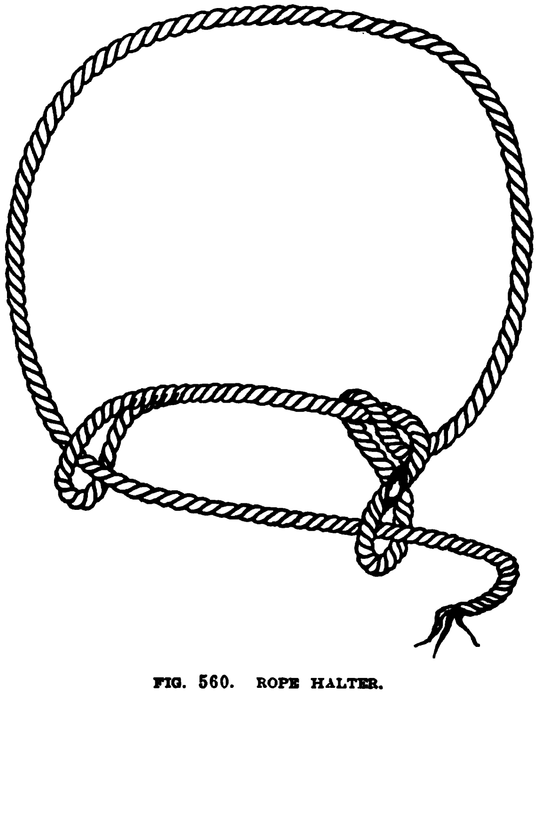


FIG. 560. ROPE HALTER.

Another type of rope halter is shown in *Fig. 561.* It is made without cutting the rope. The knots are not objectionable when properly made. This halter can be made without tools and as quickly unmade. It is perfectly adjustable and can be fitted to calf or cow in a minute from a straight rope.

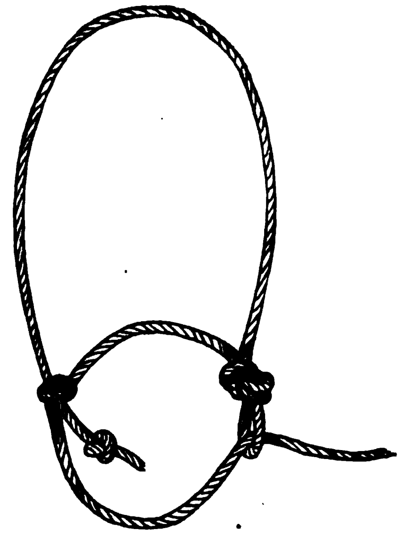


FIG. 561. ANOTHER TYPE OF ROPE HALTER.

PREVENTING COWS FROM SUCKING.

The device shown in *Fig. 562* nine times out of ten will cure cows from sucking themselves or others. Put it in the cow's nose and with a pair of large blacksmith pinchers close it enough to prevent its coming out. To remove it run the handles of the pinchers through the ring and

FIG. 562. DEVICE FOR SELF-SUCKING COW.

spread it. Smaller ones can be made for calves and heifers. A blacksmith can make one of these devices in a short time at small cost.

DEVICE FOR SELF-SUCKING COWS.

Cows addicted to the habit of sucking themselves should be taken in hand as soon as they are known to be self-suckers. The longer the habit remains unchecked the more difficult it will be to effect a cure. The only cure is some sort of a device to be worn by the cow. (See

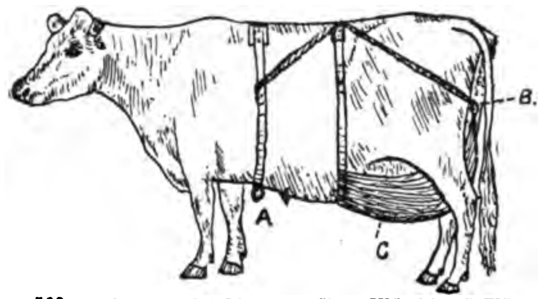


FIG. 563. ANOTHER DEVICE FOR SELF-SUCKING COWS.

Fig. 563.) *C* shows the form to make canvas bag. A piece of iron is riveted on front belt to fit over back to keep harness from slipping to one side. *B* shows snap at rear end of canvas bag. *A* shows ring which is fastened on front belt to hold bag forward while milking in summer. Harness is made of 1″ leather straps.

A YOKE FOR SELF-SUCKING COW.

A device to break self-sucking cows is described as follows: *A* is the straps 32″ long to be buckled around the cow's neck. *B* represents

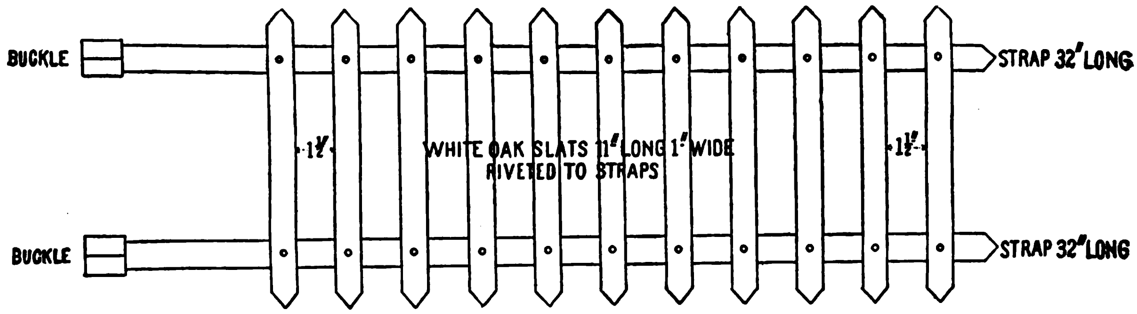


FIG. 564. YOKE FOR SELF-SUCKING COWS.

the slats to be riveted to the straps. The slats should be 11″ long and 1″ wide. The slats should be made of well-seasoned white oak and should be placed at the distance of 1½″ apart. There should be eleven slats in all. (*Fig. 564.*)

Another device (*Fig. 565*) is thus described: "A rope is passed over the hip, down in front of the udder and drawn tolerably tight and tied." The objection would be that injury might happen to the mammary veins running forward

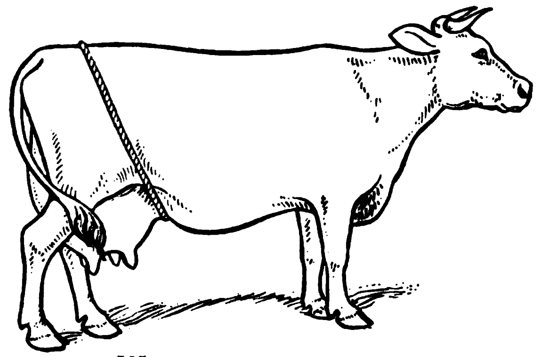


FIG. 565. ROPE FOR SELF-SUCKING COWS.

from the udder. These veins remove the blood that comes from the arteries to the udder and have nothing whatever to do with the supply of blood from which milk is elaborated.

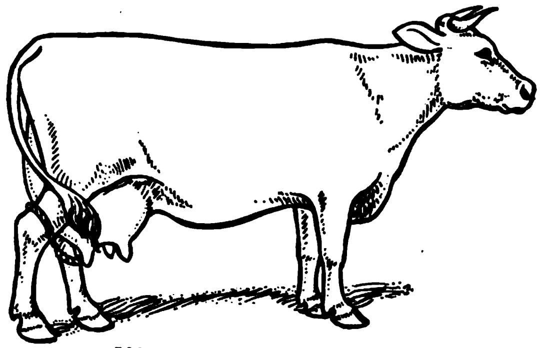


FIG. 566. BREAKING SELF-SUCKING COWS.

A New York farmer says: "We had a man who tried the same plan and forgot to take the rope off the heifer, with the result that she was nearly ruined for future use in the dairy and for more than a week could not walk without hitching her hind legs along, and I would not want anyone to try this method on a cow that he cared anything about, as it is not only dangerous but rather inhuman. *Fig. 566* shows an arrangement that is not nearly so dangerous. The rope or strap is placed just above the hock on the right hind leg and from there it is placed just below the hock on the left hind leg, and in this manner it will be impossible for the animal to raise her leg on the side of the man who is milking her. We have hardly ever found it necessary to strap any of our cattle unless they had sore teats."

JACK PIT FOR RANGE MARES.

There are a number of devices for such work. But preferable for gentle mares are the breeding hopples, of which there are several kinds manufactured.

A pit can be constructed by making a chute with panels high up (*Fig. 567*), and can be put on hinges at the posts *A*, and when the mare

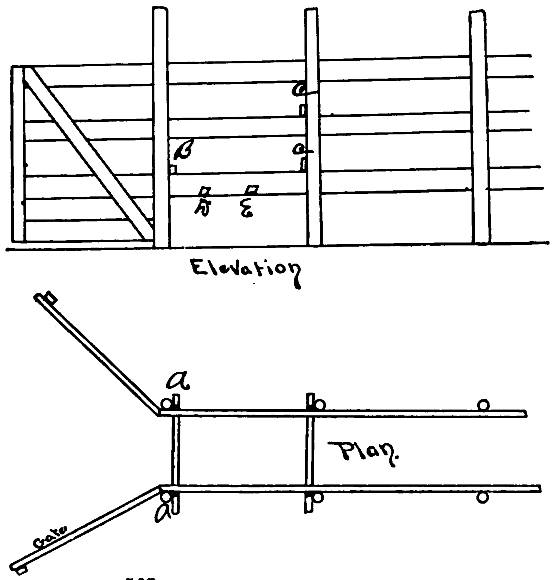


FIG. 567. JACK PIT FOR RANGE MARES.

is put in these can be lifted around out of the way. When the mare is in with the slats in front at *C*, and the slat behind at *B*, with the planks made strong and close together and wider at the top, then the jack may not be hindered. In case the mare is inclined to lie down put two slats under her at *D* and *E* and when the service is over remove slats at *C* and if slats *D* and *E* are in remove them and let the mare out and the place is ready for another.

ANCHORING A BARN TO GROUND.

To anchor a barn to the ground by means of concrete blocks is quickly and cheaply done by means of the wooden form, a frustum of a pyramid, or a pyramid with the top cut off. It may be 12" square on top, 24" square at the bottom and 36" high, imbedded in the ground, according to the lay of the land, about 24"; holes being dug at exactly the right places and to the right depth the form is accurately placed (this is better done by the head carpenter) and the block built by ramming in concrete. Two bolts are imbedded in the concrete; they may

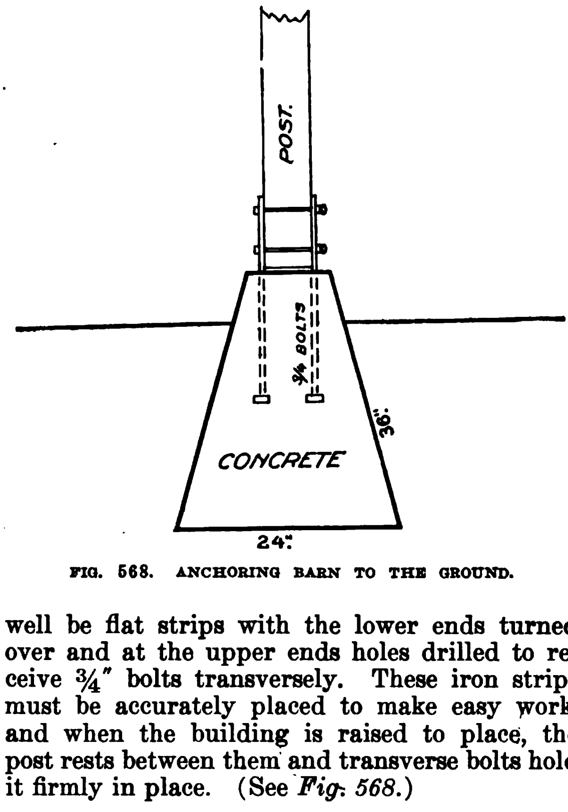


FIG. 568. ANCHORING BARN TO THE GROUND.

well be flat strips with the lower ends turned over and at the upper ends holes drilled to receive 3/4" bolts transversely. These iron strips must be accurately placed to make easy work, and when the building is raised to place, the post rests between them and transverse bolts hold it firmly in place. (See *Fig. 568.*)

RACK FOR DEHORNING AND RINGING.

The illustrations (*Figs. 569* and *570*) are of a rack for dehorning cattle and ringing hogs. For sills use three pieces 4' long and 4" x 4" mortised for bottom of posts 8" each side of center to allow the side and bottom boards to drop into place. Four posts 4" x 4" and 5' 4" long and two posts 4" x 4" and 5' 8" long are tenoned to sills. Three cap pieces 2" x 4" and 4' 2" long are mortised at ends to receive tops of posts. The caps are of oak. One oak piece in front of the cap which holds the stanchion is 2" x 2" and 4' 2" long. The lower oak piece in front of stanchion is 2" x 4" x 2' long. The lumber is 2" thick and 7' long for sides. One board, 2" x 17", 7' long, is for the bottom. For stanchions in front one board 2" x 10", 5' 6"; one board 2" x 10", 5' 2". For back gate, two pieces, 2" x 12", 4' 4" long, cut sloping to fit frame. It is put on with hinges as shown in the diagram. The gate is held up by a piece of iron 1' long stapled to the upper board at the side of the frame to allow the cattle to enter, and gate fastens when down with a forked piece of iron as shown in *Fig. 569.* Stanchions in front are bolted at the bottom between 2" x 4"

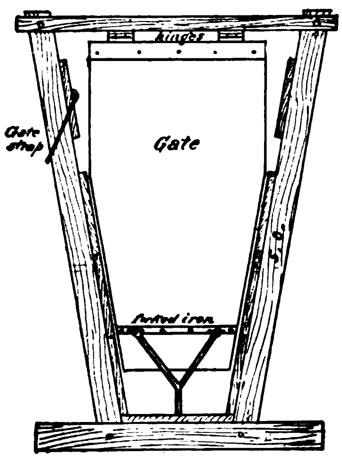


FIG. 569. RACK FOR DEHORNING AND RINGING.

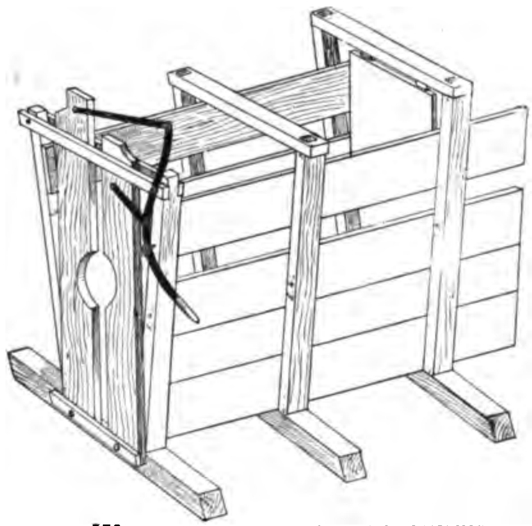


FIG. 570. RACK FOR DEHORNING AND RINGING.

oak piece and sill, leaving a space up and down in front 5" wide. Two and one-half feet from the bottom of the stanchion slope out a place for animal's neck. The 2" x 2" oak piece is bolted to side of cap with blocks to allow the top of stanchions to open and close and work with a lever as shown in *Fig. 570.* The lever of wagon tire is 5' 6" long. A 3/8" hole is punched in top of lever. The second hole is 13½" from top hole and the third hole 11" from second hole. This lever is rounded at the lower part for a handle and bent, being bolted between oak piece and cap on corner of frame through middle hole of lever. The upper hole is fastened to the left-hand stanchion by two iron straps, one on each side of stanchion. These straps are 3' long, ¼" thick and 1¼" wide. The lower hole is fastened to the right-hand stanchion with two pieces of strap iron 14" long. When the stanchions are closed bore one or two ½" holes in post back of lever, in which use iron pin to open and close the dehorner. Bore a hole outside of each post 1' from the top to put rope around to hold the head. Also spike two wedge-shaped pieces outside of stanchions, as shown in diagram, to keep cattle from getting their knees fastened.

The experience of most operators is that the saw is the best implement used in dehorning. Unless the horns are taken off very close they will bleed badly, and unless they are slanted with the natural slope of the head there will be an ugly square head, very unsightly to see. There must be some skin removed from the upper side of the horn.

A DEHORNING CHUTE.

This chute can be made any length desired, boarded on the inside with a space about 4" or 5" wide, 2½' from the ground, that will admit of a bar to be placed behind the steer after he enters the chute; 24" to 26" in the clear is wide enough for any cattle. Chutes should be at least 5' high. At the end of chute have two good posts 1 and 2 (*Fig. 571*); on these posts at top and bottom bolt two 2" x 6" pieces of elm, oak or any tough timber, 2½" apart (5 and 6). As you stand in front of chute let 5 project to the right past chute about 15", and 6 project about 8" to the left of chute; bore a few ½" holes through 5 and 6 to regulate size needed between 3 and 4 and use iron pin for these holes.

In the diagram, 1 and 2 are stationary posts at end of chute; 1 has 3¾" holes bored in it and has two iron pins driven in, projecting 2"; 3 and 4, of solid 2¼" x 6" material, stand most of the strain; 3 hangs from the top and 4 from the bottom; 7 is a bar that goes over the neck, one end under stationary pin in post 2 and other under pin put in hole in post 1; 9 is rope that goes over nose of steer, is drawn tight and held or tied; 8 is rope that works lever 4. *A* represents chute ready for steer; one end of bar 7 rests on pin, other end on ground. When steer's head is through pull up 4 and put pin in

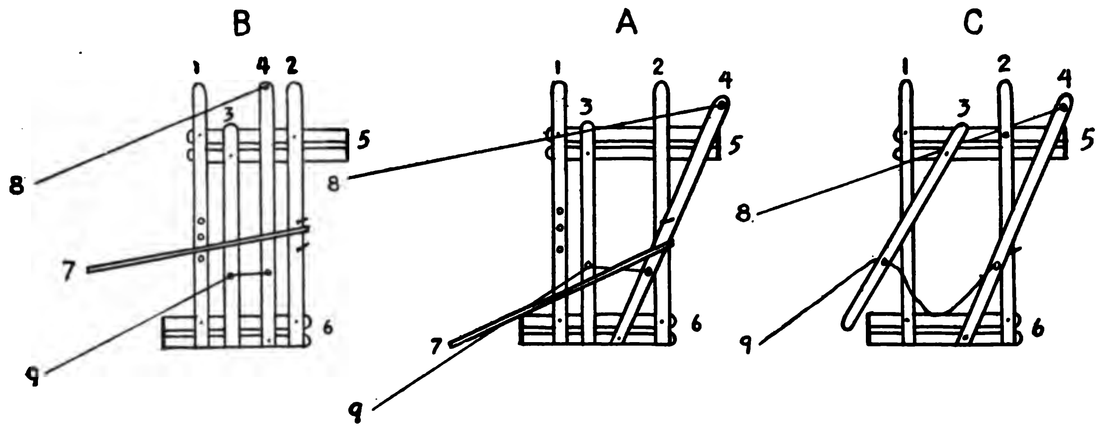


FIG. 571. DEHORNING CHUTE (CONSTRUCTION).

to hold in place, take 7 from under neck and put over neck and fasten; draw rope over nose, and fasten. When horns are off loosen rope, take bar 7 out and let 4 back. For small cattle you need not release 3 at bottom, but for large cattle let 3 back as in *C*. Cattle come out through the chute. *B* represents chute closed with steer's head out of chute between 3 and 4, bar 7 in place over neck and rope, 9 over nose. Steer is now fast and cannot get loose. About 15 inches up on 3 and 4 bore a 1" hole through to work rope 9 through. Put rope through 4 from front and through 3 from back. Three or four men can dehorn cattle through this chute very fast.

The especial chute described is 25" in the clear; between 5 and 6 about 4' 4"; the chute proper is about 7' long. It will hold a 300-pound calf or a 1,500-pound bull. It can also be used when castrating. Be sure pen is strong enough to hold cattle, and do not try to put cattle direct from pen into dehorning chute proper, but have narrow alley leading up to it. Put the best man you have at rope 8 to work lever 4, and next man to pin lever 4 in place; be sure bar 7 is in place, as in *A*, and with 7 in place you will find occasionally a steer that is too fast for the operators and goes through, taking his horns with him.

A DEVICE FOR HOLDING HOGS.

The device shown in *Fig. 572* for holding hogs by the head while ringing is simple and cheap in its construction and easy in its operation—so simple, in fact, that the mere illustration furnishes all the specifications necessary. The uprights should be firmly set in the ground and the upper piece of stocks pinioned to the upright on a pivot at *A*. By nailing boards to the uprights on both sides in the rear a small chute may be formed by means of which the hogs may easily be driven into the "trap."

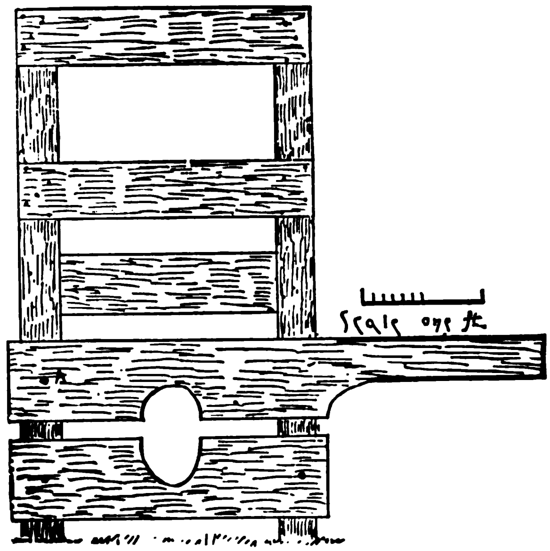


FIG. 572. DEVICE FOR HOLDING HOGS.

PLAN FOR EAR-MARKING HOGS.

Figs. 573 and *574* show a system used by A. J. Lovejoy, who thus explains it: "After using different breeding records for many years we put in a card system for keeping records. We index our cabinet by number and give each sow in the breeding herd a number. For each litter she produces we fill out a card giving the number of pigs farrowed, number of boars and sows, date of farrow and the sire of the litter. At the bottom of the card we mark on a pig's head (made with a rubber stamp) the way the litter is marked. When we sell any produce from the litter we have to write

INDEX NO. ( ) BOARS ( ) SOWS (

FARROWED

SIRE DAM

SEX	NAME	NUMBER	SOLD TO	PRICE

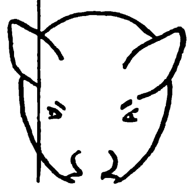


FIG. 573. EAR-MARKING HOGS (FIRST SIDE OF CARD).

one for the buyer. We also have a small pocket memorandum book showing the various litters and how marked which we carry when we go out among the pigs. When a buyer asks how a pig is bred we look at the ear-mark, then refer to the book and have the breeding for him at once. In this little book we put the sow's index number so we can refer to the cabinet when we get back to the office.

"In regard to marking pigs, there are two very good systems of marking by notches in the ears, made with a harness punch when the pigs are about two weeks old. One system is where you give each litter the same mark. This system we advise where the pig crop is large. It is as follows: Every notch of the outer rim of the right ear counts 1; inner rim of right ear, 10; outer rim of left ear, 3; inner rim of left ear, 30. For the first litter farrowed we place one notch in the outer rim of the right ear; for the second litter we put two notches in the outer rim of the right ear; this stands for two. For the third litter we go to the left ear and put one notch in its outer rim; this means three; for the fourth litter we mark one notch in the outer rim of each ear; this means four; for the fifth we put two in the outer right and one in the left—two plus three=5. For the sixth litter farrowed we put two notches in the outer left; this means six. For the seventh litter we put two notches in the left and one in the right. For the eighth litter we put two notches in each ear outer rim, making 8. For the ninth litter, three in the outer ear, meaning 9. For the tenth litter we go to the upper right ear and put one notch in that place; this stands for 10. We follow up the succeeding litters by a combination of marks in the same way. We have found this method very satisfactory for keeping the records, and when the breeding season starts we simply take the ear-mark and the markings of white in keeping sisters from the same litter identified.

"The other method for say 100 pigs and where one is dependent on outside help to attend to the breeders gives each pig of a litter an individual mark and is as follows: The right ear has a notch close to head which means 1; in the middle of the outer rim it stands for 2, and close to the top it stands for 3; just around in the inner rim means 4 and in middle of the inner rim means 5. The left ear stands for just 10 times as much. Now for the first litter farrowed we start and mark one pig with 1 notch; that stands for 1; the second pig we give mark No. 2; the third pig No. 3, and so on up as far as the litter goes by using a combination that stands for the number required. When all of that litter is marked we start with the next litter where we leave off and continue as before. You can mark up to 99 pigs with not more than 4 notches in the ear of any one pig; then when the breeding season starts you can go out and select

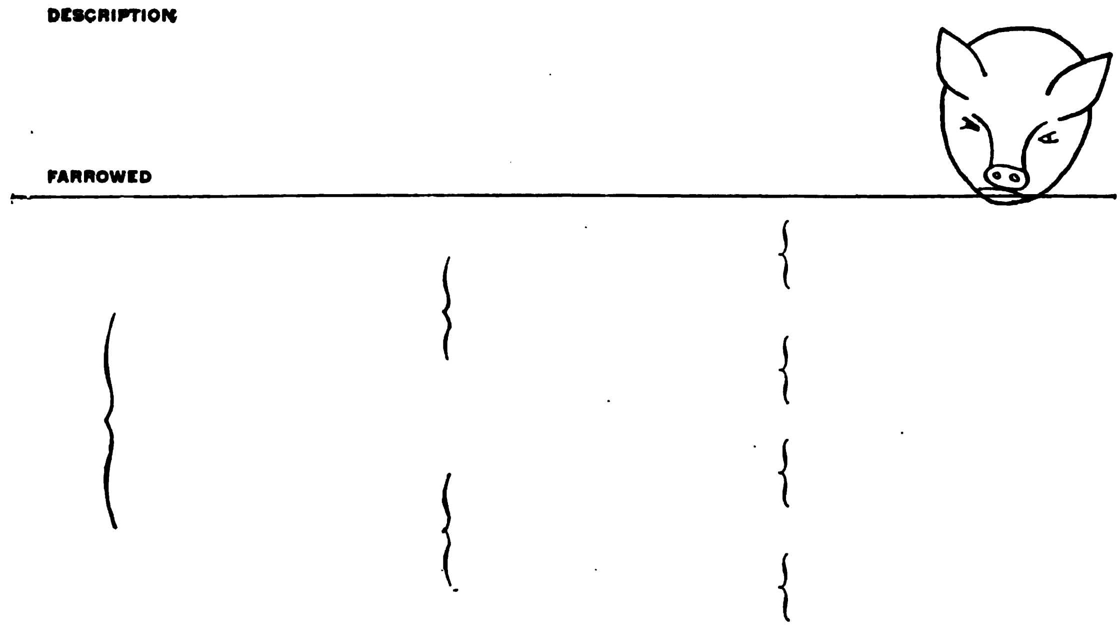
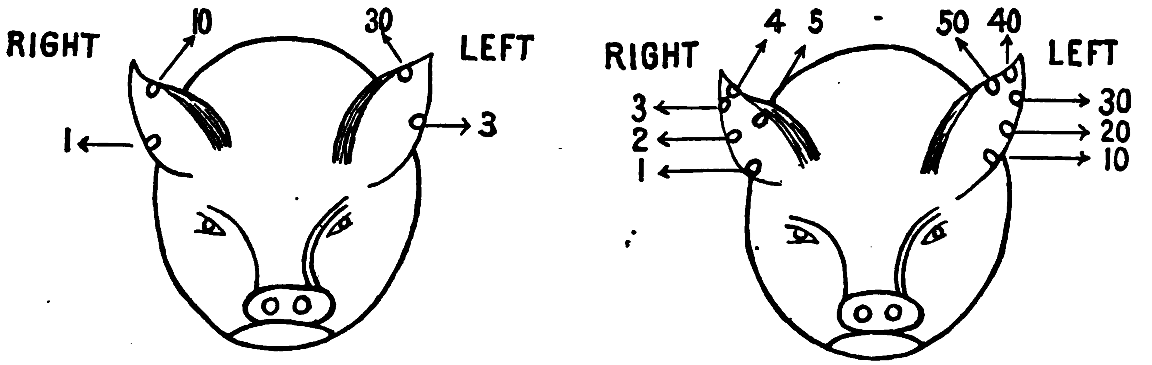


FIG. 574. EAR-MARKING HOGS (REVERSE SIDE OF FIG. 573).



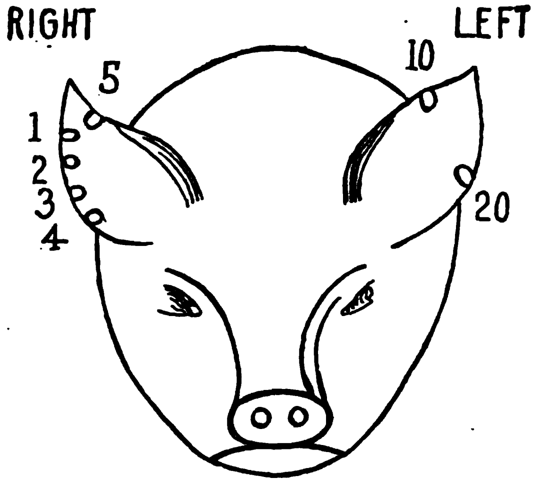


FIG. 575. PLAN TO IMPROVE FIGS. 573 AND 574.

the sows and decide as to what boars you wish them bred to; make out a list and leave it with the man in charge, saying breed gilts Nos. 8, 11, 23, 25, 30 to whatever boars you decide on. When he puts a gilt in the breeding box all he has to do is to count the notches, look at his list and act accordingly."

Commenting on the foregoing system (*Figs. 573* and *574*) an Illinois farmer writes: "Mr. Lovejoy's method requires a little book in case one forgets. Here is a system (*Fig. 575*) that is easier to keep in mind. In the lower part of the right ear are 1, 2, 3, 4. In upper part of right ear one cut means 5; in upper part of the left ear one cut means 10; in the lower part of the left ear one cut tells the number 20 is on the animal; cuts on the lower and upper ear left will call 30; the lower and upper right ear will be 9, so the animal marked that way with 7 cuts will be numbered 39. This means the fewest cuts and is easier to remember."

BULL STOCKS.

The diagram (*Fig. 576*) and description of stocks for securing a bull so that his feet may be trimmed or any other operation performed are herewith presented. Probably most of the stocks now in use at cattle breeding establishments in the Central West were patterned after the one built at Shadeland by the late Adams Earl. Such stocks are a very great convenience if not a necessity at all breeding establishments where the bull is accorded proper care.

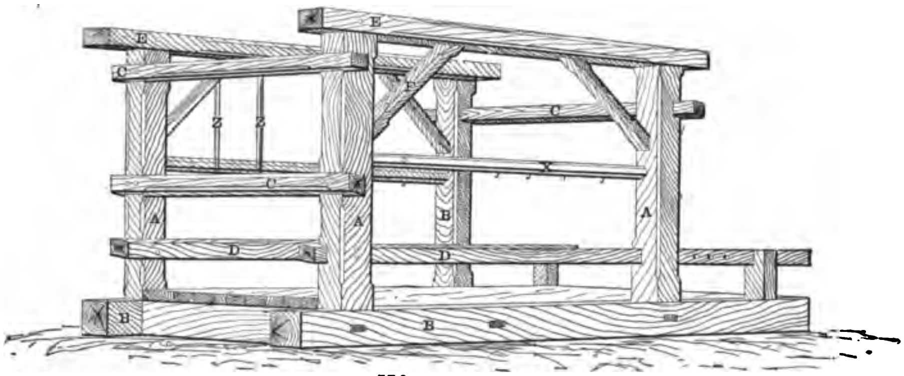


FIG. 576. BULL STOCKS.

The timber is pine or hemlock, and the floor the same, 3″ or 4″ thick. This gives a solid foundation to stand on, and in some cases the operator can trim the feet to advantage while the animal is standing on the floor. The side timber *D* should be of oak; it extends beyond the frame and there are three holes bored through it. This is to bring the foot back as follows: Buckle a strap around the foot just above the hoof (after the animal is drawn up), and bring the rope through one of these holes. This will bring the foot on top of *D*, and it can be tied there and the bottom of the foot pared off as much as necessary.

In the octagon roller are hooks to which the chains are fastened and two holes are bored in the roller to hold iron rods used in turning the roller and drawing the animal up. The chains are ordinary trace chains, five on each side. The belt is made with an iron rod on each end 1″ in diameter, and the belt is fastened around this with chains attached to rods. Use heavy leather. The drawing shows the front of stocks. The round sticks *Z Z* are removable from the top, usually taking out one until the animal is led in and placed, then put the other one in, thus making the head secure. There is only one timber across the rear end of the stock, as shown by *C*.

It is a good idea to let the animal stand awhile in the stocks before drawing him up, and the time can be utilized in trimming off the ends of the hoofs with a chisel. The tools commonly used are a heavy mallet, an inch-and-a-quarter chisel and two crooked knives (right and left), such as blacksmiths use. The bottom of the feet often require attention and this can be done best by swinging the animal up and drawing the feet back and using the crooked knives. The dimensions of timbers are as follows: *A*—6″ x 6″ by 7′ 6″; *B*—6″ x 6″ by 9′ 1½″; *C*—6″ x 6″ by 4′ 10½″; *D*—4″ x 4″ by 9′ 1″; *E*—6″ x 6″ by 6′ 8½″; *F*—4″ x 4″ by 2′; *X*—Octagon roller, 6′ 6″ long, 8″ diameter; size of belt, 2′ 11″ by 5′ 3″; length of chains, 3′ 5″ (five chains); *Z*—Round oak sticks; 1¾″ in diameter by 3′ 8″ in length (15″ apart). Distance between *D* and *B* (base) is 7″.

POULTRY DRINKING FOUNTAIN.

A simple drinking fountain for poultry (see *Fig. 577*) may be made as follows: Place an

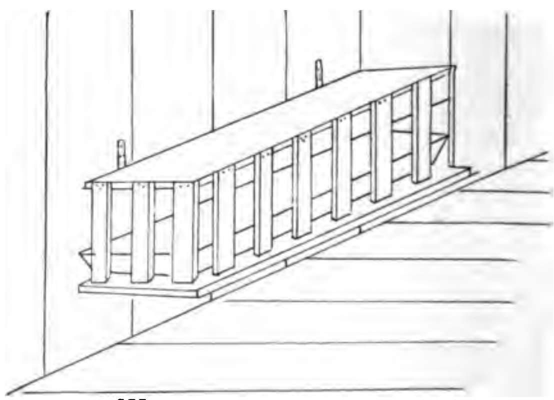


FIG. 577. POULTRY DRINKING FOUNTAIN.

ordinary milk-pan on a block or shallow box, the top of which shall be 4″ or 5″ from the floor. The water or milk to be drunk by the fowls is to be placed in this pan. Over the pan is to be placed a board cover supported on laths about 8″ long, nailed to the cover so that they are about 2″ apart, the lower ends resting upon the box which forms the support of the pan. In order to drink from the pan it will be necessary for the fowls to insert their heads between these laths. The cover over the pan and the laths at the sides prevent the birds from fowling the water in any manner except in the act of drinking. Where drinking-pans of this kind are used it is very easy to cleanse and scald them with hot water as occasion demands. This arrangement can be carried a little further by placing a pan or what would be still better a long narrow dish, something like a tin bread-tray, on a low shelf a few inches from the floor, and hinge the cover to one side of the poultry-house so that it can be tipped up in front for the removal of the dish or for filling it with water. Whatever device is used it must be easily cleaned and free of access to the fowls at all times.

FENCE-BREAKING BULLS.

A block of wood is screwed on to each horn (see *Fig. 578*), and a wire stretched from block to block and also to the nose ring, as shown. So long as there is no pressure on the wires between

FIG. 578. FENCE-BREAKING BULL DEVICE.

the ring and the horns the nose ring is simply held upwards without any discomfort to the animal. Should the bull rush any other animal or attempt to get through any fence, the pressure pulls the nose ring upwards, causing considerable pain. It requires very few experiences to teach the animal that any misbehavior on his part is attended by suffering to himself. In place of the blocks on the horns the latter are sometimes bored through near the point and the wires secured. The blocks may also be put on in different ways, the object being to bring the wires from the horns to the nose away from the head and face.

A HOG SHIPPING CRATE.

The illustration (*Fig 579*) shows a strong shipping crate for hogs. It should be well built of pine or other light wood. For sheep a similar construction is good but ½″ lumber is heavy enough. About 16″ wide, 3½′ to 4′ long and 30″ to 36″ high are the right dimensions for a sheep crate. If it is to go a long journey wire in a small tin pail on one corner, so that the sheep can be watered. One can put a lot of green clover or grass in the crate at the begin-

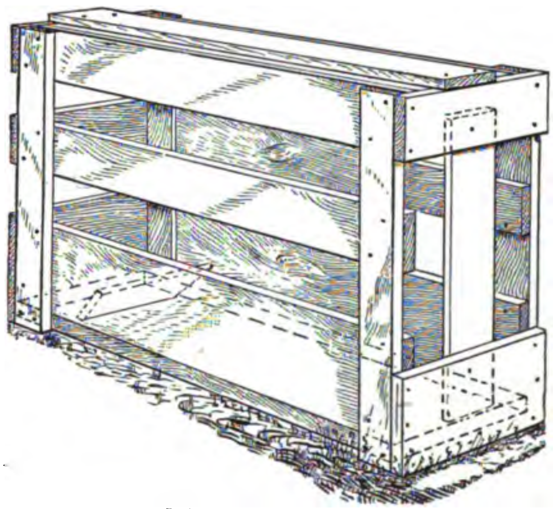


FIG. 579. HOG SHIPPING CRATE.

ning of the journey. Do not try to feed much grain nor to send a bag of it along unless a very dilute chop, mostly of bran, for a short period of starvation is better than feeding by expressmen. A neatly-built crate, a shipping tag bearing the shipper's name and that of his farm will often aid in selling stock.

A SINGLE POLE HAY STACKER.

Fig. 580 shows a simple stacker that any farmer can make by having the one pole 20′ to 30′ long. The boom on this will swing over the stack by leaning the main pole toward the stack. The trip rope can be worked either by the man on the stack or load. *Fig. 581* shows what is known in some sections as the Crowe stacker. It will build a stack fully 25′ high if

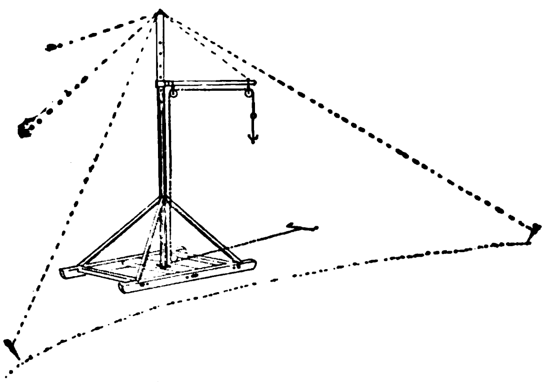


FIG. 580. SINGLE-POLE HAY STACKER.

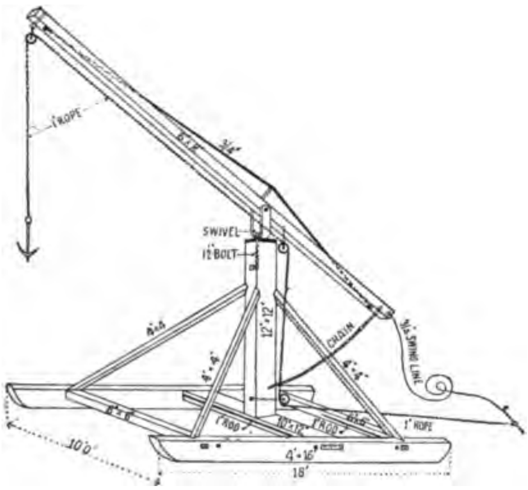


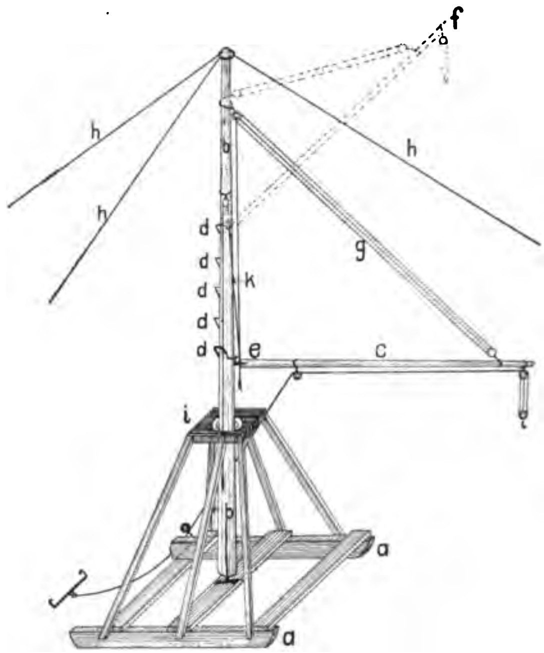
FIG. 581. CROWE HAY STACKER.

needed. With a little attention the farmer can learn to handle his hay and both load and unload his wagon and drop the hay just where he wants it.

A BOOM STACKER.

Fig. 582 shows a boom stacker which is used extensively in some of the valleys in California. It can be built any size according to the size stack which you want. The guy ropes are arranged so that the stack can be built on either side of the stacker and the boom may be used on either end of the skids. This kind of stacker will build a stack 10′ or twice the length of the boom in length and the length of the boom in width and as high as the mast and the stack that holds from 50 to 60 tons of forage.

The explanations of the drawing are by the use of the letters. The skids, *a*, are made of plank (3″x14″) 14′ long and 7′ wide, and the braces leading to the platform *i* are 2″x6″ and must be well braced with cross braces not represented in the drawing. The platform has a circular opening for the mast 3″ wider than the diameter of the mast, so as to allow the mast to lean to the further corner of the stack from the unloading point and held in place by the guy ropes *h*. This will allow the weight of the load to carry itself to any place on the stack and can be successfully used on a windy day.



A BOOM STACKER

FIG. 582. BOOM HAY STACKER.

The mast *b* is made of a telephone pole 35′ long and sets on a pivot on the skids. At the top is a wheel attached to the pole to which the guy ropes *h* are fastened and when in operation the guy ropes must be attached strongly to stakes. The boom is made of a lighter telephone pole 24½′ long and held in place to the mast by the semicircular piece *e*, and held in position by an iron rod that goes over the three-cornered piece *d*, and is raised by the rope *k* according to the height of the stack. The three-ply rope *g* is for bringing the load in place on the stack. *F* is the position of the boom when the stack is finished. This stacker can be moved and set very quickly. Slings and ground or rack nets give the best satisfaction.

Another type is shown in *Fig. 583.* Lay a 30′ telephone pole on the ground with the butt 4′ from the side of the proposed stack and about 6′ back from the end at which you will unload, letting the pole lie at an angle of about 45° with the longitudinal line of the stack. Dig holes 6″ or 8″ deep under butt of pole and drive three or four stakes behind edge of hole.

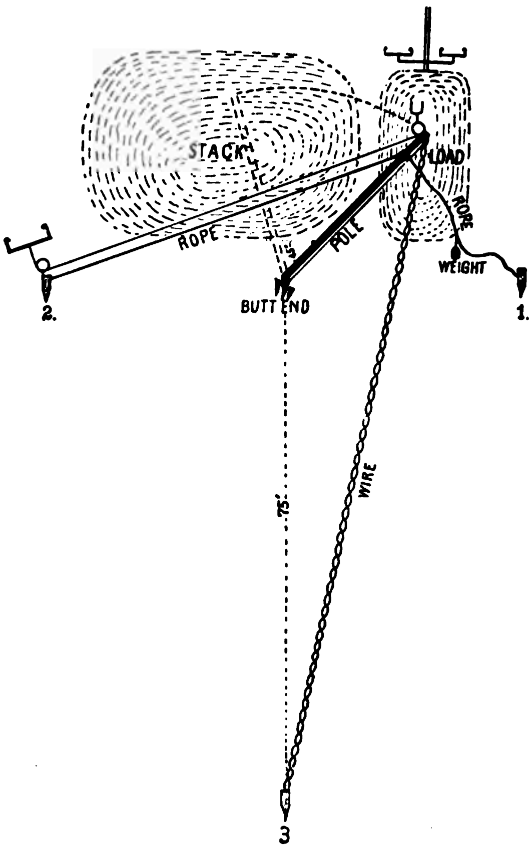


FIG. 583. ANOTHER TYPE OF STACKER.

Thirty-five feet each side of the butt of the pole and on a line with it and parallel to side of stack drive a heavy stake. Now, 5′ from top of pole spike on a heavy block to hold ropes up and tie on two ropes each about 50′ long. Do not notch the pole there. Tie the other end of one rope to stake No. 1 toward which the pole lies, leaving the end of one rope loose till pole is raised. From top of pole run four strands of No. 9 wire back to a heavy stake (No. 3), 75′ from butt of pole and on a line perpendicular to line of other stakes. Wire does as well as rope for this tight guy and is cheaper. Now tie the pulley to top of pole and one to stake No. 2. Put in the rope, tie on the fork and hitch up. Lift the top of pole to aid the horses in starting it and they can raise it into place. Now tie the loose end of the last guy rope to stake to which pulley is fastened. Adjust the guy ropes with slack so that the top of pole will swing out past end of stack over load of hay far enough so that it will not start to swing back over stack until fork full of hay is raised. Then it will swing over stack far enough to drop hay in center of stack 30′ long. A weight tied to the guy rope next to load of hay will help in pulling pole back. By tying a stick in the rope a few feet above the fork, the pole will swing without raising the load to the top. This is an advantage while the stack is low or when the wind is strong. By using a long pole so that side of stack is kept clear of pole and guy ropes, this derrick works very satisfactorily. If the pole rubs the stack it will make it settle out of line.

ONE-POLE HAY STACKER.

Fig. 584 shows another type of single pole hay stacker. Take a pole 30′ to 40′ long and 3 ropes 60′ to 70′ long. To raise the pole put on a good load of hay; put the top of the pole on the load and the butt in a hole in the ground about 8″ deep. Now put on all the ropes and the fork; stake the two side ropes and pull the

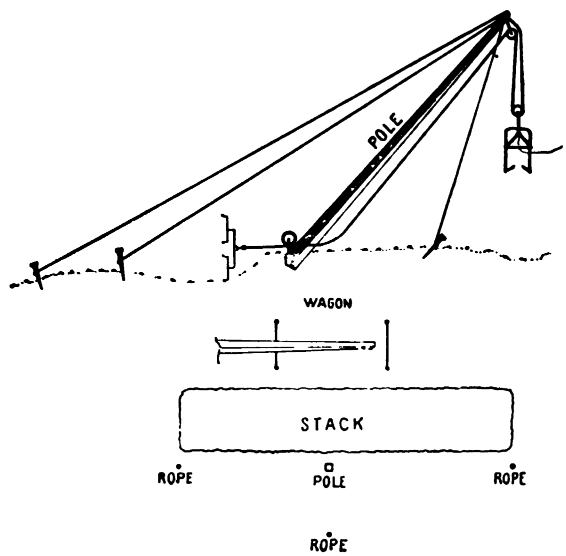


FIG. 584. ONE-POLE HAY STACKER.

pole up with the team and snub the rope with the team around a solid stake previously set. Let the pole lean so the fork will hang over the middle of the stack. The two pulleys are fastened with short pieces of rope or chain on the pole. To build two stacks alongside of each other simply swing the pole over to the other side and change the middle rope over the stack to the other side.

RETURNING HAYFORK TO THE LOAD.

Fig. 585 shows a simple arrangement of ropes and pulleys, by means of which the horses pull the loaded hayfork up into the barn and return the fork to the load. The rope *a b c d* is the regular hayfork rope to which the team is hitched at *d*. The small rope *a y d*, which passes around a pulley at *y*, is tied to the large hayfork rope at *d*. When the team travels from *d*, towards *y*, the hayfork moves from the load up into the barn, and when the team returns to *d* the fork is pulled back to the load by means of the light rope. The fork is unloaded with the trip rope *r* as usual. If the driveway is inside the barn, a different arrangement of pulleys will be necessary.

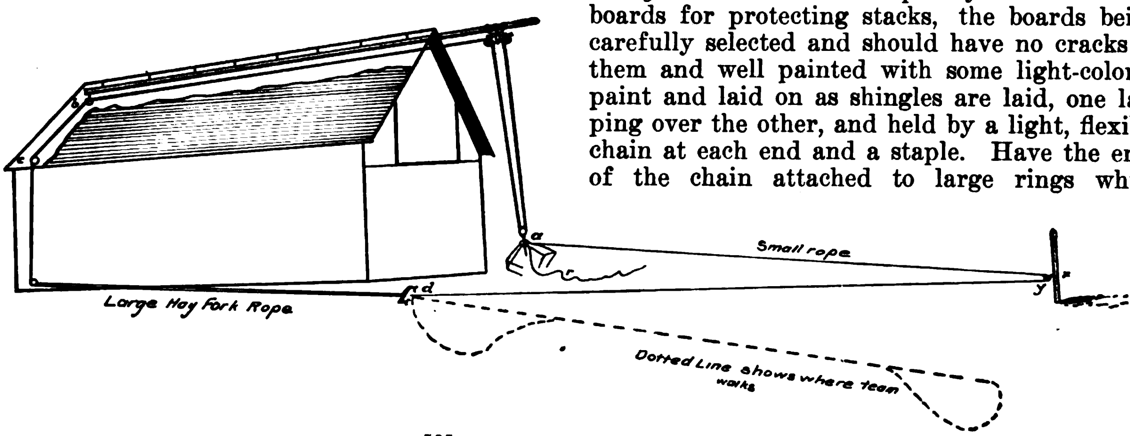


FIG. 585. RETURNING HAY FORK TO LOAD.

A SEED CORN CRATE.

Fig. 586 shows a seed corn crate suitable for about 76 ears per bushel. The corner posts 1″ x 1″ x 13″ hardwood; end slats top and bottom ½″ x 2½″ x 11″ hardwood; end slats middle ½″ x 2½″ x 11″ soft wood. There are 12 slats for slides, top and bottom, ½″ x 3″ x 30″ soft wood. The side slats are dropped ½′ from ends of posts to make spaces between them smaller. This crate, 13″ x 11″ x 30″, will hold a bushel of ears from 9″ to 11″ in length.

PROTECTING STACKS FROM WEATHER.

Fig. 587 shows a temporary roof of inch boards for protecting stacks, the boards being carefully selected and should have no cracks in them and well painted with some light-colored paint and laid on as shingles are laid, one lapping over the other, and held by a light, flexible chain at each end and a staple. Have the ends of the chain attached to large rings which slip over slender poles driven in the ground and with headless spikes driven in like barbs so the winds cannot lift the roof. Bore one small hole near the lower edge of each board so that a wire will tie the two to the chain and not injure the board as staples might. Select lumber not apt to warp or spring and before using paint it well on both sides. Explanation: 1. Boards laid lengthwise of stacks. 2. Wire chain or heavy

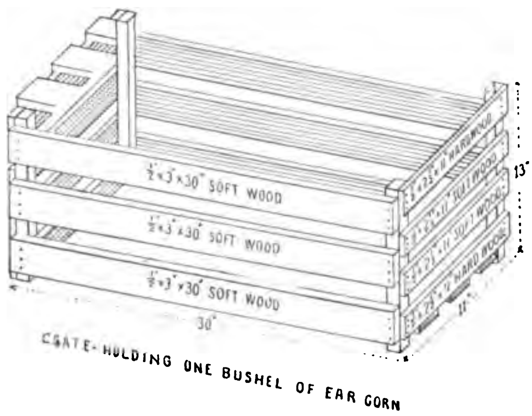


FIG. 586. SEED CORN SHIPPING CRATE.

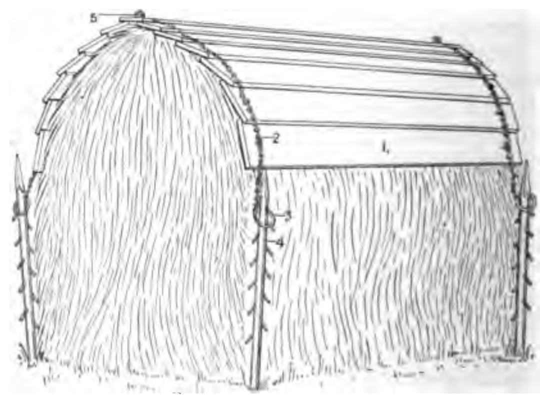


FIG. 587. DEVICE FOR PROTECTING STACKS.

wire stapled to boards. 3. Iron ring. 4. Tough slender posts, anchored with rows of headless spikes to catch rings as stack settles. 5. Hooks to connect with two sections.

CURING PEAVINE HAY.

The accompanying engravings (*Figs. 588* to *590*) from photographs supplied by the Tennessee Experiment Station illustrate a method of curing pea hay. This rack is made to be taken apart when not in use. It affords a means of permitting free circulation of air through a cock of peavine hay, thus greatly promoting the uniform curing of the hay.

FIG. 588. RACK FOR CURING PEAVINE HAY.

FIG. 589. RACK FOR CURING PEAVINE HAY.

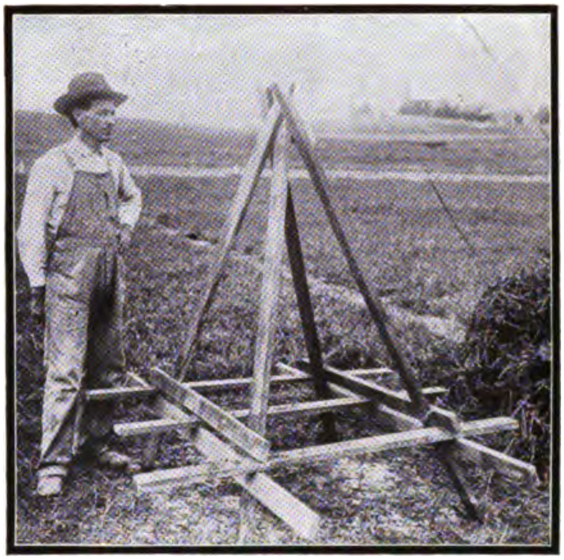


FIG. 590. RACK FOR CURING PEAVINE HAY.

DEVICE FOR COVERING STACKS.

A simple and inexpensive device for the preservation of hay put up in ricks or stacks (*Fig. 591*) is constructed as follows: Use common boards 12′ to 16′ long, a foot or more wide, putting one on top of the rick first, then slipping one on each side under the top one about two inches and fastening by driving a common fence staple over a No. 9 smooth wire just at the edge of the upper board so as to make a sharp bend

FIG. 591. STACK-COVERING DEVICE.

in the wire over the edge of the upper board, and so on down as far as wanted; six to eight boards on each side are generally enough; then fasten a good-sized stone in the end of the wire and the thing is finished. Use two wires to each length of board about 2′ from the ends and as many sections as may be needed for the length of rick, putting the middle section on last with the ends lapping over the next ones. In using the hay a single section is taken off by drawing out the staples and the rick cut down so as to leave the cover over the remainder. Boards and wire can be used over and over again.

A PORTABLE HOG LOADER.

A device for loading hogs and sheep that is very handy, light and strong is shown in *Fig. 592.* It can be moved readily or it can be backed up on a wagon and by a rope or chain attached to the wagon bed and hauled to the distant pen or lot where hogs are to be loaded. It saves moving the hogs from their fed-lot to some

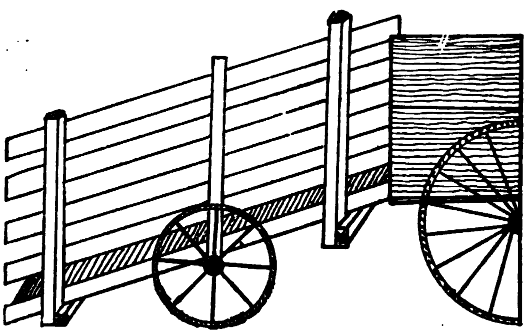


FIG. 592. PORTABLE HOG LOADER.

strange place or corner, which always excites or worries some of them. By the use of a hurdle or two as many can be cut out from the drove as will load the wagon, or the chute and wagon can be backed up to the door of house or pen and the hogs enter the wagon without any worry.

The cut (*Fig. 592*) represents one side of the chute set ready to load into the wagon. It is easily made. The bottom is two 12″ boards, 1″ thick and 10′ long. Each side has one board of the same dimensions and two boards 6″ wide and 1″ thick, with space of 4″. This makes the side 2′ 8″ high. The two uprights are 2″ x 4″ with a mortise 4″ x 1″ at top and bottom to receive ties that are tightened by a draw pin. The lower ties support the floor and are 16″ from the end of the floor boards, which also rest on the axle of the old buggy wheels used for moving the chute. A third or middle upright has a slot cut in the lower end large enough to drop down over the axle. By cutting the slot 4″ deep the ends extend below the axle 3″ and a 40-penny spike or wooden pin put through the upright just under the axle will keep it in place. The chute is 2′ in the clear and the bottom board of the side is nailed to the floor, which helps to stiffen the floor and sides.

It will be more convenient to make the chute without the middle uprights, and before locating them place one end of the chute in the wagon bed and the other end on ground. Now put the axle and the wheels under the chute and locate so the axle will be a support to the bottom, and then drop the middle upright down over the axle and nail to the side of the chute, using care to have the axle at right angles to the bottom, and put in the spike or pin to hold the axle in the slots of the upright. Cleats should be nailed in the bottom to keep stock from slipping. Before loading put straw in the wagon and down the chute, which makes the hogs take more kindly to the chute.

In some cases a cast-off pair of buggy wheels and axle have been used for the chute. Of course the axle must be cut so the hubs fit neatly against the middle uprights.

PORTABLE HOG CHUTE.

This chute is made like a shed (see *Fig. 593*) and can be used for hauling a hog a short distance by putting end-gates in slides nailed in for that purpose. The cut shows one side. Use

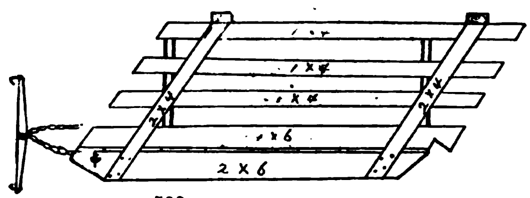


FIG. 593. PORTABLE HOG CHUTE.

a 2″ x 6″ x 16′, making the runners 6′ 9″ long; 1″ x 6″ and 1″ x 4″ should be 18′ long to cut to advantage. Cut floor boards 2′ long, and nail them 1″ apart. The angle for the end cut and standards can be found by placing one end into the wagon. Bore holes and use stay chains to pull by. It is light and convenient.

A FARM ICEHOUSE.

In building an icehouse one of the main objects is to secure isolation of the ice and to surround it with an adequate barrier of non-conducting materials. To do this a triple wall of planks or boards must be made from 12″ to 18″ apart and the spaces between each compactly filled with sawdust or straw. The bottom must be equally well secured and a drain provided for the escape of water, yet not for the admission of air. The drain as shown in *Fig. 594* is one of the cheapest and best that can be made. This drain is made by digging a hole 3′ deep and 4′ square; over this are laid logs say 5½′ long, 1′ wide and 6″ thick. This permits the water to run off the ice, but this will not be the case if the ice has been securely and properly packed. In addition to this drain is a box 17′ long made of 6″ boards in which can be applied whenever necessary a pump to draw out water. Over this box should be kept a lid so as to prevent the entrance of warm air. The dotted lines in *Fig. 595* show that between the plank wall and ice is left a space 6″ or 8″ on all sides of the ice, which is packed in with straw or sawdust, all spaces or cracks between the cakes of ice being also filled in with sawdust.

When filling the house 5″ or 6″ of straw and sawdust are put on the floor. The ice is packed solidly on this. Experience proves that this surrounding of sawdust on all sides will keep the ice satisfactorily the entire summer. The wall on which the framework is built is 1′ in height and is built of brick or stone. This icehouse is 12′ x 12′ and 17′ in height, not including roof. The house is filled in front by a door 3′ wide and 4′ high. About half of the middle (as shown in *Fig. 594*) of the ridge is cut out, leaving an opening 4″ or 5″ wide, and over this is a cap, supported by a saddle piece at each end of it, leaving an opening on each side under it for ventilation. The cap extends far enough over to keep out rain. An icehouse of this kind will cost from $35 to $60. The entire house except the foundation is made of pine lumber.

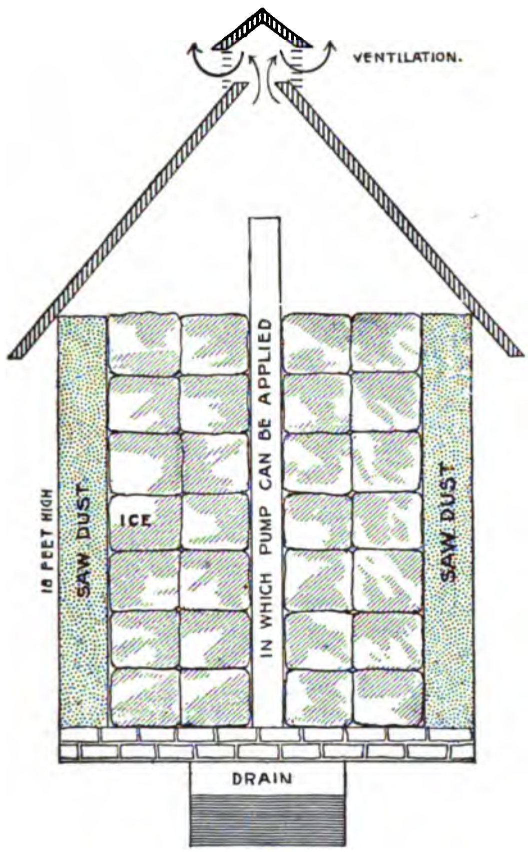


FIG. 594. FARM ICEHOUSE (INTERIOR).

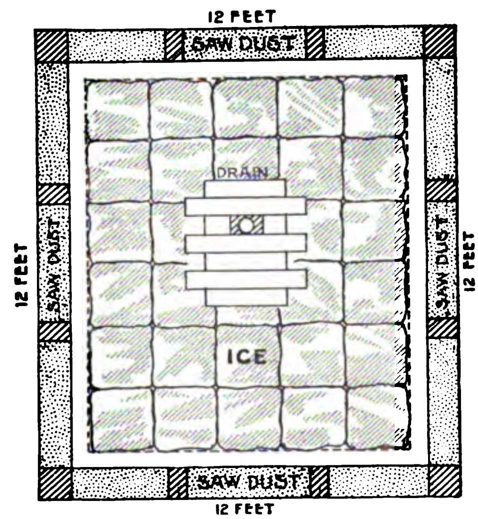


FIG. 595. FARM ICEHOUSE (FLOOR).

A CHEAP ICEHOUSE.

An icehouse to hold 75 tons of ice should be about 16′ wide, 20′ long and 12′ high (see *Figs. 596* and *597*). If the building is to be located upon high ground, a pit 6′ deep may be dug and 2″ x 6″ plates laid on the bottom and the 2″ x 6″ studding toe-nailed to them, studding being placed 4′ apart. Plates are spiked to the top of the studs and the outside covered with matched boards. A door frame is provided at one end or at both ends if greater convenience in filling

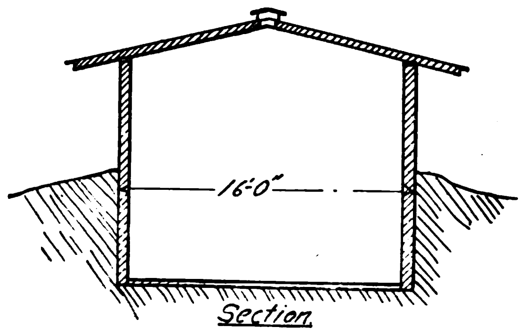


FIG. 596. CHEAP ICEHOUSE.

is desired. The rafters need not have more than one-quarter pitch but should extend well over the sides to shade the walls. The roof may be of roofing boards battened, or shingles, but should be perfectly water-proof.

The house is lined throughout with sheathing

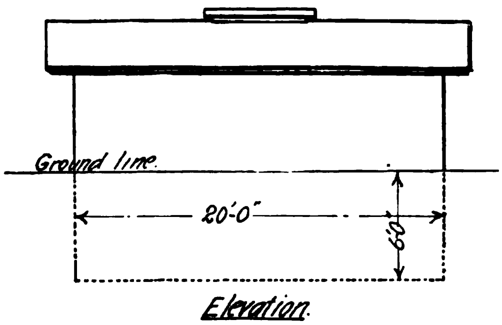


FIG. 597. CHEAP ICEHOUSE.

and the intervening space to the siding filled with packing, sawdust being preferred. The house should be provided with a ventilator to allow the water vapor formed to pass out. When filled a foot of straw or other packing should be placed below and around the ice and a covering of 2'. The door should be made as near air-tight as possible.

The amount of material needed will be about as follows: 600' matched lumber, 340' 2" x 6" studding, 12 rafters 2" x 6" x 12', 864' boards for lining, 480' roofing boards with battens, hinges and nails.

ANOTHER ICEHOUSE.

The building shown in *Fig. 599* is 14' x 16' and 10' high with a 10' wall which is filled with sawdust. When packing the ice, place it within 4" of the lining of inner wall and fill the open space with sawdust.

The building is of native lumber with matched board roof and battened. No part of the icehouse is under ground. The cellar is beneath the icehouse and the entrance to it is on the outside. The cellar is 6' x 10' and 6½' high (*Fig. 598*), inside measurement, but can of course be made any desired size. The top of it is in the form of a half circle or arch, the middle of which extends 2' up into the icehouse. The walls are of brick plastered over with cement. The side walls are 8"; those of the arch 4", plastered outside and inside with cement. When building the arch, a wooden support should be used, which is made of 6" fencing supported by a 2" x 4" on each end. Two of these supports are required placed about 2' from each end of the cellar and are covered with 6" fencing laid lengthwise of the cellar. All of these wooden structures are removed after the brick arch is made.

A drain tile extends around the outside of the cellar and enters the one which drains the cellar. The outside cellar door is raised and lowered by a weight and pulley. The only ventilators to the cellar are three 2" auger holes in the top of inner door; these seem to be sufficient

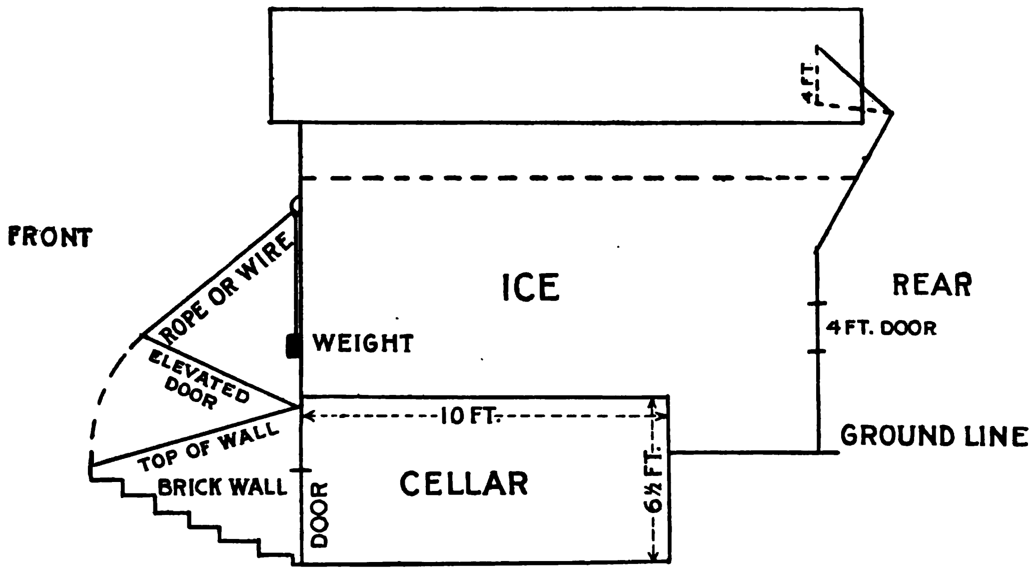


FIG. 598. ANOTHER ICEHOUSE (OUTLINE).

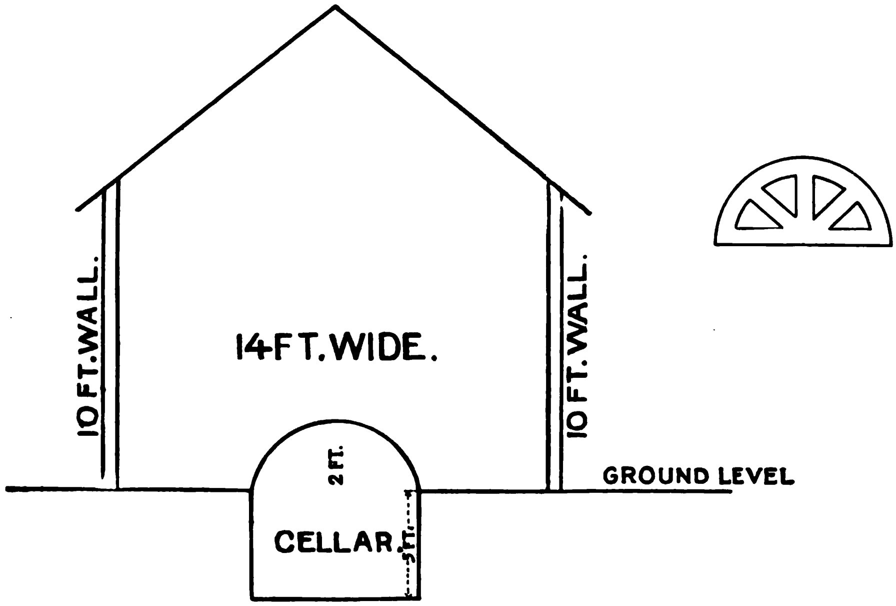


FIG. 599. ANOTHER ICEHOUSE (OUTLINE).

A COMMERCIAL ICEHOUSE.

The icehouse shown in *Fig. 600* and *601* was built a few years ago in Muscatine Co., Ia., by W. M. Lambing to supply a superior quality of ice to a limited number of consumers in a near-by city. It is 36′ x 60′ and 22′ to the plates, 6′ of this height being below ground and the re-

FIG. 600. COMMERCIAL ICEHOUSE.

maining 16′ above. The building holds about 1,400 tons of ice and cost about $1,500. A stone wall 2′ thick encloses the basement. The studding used is 2″ x 10″, placed 2′ apart. Tar paper is placed on each side of the studding, forming a 10″ dead air space. The floor is made of cinders spread 4″ deep and a 4″ tile drain leads out from one corner, which is lower than the other corners. The inside lining consists of 8″ flooring put on diagonally and the outside is covered with 8″ drop siding nailed on diagonally, as shown in the engravings. The

FIG. 601. COMMERCIAL ICEHOUSE AND LOADER.

building attached to the icehouse contains a 6-horsepower gasoline engine which hoists 4,500 pounds of ice per minute with the elevator shown standing in the water.

SUGGESTION FOR SMALL ICEHOUSE.

We do not advise the placing of cooling rooms in the icehouse. The ice soon melts around the room, leaving great air spaces that cause the ice rapidly to disappear. Ice should be kept in as solid a pile as possible and be taken out of the house only from the top and carefully covered up again. Better build a home-made refrigerator by placing two boxes together, one inside the other, with two or three-inch space between filled with some kind of non-conducting material like sawdust or mineral wool. Put in galvanized bottom inside, make deep enough to hold the drip or melting of the ice for a day or so, with outlet properly guarded. Make two doors, one for each box and reasonably tight, the upper one balanced with rope and weight. Make a shelf in one end to hold a cake or more of ice. For dimensions say about 6′ long 20″ wide and deep, all inside measures. Ice piled in one end every day or so can be readily available without the risk of letting out all the confined cold air, as would have been the case if we had a room under the ice in the icehouse. This kind of a refrigerator is more economical of ice than those that have perpendicular doors, which as soon as opened allow the cold air to pour out. One the size mentioned will hold the milk for an ordinary farm dairy and a lot of other stuff placed on shelves above.

CORRAL FOR 7,000 ANIMALS.

Fig. 602 shows a plan for circular corrals with a radius of 100′, one a little back of the other, connected by a gateway and also by a narrow lane or chute, in the narrowest part of which should be a "squeezer" for branding mature cattle, and a dodge gate opening into either the large corral or the lesser one. By means of this gate cattle are very easily and surely assorted and the squeezer saves immensely in time and labor of branding. The small corral will be used also as a horse corral and should probably be about 80′ in diameter for easy working. The chute should be of the same width throughout, for if it is wedge-shaped there is danger of wedging, but there should be a small pen at the entrance of it where a few cattle at a time may be held and forced to pass through.

Strong fences run in diverging lines from the corrals to make it easy to pen the cattle, and along one of these fences the dipping tank may be built, with a draining platform at the exit.

It is of course very strongly built, with large posts, at least 6′ high, and boards perfectly 1½″ thick, especially along the chute. The squeezer is simply a short panel hinged at bottom and drawn together at top by lever, rope and tackle; two men can with this hold without injury the strongest cow.

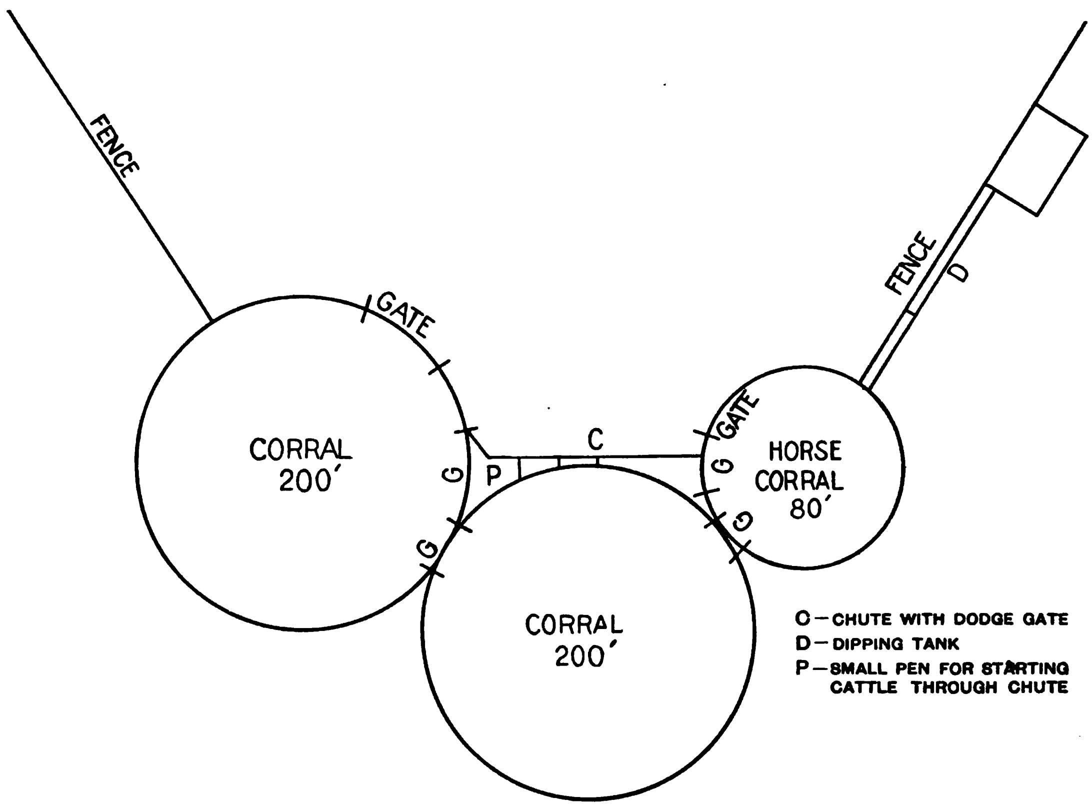


FIG. 602. CORRAL FOR 7,000 ANIMALS.

HORSE-BREAKING CORRAL.

Corrals for horses should be built higher and stronger than for cattle, as they run faster and strike the opposite side with great force before they can stop. A corral proportioned as 50 to 100 (*Fig. 603*) is easy to handle stock in. The

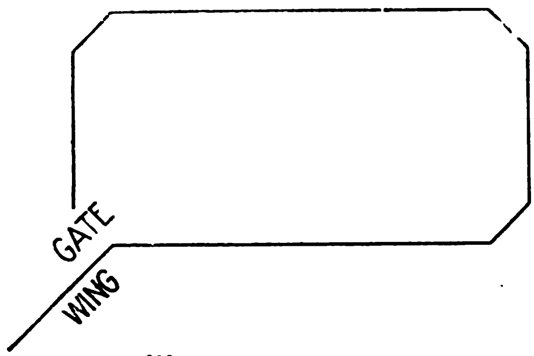


FIG. 603. HORSE-BREAKING CORRAL.

corners should be made round so that cattle cannot horn each other, and have all gates made in the corners. The outside gates should have a wing extending as shown in *Fig. 603.* The foregoing applies solely to the range business and not to the curry-comb stock.

A COLD STORAGE HOUSE.

A beef carcass requires a space about $3\frac{1}{2}'$ wide and $3\frac{1}{2}'$ long, while the average sheep and hog carcass would together require a space about 2′ wide and $2\frac{1}{2}'$ long. A refrigerator designed for neighborhood purposes should have space for a meat block, lard cans, salt pork barrels and such accessories. The maximum space that would probably be required should always be allowed, since it is cheaper to construct the building large enough in the beginning than to enlarge it later on. A drawing, specifications and building notes for a refrigerator follow:

The drawing (*Fig. 604*) shows most of the work except the drain. As to marks *A, B* and *C, A* is soldered to the bottom of the box and *C* is fastened to the underground drain. *B* is the trap and is made to slip up on *A,* thus freeing it from *C* and by turning it one-quarter way around can be pulled down from *A.* This will enable one to clean the trap and to protect it for winter. An underground trap gives trouble in freezing. Place the tile pipe for the underground drain before the floor is laid. Be sure to pitch the bottom of the icebox and drain the right way.

The ceiling of the room should be about 2″ higher on the ice side, thus causing the heated air to be brought over the ice where it will be cooled and sent down, giving good circulation. A trap door should be placed in the ceiling also, in case it should be needed for ventilation and circulation. Make the icebox strong and true, as it will get hard usage. Protect the sides and bottom with oak strips. Use care in having the air space as complete as possible and the paper smooth and well secured. The entire inside should be painted three coats, white, at completion and have in the last coat about one-quarter varnish. Paint the outside a green.

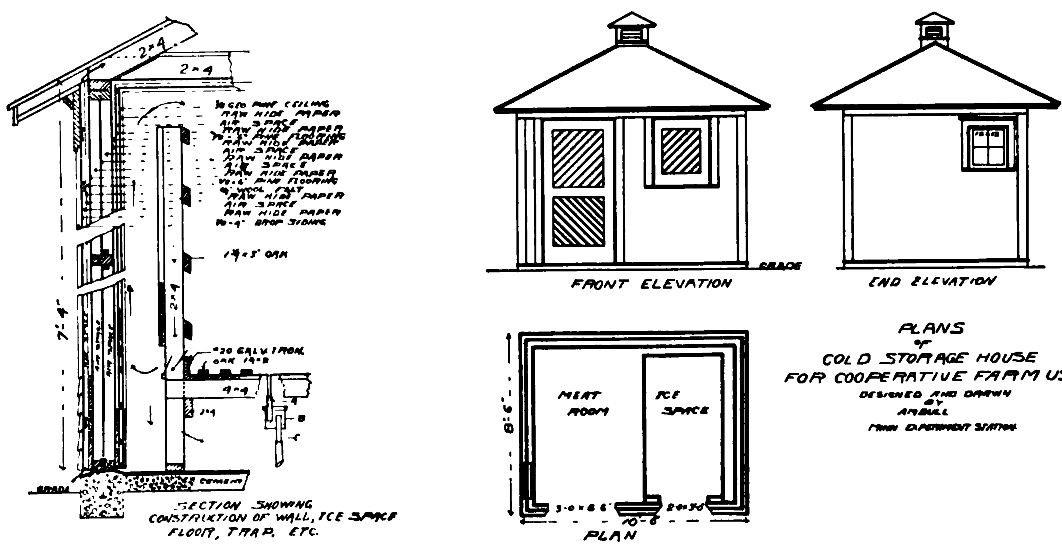


FIG. 604. COLD STORAGE HOUSE FOR A COMMUNITY.

Build in a shaded place and face the building to the north if possible. The window should be triple to make the air spaces and put shades inside to keep out sunlight. With care in construction this house should be dry and give excellent cooling results with a small amount of ice and at a cost not to exceed $40.

THE VENTILATION OF STABLES.

Climates differ so widely that it is not possible to lay down a rule of building that will be perfectly adapted to all situations. So also do breeds differ in their requirements. The dairy cow should be kept fairly warm, yet she needs abundance of pure air; the beef steer, heavily fed, cares little for temperatures, so he is dry and out of the wind. Horses need especially to have plenty of fresh air.

Sheep can hardly have too much air. Being of an essentially delicate organization they suffer severely from the poison of each other's breath. A good way to ventilate the sheep barn is to have on two sides or more a continuous series of doors; that is, make all the siding into doors and hang on hinges. This costs little more than to side up as it is usually done and is profitable from many standpoints. Let the doors be cut in two horizontally, the lower part about $3\frac{1}{2}'$ high, swinging as a gate swings, the upper part hinged at its upper edge and lifting upwards like a box lid so that it is supported by ropes with rings, or by little braces hung on hinges. It is advisable to put three strong hinges on the upper doors to keep them in shape, and as they will be exposed more or less they should be of good material. When the weather is suitable all these upper doors may be open, permitting a free circulation of air through the barn, making it practically a covered yard; and when storms blow one side or the other may be closed and only the lee side left open.

An architect and builder of stables says that "if possible there should be a continuous but narrow opening high up so arranged that the stablemen cannot conveniently close it." This should not be on the north or west side, but on sheltered sides. Draughts on the horses are sources of trouble, yet in some way provision should be made for the ingress of a great abundance of air. Windows, 2′ x 3′, put as high as the story will allow, each one hinged at the middle of the sash and controlled by a greenhouse adjuster, which can manage several windows, provide the most ready means of letting in fresh air. The hay chutes may carry off more or less impure air and should be boxed tight, with doors to open for throwing in hay. There must be provision for the escape of the air at the roof.

Milking cows seem to be of a nervous and susceptible temperament, making it necessary for them to be kept much warmer than other farm animals, so the supplying of fresh air and the removal of that which is impure is a most important matter. What is known as the King system works very effectively. It is the building of the stable to be as warm and as nearly airtight as possible, using two or more layers of wood with building paper between. (See *Figs. 605* and *606.*) A covering of plaster on the outside would be of advantage in this connection and save the wood from weather as well. Unless the stable is nearly airtight the ventilators will not work well.

Ingress of fresh air is provided above the cows. Prof. King says there should be an opening of 2′ x 2′ for 20 cows. It would perhaps be better to provide more than one opening and of somewhate greater capacity than that. Cow stables in cold climates should not be above 8′ in height, as the warm air rises out of reach

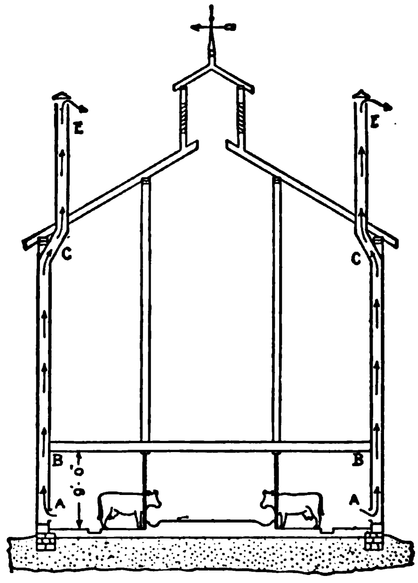


FIG. 605. VENTILATING A STABLE.

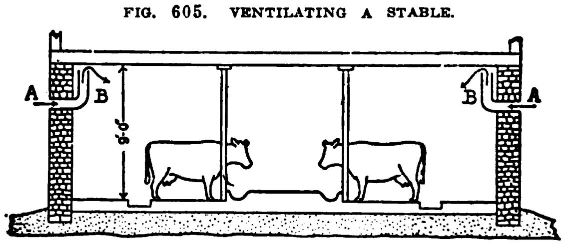


FIG. 606. VENTILATING A STABLE.

of the animal, and her body is to warm the stable. The ingress of air is through a box that starts 2′ or 3′ below the ceiling, rises and enters at the ceiling level. This rise is to prevent the thing working the wrong way and to permit the warm air to escape at that point. The doors and windows should fit well and there should be no leakage of cold air from beneath the doors. The air escapes from the stable through flues starting close to the floor level. These flues are better if they run straight up through the roof to the level of the peak. They may, however, be curved to follow the under side of the roof and escape at the peak through a cupola. These boxes in a cold climate should be of wood, else they may fill with frost in very severe weather from the condensation of the cows' breath. The size of the flues should be in excess of the size of the intakes; that is, for 20 cows there should be flues of a capacity of over 24″ x 24″ inside diameter; for 40 cows twice that amount. Warm air is lighter than cold air; the column of air in the flues is much warmer than the column outside, therefore it rises, cool air enters over the cows, flows over them, diffuses, sinks to the ground, enters the flues at that level and goes out from the building. Carbon dioxide, the poisonous product of breathing, is heavier than air and tends to settle to the floor, even though it is warm; it is thus drawn up and out. Also the coldest air in the stable is that which is drawn out. There should be, however, provision made for letting the air at the ceiling escape directly into the ventilators when that is desired. Both openings should be provided with valves that may be opened or closed at will.

ANOTHER STABLE VENTILATOR.

The object of having stables well ventilated is to furnish pure air during the time the animals are confined to their quarters. The sketch in *Fig. 607* is of a ventilating shaft for stables and box stalls which is inexpensive and at the same time admits pure air and carries off all foul gases. This shaft will furnish pure air and will carry off foul gases from large and small stables. The shaft should be about in the middle of the stable or near the heads of the horses, as shown in the sketch of stalled stable.

The best material is wood, because it does not condense the steam as it ascends nearly so much as metal, and there is less dropping of water from it. The upper end should be guarded from down draft, either by a cowl which will turn with the wind, or by a covered ventilator of tin fixed on the ridge of the roof. At the bottom a sheet of iron, considerably larger than the shaft, should be fixed about 3″ or 4″ below the mouth, so as to prevent any down draft

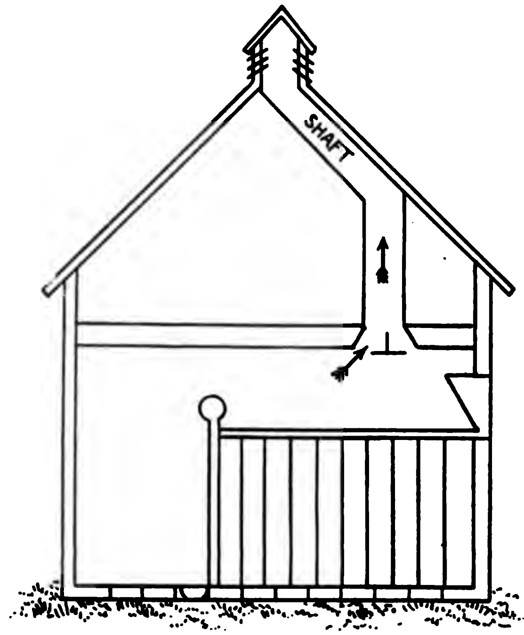


FIG. 607. ANOTHER STABLE VENTILATOR.

striking the horses, or to catch any drip from the condensations of the steam of the stable. This draft can also be used in separate box stalls as well as in stalled stables.

A shaft about 6″ in diameter is amply large for one box, and this with the ventilating window or the separate ventilator, will keep any stable in a healthy condition, if its drainage is properly attended to. There is a common notion that no ascending shaft will remove the carbonic acid gas, which is one of the results of respiration. This, however, is a mistaken idea, because all gases have a tendency to mix rapidly together and hence, although the weight of pure carbonic acid gas is so great that it may be poured from one glass into another, yet as it is given off gradually by the lungs it does not remain separate, but mixes with the bulk of the air in the stable and is carried off with it.

This system of ventilation will undoubtedly prove efficient and all right in a mild climate. The part above the roof should be fitted with Woodward's system of self-closing shutters that close on the windward side and open on the leeward side; then there will be no down drafts.

SELF-REGULATING VENTILATOR.

This ventilator is always in working order; there is never any chance for wind to blow into it, but always the air currents are out, as they should be, and when it is desired it is readily closed up tight.

By referring to *Fig 608* it will be seen that it consists of the ordinary cupola, which may be of any form, on the sides of which are hinged light-tight doors, the hinges at the top. These doors are connected by a board that holds one or both a little way ajar. Suppose the wind blows; one of them will shut and on the leeward side the other will be open. This makes it impossible for cold draughts to come down. Then supposing you wish to lessen the amount of air entering; you simply draw down on a cord that is attached to the middle of the connecting board at a place where there is a hinge, and it bends there, drawing the doors together somewhat or close up as you like. In the illustration the dotted line *S* shows the ventilators closed; *O* shows them open.

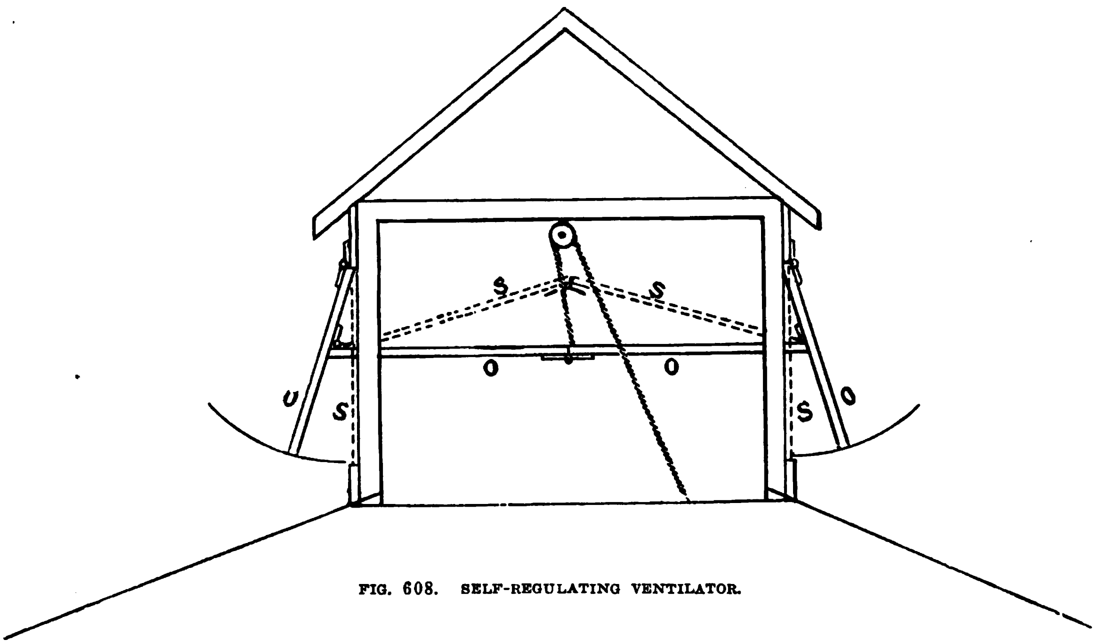


FIG. 608. SELF-REGULATING VENTILATOR.

THE WATER SUPPLY ON THE FARM.

Proximity of a source of pure water to the barn or stable is of more importance than might at first thought appear. To have a spring or running stream located a quarter of a mile from the barns often means a great deal of extra labor on the part of the work stock in traveling that distance every day for their water. Put the water even one-eighth of a mile from the barn and say the horses are watered there. Three trips a day with work horses means three-quarters of a mile of travel, and generally not over the smoothest road. This amounts to some 270 miles each year and a farmer may live sixty years on his farm. Put it low and say that he travels but 15,000 miles in watering his horses during his lifetime. Is this not an important item in farm economics?

Small streams to water live stock are usually of more detriment than value in that they are the distributers of many diseases. Swine breeders know to their sorrow the cost of watering at running streams where contagion is so easily carried with the current.

A spring high enough above the farm so that water from it may be carried in iron pipes to the yards and buildings is of incalculable value on a stock farm. Next to this comes the well and wind pump. Dug wells are sink-holes of iniquity, summer resorts for mice, toads, worms and insects, breeding places for disease germs. The drainage of the yards, distant privy vaults and sink drains is often to these wells. The driven well, put down where there are tight veins of clay to keep out surface water, is generally safe. Nothing can get in it from above. Seepage of surface impurities is almost impossible. The driven well can be put any place where it is desired, within the stable, at the kitchen door, in the barnyard or wherever it is most convenient.

Where the subsoil is of sand or gravel or is not watertight the driven well will of course afford no security against water pollution. It will, however, in any case be free from danger of invasion by rats, mice or insects. A good driven well at the house will repay its cost many times over.

Best of all is the well which is sunk clear into the hard rock. Then if the steel tubing is sunk properly there can be no fear of contamination.

A farm water supply system is thus described by one who is using it: An ordinary windmill forces the water into an underground tank, from which it is conducted by pipes where wanted. The water being forced through a check-valve from the pump into the tank fills the bottom of the tank and thus compresses the air in the top of the tank. The pressure thus obtained is sufficient to force the water into any part of the barn or house. A water pressure gauge is attached to the pipes just over the kitchen sink and shows at a glance and at all times the exact amount of pressure, obviating any liability to excess pressure and danger of breaking pipes. The pump is usually shut off at forty pounds, when a hose can be attached and the water thrown over the house or barn. The tank may be located in the cellar. It may be an iron tank 3½′ in diameter, and 12′ long, or located underground near the well. Its capacity is 30 barrels, but it is never full, as the air occupies some of the space in the tank. A 50-barrel tank for a stock or dairy farm would be advisable.

The system is very simple, easily constructed and anybody can manage it successfully. It puts the enterprising farmer on a par with the dwellers of cities as regards a water supply, and it is not expensive. Including a well 100′ deep, a windmill and force pump, tank, 1000′ of supply pipe, 400′ of sewer pipe, hydrants, sinks and bathroom fixtures this water system costs $600. It can generally be installed at much less cost than the estimate given. Very often a second-hand boiler good enough to hold water can be obtained at low cost. Any iron tank strong enough to sustain a pressure of about 40 pounds will serve. There is no danger of the water freezing, no lukewarm water in summer and there is a lively pressure at any point where it is led in pipes.

There is a simple system operating on the same plan applicable to houses. It consists of two or three of the cylindrical galvanized boilers, of about 40 gallons capacity, one of which is heated from the range. A force pump in the kitchen forces water into the bottom of the other two tanks and the air is compressed in the upper ends. This keeps the hot water reservoir always filled and gives pressure to force either cold or hot water to any part of the house. A small steam gauge registers the amount of pressure, which is usually about 20 pounds.

This system is so simple and cheap that any farmer can afford it and the satisfaction it gives is beyond calculation. Any plumber can put it in and it should not cost, piping and all, more than $40.

EARTH WATER TANK.

The plan illustrated in *Fig. 609* shows a section of a dirt tank. The dimensions are given, but the size can be suited to requirements. A 100,000-gallon dirt tank costs very little more than a 10,000-gallon cypress cistern. Hundreds of these dirt tanks have been made, and are being made in western and southern Texas.

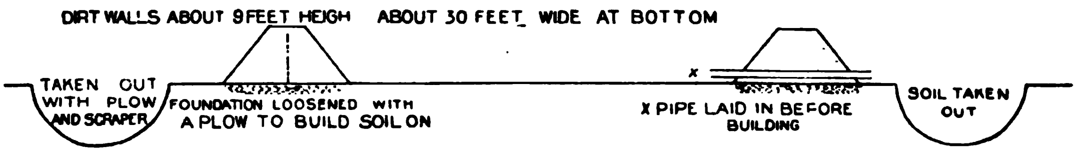


FIG. 609. EARTH WATER TANK CONSTRUCTION.

Fig. 610 shows the plan for water supply at a farm to accommodate 20 to 30 head of cattle and from 4 to 6 horses. During the summer and fall only the work horses will be to water and in the winter the cattle will have access to a spring. At *J* a waste pipe can be installed if necessary; this is the lowest point in pipe from cistern to tank. By letting water out here the danger of the pipe freezing up in very cold weather would be avoided. The plan is described thus: *A*, bank barn, 50′ x 56′ x 26′. *B*, horse stable with plank floor *M*; all the rest is dirt floor. *F C*, feed room for stable. *D D*, tanks or tubs for water in barn. *E*, level. *F*, contour of surface. *G*, level at which water must be delivered in barn which is also the level of bottom of cistern. *H*, cistern. *I I*, posts supporting conductor. *L*, pipe from cistern to tank. *K*, conductor from eave of barn to cistern. *J*, lowest point in *L*. *N*, vertical distance from surface where cistern must be located to *G*; this distance is 7½′.

An architect comments thus:

"I should build a large cistern, or if preferred a pair of cisterns side by side, building them square because that form is easiest walled, and walling with a concrete wall about 6" thick. Make the cisterns 4' wide and 12' long, inside diameter, and as deep as the water will drain from, and cover over with flat slabs of reinforced concrete. These flat covers are cheaper and easier built than arched ones and strong enough if well reinforced with steel. To make the covers first support on temporary posts a false floor of planking. Lay on this floor an inch of rich and fine concrete. Now lay down a network of small iron rods, about ½" in diameter, laying them 12" apart and in each direction. Next lay down 5" more of concrete on top of the reinforcing, finishing it with an inch of richer concrete such as is used to face sidewalks. Leave manholes to clean out with and for taking out the wooden forms. Do not take out the forms for 30 days. Wash the interior of the cistern twice with a wash of pure cement and water, as thick as cream."

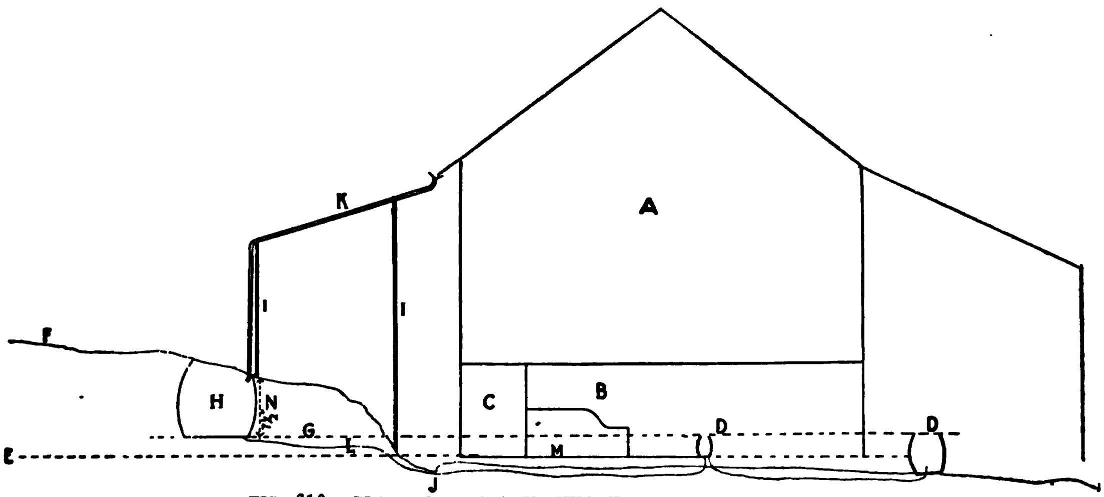


FIG. 610. PLAN FOR A WATER SUPPLY SYSTEM ON THE FARM.

BARN CISTERN TO HOLD 400 BARRELS.

An Ohio farmer desired to build of concrete above his barn in a bank a cistern 10' wide, 35' long and 6' deep. He was thus counseled by an architect:

The outer walls against the earth need not be more than 6" thick. The wall between the cistern and stable should be 12". It should also be built up solidly under the barn and against the cross timbers so that the water pressure will have no tendency to overthrow it. Then if it is well washed with pure cement on the inner side it will be as dry as any wall can be. It is not neecssary to cover this cistern with planks; a covering of one solid slab of concrete for the whole of it may be made safe to drive over with teams. It should however have in it a considerable amount of steel, and at intervals of 8' there should be concrete beams, with inch steel or iron rods imbedded in the under part of them, thrown across beneath the cover, these beams being perhaps 16" deep and 12" wide. These may be built when the walls are built; then after they are well set and hardened a temporary floor laid with its top just even with the top of the beams and an inch of concrete laid down, after which there should be laid lengthwise of the cistern and across the beams 5 steel rods, with the ends turned over an inch, the rods ¾" in diameter. Across them now lay transversely No. 2 wires, one about 8", and on the whole network of steel thus laid down put on 6" of first-class concrete. In each of the beams put four of the inch rods. Have all the metal imbedded and completely covered with concrete. Have the ends of each wire and rod turned over so that it cannot slip. Then there will be at little expense a solid concrete cover for this cistern that should endure for many centuries, whereas oak boards are short-lived and dangerous when covering a cistern in a barnyard.

INSULATING WATER PIPES.

This is a hard proposition. Words fail to convey the aggravation that is caused by a frozen water system. Underground pipes even fail at times to obviate the difficulty, as the frost sometimes reaches as far down as five feet and makes plenty of trouble. With the elevated tanks the greatest care must be taken to prevent freezing. Railroad tanks are generally kept in more or less state of agitation with drawing out and filling, but their pipes are very carefully insulated against frost.

Boxing, sawdust filling, paper wrapping and specially prepared insulating material are depended on to fight off frost. Double boxing is necessary in order to be efficient, and building paper should be used on the inner box, but even this has proved unreliable in our experience. We have finished with such makeshifts and gone to the use of special insulation made of hair-felt, which has thus far proved satisfactory. It is a regular article of trade and can be ordered through stores or supply houses. For small pipes, such as two-inch, this insulation can be obtained molded, just like the asbestos covering of steam pipes, but for larger pipes it may be applied in sheets, wrapping it around several times. A tight boxing should be built around this insulation. It requires no little care to fight off frost in the cold climates where zero weather is common. In small tanks it may be necessary to put a float valve in the bottom with wire attached, so that the inlet may be closed and the pipe drained on very cold nights.

AS TO COLD STORAGE.

We hear so much about cold storage that it is an old story to most of us, but how many have stopped to consider what the words really mean? Commercial cold storage means the "ice box" or refrigerator of every day use on a large scale. It is merely the utilization of the preserving properties of ice put into play on a larger scale. The milk could not be kept sweet for the baby were it not for the beneficent cooling properties of ice. And no matter how these cooling qualities are obtained, whether by steam and anhydrous ammonia, or by the frozen water itself, it is all the same. The whole modern packing system—that system which day by day prevents cataclysms in the market for live stock—rests absolutely on the chill rooms.

Here is a suggestion for all farmers who have not so far embraced it: keep ice on hand all the year around. In winter it comes of its own accord; in summer it can be had at small expense, considering the great benefits to be derived from having it constantly on hand. Like interest on money ice never ceases working, day or night. In the refrigerator it keeps sweet and wholesome all manner of human food. In sickness it is almost priceless.

It is not hard to keep ice, nor to transport it, except for its weight. We know, for instance, of a farm where a ton of ice is hauled seven miles every Monday morning and placed in the cooler. That is for the house of the proprietor. As much as two strong horses can draw is hauled on a big lumber wagon for the use of the men who work. The ice costs but little; the saving in the quality and quantity of fresh meats, to say nothing about milk, butter and the like, is greater than the amount that is paid out for the frozen water hauled seven miles once a week.

The place to keep this ice in such quantities is not necessarily expensive to build. A very good cold storage plant can be erected on any farm for a comparatively small sum. Once put up the cold storage will soon pay for itself. A trial to the thrifty farmer in hot weather is the lack of fresh meat and inability to kill young animals off the farm. With a cold storage plant commensurate to his needs the farmer may have continually on his table at first cost lamb, mutton, fresh pork; and when it comes to the poultry, they may be killed in quantity and stowed away for future consumption as needed, instead of having to chase them every time they are required.

There is profit and great comfort in having cold storage on a farm. Surely when it is the backbone of one of the greatest industries on earth it is worth the while of the farmer who sells to that industry to take a leaf out of its book.

PACKING FOR COLD STORAGE CLOSET.

To line a small cold storage closet opening into the pantry, with space above it for ice to be put in from the outside, use soldered galvanized iron, water-tight, especially where the ice is put, else it will cause decay in the adjoining parts. For packing mineral wool is probably as good as anything; it can be bought cheaply of any dealer in deadening felts and builders' supplies. Dry sawdust is just as good if it is kept dry. Let the ice compartment have a drain with air-trap leading safely away from the woodwork. Be sure that the doors fit closely so as not to let air currents pass through the refrigerator, else there will be great waste of ice. Double doors are best.

FARM DRAINAGE SYSTEM.

The drainage system shown in *Fig. 611* is cheap and effective and can be put in by the farmer himself with but little help. The plan explains itself fully, the principle being that the bacteria which are generated by putrefaction multiply very quickly in the first septic tank, devouring the solid matter until almost eliminated. What passes into the second septic tank undergoes the same process, but to a less amount, owing to its being purer. The liquid now flows into the primary filter, being a trench 15′ long and 3′ to 4′ deep. At its bottom is a layer of broken stone, surmounted by a layer of gravel, which is underdrained by an Akron pipe, leading the filtered water into a siphon set a foot below the bed and made of the same piping. The secondary filter, reached through the siphon, consists of an air chamber of cobblestones, above which rests three feet of double-screened gravel and sand. An 8′ pipe runs from the surface of the ground into this air chamber and by means of a force pump the purified water is raised.

The septic tanks must be water-tight and sealed practically air-tight on top by an iron manhole. The bacteria thrive without oxygen, and sewer gas will not generate unless a certain amount of air space is provided. One cubic yard of filtering space is sufficient for one person. In this plan 50′ of filter space has been provided with 15 cubic yards of filtering material in this instance, because 15 is the average number of persons supposed to occupy the farm and using it. This system is becoming popular both for private and public places.

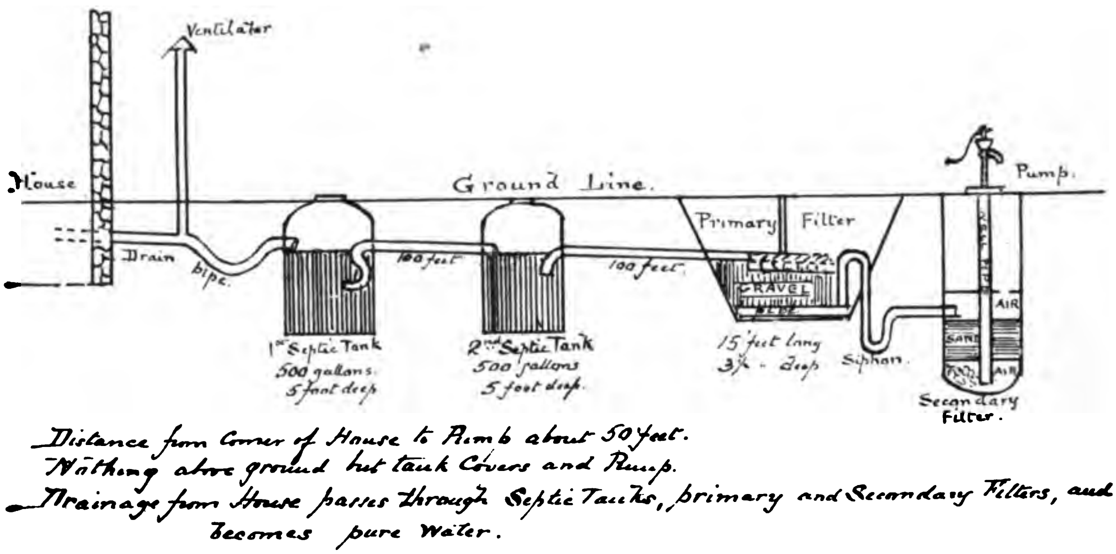


FIG. 611. FARM DRAINAGE SYSTEM.

FORMULA FOR WHITEWASH.

Take a half bushel of unslacked lime, slake it with boiling water, cover during the process to keep in steam; strain the liquid through a fine sieve or strainer, and add to it a peck of salt, previously dissolved in warm water, three pounds of ground rice boiled to a thin paste and stirred in while hot; half a pound Spanish whiting and one pound of glue, previously dissolved by soaking in cold water, and then hanging over the fire in a small pot hung in a larger one filled with water; add five gallons of hot water to the mixture, stir well and let it stand a few days covered from dirt. It should be applied hot, for which purpose it can be kept in a portable furnace. Whitewash makes things look neat and clean and is especially adapted to the inside of stables and sheds. For outside work a little tint added to it makes it better. Pretty tints of yellow are made by the use of yellow ochre. It is necessary to use considerable of the ochre. It is much lighter after it is dry than it appears when first put on. When outside plastering is done this limewash with ochre in it is admirable. The addition of ochre to the wash seems to add to its permanence and to make it less liable to rub off. The essential thing in making limewash seems to be to have good fresh lime, slake it in boiling water, add some corn starch or flour paste or paste made from boiled rice, which is supposed to make it stick, and some glue.

CONSTRUCTION OF BOX-STALLS.

Do not make them too small; 8′ x 10′ will serve, and as much larger as you can afford. Make the walls of strong material, well fastened. Have no crevices large enough for a horse to thrust a foot through. Make the walls of 2″ stuff if you want it right, say of 2″ x 6″ which may be spaced 3" between. Put this stuff on vertically, let the sides come up at least 7' high between the boxes, and if you want it right bolt it together with small bolts which cost little and are not slow to put in. Cut off the ends of the bolts smooth with the nuts, then there will be no hair rubbed off. Protect well the windows.

Some of the best stables now feed hay upon the floor of the box-stalls. Make the grain boxes

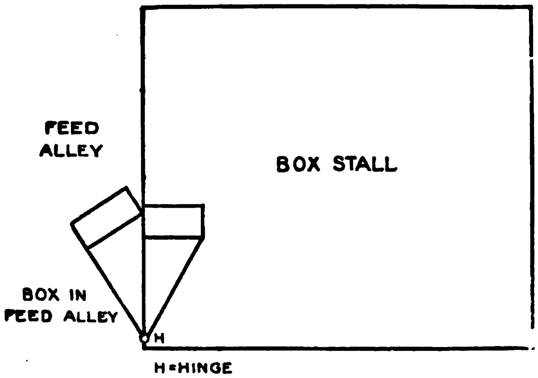


FIG. 612. CONSTRUCTION OF BOX-STALLS.

hinge to tilt outward into their feed passage entirely out of the stalls; then they will be clean when needed and the feed may be put in at any time and pushed through when needed, or at the regular feeding time. Have a sliding latch to hold the feed box either in or out. *Fig. 612* will show this swinging feed box, which costs but a trifle to make, though it should be strongly put together. Whatever may be necessary in other parts of the barn make the floors of box-stalls of natural earth. It is a luxury that the horse will appreciate. If necessary go somewhere and get hard clay for this purpose.

Box doors should slide on the inside of the stalls. They should come down within 8" or 12" of the floor, and beneath them there must be a plank 2" thick coming within 2" of the bottom of the door so that in no case can the horse thrust out a foot and get it under the door when lying down. This plank will serve to retain straw and litter in the stall and is not much to step over.

SCOTT'S COW STALL.

Joseph E. Wing describes this stall thus: There are three essentials to a perfect stall: that it be comfortable for the cow, that it keep her clean, and that it be convenient for the man who cares for the cow. The stall I describe (see *Fig. 614*) is nearly perfect in all these particulars. I am indebted to Geo. E. Scott, of Ohio, for my first knowledge of this stall, but I have since changed it slightly from his model.

The cement floor is admirable. Let it extend forward far enough to form the bottom of the feed box at *A* (*Fig. 614*). Imbedded in it set

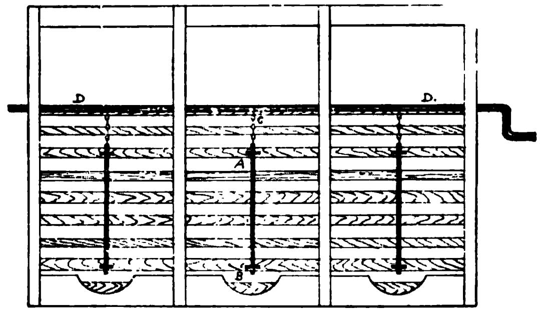


FIG. 613. SCOTT'S COW STALL.

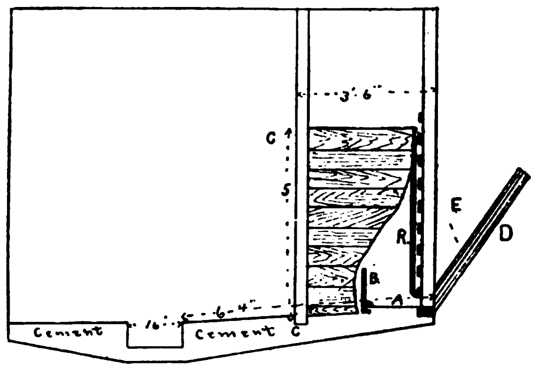


FIG. 614. SCOTT'S COW STALL.

the foot of the post *C*, and place the 2" x 4" on which rests the ends of the front posts at *A*. Let the manure trench be 16" wide and 8" or 10" deep. This depth permits the use of plenty of absorbents and also prevents the cows from stepping into the ditch either when standing in their stalls or when passing out and in. The distance back of the ditch may be 3' or more, according to space at hand. From *B* to trench let there be a slope of not more than 4". From the edge of the trench to the front of the stall at *A* the distance should be from 6' to 6' 8", according to the size of the cows to be stabled. The partitions between the cows are 5' high and 3' 6" long, and in the drawing are shown cut away to give sight of the ¾" iron rod *R*, on which slides the chain that confines the cow. This rod is best placed midway between the partitions, as then the cow can lick herself on either side.

The ends of the 1" x 3" laths that form the front of the manger are shown. They should be spaced about 4" apart. The cow draws her hay through these spaces. The board *B* is about 1′ high and hollowed slightly in the center where the cow's neck comes when she lies down. The one-quarter round keeps it solid and makes it easier for her to clean the meal out of her box. The partitions go clear across the manger and feed boxes. The sloping side of the manger *D* is tight, so that meal may be poured thereon and allowed to run down into feed box below. Hay is put in at *E*. The space *E* is not partitioned off but is continuous along the entire front row of the cows. A box for bran may easily be made below the sloping board *D*.

The advantage of this stall is that as the cow cannot push ahead, being restrained by the slats in front of her, she is compelled to drop her manure in the gutter. She will not step in this, as it would be uncomfortable for her to do so and the real and practical working of the thing is perfection. We have fitted a small stable with these stalls and the cows have never soiled themselves in it since it was made.

Place the partitions from 3′ 6″ apart to 4′, according to the size of the cows to be stabled. The partitions being high and tight prevent cows annoying each other, and being short give room to the milker and groom and also cause the cows to present a handsome appearance when viewed from side or rear. The rod *R* is bolted at each end, but if a safe fire-escape is wanted it should be arranged as shown in *Fig. 614*. Here the rod slips through the eyes of the eye bolts *A* and *B* and is held suspended by the small chain *C*. This is riveted to the 1½″ gas pipe *D*, which has a short piece turned down to make a crank at one end, as *E*. This pipe extends along the entire row of cattle and turns easily in its supports. When there is danger or the cows are to be loosened a few turns of the crank winds all the chains and raises the rods out of their places, when the cow chains slip off and the cows are free. It may pay to fit a stable with this simple device with a view of freeing cows at any time when they are to be watered or turned out. Of course the chains would be unwound before the cows are put back in their stalls. This device is, so far as I know, original with me.

THE VAN NORMAN COW STALL.

The ideal cow stall should have among other requisites the following: A fastener that will hold the animal securely, be easy to fasten when securing the animal and to unfasten when turning it out. The fastener should be so arranged that there is no danger of the animal getting the feet caught in it, and should give the maximum of liberty commensurate with cleanliness. The stall should be so constructed as to keep the animal clean and absolutely to prevent one animal from injuring another by stepping on the udder or by hooking and from frightening another by being able almost to reach it. The manger should hold the necessary feed and roughage, keeping it within reach of the animal, preventing it being gotten under foot and should be easily cleaned of all refuse matter. Often the owner of a herd of cattle desires a stall that will expose to the visitor's view as much of each animal as possible without lessening the security to his animals. A stall should be inexpensive and strong. These conditions are met fully in the cow stall designed by Prof. H. E. Van Norman of the Pennsylvania Experiment Station.

Fig. 2 represents the arrangement for two rows of stalls facing each other with the feeding alley raised to the top of the manger, allowing feed and hay to be swept into the manger and refuse to be swept out of the manger into the alley for removal. The stall may be constructed of 2″ lumber, dressed on two sides, or if it be whitewashed 1½″ stuff, rough, will hold the whitewash better than if smooth. These are standard sizes of lumber, but 1½″ dressed and 1¼″ rough are strong enough. For dairy cows of average size, stalls 3′ 6″ from center to center and 5′ from gutter to manger will be about right. The animal should have just room to stand comfortably with hind feet an inch from the gutter and front feet just back of *A* in *Fig. 3*. A desirable arrangement is to place the timber *A* 5′ from the gutter at one end of the barn and enough closer at the other end to fit the smallest animal, thus giving the stalls varied lengths.

To build the stall place the 2″ x 6″ *A* (*Fig. 3*) in position 5′ or less from the gutter, then the raised feeding floor should be built with the joist *S* 2½′ in the clear from *A*; then cut the plank *B* and fasten in place, and successively planks *C*, *D*, and *E*, holding them temporarily with a cleat until *F* and *G* are secured. To cut *F* and *G*, lay two pieces of plank on the floor, and on the one *G* (*Fig. 6*) lay off the distance 1 to 2 along the edge equal to the distance from the top of partition 2 (*Fig. 4*) to middle of manger on top of *A* at 1 (*Fig. 4*); then mark off 2-3 and 3-1, making the corner at 3 exactly square. It will make little difference if plank *G* and *P* (*Fig. 4*) do not touch at 1. When properly fitted toe-nail *G* to *A* at 1, and nail *B, C, D* and *E* to *F* and *G*; then toe-nail *H*, and *I* in place. The partition between the stalls is now held securely in place and the operation may be repeated for as many stalls as wanted.

It is well to leave the planks *B, C, D* and *E* a little long, or even square and when in position draw lines from 4 to 5 and 4 to 6 (*Fig. 3*), and saw off along these lines. The ends of the planks *B, C, D,* and *E* should be covered with a partition cap *O* (*Fig. 3*), which holds them in place and gives a finished appearance to the stalls.

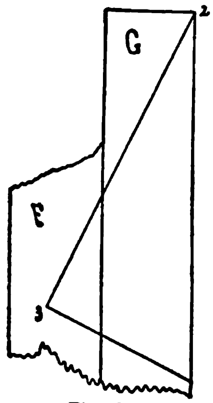


Fig. 6.

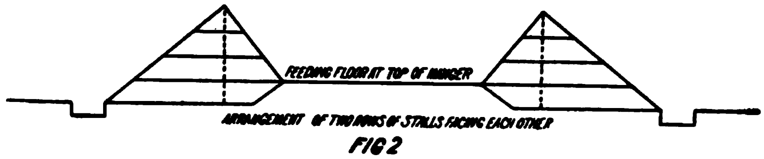


FIG 2

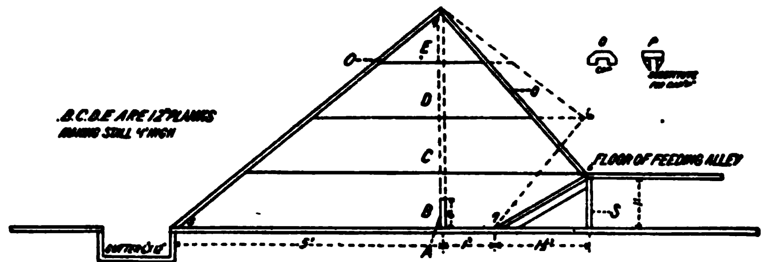


FIG 3

Fig. 7

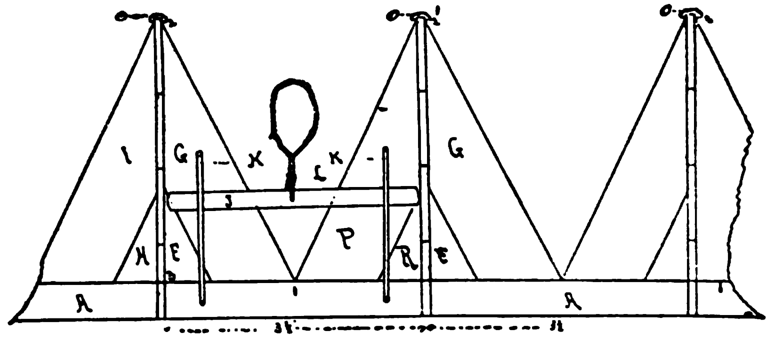


Fig. 4.

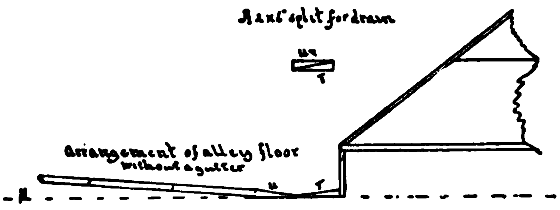


Fig. 5

FIG. 615. VAN NORMAN COW STALL SHOWING DETAILS OF CONSTRUCTION.

In the absence of the capping *O*, strips as shown at *P* (*Fig. 3*) may be used. The bar *J* (*Fig. 4*) should be 1" shorter than the distance between partitions and made of 1" x 3" light strong wood, round corners and slides behind iron staples. *K* (*Figs. 4* and *7*), are made of 1½" round iron, with nuts on the end or with a hole and key. These staples *K* should be placed 9" from the partition and lower end near the floor. In the middle of *J* place a clevis of 1" x ⅛" strap iron, in which to fasten a common chain tie. Bore a hole for clevis belt just above the middle of the bar. This bar should hang far enough from the neck to allow the cow to stand comfortably with the head in a natural position. Where conditions make the feeding alley impracticable the front of the manger may be arranged on the plan of the dotted lines in *Fig. 3.* If desired a 2" x 2" piece may be run along on top of the stalls at 2 (*Fig. 4*), though it is not recommended. It has been suggested that instead of the gutter a drop be arranged, as shown in *Fig. 5. T* and *U* are made of a 2" x 6", split diagonally.

Commenting on the Van Norman stall Joseph E. Wing says: "It is the simplest, cheapest and in some ways the most hygienic stall of them all. It gives an uninterrupted view of the cattle. It does not waste the feed. The objection to it is that cows that are wild are not so readily secured as with some other stalls and there is some noise when cattle are feeding, owing to their being fastened to a sliding bar in front. It keeps them clean and they are comfortable."

STALLS AND STALL FLOORS.

Concrete is used in many good horse stables, the only substitute being hard clay. The hard clay is best of any material for the horse, but it is not so easily kept clean as the concrete floor. It is usual to lay over the concrete a grating of wood, which may be 2" x 2" stuff, put together by long bolts running clear through and spacing the bars 2" apart. This permits of draining out of liquids and keeps the horse off the concrete.

Back of the stall there is usually put in a shallow gutter which in some cases has over it

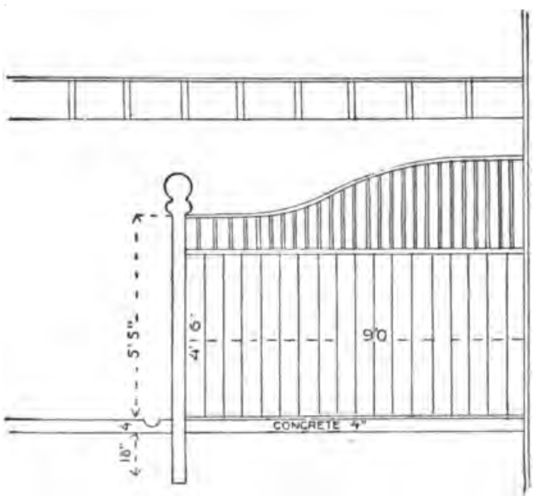


FIG. 616. STALL AND STALL FLOORS.

an iron grating. These gratings are for sale by makers of ironware for horse stables.

For farm stables many do not think this elaborate system the best one. The urine-soaked bars and floor and gutter send forth steady streams of ammonia and in some of the very finest and most costly stables visited in the East this offense was very glaring. Let the horses stand right on the concrete and use liberal allowance of straw bedding. It is abundant on the farm, and, if not, shredded corn fodder is at hand, and this will absorb the urine and put it back to the fields. Then if there is kept at hand a lot of "floats" (finely ground phosphate rock) which absorbs and sweetens, or land plaster, nearly as good for sweetening, there will come from the stable a steady stream of fertility to add to the fields. Drains leading to cisterns are an annoyance from start to finish and a constant waste of nitrogen which readily escapes at the urine ferments.

As to the cost, these floors are laid 4" thick, on a foundation of hard-packed gravel or broken stone. A yard of concrete will cover a space 8' x 10' and that yard will cost to make and lay about $5, using best cement and charging $1 for the yard of gravel or crushed stone. That is cheaper than a wooden floor 2" thick on joists and will outlast several wooden floors. *Fig. 616* shows a cross-section of good stall, the dimensions are right and the materials need not be used just as shown; the coping of iron may be of wood for economy's sake. The post should be imbedded in concrete and go at least 18" deep.

TRANSMISSION OF POWER.

A case is assumed in which a boiler is 94' distant from an engine, the engine being placed close to a barn. The steam is conducted to the engine through a 1½-inch pipe, this pipe being encased in a larger pipe. If the engine is moved back to the boiler is there any better means of transmitting the power to the barn (for sawing, grinding and cutting silage) than by the use of an endless wire rope?

Assuming that his conditions are similar to *Fig. 617,* where the boiler is located at a distance of 94' from the engine, the steam being fed to the engine through a 1½-inch pipe encased in a larger pipe which is represented by "4" in the sketch, the results obtained under most favorable conditions would be far from good owing to the condensation. This would depend largely on the size of the pipe used for the amount of steam to be transmitted, the number of bends in the pipe, the drainage of the pipe, whether it was placed above or below ground, the kind of covering used over pipe, and the weather to which it was submitted.

It no doubt would be possible to transmit this power by rope drive. The advisability of using this method would largely depend on the number of different directions the rope would have to be led in order to reach the point of application, the amount of power to be driven, the means of supporting such driving cable, and the difficulty of keeping the sheave system in alignment so that it would work satisfactorily. Upon the assumption that the location of the different buildings is similar to *Fig. 618,* and that the engine is placed close to the boiler as represented at "2," you will note that it would be necessary to change the direction of the rope driven at least four times. The first case in leading from the engine driver up in a more or less vertical direction, then around the sheave at "6," from thence to the second sheave in the power room as represented at "6," and from there to the point of application. For a distance of 94' it would more than likely be necessary to support this cable at some

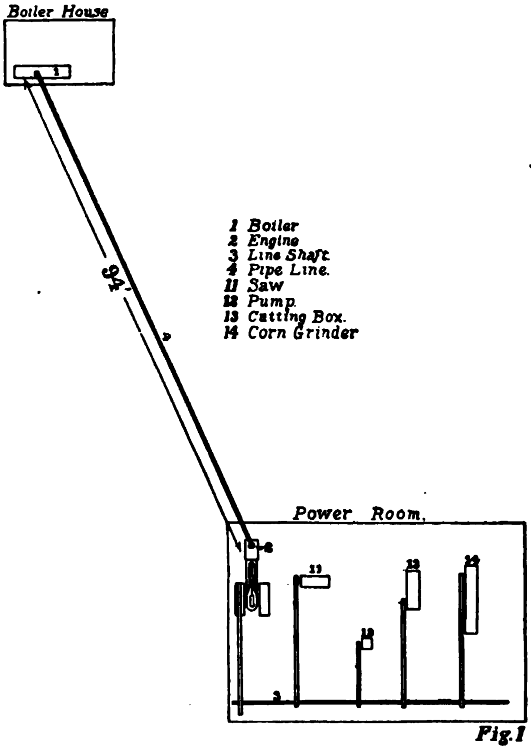


FIG. 617. TRANSMISSION OF POWER.

intermediate point between the two buildings, so that there would be an additional pair of sheaves at that point. It is also well to take into consideration the fact that this cable will be affected more or less by the weather, by expansion and contraction. In the event that it is out of doors there will be the matter of rust to be taken into consideration as well as snow and ice in the winter weather. The efficiency of such a method would be largely dependent upon the local conditions and the care with which the different sheave pulleys were aligned. The maintenance would depend largely upon the amount of power to be transmitted and the care that the system was given after the first installation.

Another method for this class of transmission, albeit a little more expensive in first cost, would be to use electrical transmission. By this method it would be possible to place the engine within a few feet of the boiler and get rid of the 50 per cent loss in condensation, then by driving the generator from the engine the power could be distributed by wires to the various

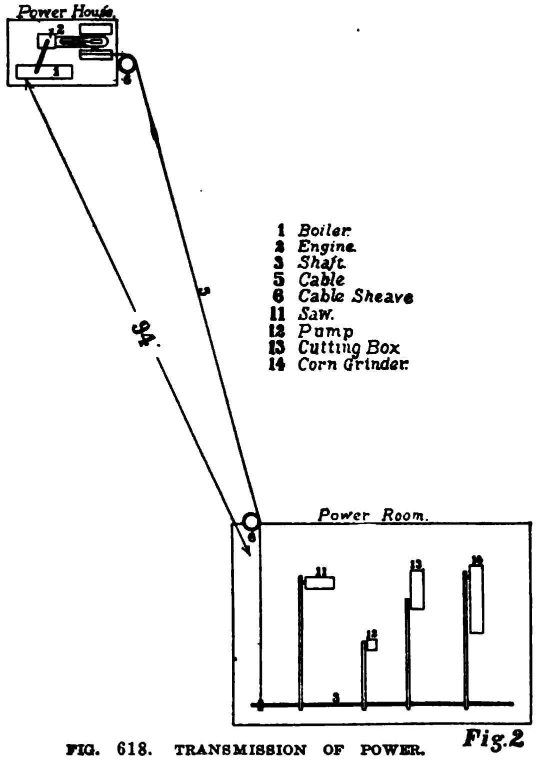


FIG. 618. TRANSMISSION OF POWER.

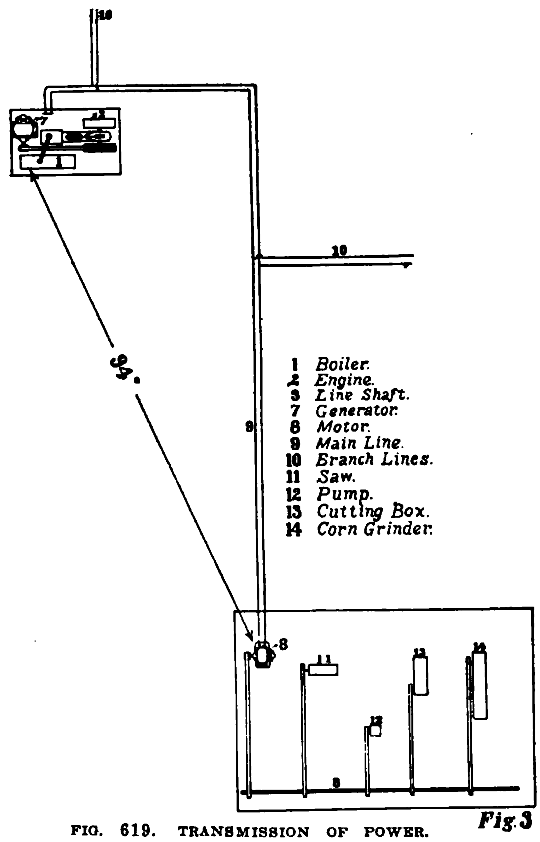


FIG. 619. TRANSMISSION OF POWER.

points of application as desired. At these different points a motor could be used, set in any position most applicable to the machine driven irrespective of the relative position of the engine or boiler plant. Such an installation is represented by *Fig. 619* showing the engine located at "2" and the generator belted from the engine as illustrated by "7." The line wire can be led through any number of different turns to the various points of application. At these different points it is customary to arrange suitable junction boxes so that the motor can be connected readily and the power obtained without further delay.

There is the additional advantage that light can be obtained from the same line wire as used for power purposes. In *Fig. 619* the main line is represented by "9," while branch circuits can be led off at any desired point as represented at "10." In some cases it has been found desirable to use a portable motor in place of the stationary motor represented at "8," which can be moved from one machine to another and connected direct by belt, replacing the line shaft "3." This is especially desirable where there is any of the machinery to be driven about the various barnyards for such applications as cutting ensilage or threshing. Taking into consideration the various advantages of electrical transmission, many think that it more than compensates for the additional first cost over the other method of rope transmission.

LIGHT AND HEAT BY ELECTRICITY.

While it is entirely feasible to heat buildings by electricity it is not practical because of the large first cost, unless a water-power of considerable size is available for large and cheap power.

The cost of operating a small steam, gasoline or kerosene plant for the sole purpose of generating heat by electricity will be altogether too expensive to consider. It is on the other hand entirely practicable to light small homes from such small electric plants. Take for instance an eight-room house requiring say about twelve 16-candle-power incandescent lights. This would require about a one-horsepower outfit to operate, and figuring gasoline at 20 cents per gallon for operating the gasoline engine the cost of these 12 lights per hour will be approximately 2½ cents total. The combined engine and dynamo for this equipment will cost about $175.

Assuming that the house is not wired and that it would have to be wired throughout, the wire, drop cords and lamps would cost about $40, and if the little power station were located some distance from the dwelling an addition of $40 might be considered for wire and installation of the power circuit, thus making the total cost of the outfit installed, ready for operation, about $250. This may be slightly excessive but is approximate.

Ordinarily, however, the cheaper plan would be to install a larger outfit, say at least 6-horsepower combined engine and dynamo. This would cost about $400 and would furnish all the lights needed for the home and barns, and if there are neighbors they could also be furnished with electric lights for their houses and barns. There would also be adequate power for operating small machines in the barns, so that by the addition of one small portable motor, much of the machinery about the place could be operated.

PROPER SPEEDS FOR LINE SHAFTS.

In figuring out the arrangement for the transmission mechanisms for the operation of groups of machinery in barns and elsewhere one of the first questions arising is, What is the proper speed for the line shafts and how shall it be figured? Custom varies somewhat on this point, depending to a large extent upon the class of machinery that is to be operated, though of course all is governed by fixed rules. If the machinery to be operated is slow-moving the line shafting should operate at slow speed so as not to require too large diameter in pulleys, giving to the operative machines their correct speeds. On the other hand, in operating high-speed machinery a higher speed may be tolerated on the line shafting, thus attaining the same end—that of keeping the pulleys as near uniform or of the same diameter as possible.

For farm use the ordinary use for line shafting should be from 150 to 200 revolutions per minute, while on the other hand, for figuring the operation of machines in woodworking factories, the speed of the line shafts might safely run up as high as 500 or 600. The slower the possible speed the less rigid the equipment need be, provided the amount of power to be transmitted is not relatively large.

It is of the utmost importance that line shafting be put in perfect alignment and that all bearings or hangers be securely anchored to firm supports. Any misalignment causes loss of power and tends to cause vibration, which is transmitted to the building. This vibration is not only detrimental to the line shafting in causing it to loosen up its anchorage and in throwing off the belts while in operation, but also tends to deteriorate the building. Upon tests it has been found in factories where the line shafting was not kept in perfect alignment that from 50 per cent to 75 per cent of the power generated at the engine was consumed in driving the line shafting and belting and only 25 per cent to 50 per cent actually used in doing useful work.

The hangers should be spaced not less than 8′ apart and when possible the pulleys should be put close to a hanger. This is done in order to keep the shaft from vibrating or sagging and so as to keep it in perfect alignment.

In laying out line shafting and belting too much care cannot be exercised in laying out the pulleys and belting. The life of a belt depends among other things upon the rate of travel and the tension or strain per square inch of section. The faster the belt travels the quicker it wears out, the same as any other piece of moving machinery, and the heavier the strain it is subjected to the quicker it deteriorates.

For ordinary work the belt speed used may be anywhere up to 4,000 feet per minute. In high-speed machinery in machine shop equipments belt speeds as high as 6,000 feet and 7,000 feet are permissible, but for ordinary work 3,000 to 4,000 feet is the common and the better practice. The belt speed is found by multiplying the circumference of the pulley in feet by the number of revolutions per minute of the pulley. The circumference of a pulley is found by multiplying its diameter in inches by 3.14 and dividing by 12. The answer will be the circumference in feet.

Using pulleys of ample face so as to use wide belting reduces the strain per square inch of suction, which adds to the life of the belt and also to the life of the machinery by reducing the pressure against the bearings which produces less friction and requires less oil to keep them properly lubricated.

In general, as large pulleys should be used as possible and yet keep within the speed of the belting given above. This is in order to prevent the belts running over too small diameters which cause them to wear out quickly by being rapidly bent forward and backward over small diameters. Wherever it is possible to avoid it, the belts should be bent only in one direction, as the alternate bending of belts first in one direction and then in the other very soon wears them out.

Crossing a belt should also be avoided because of the uneven strain that is brought to bear on the outer edges of the belt which tends to shorten its life.

Care must be taken that the driving and driven pulleys are not placed too close together so as to get too short belt centers. The longer the distance to belt centers the more arc of contact the belting has on the pulleys and the less tension will have to be maintained on the belting in order to have it transmit the power. A rule that is generally used for ordinary work is that a belt 1″ wide running at 1,000 feet a minute will transmit one horsepower.

SIZES AND SPEEDS OF PULLEYS.

In arranging groups of machinery for operation there is nothing more essential than a thorough understanding of the relationship of the pulleys to one another, and the proper speeds at which they should operate.

There are several ways of figuring the required diameter of pulleys. A simple rule that is quite generally used by engineers, is to multiply the revolutions per minute of the driving pulley by the diameter of the driving pulley, and divide this result by the revolution per minute of the driven pulley, the result giving the diameter of pulley required; or if the revolution per minute of the driven pulley is unknown divide by its diameter, the result giving the revolutions per minute. For example: Given a traction engine whose driving shaft is run at 225 revolutions per minute, fitted with a driving pulley 38″, required to know what size pulley shall we put on a feed mill, specified by its manufacturer to run at 975 revolutions per minute. We multiply 225 by 38 and divide by 975, which gives us 8.77″ as the diameter of the pulley for the feed mill. If on the other hand, the mill was already equipped with an 8″ pulley, and we wished to know how fast the engine mentioned would drive the mill with that pulley, we would multiply 225 by 38 and divide by 8, which would give us 1,069 as the speed at which the mill would run when thus equipped.

This way of figuring does not take into account any slippage of the belts on the pulleys. There is always a certain amount of this slippage of belts and for ordinary work an allowance of from 1 to 5 per cent for slippage is made, although in extreme cases there may be a great deal more.

In the case cited above, 8.77″ is not a standard commercial size for a pulley and if we allow about 3 per cent for slippage, this will give us a pulley of 8½″ diameter as the proper size to be placed upon the mill, and also bring it to a standard size that can be bought anywhere from stock. It is always desirable in figuring machinery equipments that so far as possible absolutely standard stock be used, thus avoiding vexatious delays in obtaining the parts required from time to time, either for the original equipment or for repairs to same.

ATTACHING PUMP TO POWER.

To determine what size shafting should be used to transmit power from a six-horsepower gasoline engine to mill and other machinery 16 feet or less distant, and what width of pulley and belting is required, what is the most practicable method of attaching to pump about 75 feet distant from engine and powerhouse, assuming the well being hand-dug, with water less than 20 feet from surface, pump cylinder 3½ inches. The best method of obtaining the result desired would largely depend on local conditions. On the assumption of the ground being practically level, the most practical method would be to remove the pump to power-room where pump jack could be operated direct from line shaft. This would necessitate placing a dry well underneath the power-room of sufficient depth so that the pipe leading from pump cylinder to the well would be below the frost line. Again assuming that this depth would be 6′, this would make the pump cylinder only 14′ above the water level in the well, under which conditions the pump should work entirely satisfactory providing one is careful to get the suction line air-tight. This method would work satisfactorily until the water level in the well dropped 8′, or the total distance from the bottom of the cylinder to the water level would not exceed 22′.

In the event that it is necessary to leave the pump at the well, the method of drive would depend largely on the relative position of line shaft in power-room to that of the well and as to whether the pump jack would be located in power-room or at the well. In the event that the pump jack was located at the pump, the power could be transmitted by flexible cable over suitable sheaves from the line shaft. This cable should be supported at least every 40′. In case the pump jack is located in power-room, the reciprocating motion can be transferred to the pump by means of angle levers and flexible cable.

The vacuum method, as suggested in the first place, we think would be much more satisfactory, and the only question would be in getting the pipe line from the cylinder to the well air-tight. In order to do this, all the joints should be leaded and after tightened as tight as practicable, it would not be a bad idea to coat them over with asphalt.

Relative to the size shaft to be used for transmitting 6-HP, we would recommend 1 7-16′ with hangers placed not to exceed every 8′. The size of belting would depend somewhat on the speed of the engine as well as the diameter of the pulley. It is quite likely that a 6″ belt would meet the requirements.

In *Fig. 620* *A* represents an end view of posts which are made of 2″ x 4″ 14′ long bolted onto posts put in the ground, good and solid. *B* is a triangle made of heavy cast iron and especially for this purpose and bolted in at top of *A*. *C* is a side view of wires and triangles. *D* is made of wood and iron, to which the wire is clamped fast, and will not wear the wire. *E* is pump jack run from engine by a belt, and when the pitman wheel goes around that moves the triangles and the wires go back and forth, thus moving the pump rod up and down. *F* is a rod attached to pump jack. This could be attached to a windmill rod and run the pump just the same. *G* is a turnbuckle with which to tighten wires. Use a galvanized wire cable ¼″ or 5-16″ made of seven wires twisted together.

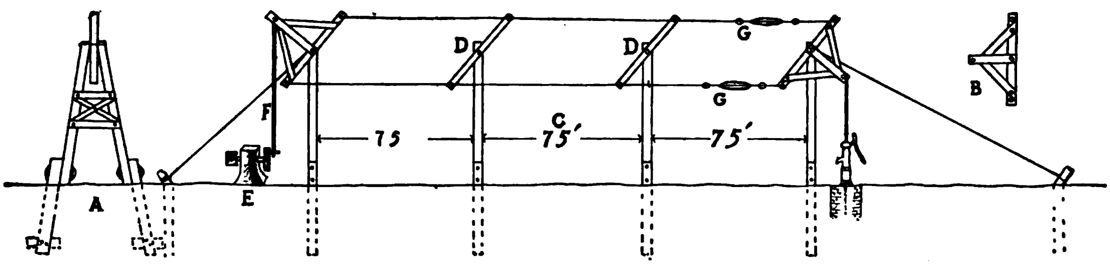


FIG. 620. TRIANGLES IN CONNECTING PUMP TO POWER.

GEARING A PUMP TO A WINDMILL.

The problem of pumping water by means of a windmill that is located some distance from the well is not always easy of a satisfactory solution, especially with any light, cheap equipment. For example: Suppose we had a 14′ wheel and wooden tower and want to pump at about 125′ from the tower. Water can be had at 18′ deep in quicksand.

First: To locate the pump at the windmill, which could be located as desired at one end of the granary. Then connect this pump with the well by means of piping that is laid in the ground of sufficient depth to protect it from frost, the piping being carefully laid so as to prevent its getting out of alignment and developing any possibility of leaks.

This would work satisfactorily as long as the suction did not exceed 25′, depending to some extent, however, upon the altitude of the place where the pump is located.

If it is desirable to pump water from more than one well this can be accomplished by piping to each well and putting a cut-off valve on each line of suction pipe installed.

In order to have this equipment work satisfactorily it is of utmost importance that good material be used and that the possibility of leaks in the pipe be prevented, as any small leak in the piping would destroy the vacuum and would cause the equipment to work imperfectly.

Second: Another method would be to equip the windmill with gearing instead of the ordinary reciprocating motion. (*Fig. 621.*) The power could then be transmitted to the pumps located at the different wells by means of tumbling rods or shafting. The power from the windmill to these tumbling rods or shafting could be transmitted by bevel gears at the windmill end, and at the other end the power would be transmitted from the tumbling rods or shafting by means of a pump head or crank and connecting rod.

The shafting of the transmitting mechanism can be placed in a shallow covered trench, care being taken to see that the bearings are given a good foundation and that it is in good alignment. In this way the transmitting mechanism would not encumber the ground and would be less liable to be injured and misplaced than when placed on top of the ground or on scaffolds overhead.

There would be some lost motion and some lost power in this kind of mechanism, due to the friction of the shafting in the bearings and gearing. The amount of power lost would depend to a large extent on the manner in which the apparatus was installed.

Third: Where the windmill is already installed with a reciprocating motion an installation similar to the second could be used by equipping each end of the shaft with a rocker arm that could be connected with the pump at one

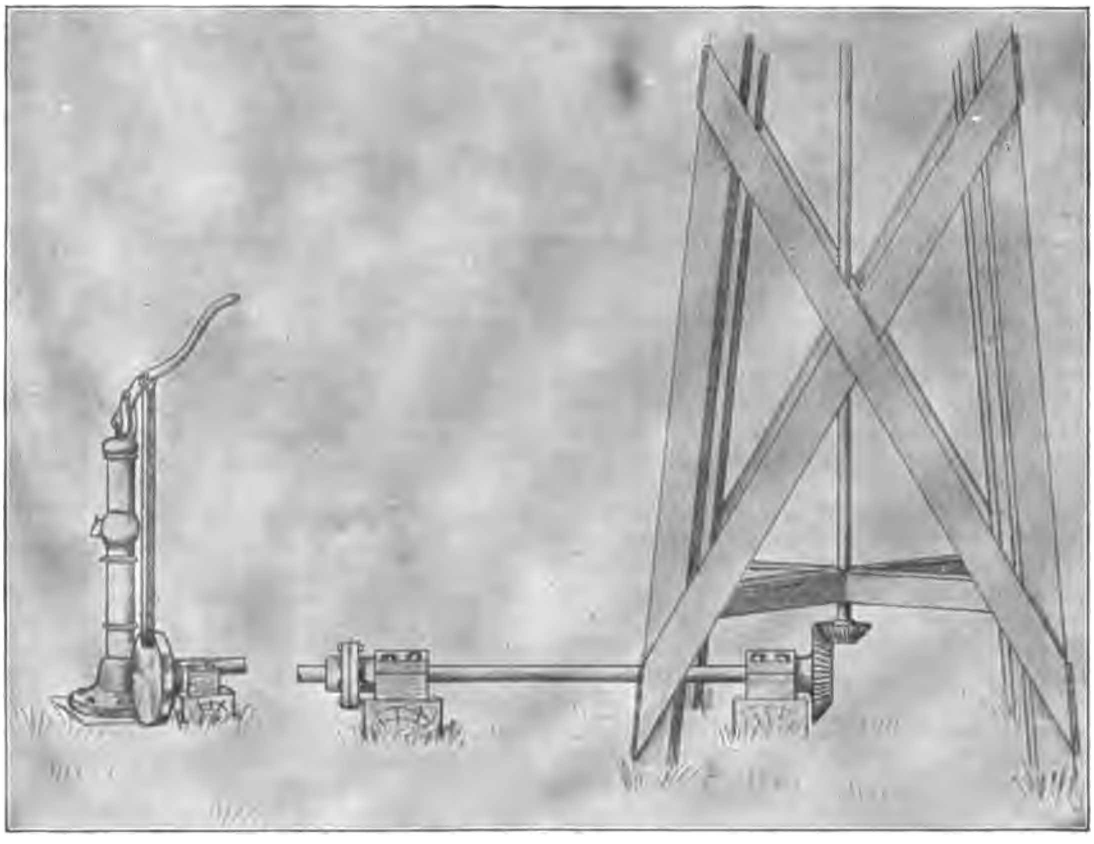


FIG. 621. GEARING A PUMP TO A WINDMILL.

end and the windmill at the other by means of a link. In this kind of installation it is advisable to make the stroke of the windmill as long as possible so as to use as long a link on that end as it is possible so as to compensate for the lost motion, which is considerable in some cases.

This latter equipment would most likely be cheaper than No. 2, but not so efficient, and we do not recommend it, as it is at best short-lived.

Fourth: Where the farm is of sufficient size and the use of power is frequently needed for various kinds of work, a small kerosene or gasoline engine capable of delivering such power is recommended as being most reliable. Where such power is installed a small dynamo for furnishing electric current for distribution of power and for lights can easily be installed. The question of transmitting power to any part of the farm is a very simple matter, it only being then necessary to have one or more motors, as the case might require, that can be used from place to place wherever the power is required, the motor driving the pumps, feed grinders or any other machinery by means of a short belt.

In the present case, if an electric trolley line is in the neighborhood and available, current could be taken directly from this for the power supply for the motors and could be readily distributed wherever needed.

A FARM DAIRY ROOM.

Every farmhouse needs three things: a dairy-room—cool, clean, sanitary, convenient—a store of ice and an abundant supply of water. Fortunately all of these can easily be secured in one building, and that may be a very sightly and even pleasing building in appearance. *Fig. 622* shows a concrete structure whose walls may be of plain plaster effect, if rough all the better, and afterwards covered with vines and creepers. Concrete walls may be plastered after the forms are taken away. This is not the cheap way, nor does it always look best. They may be etched with acid to take away the newness and rawness; this gives a very pretty effect. Or they may be hammered with a rough-faced hammer, similar to what cooks use for making tender beefsteak; this also gives a nice roughness. The plain plaster wall looks better, usually, than the wall made of imitation stone. It is not practicable to color the whole mass of concrete to imitate brick, since it would take too much coloring matter. The best color is the dry iron ore red. It might be put on as a wash after the wall was complete. The building (*Fig. 622*) is 13′ x 13′; its walls are 6″ thick, reinforced with steel. The walls and floors take about 40 yards of material—that is, 40 yards of coarse stuff for concrete and as many barrels of cement. Thus in regions where these things are

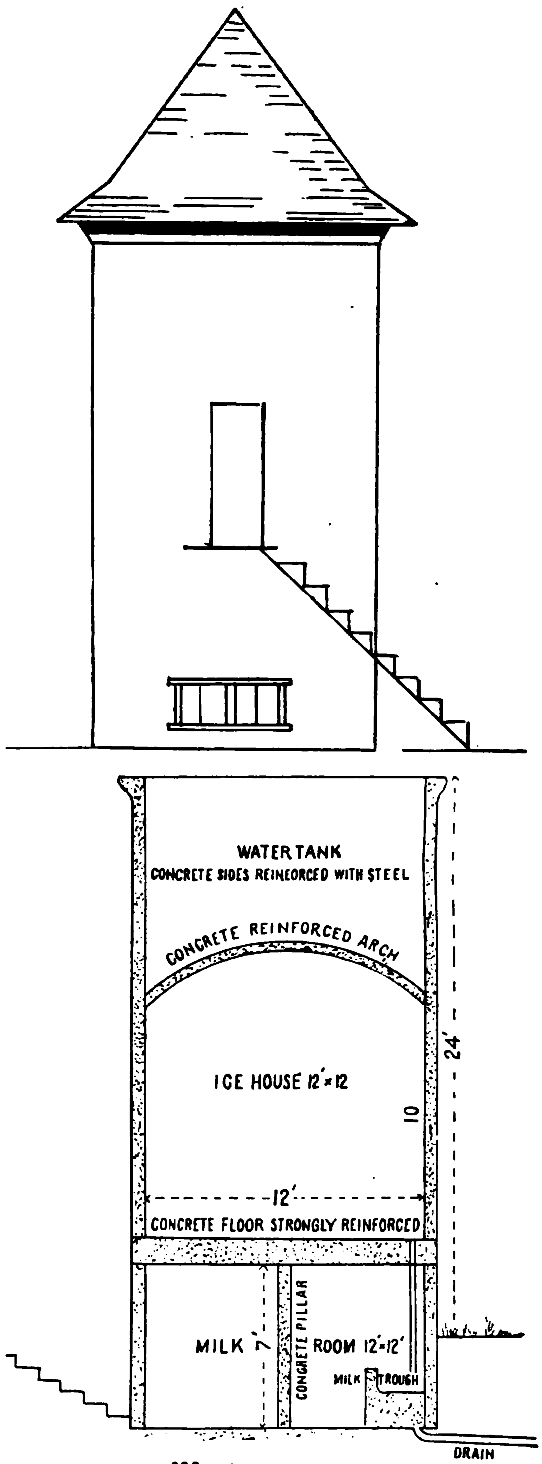


FIG. 622. FARM DAIRY ROOM.

at hand the materials for the concreting will cost less than $250, not counting the steel, which will probably cost about $25. Ample reinforcement will be provided for the walls if there is a vertical ½" rod each 24" of wall, and a horizontal one of the same diameter for each foot of height. Build up to the level of the bottom of the icehouse floor and erect also a pillar of concrete, well reinforced, 12" x 12", in the middle of the milkroom, then put a girder across from wall to wall of strongly reinforced concrete, the girder 8" thick and 12" deep. There should be two rods in the underside of this girder, each one 1½" in diameter, and the ends turned up into the thickness of the wall a few inches. These will be all the heavy reinforcing irons needed. Over this girder lay the concrete floor to hold the ice. It must be well reinforced. Use ½" steel bars, the best are the corrugated sort, and space them 8" apart in each direction, crossing each other. Lay these bars on the wooden floor, but hold them up from it about ¾" by driving little nails under them. On them lay concrete floor 6" thick. Make it of good strong concrete, using about 1 part cement, 2 parts clean coarse sand and 5 parts clean coarse gravel or broken stone. Finish it with a face of 1" good stuff that will make it water-tight and smooth. There will be need of putting through this floor three pipes; they should be in the corners, one for filling the water tank, one for overflow of water tank, one for drainage of the iceroom. This latter may as well be over the water trough for the milk.

When the floor is laid the walls may rise above it to the base of the arch under the water tank. Here a very thorough reinforcement must be given so that the arch will not by its thrust bulge the walls. The thickness of the arch need be no more than 6" and the reinforcement as for the floor below. When the arch is complete the walls will rise on up to the top of the structure, which is designed to be about 9'; it may be less. A simple concrete cornice finishes the tower, which may have a roof provided or not as the user prefers. Let the walls of the water tank be thoroughly well reinforced, using a ½" bar for each 6" of vertical rise; then there will be no fear of cracks ever forming to make leaks. If the water is used in the house a roof is advisable. Make a simple pyramidal roof of rather sharp pitch to give a nice finish to the tower. When complete there is a fine cool milkroom, partly under ground, with its water trough for cans, and a constant drip of ice water into it; an icehouse above holding a cube of ice 10' square, sawdust being packed between the ice and the walls, and high over that a great supply of water for house, yard or lawn. The cost of it all in good finish should be between $500 and $600.

A CHEAP DRILL FOR BORING WELLS.

"Give instructions and diagram for building and operating a drill that will drill a well 3" in diameter and 50' to 75' deep with a horse. I would like something of the kind, not expensive, which I could use at odd times to drill for water."

Answering, a correspondent of THE GAZETTE says: "No mention is made of the nature of the soil or rock in which he expects to sink his well. While it is entirely practical to do this drilling by means of horse-power for small diameters we would doubt the advisability of attempting to use a drill 3" in diameter with this form of power. It is customary to use a diameter of from 1¼" to 1½". The 3" drill could be used,

FIG. 623. DRILL FOR BORING WELLS.

but would be rather heavy to handle by such a method as we would recommend. The method customarily used for drilling wells of this type by means of horse-power is to use a tripod derrick with sheave wheel suspended at the top of the derrick over the center of the well. A rope is run down from the clevis in the top of drill rod over the sheave and wound around a drum mounted between the two outer legs of the tripod. One or two turns of the rope is taken around the drum. The drum is driven direct from the tumbling shaft of the horse-power and runs continuously in one direction. When it is desired to lift the drill it is customary for the operator to tighten the rope running around the drum which causes the drill to be raised. When it is raised to a sufficient height it is allowed to drop by loosening the rope, furnishing the necessary blow for doing the drilling. The drill at the same time is turned slightly at each blow so as to make the hole round. It is customary to use gas pipe for the drill rod with the exception of 18″ to 2′ of the point which is of drill steel, the gas pipe making the drill rod much lighter. The sketch in *Fig. 623* will be self-explanatory and the device can be rigged up at slight expense.''

HOW TO HEAT WATER IN A TANK.

Tap the tank in the bottom near the center with two pipes, ¾″ or 1″ pipe, as shown in *Fig. 624*, making a circuit, build a small fire under the pipes where the turn is and one can heat a tank with very little fuel. The pipes must be below the frost line and have a continuous rise from fire to tank. As the water warms in the

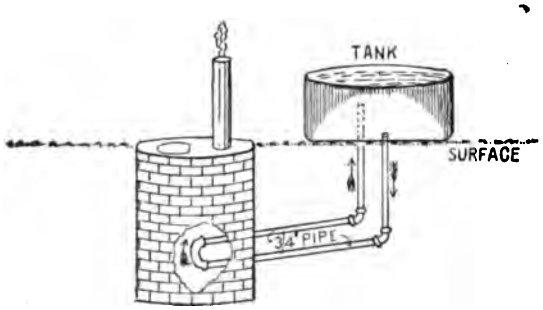


FIG. 624. HEATING WATER IN A TANK.

pipes at the fire, it rises through the upper pipe into the tank and the cold water follows in, thus making a circulation which will continue as long as the fire goes. A barrel of water can be heated to the boiling point in a short time for scalding hogs in the same way.

DEVICE FOR TRAINING HORNS.

Fig. 625 shows a device for training the horns of cattle. Take an ordinary piece of 2″ x 4″ about 2″ longer than from tip to tip of horns; put two holes near each end at the base of the horns; also put a staple or loop in each edge in the center to fasten one string around the neck.

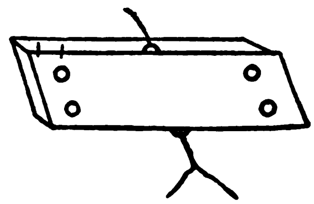


FIG. 625. DEVICE FOR TRAINING HORNS.

Then twist two strings together from front loop to base of nose, then tie around the nose. Put heavy cords around each horn and tie through the 2″ x 4″. Do not use wire for loop around horn, as it will indent the horn.

COMPRESSED-AIR WATER SERVICE.

An Indiana farmer has invented a novel form of compressed-air water service system. As water in wells is often found within slight distance from the surface, from 12′ to 30′, he would dig the well of good size and immerse an air-tight reservoir directly in the water. This would fill by merely opening a valve, and the water he would force out by pumping air into the reservoir. The air pump could be located anywhere and connected by small pipe. Wind or gasoline would work the pumps. *Fig. 626* shows the idea.

In order to have a continuous flow of water

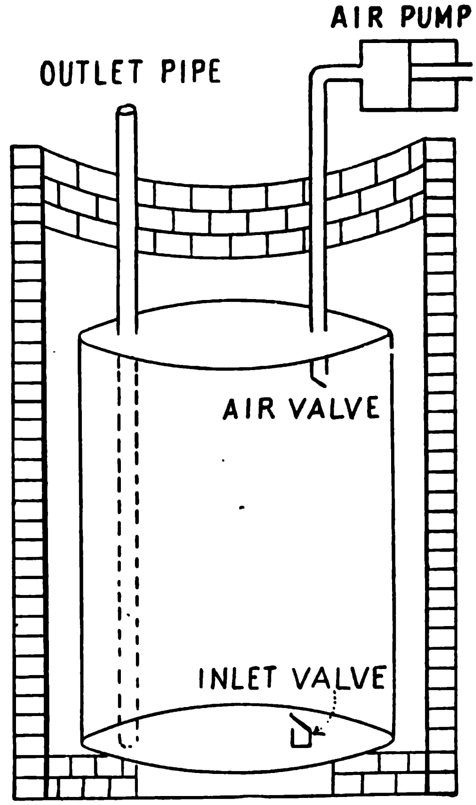


FIG. 626. COMPRESSED-AIR WATER SERVICE.

there should be two of these reservoirs, and if above them there was a separate reservoir for compressed air all the better, since the windmill would not always operate. The main difficulties are two: it is costly to open a large well and most modern wells are drilled ones, and air is not an easy thing to pump with a windmill, since a slow motion is wasteful in operating an air pump.

BOX-STALLS ON FAIRGROUNDS.

For fairground stalls, where only one animal is to be placed in a stall, 10′ x 12′ is large enough, except perhaps for the largest stallions a few stalls 12′ x 12′ should be provided. The foundation should be of concrete blocks molded in place, on which the 6″ x 6″ posts are set. If great cheapness is sought these posts may be 4″ x 4″; they will answer nearly as well. The height at rear of stall need be no more than 8′ and of front 10′, though the cost of adding a foot to these heights would be little and the stalls more airy and cool. The roof need have slight slant, being covered with tarred roofing material. Let there be solid divisions between the stalls, made of planking 2″ thick to a height of 5′, above that slatted partitions to keep horses from fighting each other. The natural earth or hard clay is best for floors; let it be raised about 12″ above the adjacent ground to make sure of dryness during fairground deluges. The projecting

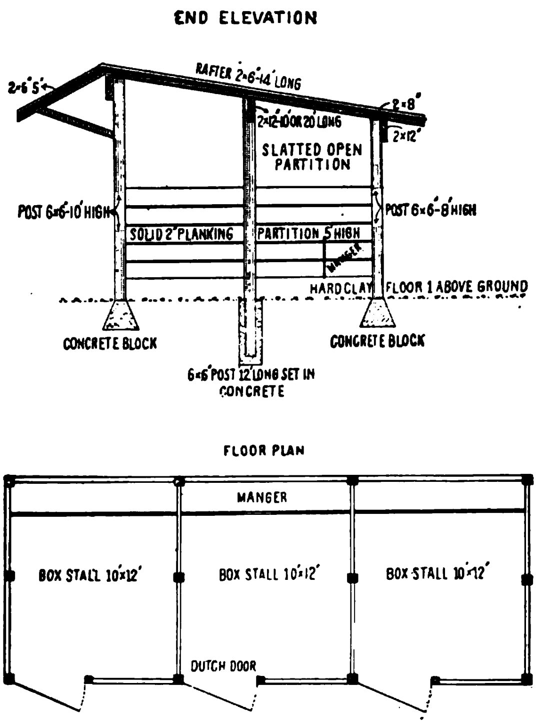


FIG. 627. BOX-STALLS ON FAIRGROUNDS.

roof in front covers 5′ (shown in *Fig. 627*) and will be much appreciated by fairground visitors. Let all doors be sawed in two, horizontally, so that the upper halves may be opened to permit air to enter and visitors to see the animals within. The front should not be boarded clear to the roof, at least there should be abundant slatted opening to allow of free circulation of air.

PIVOTED BARN WINDOW.

This plan (shown in *Fig. 628*) permits the opening of windows at the top. There is a weight for holding the window closed and a rope for pulling open. An ordinary cleat can be fastened

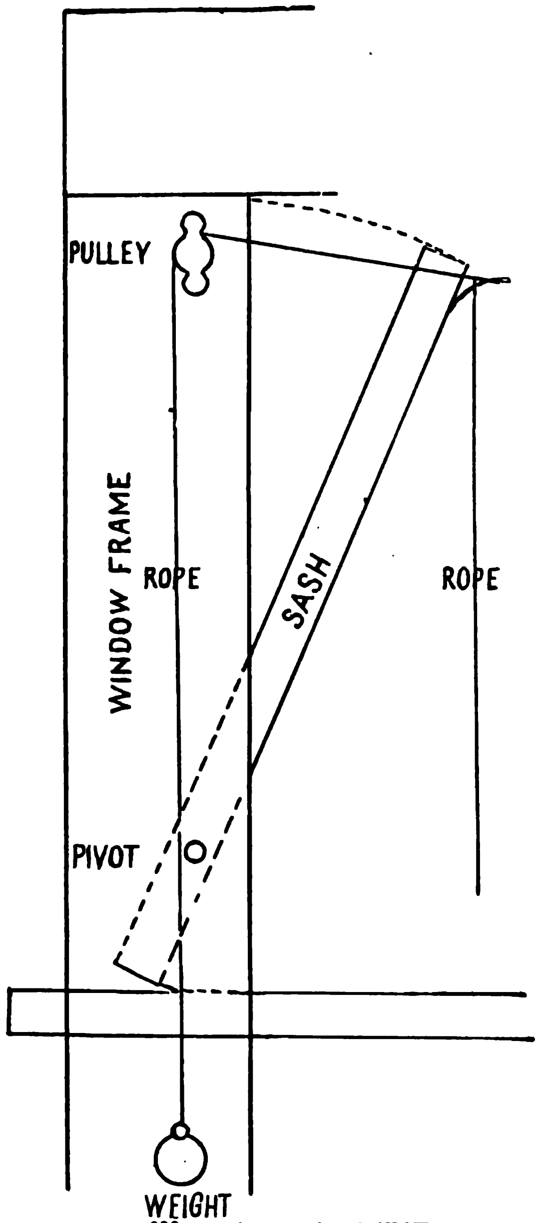
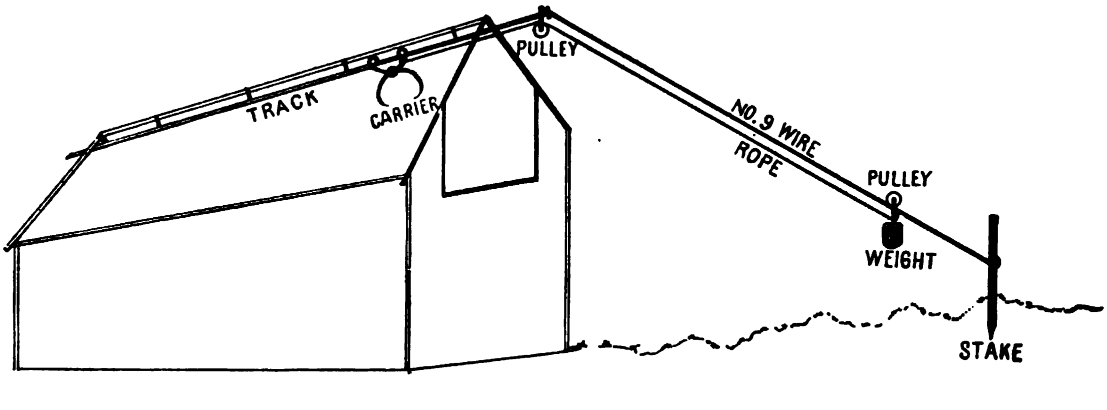


FIG. 628. PIVOTED BARN WINDOW.

conveniently allowing for a couple of turns of the rope in order to hold the window open. The iron bracket projecting from sash permits the pulley to draw the window clear shut.

CARRIER FOR A HAY BARN.

The sketch (*Fig. 630*) is of a device for pulling a hay carrier and fork back. Use a No. 9 wire from the end of the track to the peak; stretch tight. Fasten a rope to the carrier and pass it through the pulley and fasten it to pulley and weight. The post should be set a little farther from the end of the track than the barn is long.



HAY CARRIER

FIG. 630. CARRIER FOR A HAY BARN.

PLAN FOR A SMALL LIVERY STABLE.

Answering an inquirer wishing a plan for a livery stable and stallion barn combined, with three large box-stalls, an office with stairway and an outer stairway to the second floor, where are to be three living rooms, the size of the barn to by 40′ x 56′, a correspondent of The Gazette offers the subjoined:

"The accompanying sketch (*Fig. 629*) may serve the purpose. The building is constructed with 14′ bents, thus giving between posts three stalls, each 14′ x 14′. There will also be built 12 stalls, 4′ 8″ x 10′, with a passageway 16′ wide through the middle. The arrangement of the living rooms upstairs may be left to the fancy of the builder. Hay may be taken in at the rear. If baled hay is used the danger of fire is somewhat decreased and loft room saved. Thus also there will be a bridge besides the box-stalls, up which buggies may be taken for storage purposes. This type of livery barn is well adapted to small towns. Although concrete is used in such buildings, there is a well-founded prejudice against this material as a floor for livery barns."

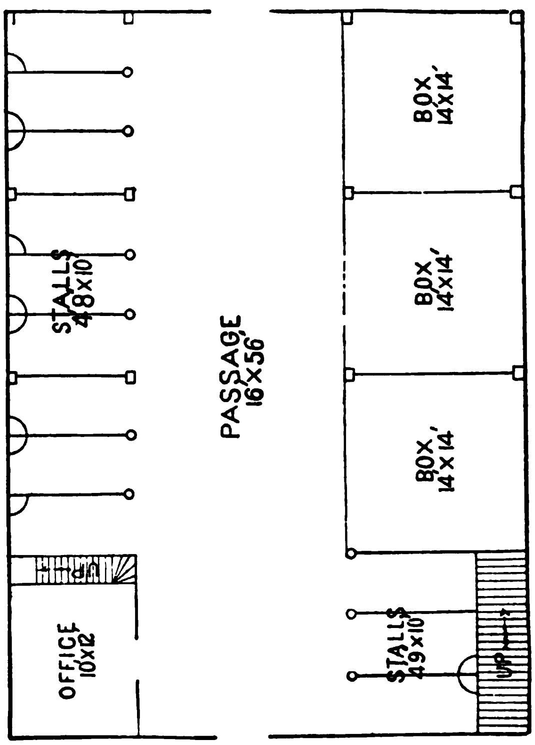


FIG. 629. SMALL LIVERY STABLE.

A SCALE LOT AND DIPPING TANK.

The scale lot shown in *Fig. 631* is 60′ x 120′ divided as shown. Though the size is small it will be found to hold a good many animals, and an additional large pen may be added at the back if needed. The dipping tank in connection with it is 12″ wide at the bottom, amply wide for the feet of any animal dipped in America, 8′ deep and 4′ wide at top. This gives it a width of 36″ at a depth of 5′. The hip bones of a large cow are about 5′ from the earth, and no one has a cow wider than 36″ there. Of course cows are somewhat wider below, but the width is ample for anything that would be passed through a dipping vat. As to depth, 8′ is scant, and for range dipping add 2′, making it 10′, but for the farm it will suffice, filling the vat 6′ and allowing 24″ for splashway. The sides may also be raised very easily an additional foot by use of boards, which, while not having water-tight joint with the concrete, will yet throw back any splashed liquid. To get the cattle in, the device of a sheet of steel for them to slide on is desirable. This steel when wet is slippery enough. To restrain the cattle from emerging too soon a gate may be dropped in for a moment, then raised, though for ordinary dipping if the animal is completely immersed once it is sufficient; they keep wet a good while when they emerge. The incline must be very rough to let the animals climb out with no slipping. This tank is 30′ long over all, the incline 16′, the level bottom 10′. It should be made of concrete 6″ thick. This will require about 8 cubic yards of material, and as many barrels of cement, or a little more, say 10 barrels of cement all told. The tank for use of hogs will work very well, a trifle wide, and some may possibly turn wrong end to, but on the whole it will prove satisfactory.

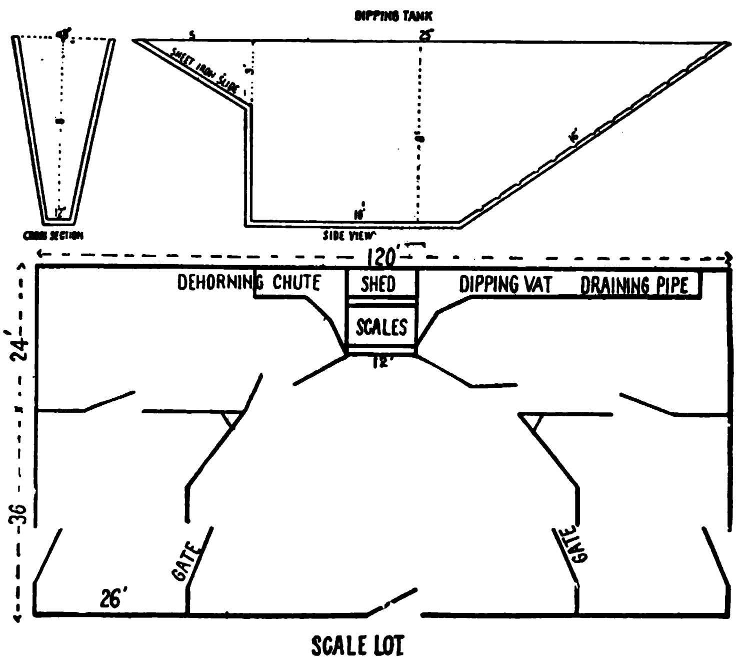


FIG. 631. A DIPPING TANK AND SCALE LOT.

POWER FOR FARM PURPOSES.

There is nothing of more interest to the farmer today than the question of suitable power for his particular requirements. In referring to all power questions, it is customary to make comparison in the term known as horsepower, which is the unit of comparison for power the same as we have the pound as a unit of weight and the foot as a unit of length. This term, horsepower, was originally supposed to be equivalent to the power of one horse and is the force necessary to raise 33,000 pounds one foot in one minute. Or, it is the product of the weight, multiplied by the distance per minute through which this weight acts, divided by 33,000. For instance, one horsepower would be capable of lifting 33,000 pounds one foot per minute, or it would be capable of lifting 66,000 pounds one-half foot per minute. This gives us the rule for horsepower as follows:

$$\text{Horsepower} = \frac{\text{Weight in} \times \text{distance in feet per minute}}{33000}$$

Power for useful work may be applied in a variety of different ways. For instance, it may be the direct lift of weight similar to raising hay with a hayfork; it may be the belt pull as applied to the circumference of a pulley, or it may be the steam pressure as applied to piston head of an engine; but in all cases it is reduced to the same basis of so many pounds acting through so many feet per minute.

Though it was originally supposed that this amount of work was equivalent to one horsepower, a series of tests have been made showing that a horse as a rule is hardly capable of this amount of work, it depending, however, upon the weight of the horse and the method of hitching. From tests made it is indicated that the horse is capable of pulling one-tenth of his weight for ten hours, and the average walking speed is 220 feet per minute. From this it would appear that the weight of the horse, exerting one-tenth of his weight necessary to develop one horsepower, would be as follows:

$$\frac{\text{Weight of horse}}{10} \text{x } 220 = 33000.$$

$$\text{Weight of horse} \frac{33000}{22} = 1500.$$

As a matter of fact, the average draft horse will not weight this amount and is therefore not capable of one mechanical horsepower of work.

The power as required for various farm purposes may be divided into two particular classes. First is used for doing various outside operations requiring the propulsion of the equipment over the ground. The other class is to be used for imparting motion to machines which remain in one position during their process. As a means of the first class of power, the horse is the more practicable and furnishes more than nine-tenths of the power used.

Until recent years there was not much attention paid to the power as furnished by the horse, it being the practice to call upon him for all he was capable of. As a result in many cases he was greatly abused. In recent years there has been considerable valuable information collected by several of the universities showing the amount of power required for the operation of different farm machines as well as data on the amount of feed and cost of same for keeping the horse. The tests show that as a rule the average horse is over-worked, which is quite evident from the number of poor horses we see through the country during the busy season. The results of these various tests are certainly worthy of consideration even though the conditions are not the same as we would have on our own farm. These show what can actually be done in the way of keep for a team of horses under reasonable conditions as well as the average work the horse is capable of doing in accordance with his weight for the average working days of the year.

The only other means that we have for operating the portable equipments is the traction engine or the electric motor. The field for these is limited to large farms where it is advantageous to use gang plows and other large tools in proportion. Where there is a large area to be covered, there is no question about the practicability and the advantage of operating these large equipments.

The study of power as applied to the other class of stationary machinery is much further developed. As a means of operating these equipments we have the windmill, the tread or sweep-power, steam engine, internal combustion engine and the electric motor. The windmill was one of the first means used to do mechanical work. Its use dates back as much as 1,000 years. This was first used by the Hollanders for pumping purposes. The Dutch mill, as it was termed, was a crude structure consisting of main shaft supporting four or six radiating arms, each carrying a light framework to support canvas or other sail. The entire wheelhouse was rotated to face the wheel up to the wind. These wheels were from 50 to 100 feet in diameter. There was not much study given to utilizing the wind for power purposes until about 60 years ago when the present form of wheel was developed, consisting of a group of slats mounted so as to face more or less at an angle to the wind, the wheel being kept faced to the wind by means of suitable vane.

There have been numerous methods used for governing the speed of the wheels so that they will operate satisfactorily in varying winds. The velocity of the wind varies all the way from one mile per hour, which is hardly perceptible, to 100 miles, which is the velocity of a tornado and it is necessary for these mills to take care of themselves throughout this variation. The horsepower obtainable from windmills is greatly affected by the velocity of the wind, which is quite variable in different periods of the year.

The most practical use to which windmills may be put is pumping, but they have been used to advantage for other power purposes where only a limited amount of power is required. The great advantage of the windmill over other forms of power is its low cost of operation as well as the small cost of keeping it in repair. There are a number of good power mills in the market as well as auxiliary equipments to be operated from these mills, but there seems to be no form of governor is used in connection with these mills which makes it possible to take advantage of the high-velocity winds and to favor the mill on the low pressure. That is, a given mill would be capable of much more work when operating in a fifteen-mile wind than when operating in a ten-mile wind, but there is no means of varying the quantity of work applied under the two different conditions.

There is also quite a demand for a constant speed regulator for windmill-power where it is desired to operate constant speed machinery. This would make them useful for driving generators for lighting purposes and for charging storage battery. There have been a few regulators of this class built, but they have never come into commercial use. It would appear that there would be considerable demand for this kind of governor if a suitable one were placed on the market.

The use of the tread or sweep-power is an easy means of making use of the horse for driving the stationary class of machinery. For light jobs these work very satisfactorily and make a cheap source of power. It also enables us to utilize the horse in the winter season where otherwise he might be standing idle.

The development of the internal combustion engine in recent years makes it possible for the farmer to have a source of power available at reasonable cost. The fact that they can be started on short notice and run with little care has led to their adoption for this class of service. Under this class of engine come all engines where the combustion of the fuel takes place in the cylinder acting direct against the piston head. The cost of the fuel consumed varies according to location and price. At first the majority of these engines were of the gasoline type, but the advance in price of gasoline has brought about the consideration of kerosene and alcohol for fuel. A great deal of study is being given at the present time to the use of different fuels as applied to these internal combustion engines. It would appear that the development of these engines will enable us to make use of a number of fuels which heretofore have not been utilized.

The results obtained by the internal combustion engine depend largely upon the individual equipment and the person in charge. It is not possible to lay down any specific rules as to the operation of these engines, as there are hardly any two of them which have the same construction. It necessitates becoming familiar with the particular make in each case and learning their own peculiarities. While at first there were many of these gasoline engines that were trying on the nerves, they are at present sufficiently perfected so that they can be made to operate satisfactorily with a reasonable amount of care.

Most of the manufacturers of these small units guarantee that the amount of fuel consumed per brake horsepower per hour, will not exceed 1.2 pints of standard seventy-six degrees test gasoline when working at full load. As a matter of fact, the majority of these small units will not work at anything like full load, so that in the majority of cases the results would not be so favorable. From a number of tests made on different makes of engines, it would appear that two pints of gasoline per brake horsepower per hour would come nearer the average conditions.

In these internal combustion engines we have portable and the stationary. Where possible the stationary engine is more desirable than the portable, as it can be mounted on permanent foundation which will overcome the vibration to a large extent. There are cases, however, where it is very advantageous to have the portable equipment and these can be used to good advantage where sufficient care is used in setting them.

It is the common practice to locate the stationary equipment in a position where most of the various machines can be driven from a line shaft, the power-room to be so constructed that the engine will not be greatly affected by the variation in temperature and should be practically frost-proof. The cooling and supplying tanks should be located as best suited to the particular conditions, but the equipment should be installed so as to conform to the insurance requirements, otherwise the insurance inspectors might take exception to the installation and request alterations which might be expensive or might necessitate the changing of the entire outfit.

The transmission of the power to the various machines is usually by shaft and belting, but in a few cases there has been used in connection with the engine a dynamo, in which case it makes possible the use of motors at the various points of distribution where power is desired.

The generator is mounted in the power-room and from this distributing lines are led to the various points where it is desired to use power or have lights. For the motor in some cases it is found advantageous to use a stationary machine for some particular equipment. In other cases it is convenient to have a portable motor which can be moved from one point to another and applied to whatever machines it is desired to drive. The chief advantage of the electric system is the flexibility, and in addition to the power you have the advantage of the lights.

When it is possible to obtain electric current from an outside source, such as from a light and power company or suburban road, the motor power is very desirable in that it makes possible a source of power that can be depended upon at a moment's notice. This also enables you to have the use of the electric lights. Motor power is a rotary motion and does not necessitate the heavy foundation that the reciprocating engine does. While the cost of electric power may be somewhat higher than that obtained from the internal combustion engine, it is well to take into consideration the fact that it is a power than can be depended upon and will eliminate much of the trouble experienced with the other system.

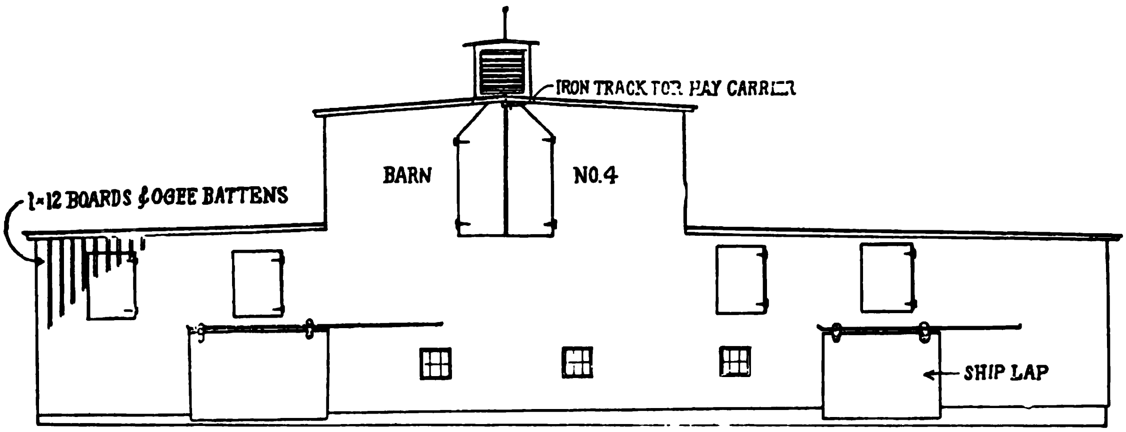


FIG. 632. IOWA BARN FOR BREEDING CATTLE (ELEVATION).

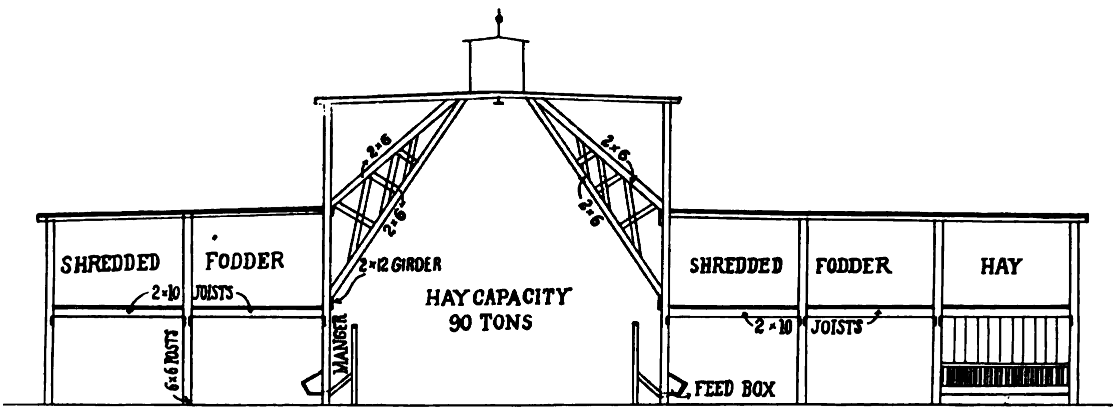


FIG. 633. IOWA BARN FOR BREEDING CATTLE (FRAMEWORK).

The charge being made for current as supplied for this purpose varies materially according to location. There are instances where this is being furnished for as little as 3½ cents per kilowatt hour, while there are but few cases where the charge exceeds 5 cents per kilowatt hour furnished for farm purposes. On the basis of 4 cents per kilowatt hour the cost of one horsepower for one hour would be as 746 is to 1,000, or one horse-power is practically ¾ of one kilowatt. The charge then for one horsepower would be 3 cents per horsepower hour or it would cost thirty cents to run 1-horsepower motor at full load for ten hours.

AN IOWA BARN FOR BREEDING CATTLE.

The barn shown in *Figs. 632* to *637* was planned and erected with a view of reducing the labor of caring for Short-horn cattle. The barn will comfortably house 70 cows, a large per cent of them having calves at foot. When cattle are in the barn the gates are opened and there is no danger of a cow being cornered and hooked by other animals, and at the same time gates are so arranged that they may be closed and cattle can be changed and sorted very readily.

One man can care for all the cattle in this barn in a few hours every day. The manure spreader can be drawn into the barn, thus reducing to a minimum the work of cleaning. All of the feed and roughness are very convenient.

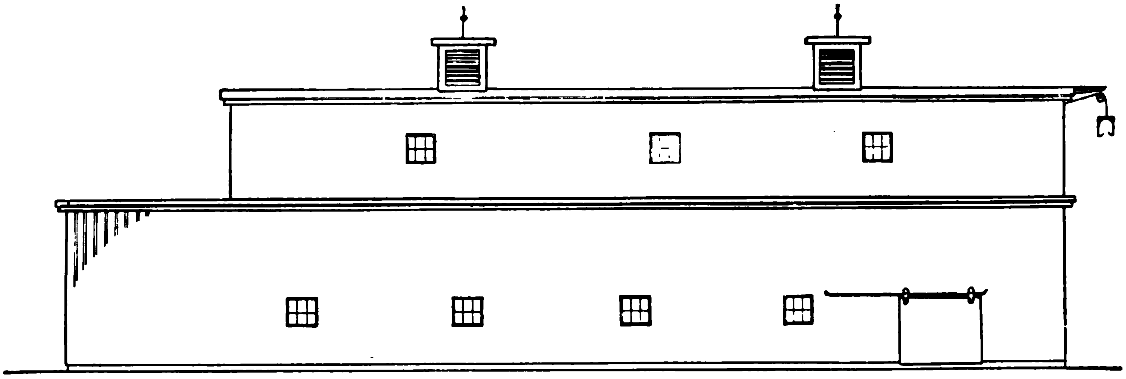


FIG. 634. IOWA BARN FOR BREEDING CATTLE (SIDE VIEW).

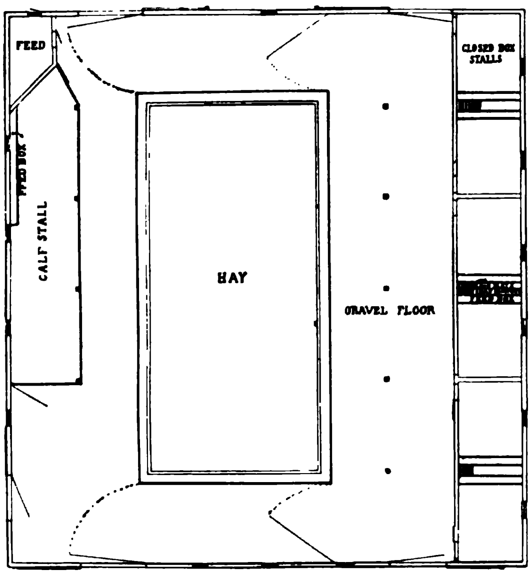
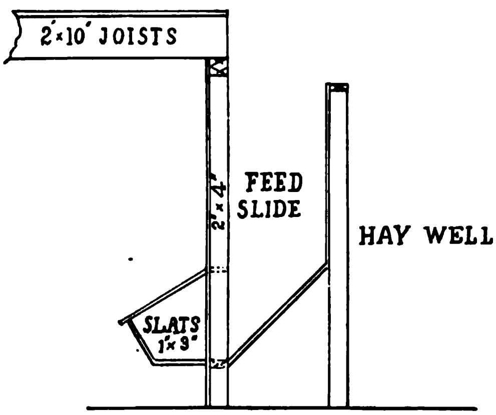


FIG. 635. IOWA BARN (FLOOR).

Except during the very severe stormy weather, south sliding doors are left open so that cattle may go out and in at pleasure. The barn is provided with six commodious closed stalls where in winter cows with very young calves or near calving are kept. At night the cows and calves are separated, except in case of cows with young calves in box stalls. The calves that are separated from their mothers at night are provided with a comfortable calf pen in the east side of the barn.

The hay compartment designated in the plan as well will hold 90 tons of hay. The box stalls are provided with hay mangers or racks which are filled from second floor. Ample storage for roughness like shredded fodder is provided on the second floor over where cattle run, and it can



SECTION OF MANGER

FIG. 636. IOWA BARN (MANGER).

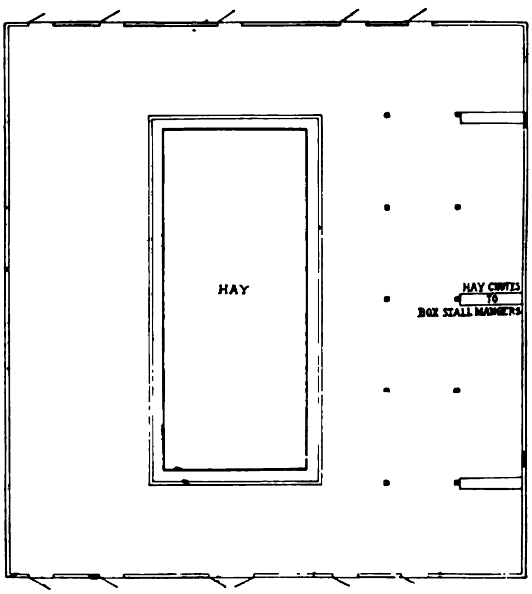


FIG. 637. IOWA BARN (HAY MOW AND STALLS).

be readily fed in the mangers in the barn, all of which are of the rack plan extending to the second floor.

The cattle except the cows in box stalls run loose in the barn and may go out and in at will, except in very severe weather. The calf pen is in the most protected part of the barn and away from cold draughts, although the barn is very comfortable and at the same time the cattle can be cared for at a minimum cost of labor.