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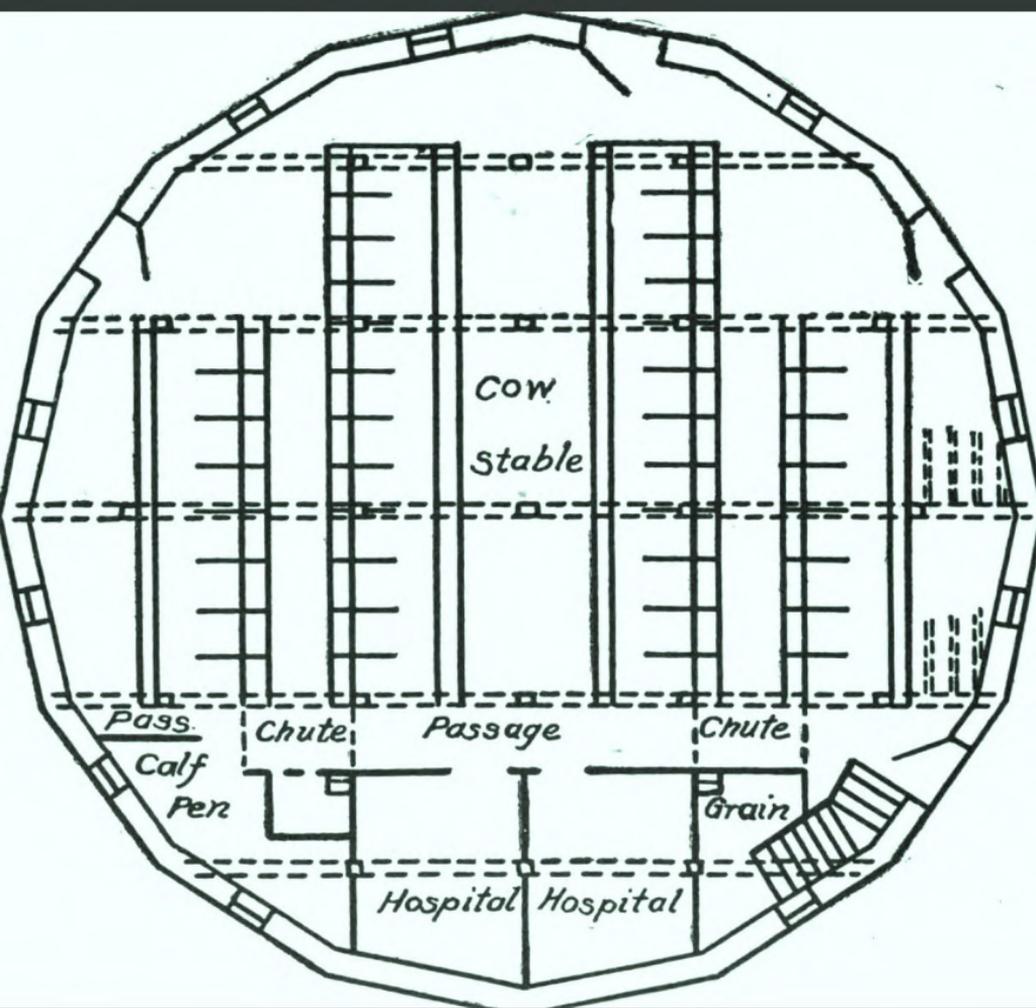
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## *Barn plans and outbuildings*

Byron David Halsted, Edwin C. Powell



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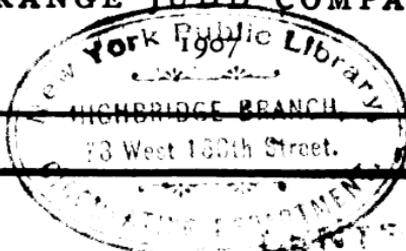
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# Barn Plans *and* Outbuildings

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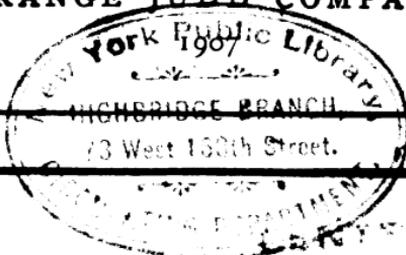
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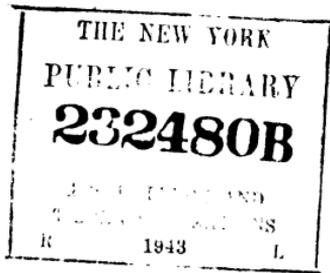
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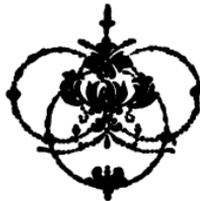
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## PUBLISHERS' ANNOUNCEMENT

Works upon Barns and Outdoor Buildings have hitherto been so expensive as to limit their circulation to comparatively few in number. Their prices have ranged from five dollars upward. Twenty years ago Orange Judd Company published *Barn Plans and Outbuildings*, a volume of 235 pages with 257 engravings. This work was prepared largely by Dr. Byron D. Halsted. Since then many changes have taken place in style and construction of buildings and in the attention given to ventilation, sanitary arrangements, heat, light, etc. The book has been revised and greatly enlarged so as to bring it down to date, and it gives the most modern styles and plans of buildings of different kinds. This revision has been done by Edwin C. Powell, Associate Editor of *American Agriculturist* weeklies. Every professional builder, and every person, be he farmer or otherwise, who intends to erect a building of any kind, can, in this book, secure a wealth of designs and plans, for a very small sum.



## INTRODUCTION

The proper and economical erection of Barns and Outbuildings requires far more forethought and planning than was ordinarily given to their construction. A barn once built is not readily moved, or altered in size and shape, and the same may be said of a corn house, a poultry house, or even a pigpen.

Only the most general rules can be laid down to guide one in the selection of a site for barns and outbuildings. Much depends upon the wants to be consulted and met. Individual taste may, and often does, have much to do in determining decisions. The approved style of construction was formerly to locate the barn upon a rise of ground where a cellar could be built opening upon the lower ground to the rear, in which were kept animals and vehicles. This is not the best plan from a sanitary point of view unless there is a clear space back of the wall. The use of hay forks for unloading forage does not make it so essential to drive in higher than the first floor with loads. The old practice of scattering buildings over the farm has been found more inconvenient and expensive than to group them near each other. The smaller risk of fire where the buildings are scattered is not enough to compensate for the extra labor in taking care of the stock nor of the inconvenience or cost of maintenance and repair. All the buildings are more or less dependent; the corn crib and granaries bear certain relations to the pigpen, the poultry house, etc. The same pump may serve the sheep, cattle and other stock, provided they are housed close by it, and therefore near one another.

The farmer who intends to erect a building should first consider the amount he wishes to store in it. This calculation must be based upon the present and prospective size of his farm, the number of acres of each crop, the kind and number of head of live stock, the system of farming, etc. It is not always easy to go into every minute detail of this sort, but it is far better to consider the matter thoroughly and base the size of the buildings required upon the calculations made, than upon none at all. In constructing farm buildings, the error usually made is on the side of too small structures, as the thousands of lean-to sheds, "annex" stables, hay stacks, etc., throughout the country testify to.

After the site and size have been carefully decided upon, there is still much to be done to make the outbuildings present a neat appearance. Barns can be pleasant objects, and impart an impression of comfort and completeness upon all who see them. Their attractiveness will depend upon the symmetry and exterior finish of the buildings themselves, their grouping, the planting of shade trees, etc. The projecting cornice and cupola cost little, but add much to the appearance of a building.

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## CHAPTER I

### *GENERAL FARM BARN*S

With the increase of wealth, and we may add of good sense and enlarged ideas, among the farmers of the country, there is a gradual but very decided improvement in farm architecture. The old custom was to build small barns, to add others on three sides of a yard, perhaps of several yards, and to construct sheds, pigpens, corn houses, and such minor structures as might seem desirable. In the course of a few years the group of roofs, big and little, span and lean-to, in the rear of a large farmer's dwelling, would present the appearance of a small crowded village. Compared with a well arranged barn, a group of small buildings is inconvenient and extremely expensive to keep in good repair, besides adding much to the labor of doing chores.

#### LIGHT, HEAT, AND VENTILATION OF STABLES

In the construction of stables for live stock, the proper lighting, heating and ventilation must be borne in mind, as well as the arrangement of the stables for convenience in feeding. These matters are not of such great importance for horses, sheep and feeding cattle as for milch cows. In the construction and arrangement of the dairy barn, they are of prime importance, not only as regards the healthfulness of the cows, but the profit to be derived from them. If the barn is well built, and of size proportionate to the number of cattle kept, the heating will take care of itself, for the warmth of the animals will maintain a proper temperature. The majority of barns are poorly lighted and badly ventilated.

In planning a cow stable 500 cubic feet of air space is sufficient for each animal. If the cows stand in a double row, and the stalls are three and one-half feet wide, this will require a width of thirty-five feet for a height of eight feet, which is plenty high enough for all practical purposes. There should be about thirty-six square feet of window surface for every 5000 cubic feet of air space, or one square foot to 140 cubic feet.

The King system of ventilation, worked out by Prof. F. H. King of Wisconsin, can be used only in a very thoroughly built stable. The essential feature of it is the control of the inflow and outflow of air through ventilating tubes governed by dampers. Windows and doors must be made as tight as possible, and the stable should be ceiled overhead. The sides must be double boarded, with an air space between inside and outside ceiling. An opening is left in the siding near the ceiling, and a corresponding opening outside the stable near the sill, to bring in air from the outside. These openings are controlled by dampers and are protected by fine wire netting. The ventilating flue should be made perfectly tight and extend from within a foot of the floor out through the roof at the ridge. There should be no metal work in this, for the moisture would condense on the metal in cold weather and drip. This tube should be at least two feet square and a wooden damper should be arranged in it to control the ventilation.

The proper ventilation of cow stables is thus described by Dr. James B. Paige, professor of veterinary science of the Massachusetts Agricultural College: "Every shaft or duct should be so constructed that it may be easily cleaned in every part. Neglect of this precaution often renders them useless. They soon become completely stopped with collections of cobwebs and dust. To insure at all times the desired action of a shaft or tube, either as inlet or outlet, cowls are sometimes attached to the upper end. There are two varieties, the fixed and movable. The principles of action vary according to the pattern. Some are so con-



structed as to produce an upward circulation by the Archimedean screw principle, the motor force being a mechanism which is operated by the wind. In other kinds the force of the wind is so directed across the open end or side that air is either driven through the tube into the building or is aspirated out of it. So far as I have observed none are absolutely positive in their action.

"The stationary variety has the advantage over the movable kind in that it is entirely automatic, acting with the wind in any direction, and is less liable to get out of order than any movable pattern. I have considered somewhat at length the construction, location, use and action of ventilating tubes on account of its being necessary to make use of them under certain conditions, although I never recommended their use, if a better plan can be followed. My preference is for the Sheringham valve system of inlets and outlets, or another system which I shall describe later on.

"The Sheringham valve, a patented device of English origin, is in principle a window, either single or double, hinged at the bottom, swinging in at the top, having when open the triangular spaces between the edge of the sash and the edge of the window casing closed with wood or a piece of sheet metal. The action of this valve is similar to that of a partially open window hinged at the bottom swinging inward at the top.

"The wind striking against the oblique window surface is deflected from its straight course and is thrown into the upper part of the building, and gradually finds its way to the floor, where it comes in contact with the animals. The closing of the triangular spaces on the sides prevents downward drafts directly upon occupants of the stable.

"All the material required to convert a common sliding sash into a Sheringham valve is a seven-eighths-inch board, eight to ten inches wide, as long as the sash and planed at both sides, two or three strips of one-half-inch material one and one-quarter inches wide, a pair of butts and an

old-fashioned spring barrel bolt. The eight-inch board is cut lengthwise between diagonally opposite corners. These pieces are nailed to the inside edges of the casing. The narrow strips of material are nailed to the inside edges of the boards first described. These overhang the inner edges and serve to prevent the windows from swinging too far in. The barrel bolt is put into place in the sash and several holes bored for it in the triangular side pieces. The hinges are fastened on, the window stops of the original window removed, and the valve is complete.

“The form of stable best adapted to ventilation with this arrangement is one not more than forty or fifty feet wide, of any length desired. A monitor roof is desirable but not essential. The animals should be arranged in rows on either side facing a central drive or passageway. There should be four rows of valves, two below, one on either side in rear of the animals, situated three and one-half or four feet from the floor, and two above near the plates, or better in the sides of the monitor roof, provided the building is constructed on that plan. The lower row of valves on the windward side of the building should be open to admit fresh air, those above on the opposite side to allow for the escape of the foul air. By having numerous valves, each of which is opened but a little, the incoming current of air is evenly distributed throughout the building and objectionable drafts prevented.

“Another plan of ventilation particularly applicable to stables with straight walls, with manure sheds on either side, provides for the introduction of fresh air through openings in the manger fronts and the escape of foul air through windows or cupola openings above. This system of inlets is only used to good advantage in those barns where the stable part is separate from the storage portion. There should not be a cellar under the stable. The arrangement of the animals should be the same as in the stables where the Sheringham valve system is employed.

“Under the floor of the central driveway running length-

wise of the building there should be a space or chamber having outside openings at both ends of the building. This space should be about two or two and one-half feet deep and of the same width as the driveway above. The openings at the end may be of any convenient size, preferably not smaller than six feet long by one foot wide. The open space under the central section, which serves as a fresh air chamber, must be completely separated from the two side spaces under the stall floors. Fresh air from the air chambers is taken into the stable through the manger fronts, which are built in the form of boxes, there being an opening at the bottom into the fresh air chamber and another at the top and into the stable. With this arrangement, air is brought into the building and delivered directly in front of the occupants at the point where it is most needed. From contact with the animals it becomes heated, rises, and with the impurities that it has received from the animals escapes through the outlets above.

“This system possesses the advantage of being quite automatic. The air is brought in through numerous small openings, preventing uncomfortable drafts. It is introduced at just that point where it is most needed and each animal gets its supply of fresh air regardless of its position in the stable. In remodeling old stables to improve sanitary conditions about them, more especially to provide effective ventilation, one or a combination of the systems mentioned may be employed. As to which system is introduced must necessarily depend upon existing conditions. In building a new barn it is very easy to provide for proper ventilation.”

#### BARN AT MASSACHUSETTS AGRICULTURAL COLLEGE

The first of the views presented (Frontispiece) gives an idea of the appearance of the barn from the campus. Three of its component parts only are shown: viz., the main or storage portion, fronting east; the cow stable,

the wing, with monitor roof; and the sheep barn, so called on the plans, which, however, accommodates young cattle and bulls on the same floor with the sheep, and below in the basement has pens for swine, swill room, slaughter room and root cellar. Reference to the main floor plan, Figure 1, will make the arrangement clear. It will be noted that the location of the cow stable, box stables and sheep

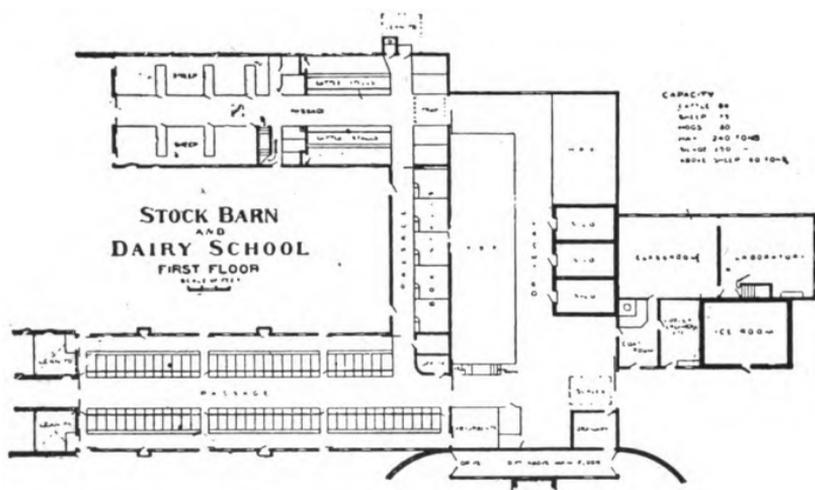


Fig. 1—MAIN FLOOR PLAN MASSACHUSETTS AGRICULTURAL COLLEGE BARN

barn, near the storage barn, is such as to protect them in large measure from the cold winds of winter. Large yards both for cattle and sheep lie between and south of the cow stable and sheep barn.

The main floor and basement plans make the chief features of the storage part of the structure sufficiently clear. The large doors in the east end give access to the upper floor, which is twenty-two feet above the main floor of the building. This elevation is reached by a drive with very moderate grade. This arrangement makes it possible

to store hay, silage, grain, stable absorbents and bedding with a minimum of expense for labor. On the right, as one enters these large doors, are traps communicating with large bins below for grain, which is drawn out through chutes into feed trucks on the main floor. On the left are traps through which sawdust, dry earth, plaster and similar materials may be dumped into rooms conveniently accessible from the stable. Near the east end is a set of hay scales. On the right, just beyond the traps for grain, is liberal floor space for the operation of heavy barn machinery. There is ample room for hay, of which 150 tons can be stored below this floor and ninety tons above it. The silos will hold about 350 tons.

There is no basement under the cow stable, and the cement passages and gutters are built upon solid earth and masonry. The cement floors under the shed roof at the south end are nine feet below the stable floor, thus making it possible to dump manure directly into a cart or manure spreader from platforms built out from the doors at the ends of the passages behind the cattle. The manure is brought out in low barrows with water-tight boiler-iron bodies.

The roof has been constructed with a view to making it non-conductive. Beginning with the outer surface there is, first, the steel, then building paper and inch boards; second, a six-inch air space; third, building paper and matched boards; fourth, an inch and one-half air space; and, lastly, lath and plaster.

This stable will accommodate sixty-five cows, and furnishes 1233 cubic feet of air space to each. A leading idea in planning the interior has been to secure smooth, hard surfaces, all readily accessible to facilitate cleaning. All ceilings and the walls of the monitor are of adamant plaster, which has been painted; the lower walls are plain North Carolina matched pine sheathing, which has been oiled. The upper windows are all hinged at the bottom,

and are moved by a ventilating apparatus by means of cranks operated from the floors. The upper sashes in the lower windows are also hinged at the bottom, and are individually moved by means of transom lifts. The lower sashes slide into the partitions, and they are protected by iron grates. Trap doors, which are moved by means of an arrangement of cords and pulleys, are placed in the cupolas.

There are in the wing known as the sheep barn two large and five small pens for sheep. The capacity is about

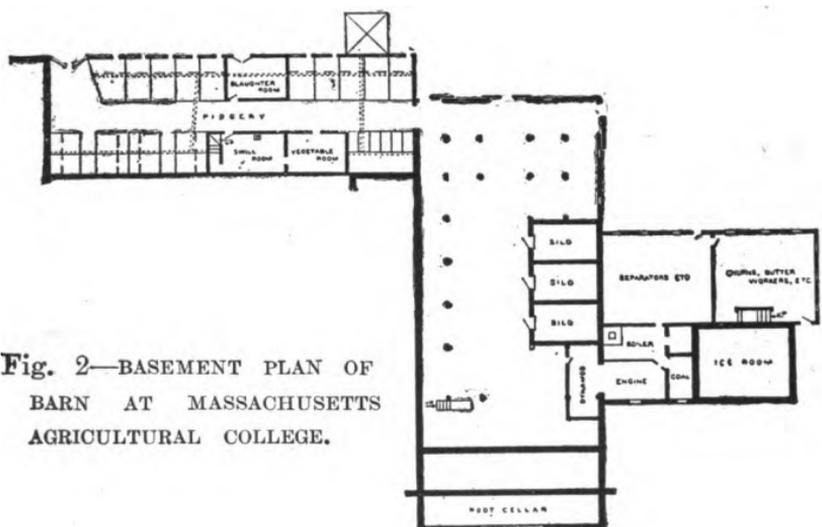


Fig. 2—BASEMENT PLAN OF  
BARN AT MASSACHUSETTS  
AGRICULTURAL COLLEGE.

seventy-five animals. The large pens are provided with patent sheep racks. They have also troughs with running water. Large doors at the south end give access to a sheltered and dry yard. The stable in this wing will accommodate twenty young cattle, and at the end are four box stalls for bulls.

The entire basement, Figure 2, has a solid cement floor. In the pens for pigs the floor slopes from each side toward

the half-round gutter which passes through the middle, leading to the manure pit outside. About one-half the floor space in each pen is covered by a raised plank floor, and the gutter has a hinged plank cover.

Both in the basement and on the first floor doors and passages are so arranged that one can drive through with carts or wagons. The loft above the sheep will hold forty tons of hay, and can be filled by the use of a horse fork working through large trap doors. Nine box stalls occupy the lean-to between the cow stable and the sheep barn, and extend across the north end of the latter.

Accommodations for instruction in matters pertaining to the dairy, as well as for manufacturing milk into butter, etc., are provided in a wing which lies north of the storage barn. The plans make the general arrangement clear. The ice room has a capacity of about 300 tons. A part of this space is used for a cold-storage room.

#### PLANK FRAME BARNES

With the scarcity of heavy timber and consequent cost it is time farmers who are to erect barns should give some study to the newer methods of framing, where no timber is thicker than two inches, and from six to eight inches wide. The use of modern hay and grain elevating machinery calls for barns with open centers. Upper cross-ties, collar-beams, etc., are in the way, and are quite unnecessary. The plank frame which is here illustrated is the newest thing in barn framing, and at the same time is very much stronger than the old-fashioned frame made of square timber of eight to twelve inches on a side. It is about half as costly, and a first-class carpenter is not required to erect it.

In the plank frame there are no timbers larger than two by eight inches. These are doubled and trebled where great strength is required. Where tensile strength is required, a two by eight is nearly as good as an eight-inch square stick tenoned and fastened in the post mortise

with a pin. In this frame there is no mortise nor tenons. The frame is put together with spikes. Hay is taken through the open center driveway with bridge, or more conveniently at end of barn, where the center is open to the peak. The advantages of this alone are manifold.

The barn of John L. Shawver of Bellefontaine, O., is shown in the accompanying illustrations. As to the frame, while it saves some labor to have the timbers of specified lengths, it is not necessary that they should be so. The frame may be constructed entirely of plank eight feet in length, or any other given length, from the fact that a splice may readily be made at any point.

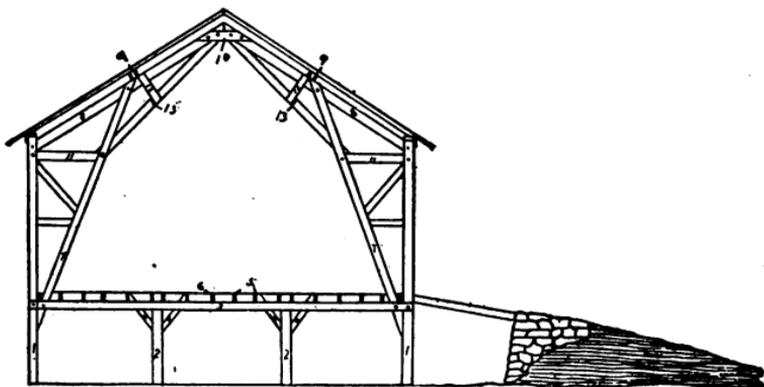


Fig. 3—INTERIOR BENT OF A BASEMENT BARN

The foundation being completed, the bents are constructed upon the ground, the sills of the first bent resting upon the foundation at the proper place and the top of the bent resting upon a temporary scaffold at the end of the foundation. The second bent is constructed with the sills at the proper place and the top of the bent resting upon the bent already made. Thus the carpenters proceed until all the bents are completed. In raising, the bent last made is raised first, carefully plumbed and firmly stayed. The next bent is then raised, and after plumbing it the side timbers are placed in position.

Figure 3 represents an interior bent in a basement barn plank frame. There may or may not be sills in the basement to suit the pleasure of the owner. If there are no sills the posts may stand on stone pillars. The posts, 1, are made of two by eight-inch plank, two pieces extending to the plates and one piece to the joist bearers, 3. The short posts, 2, extend to the floor and both joist bearers and joists are secured to them, while the braces, 4, make

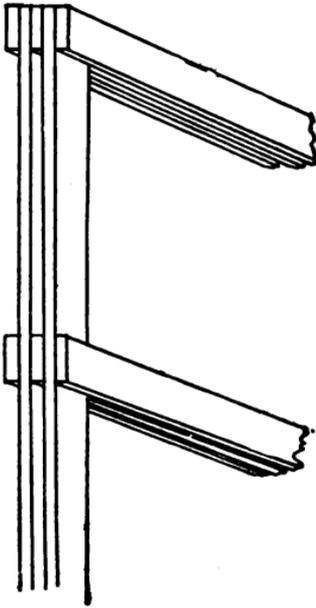


Fig. 4—THE FRAMING

the posts rigid and support the joist bearers; 5 represents the ends of the joists and 6 the floor level; 7, the purlin posts, are secured to the main posts and joist bearers and reach the roof supports, 8, just beneath the purlin plates, 9. The roof supports, 8, are secured to the side posts and purlin posts and meet at the comb with any desired pitch. Then they are secured together by the collar beams, 10, which are two by twelve inches and five or six feet long.

The main ties, 11, consist of single plank two by eight inches, secured to both posts and purlin posts, upon which rest the sub-supports secured at one end to the purlin post and at the other to the collar beams. The stays, 12, consist of two planks each two by six inches, to the lower end of which, at 13, the purlin braces are secured. In the frame one secures a thoroughly braced bent with very little labor, and at the same time there is no timber in the interior to be in the way.

Figure 4 shows the manner of putting the timbers together, sills, posts and joist bearers being represented.

Plank two by four, two by six or two by eight inches is used for packing in the posts of the end bents, and the basement posts throughout.

The purlin plates are made of two sets of two by eight inch plank with a two-inch space between them, into which the couplings, six or eight feet in length, are entered, thus firmly combining one section with the next. The purlin braces also enter this space at the proper distance from each roof support, where they are then spiked,

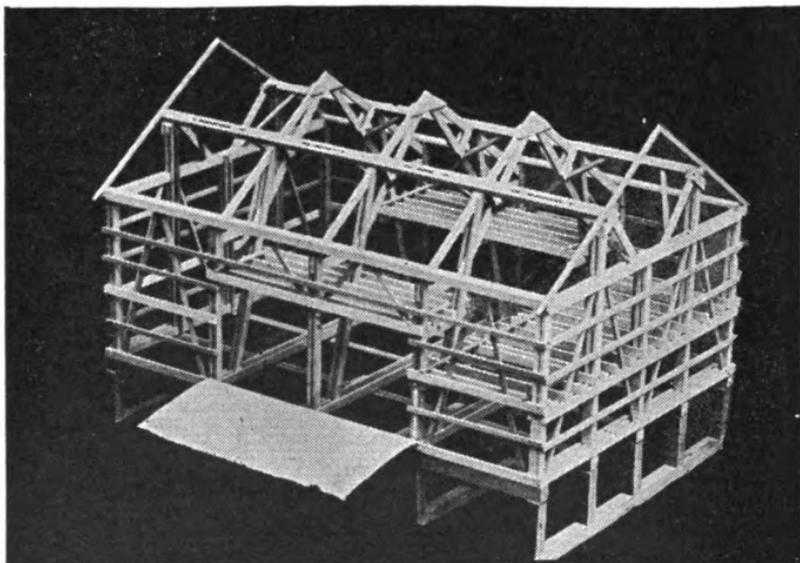


Fig. 5—MODEL OF A PLANK FRAME BARN

the lower end of these braces being secured to the lower end of the stays. The upper ends of the purlin posts are cut so as to form saddles, into which the purlin plates drop to position.

If a gambrel roof is desired the purlin posts are placed at the proper angle and extended above the roof support at a sufficient distance to give the pitch desired for both sections of the roof. At this point the stays meet the

posts and short two by eight inch plank are inserted and the saddles cut in a similar manner to those of the plain gable roof.

Figure 5 shows the model of a forty by sixty-foot plank frame barn, with nine-foot basement and twenty-foot superstructure.

Another style of construction was followed by Thomas Convey of Wisconsin in building his barn, forty by sixty feet and forty-four feet high. Figure 6, the left hand cut, is intended to represent the end bent. He says: "I do not claim anything original in this except that the bent is held in place the same as the sides by four two by eight inch pieces, two on

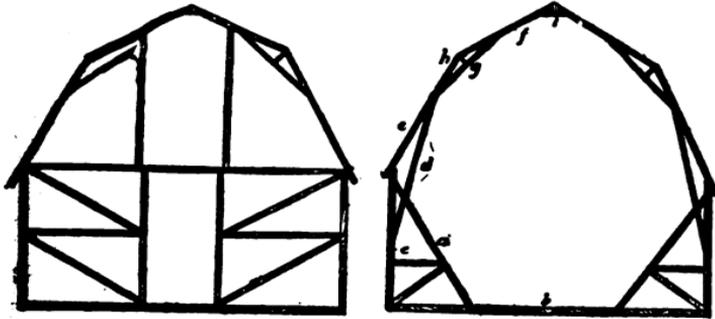


Fig. 6—CONSTRUCTION OF THOMAS CONVEY'S BARN

each center post extending from near the top of post in about twelve feet to sills running lengthwise of building beneath the floor. If desired the tie beam in end bent need not be continuous. Where it is necessary to take in hay from outside building, a series of doors would be preferable. It is unnecessary to outline manner of putting in girths to nail on lumber, as any carpenter can readily do it. Care should be taken to leave place on top of post to bolt the first pair of rafters that they may be flush with outside of frame.

"The principle of construction in the right hand cut of Figure 6 is to get each bent sufficiently strong that not

only the bent, but timbers between bents, will be rigid. *b* is made of several two by eight inch pieces. I use three pieces eighteen feet long on each side and three pieces twelve feet long in the center. This gives two feet of a splice at each joint. There is a two-inch space between except where spliced. The posts are twenty feet high, two two by eight inch pieces being used on each side with two-inch space between. The girths, *a*, to hold post in place, are twenty-two feet long. Leave a space of one foot on top of post on inside to bolt a two by eight inch joist both on inside and outside of post to carry plate. The lower end of girth *a* runs down between spaces in tie beam, *b*, just twelve feet from the outside of post."

#### HOW TO BUILD A ROUND BARN

The accompanying illustrations, Figures 7, 8, 9 and 10, are of plans for a sixteen-sided barn, circumscribed by a circle with a radius of thirty feet. There is no economy in building a strictly round barn, as curved walls, sills, cornice and roofing are very expensive and offset the trifling gain in floor space.

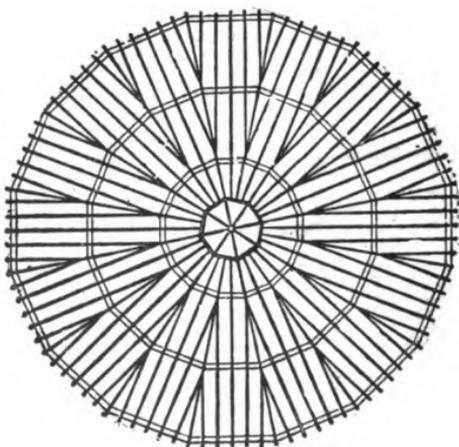


Fig. 7—POSITION OF RAFTERS

The basement floor is two feet six inches below grade, and is made of a four-inch layer of cinder concrete, covered by a two-inch plank floor where cows stand. The stable proper has a capacity of forty head. Beside this, the basement contains two large compartments for a hos-

pital, a calf pen, feed bins, and grain bin, all handy for feeding stock. Both these bins have chutes from larger bins above. Two hay chutes are centrally located, and run directly to the mow. A stanchion lever near the main door makes it possible to release all cows at once. A stair runs from near the door to main floor, which is used as a stable, with stalls for eight horses. It has a harness closet,

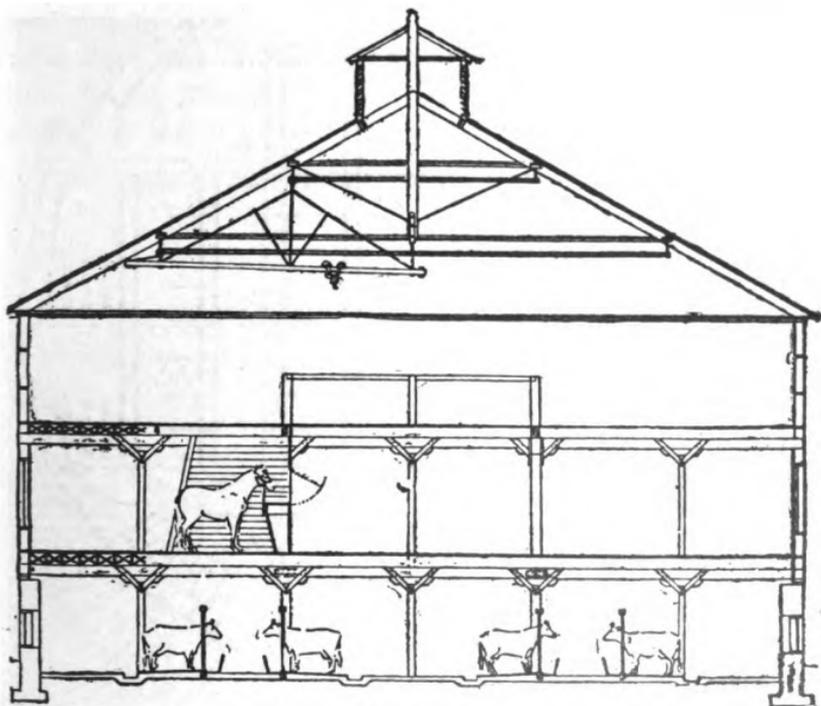


Fig. 8—CROSS-SECTION OF ELEVATION

feed bin and large granary. A large open floor may be utilized for storage, grinding or other purposes—more stable room if needed. There is no stair to mow on plan, but sufficient room to insert one.

The mow is covered by a self-supporting roof. A double plate rests on the studding, supporting a system of rafters,

which in turn support another plate, and so on. The roof plan is shown in Figure 7. An octagonal king post runs down in the center to support one end of the hay track, the other end of which is supported by a car attached to a circular track, thus allowing it to swing around like a

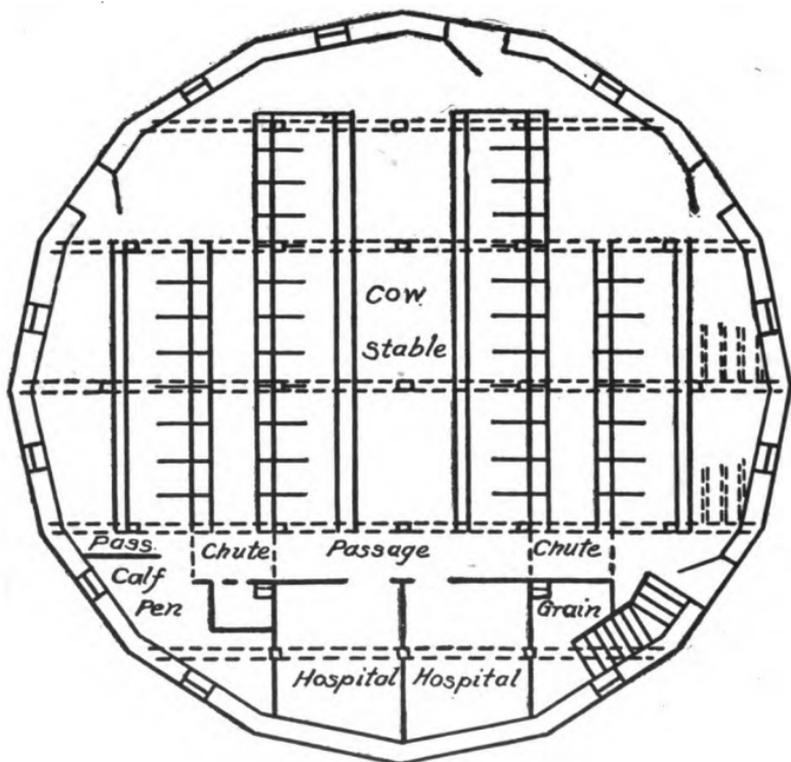


Fig. 9—ARRANGEMENT OF THE BASEMENT

clock hand, and deliver hay at any point in the mow. The track is steadied by an auxiliary arrangement at its center. It can be operated by the man in the mow without interfering with unloading operations. To make the car return easier, the pivoted end is hung six inches lower than the other.

This barn is framed after the balloon-frame system, and may be considered an example of it. The outside walls consist of two by eight inch studding, three at each angle, with nail girths between. The plates and sills are double, of two by eight inch stuff, lapped and well spiked

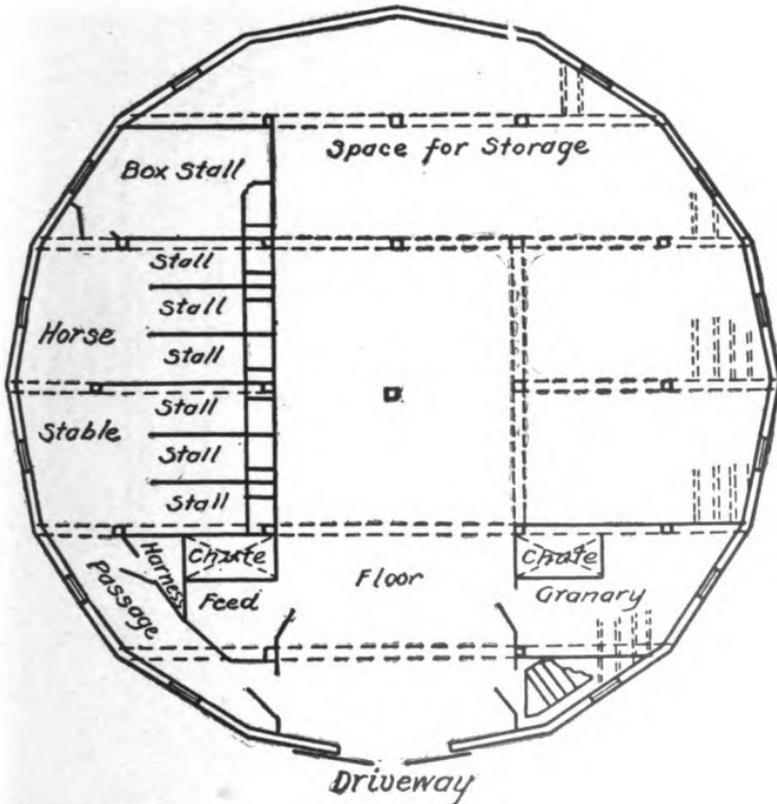


Fig. 10—PLAN OF MAIN FLOOR

at the angles. The stability of the roof depends on the security with which its plate is spiked at angles, and sheathing nailed to hip rafters. Of course the inside framing is as ordinarily made, except that instead of tenoning girths to posts, posts are cut off, and girths laid across on hanger-plates. When girths cut over

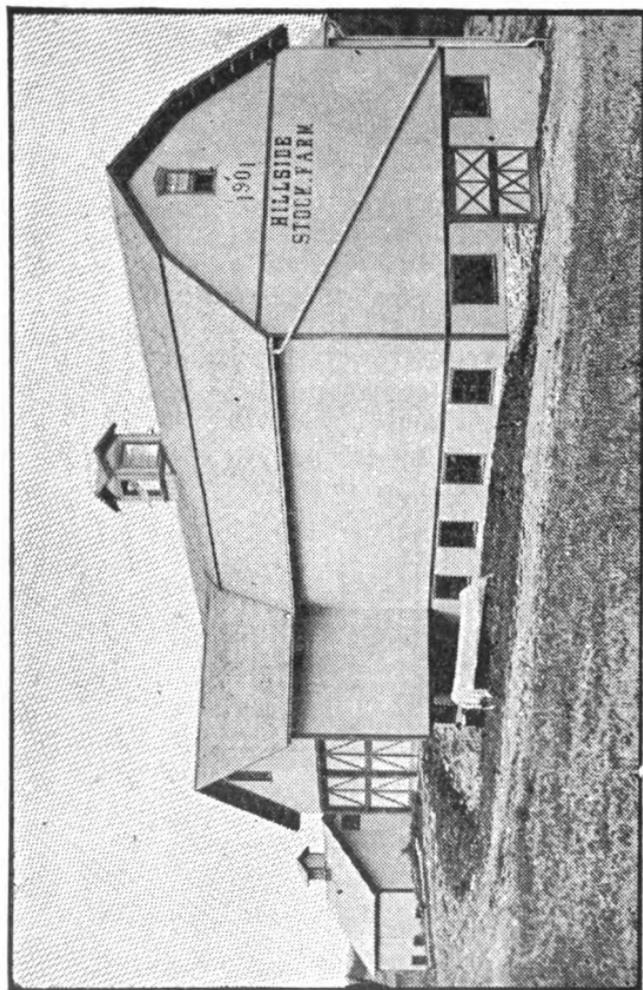


Fig. 11—C. E. COLBURN'S FARM AND STOCK BARN

posts, fish-plates tie them. All bracing is done with two by eight inch scantling spiked on. See Figure 8. The ground plans, Figures 9 and 10, and elevation here illustrated are drawn to a scale. The cut showing portion of rafters is drawn on a much smaller scale. The cost of

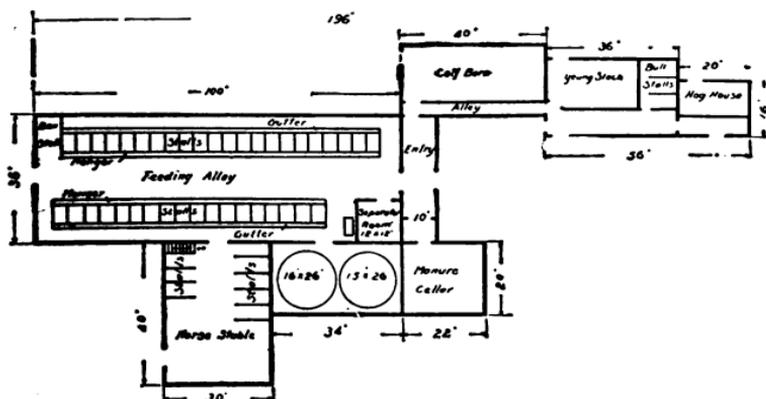


Fig. 12—GROUND PLAN OF MR. COLBURN'S BARN

this barn, including \$120 for labor, is \$2550, but this will vary somewhat with the cost of labor and material.

#### AN UP-TO-DATE NEW YORK BARN

Figures 11, 12 and 13 show the live stock and hay barn of C. E. Colburn of Portlandville, N. Y. The main barn is thirty-six by 100 feet in size, with horse stable thirty by forty feet, calf barn, hog house and manure cellar attached, Figure 12. Adjoining the horse stable are two round silos. The floors of all the buildings, except the horse stable, are cemented. A barn for young stock accommodates ten yearlings and four bulls, the calf barn twenty cows with stanchions in which to feed them. The main barn has fifty-one individual stalls and one box stall. The water tank is over the separator room and holds fifty-two barrels. A bull on a tread power is used to run the separ-



PLAN OF CONVENIENT FARM BARN AND YARD

The accompanying illustration, Figure 14, shows the ground plan of a very convenient barn with end elevation. It also shows plan of granary, chicken house and yards surrounding the building. The end elevation needs no particular explanation. *Aa* shows the construction of

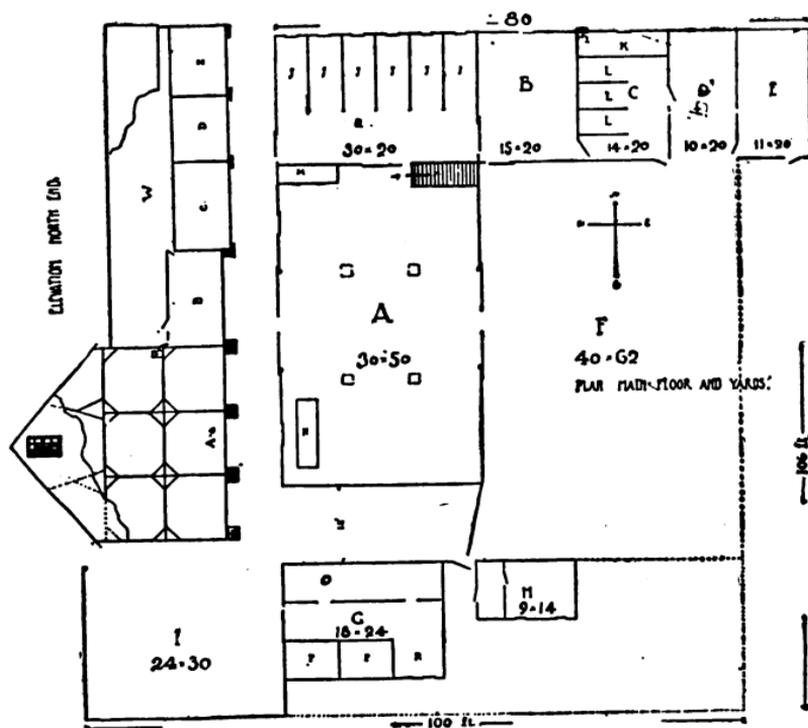


Fig. 14—SUGGESTED ARRANGEMENT FOR FARM BUILDINGS

frame and location of window in the end, *B* is the feed room, *C* is the cow stable, *D* is the open cow shed and *E* is the pig room. In the ground plan *A* shows the main floor of the barn, thirty by thirty feet, which is used for storing hay. However, a part at *N* is reserved for the

work room and at *M* as a harness room. In one corner the stairway leads to the upper story.

The horse stalls at *J* are six in number. *B* is a feed room fifteen by twenty feet and can be used for a box stall if necessary. *K* is the calf room and *C* the cow stable. *D* is open cow shed and *E* the hogpen. *F* is the open yard between granary *G* and barn. The chicken house *H* is nine by fourteen feet, *S* is the chicken yard, *I*, twenty-five by thirty feet, is the wagon shed. The dimensions are indicated on the sketch, which of course can be changed to suit individual tastes. The whole arrangement is simply suggestive. It works well on a South Dakota farm. The corn crib is a separate structure and is off to the right. Of course if it is desirable, the corn crib can be arranged within the building and also in the granary. In the granary plan *O* can be used as a corn crib, with *P* devoted exclusively to small grains and *R* for tools.

#### THE BARN OF MR. DAVID LYMAN

Among the many large and expensive barns now scattered through the country, there are few more thoroughly satisfactory to old school farmers with broad ideas than one built by the late Mr. David Lyman of Middlefield, Ct. Mr. Lyman required a very large barn for his farm purposes simply, and built one, a front view and interior plan of which are here given. The elevation of the building, Figure 15, shows entrances to its two main floors; there is a basement below.

THE UPPER, OR HAY FLOOR—This floor is shown in Figure 16; all the hay, grain and straw are stored there. It maintains the same level throughout. Two threshing floors cross the building, and are entered from the high ground on the west by a very easy ascent. The main entrance crosses over an engine room, seen in Figures 15

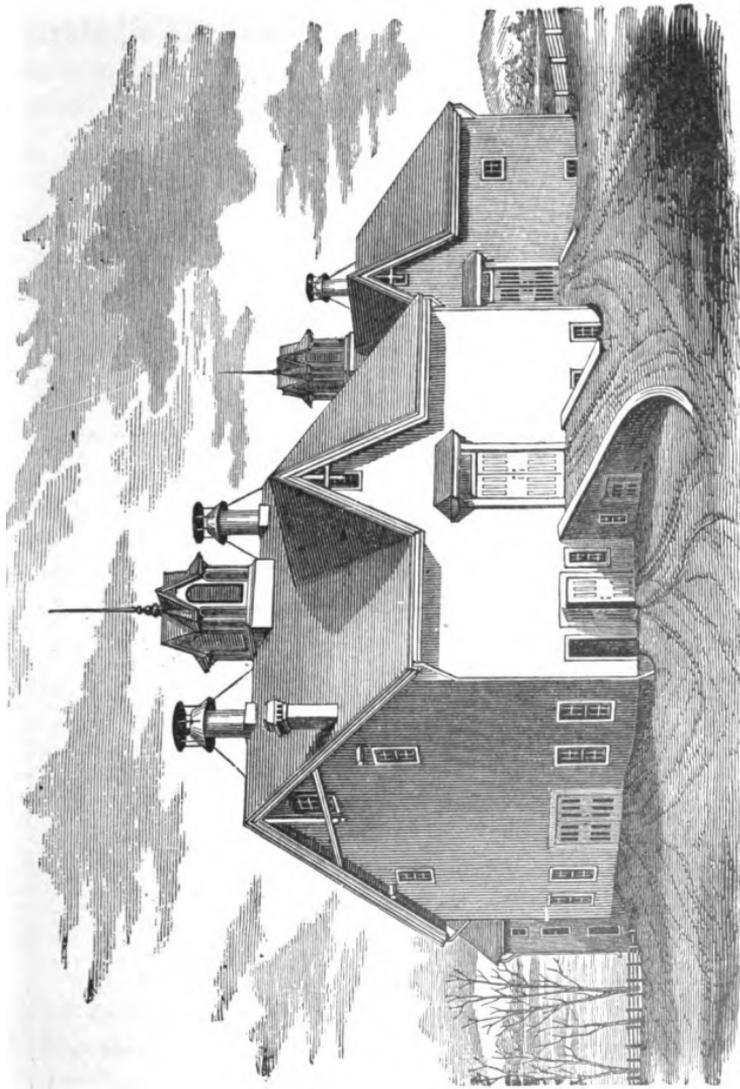


Fig. 15—PERSPECTIVE ELEVATION OF MR. DAVID LYMAN'S BARN—FROM THE NORTHWEST

and 17. This room is built of stone, arched above, and is roomy as well as secure.

By means of a hay fork and a number of travelers, the hay is taken from the loads and dropped in any part of the immense bays. The forks are worked by one horse,

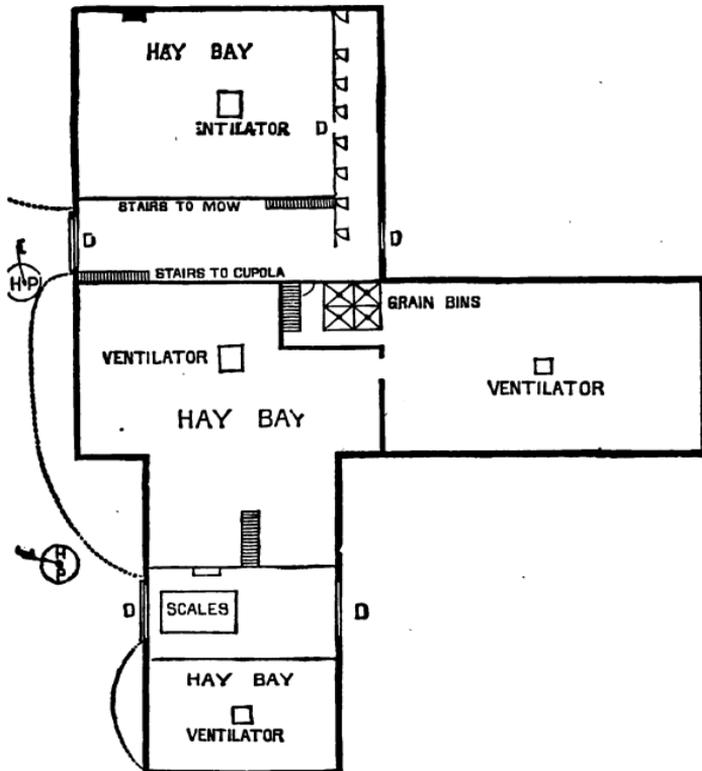


Fig. 16—PLAN OF HAY FLOOR

attached to a hoisting machine, of which there are two, placed near the great doors during the haying season, as indicated by the letters marked *H*, *P*, in the plan, Figure 16.

On the main floor are bins for grain and ground feed, provided with chutes connecting them with the feeding

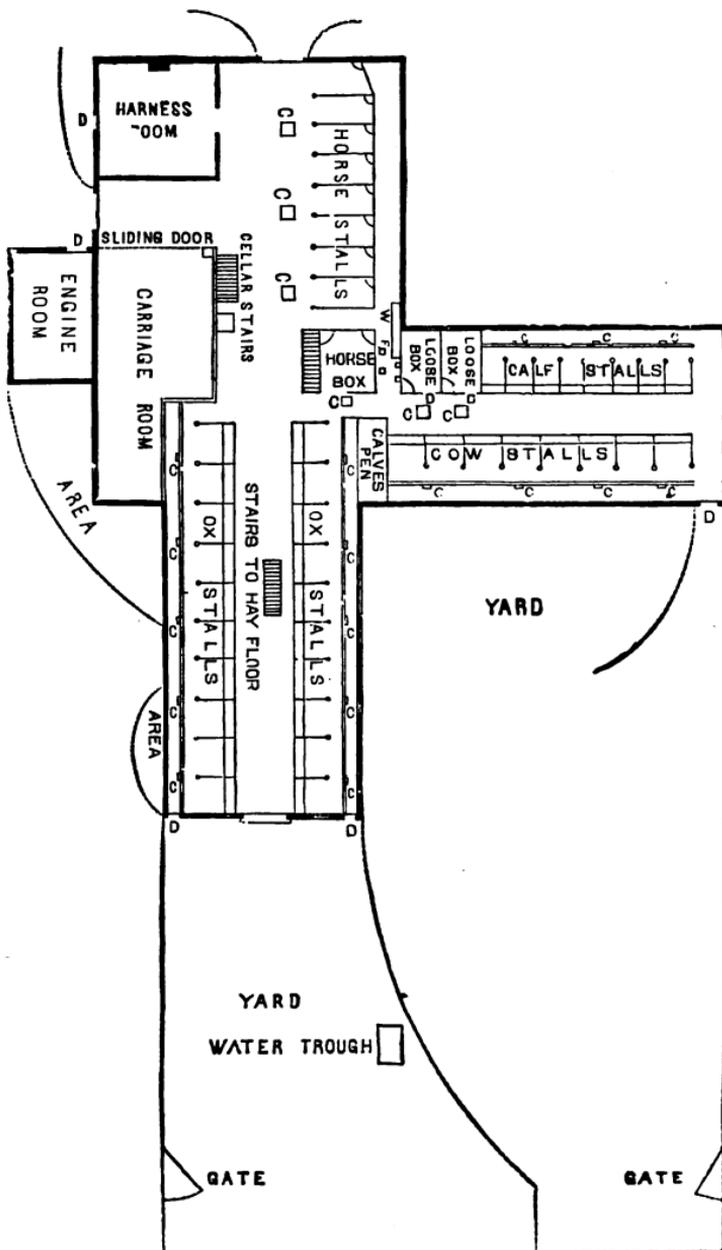


Fig. 17—PLAN OF FEEDING FLOOR

floor. There are hay scales, also—a fixture in one of the floors—which afford the means of being very accurate in many things, in regard to which guess work is ordinarily the rule. The great ventilators, so conspicuous in the cut, pass from the feeding floor to the roof, and are furnished with doors at different elevations, quite to the top of the mow, thus forming convenient chutes to throw down hay or straw. A long flight of stairs passes from the principal barn floor to the cupola, from which a magnificent view is obtained of the whole farm and surrounding country.

THE FEEDING FLOOR is entered by several doors. Two double doors open upon a spacious floor in the rear of the horse stalls, which extends through the middle of the main barn. The northwest corner, Figure 17, is occupied by a large harness and tool room, with a chimney and a stove. On the right of the front entrance is the carriage room, which is closed by a sliding door, or partition. There is room on the open part of this floor, behind the horse stalls, and adjacent, to drive in three wagons at a time, and let the horses stand hitched. Between the ox stalls in the south wing, is a ten-foot passageway through which carts with roots or green feed may be driven, the stairs in the middle being hinged at the ceiling and fastened up. The stalls are seven feet wide, and arranged to tie up two cattle in each. A gutter to conduct off the urine runs along behind each range of stalls, and there are well secured traps, one in about every fifteen feet, through which the manure is dropped to the cellar. The letter *C*, wherever it occurs in Figure 17, indicates a trap door of a manure drop. The letter *D* is placed wherever there are doors which, in the engraving, might be taken for windows.

The cattle pass to the yards through doors in the ends of the wings. The south yard is nearly upon a level with the floor, sloping gradually away toward the south and

east; but the large barn yard is on the level of the manure cellar, and an inclined way gives access to the yard on the east side, from the cow stalls. Three roomy, loose boxes are provided, one for horses, and two as lying-in stables for cows. Near the points marked *W* and *F*,

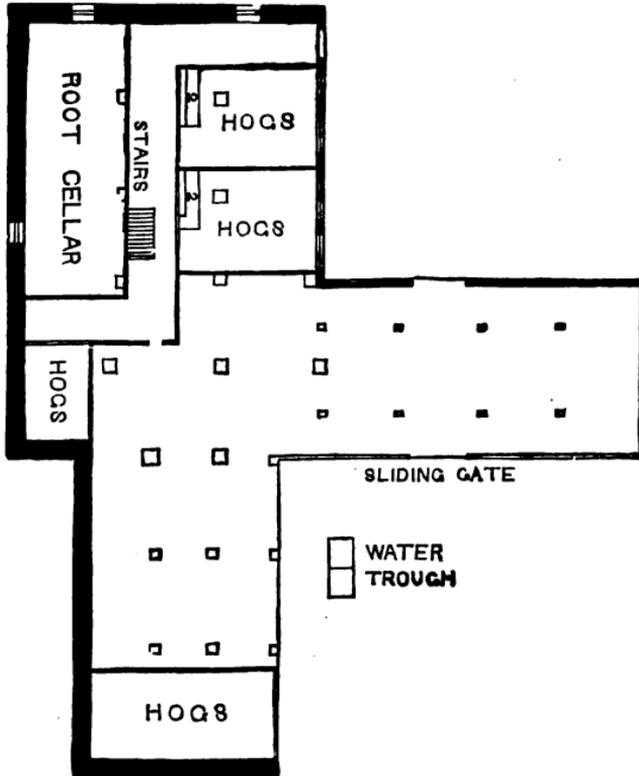


Fig. 18—PLAN OF BASEMENT

stands the hydrant for flowing water, and the trough for mixing feed, and here, too, the chutes for grain and cut feed discharge from the floor above.

**VENTILATION AND LIGHT**—Four immense ventilating trunks, four feet square, rise from the feeding floor straight to the roof. These are capped by good ventila-

tors of the largest size, and cause a constant change of air in the stables, the draft being ordinarily sufficient to be felt like a fresh breeze, by holding the hand anywhere within a few feet of the openings. This keeps the air in the whole establishment sweeter and purer than in most dwellings. The windows on all sides of this floor are of large size, with double sashes, hung with weights.

**THE BARN CELLAR**—This is arranged for hogs, roots and manure. The fixed partitions in the cellar are only two, one enclosing the root cellar, and the other, outside of that, shutting off a wide, cemented passageway, extending from the door at the northeast corner, around two sides of the root cellar, as shown in Figure 18. The rest of the cellar is occupied by the manure, and hogs are enclosed in different parts of the cellar, according to convenience.

**SIZE OF BARN**—The building covers more than one-fifth of an acre of land, and thus there is over three-fifths of an acre under a roof. The main barn is fifty-five by eighty feet. The wings are each fifty-six feet long, the south one being thirty-five wide, and the east wing thirty-one and one-half feet wide. The four leading points sought for and obtained were: First, economy of room under a given roof; second, plenty of light; third, plenty of air and ventilation, which would draw off all deleterious gas as fast as generated, and fourth, convenience to save labor. Saving of manure and many other things were of course included. The windows are all hung with pulleys, and are lowered in warm days in winter, and closed in cold days. This is important.

#### MR. LAWSON VALENTINE'S BARN

The perspective view and plans here given represent the fine barn on "Houghton Farm," the property of the late Lawson Valentine, Mountainville, Orange County, N. Y.

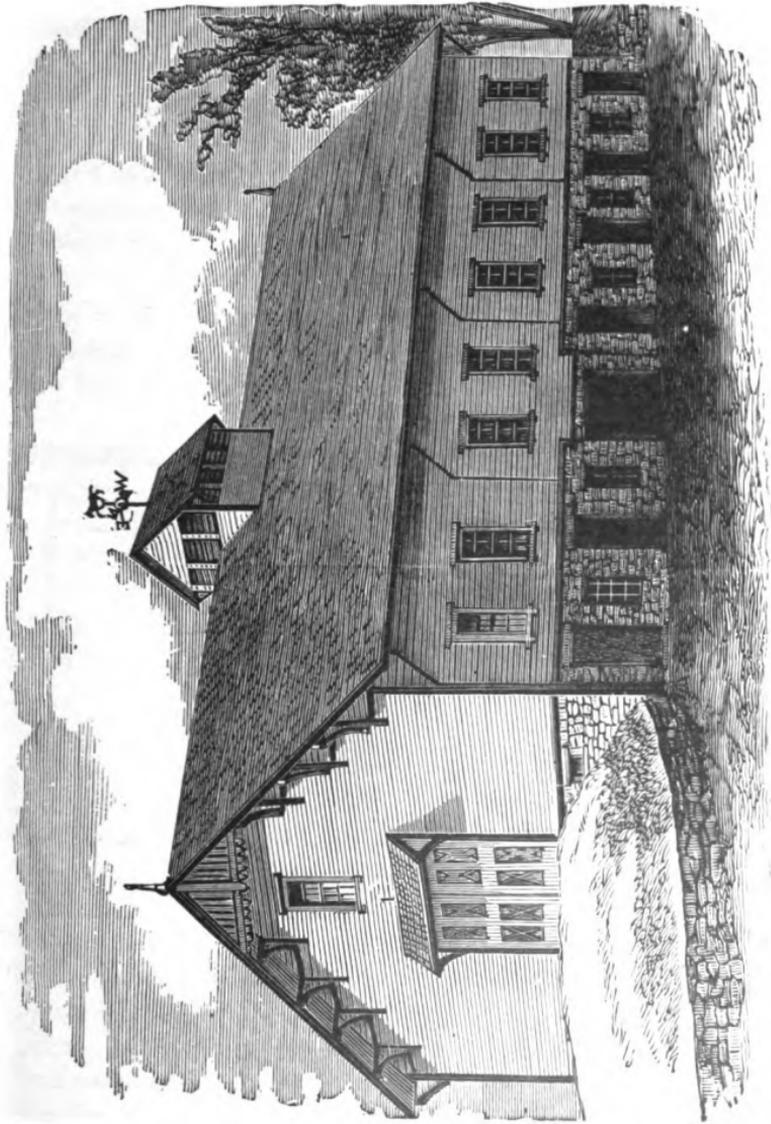


Fig. 19—MR. LAWSON VALENTINE'S BARN, "HOUGHTON FARM," MOUNTAINVILLE, N. Y.

It is located on a hillside, and is supplied with water brought from springs. The barn is handsomely proportioned, and with its slated roof and red-painted walls, with black trimmings, presents a fine appearance. It is admirably adapted for keeping a large number of horses, and a good model for any well-to-do farmer desiring a handsome and useful barn. In its general plan it may be followed on a smaller scale by anyone having horses and cattle for which to provide stabling and shelter.

The building is 110 feet long by fifty-five feet wide, with twenty-foot posts, and is forty feet from the main floor to the ridge. It rests on a stone basement ten feet

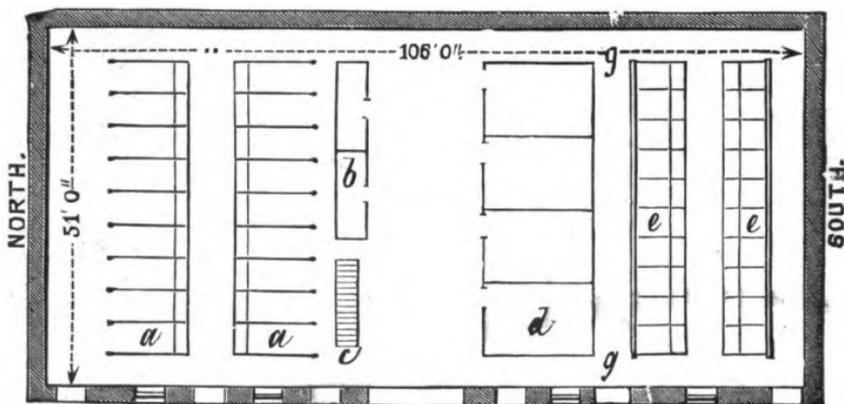


Fig. 20—PLAN OF BASEMENT

high in the clear; this basement provides comfortable and convenient stabling for the owner's fine stud. The division is shown at Figure 20; *a, a*, are the horse stalls; *b*, the harness room, four by twenty-five feet; *c*, stairs; *d*, box stalls, ten and one-half by fourteen and one-half feet; *e, e*, cow stalls, with permanent partitions and adjustable mangers; *g, g*, gates for separating the cattle department from the horses. Figure 21 shows a plan of the main floor; *a*, is the tool room; *b*, contains a horse

power for driving a feed cutter, thresher, etc.; *c*, is used as a stowage room for cut feed, etc.; *d*, is the grain room, provided with bins and convenient chutes; *e*, is a room for a keeper; which also contains closets for the nicer harnesses. The letters *V*, *V*, *V*, *V*, indicate the ventilators; *S*, shows the large platform scales. The floor of the basement is made of brick, laid on edge in mortar, underlaid by concrete. Figure 22 represents one of the horse stalls. The upper portion consists of iron rods

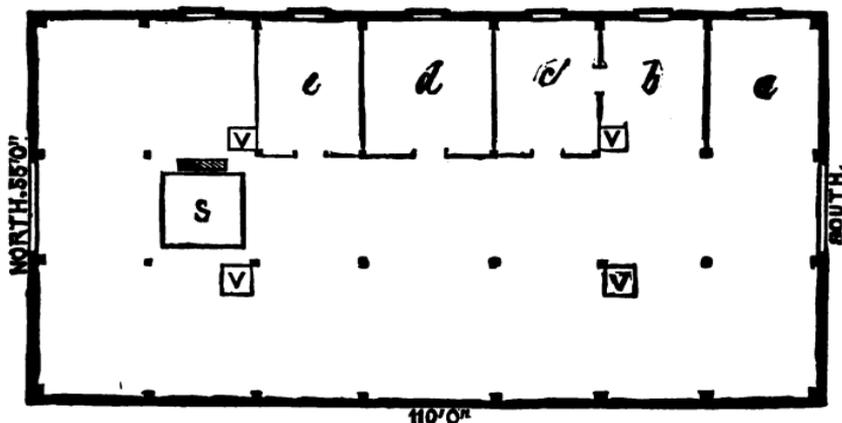


Fig. 21—PLAN OF MAIN FLOOR

extending from the top of the sides to a railing two feet above. The front is provided with screen doors. The stall is nine by four and one-half feet, and the manger is one foot nine inches from front to back. An iron feed trough for grain occupies one end of the manger, indicated by the dotted line at *G*. The remainder is taken up by the hay box, *H*, the bottom of which is shown by the dotted line. A door in front allows for cleaning out the feed box, and opens to a closet. The box stalls are also provided with the iron rods for a top finish, so that a person can easily see into them without entering. The

interior exposed wood work is varnished, making a neat and substantial finish. Opening into the basement, and extending nearly to the roof, are four ventilating flues, each four feet square. Their outer edge is on a line with the driveway, and the inner side has openings fitted

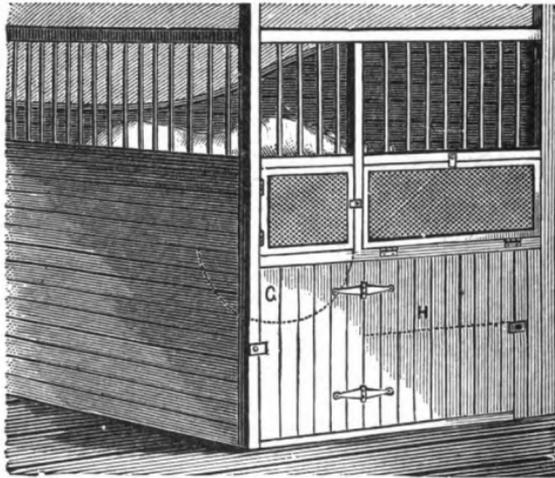


Fig. 22—VIEW OF HORSE STALL

with doors opening inwards, at various heights, which make the flues serve as convenient hay chutes to the floor below.

#### AN OHIO BARN

The accompanying engravings are of a barn built by Mr. Kyle, Greene County, Ohio. The basement is sixty feet long, twenty-four feet wide, and seven feet high in the clear; the walls contain seventy perches of stone work. The floor above is supported by two rows of pillars, Figure 23. Those in the outside row are two by six feet, the inside ones being two feet square. The barn is forty-eight feet wide. The floor of the cow stable, which is directly over the basement, rests upon joists that are laid

upon cross sills, and reach from the ends of the front pillars to the rear ones. The joists rest upon the cross sills as far as the latter reach, and then upon the pillars. The cross sills are ten inches square. There is thus a drop of ten inches in the floor upon which the cows stand and immediately behind them. This drop, *h*, Figure 24, is four feet wide, and forms a passage in



Fig. 23—PERSPECTIVE VIEW OF MR. KYLE'S BARN

which the manure collects, and from which it may be pushed through the side of the drop to the basement below. The liquids from the cows drain through this open space upon the manure in the basement. The floor upon which the cows stand, seen at *g*, is six feet wide. A passageway, seen above the arches in Figure 23, leads from the stable door to the barn yard. There are fourteen stalls for cows, *g*, Figure 24, each of which is four feet

wide. The partitions between the stalls are formed in the manner shown in Figure 27. In each stall is a manger and a feed box. The cows are tied by means of ropes around their necks. There is a passage, *f*, Figure 24, between the cow stable and the horse stable, *c*. In the latter there are seven single horse stalls, and two closed loose boxes. Each single stall is five feet wide. When the

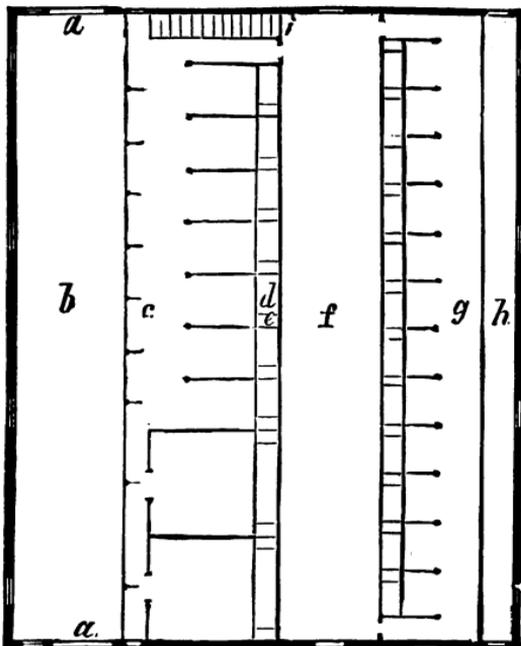


Fig. 24—PLAN OF STABLE FLOOR

horse stable is cleaned, a wagon is driven into the shed behind it, *b*; the manure is thrown into the wagon, and at once hauled wherever it may be wanted. The floor of the horse stable is on the ground. The partitions between the horse stalls are made as shown in Figure 26. The shed, *b*, Figure 24, is for storing tools and wagons, or housing sheep, and has a door, *a*, at each end. One door opens

into a yard, through which the road, seen in the engraving, runs. Here the straw and cornstalks are stacked, and a great portion of them are here fed to the stock to make manure. No water from the barn runs into this yard, or on to the manure. The stables are eight feet high, and the barn reaches eighteen feet above the stables. The plan of the barn floor is shown at Figure 25; at *a* is

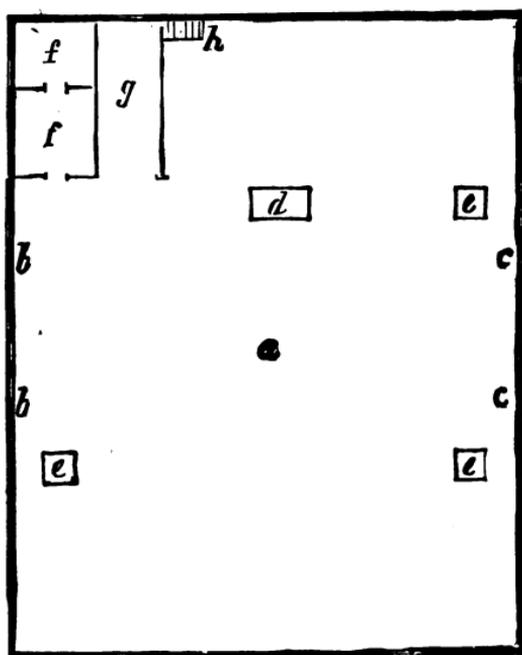


Fig. 25—PLAN OF BARN FLOOR

the main floor; at *b, b*, are the entrance doors, to which a sloping driveway, abutting against the wagon shed, leads. The rear doors, *c, c*, are hung upon rollers, and in Figure 23 are seen partly open. At *d* is the trap for hay, leading to the feed passage below, and *e, e*, are traps for straw used for bedding, leading into the stables. The granaries are seen at *f, f*, and there are spouts from these leading into the

wagon shed, so that sacks upon the wagon can be filled from the spouts. The passage to the granaries is at *g*; it is eight feet wide, and a work bench with tools is kept here. The staircase leading down to the feed passage is seen at *h*. The trap doors are double, and on hinges. The floor is also double, so that no dust can fall through to the floor below, nor any disagreeable vapors arise therefrom. This story is eighteen feet clear, there be-

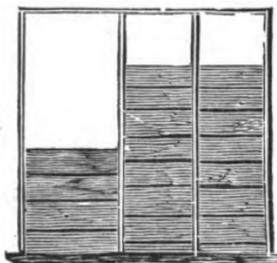


Fig. 26—HORSE STALL



Fig. 27—COW STALL

ing a truss roof which is self-supporting. The roof is shingled with pine shingles, and the whole of the barn is covered with pine weather boarding, and painted. The total cost of this barn was \$1200, in addition to the owner's work, and the value of the frame timber, which was cut upon the farm.

#### A MISSOURI BARN

The barn shown in the following engraving, Figure 28, was built by Mr. William B. Collier of St. Louis, on his country estate in Audrain County, Mo., and has been regarded by well-informed people as one of the best barns in the state. The building is eighty-four feet square, and nearly fifty feet in extreme height, not including the cellar; it fronts the south. There are eighty-four stalls, arranged as in the ground plan (Figure 29), there being

two rows of horse stalls on one side and three rows of cattle stalls on the other. The proportions of the interior are as liberal of space as those of the barn itself. The central driveway or barn floor is sixteen feet wide. The carriage and wagon rooms on each side the floor are both twenty feet square. Large loose boxes are for the accommodation of stallions. The various passageways between the rows of stalls, and at the rear of them, are four feet



Fig. 28—A MISSOURI BARN

wide, while the horse stalls are nearly six feet, and the stalls for two cows eight feet in width. The two spaces enclosed between dotted lines on the barn floor indicate the position of the hoist ways under the skylights for hay and grain. The spaces at either end outside these hoisting spaces are floored over above the great doors, and are finished off as granaries for keeping the supply of oats, meal, etc., required for the stock. On each side of the barn is a rain water cistern, twelve feet nine inches in

diameter, and twenty-five feet deep; these are connected by a pipe, passing underground across the front of the barn. There are seven windows on each side, and six besides the five sliding doors, in each gable. These, with the three great ventilators, afford unusual provision for pure air. The cattle are fed from the floor above. The

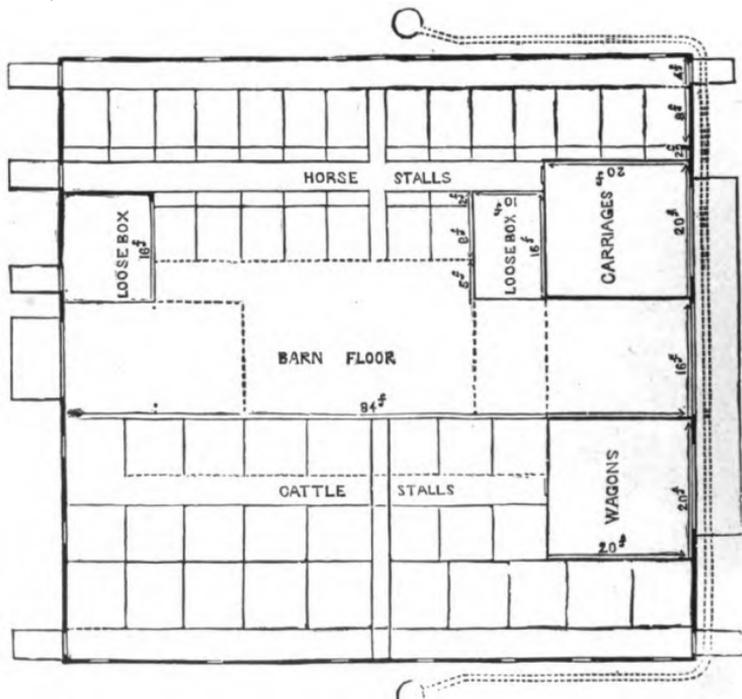


Fig. 29—PLAN OF BARN

passage between the rows of horse stalls is for feeding. The building stands upon fifty-four stone pillars, and has a tight board floor, any part of which may be easily renewed, as occasion may require. With a large corn house, thirty-five feet square, not seen in the engraving, this barn cost \$9000.

## A GOOD FARM BARN

The following plan (Figure 30) is of a simple and inexpensive barn. The size is forty by fifty-five feet; it has a large shed attached for cattle. The fifteen-foot barn floor, see Figure 31, is of good medium width; if wider the room would not be wasted. On the left are the horse stalls, five feet wide. There might be five stalls four feet wide, but for a large horse the width ought to be about five feet. The whole space given to horses is fifteen by twenty feet. Beyond, the floor widens seven feet, and the rest of

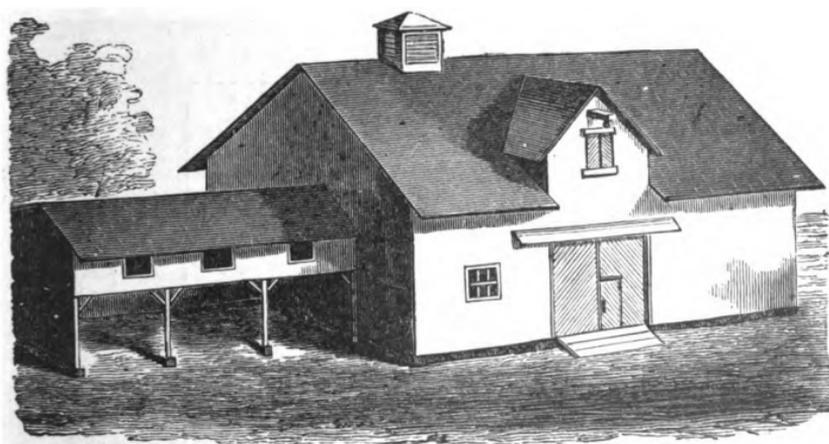


Fig. 30—ELEVATION OF BARN

the left side is devoted to cattle stalls, twenty-five feet, giving room for six cow and ox stalls, and two passages, one of which may be closed and made a stall for a cow. The seven-foot space affords abundant room for hay cutter, feed box and accompaniments, located close to both cattle and horses; and if cattle are fed in the shed on feed prepared in the feed box, a passage at the rear conducts conveniently to their mangers. A three-foot square trunk ascends, from over the seven by twenty-five-foot



pitch, more lasting than if flatter. A substantial, tight floor is laid upon the straining beams of the roof. This may be extended, if desired, through the entire length of the barn, or only from one end to over the barn floor. In it is a large trap door directly over the threshing floor. A small gable with a door in it, over the great doors, affords communication with the front of the barn, so that grain in bags or barrels may be raised or lowered as well here as through the trap door. This floor is the granary or corn loft, easily made rat proof, close under the roof, and consequently very hot in sunshiny, autumn weather. Corn in the ear is easily hoisted by horse power from the wagons, and, if spread on the floor not more than a foot thick, it will cure much sooner and more perfectly than in cribs. This grain floor is reached by a stairway from the floor over the stables; under the stairs is a chute, or chutes, for conducting the shelled corn, etc., to the feeding floor. This arrangement requires strong posts and roof framing, but not stronger than for a slate roof of a less pitch, for such a roof will support double the weight likely to be placed on the floor. Not only is the roof constructed to bear the weight of the slates, but of two feet of snow, and the force of high winds in addition. The weight of grain will only give increased steadiness, a large part being borne by the posts, the floor preventing all racking. The shed is thirty by forty feet, with twelve-foot front, and eight-foot rear posts, open in front, and having windows in the back. At the rear, a passageway four feet wide communicates with the cow stable in the barn, and forms the feeding alley to the loose boxes in the shed. Cattle will not suffer in such a shed, left entirely open, in the severest winter weather, but it is best to close the front by boarding, and doors, having large windows for light and air. The pigpens are placed contiguous to the barn yard, so that the swine may be allowed the free

range of the compost heaps, at least in their own corner. In the hog house is a steam boiler; and a pipe, boxed and packed in sawdust, and laid underground, crosses the yard to the feeding floor, for steaming and cooking the fodder for the cattle. By this arrangement the swine are located at a considerable distance from the granary and root cellar. But this is not a serious inconvenience, and it is best to remove any source of danger from fire as far away as possible.

The root cellar is seven feet deep under the hay bay, on the right side of the barn. There are two chutes from the floor to the cellar, and there is a stairway as indicated. Besides, access is had by a cellarway, on the eastern side.

This plan may very readily be reduced, to say thirty by forty-two feet, making the floor twelve feet, the bay fifteen feet, four horse stalls eighteen feet, and four cow stalls twelve feet, in a line across the left side—the floor being fifteen feet wide in front of the cow stable, and other contractions made in the same proportions.

#### ANOTHER BARN FOR MIXED FARMING

Very many farmers desire a barn for mixed husbandry, for storing hay and grain, for keeping stock, and all the labor-saving implements, with a good root cellar in a convenient place, and a yard for manure. The following plan, Figure 32, shows such a barn. Its cost ranges from \$1500 to \$2500, according to the price of materials and the amount of finish put upon the work. In most places, where stone for the lower story and lumber can be cheaply procured, \$1500 will be sufficient to build a barn fifty feet square, including everything needed. This is not a basement barn, being made on level ground. Partly underground stables are not generally desirable, on account of dampness, too much warmth in winter and lack of ventilation. But a slight rise of ground, which may be

availed of, for an easy ascent to the barn floor, is a convenience, although not at all necessary. This may be readily made by using the earth from the root cellar (which should be two or three feet below the surface) to fill in the ascending roadway. The stable floor is thus on a level with the ground, and windows on each



Fig. 32—ELEVATION OF BARN AND STABLE

side furnish ample light and ventilation. The foundation walls are of stone, sunk three feet below the surface. Drains from the bottom of the foundation would be found of great use in keeping the stables perfectly dry at all seasons. Below the ground, the walls may be built of dry work, but above the surface the best of mortar should be used in the building. Much of the solidity and dura-

bility of a building depends upon the excellence of the mortar. The stable walls are so built that the barn overhangs the entranceways six feet, which gives protection against rain or snow, as well as prevents drifting of either into the open upper-half of the doors or windows, thus permitting ventilation in stormy weather, and allowing

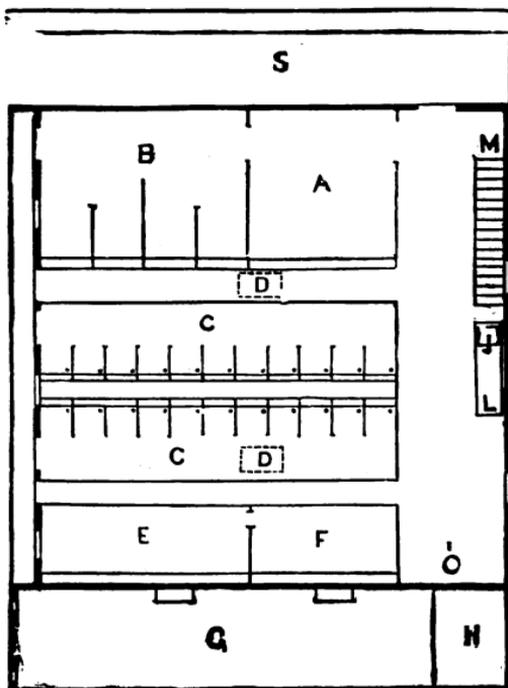


Fig. 33—PLAN OF MAIN FLOOR OF BARN

comfortable access from one door to another. The plan shown in Figure 33 gives the arrangement of stalls and passages. The horse stable, *A*, *B*, has two double stalls and a loose box for a mare and colt. *C*, *C*, is the cow stable, with stalls for twenty-two cows, arranged so that the animals' heads in the rows are toward each other, with a central feed passage between. The ventilators

and straw chutes, *D, D*, carry off, through the cupolas on the top of the building, all the effluvia from the stables; the straw for bedding is thrown down through them from the mows or barn floor above. The compartments, *E, F*, are for calves or a few ewes with early lambs, which may require extra care and protection. The root cellar, *G*, is entered from the feeding room, which also communicates directly with each compartment. The cistern, *H*, is sunk

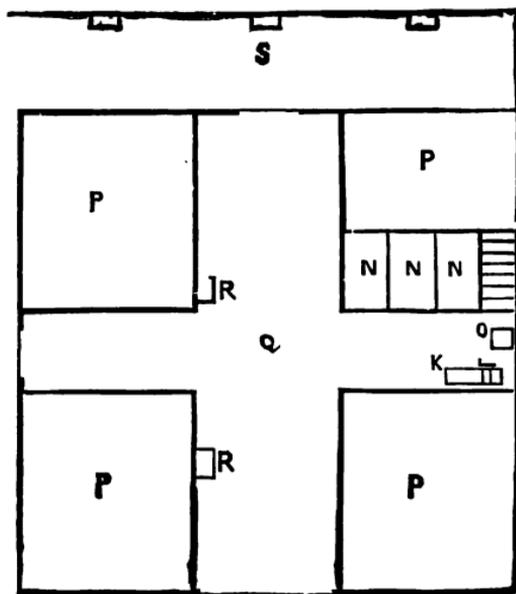


Fig. 34—SECOND STORY OF BARN

twelve feet beneath the floor of the root cellar, and receives the whole of the water shed from all the roofs. It is prevented from overflowing by an outlet into the drain, which runs beneath the stable floor. The pump, *I*, is in the feed passage. *J* is the chute by which cut hay or fodder is thrown down from the barn floor. *L* is the feed-mixing box, or steam chest, if steaming is practiced, and *M*, the stairs to the barn floor above. On this floor, Figure 34,

are four bays for hay, straw, etc. a large threshing floor, with a cross hall for a cutting machine, and a chute, *O*, to pass the cut feed below. A door in this cross hall opens into the barn yard, by which straw may be thrown out for litter. A door at the rear of the threshing floor opens into the upper part of the open shed, where hay, straw or fodder may be stored. The cutting machine is shown at *K*, with grain bins or boxes for feed at *N, N, N*. The bays are marked *P, P*; *Q* is the threshing floor. *R, R*, are hay chutes and ventilators, which are carried up level with the plates, doors being made in them, through which to pass the hay either from the barn floor or the mows; *S* is the straw bed, with open traps to pass straw or fodder into the racks, shown beneath, in Figure 33.

The open shed seen in the rear of the barn yard is for the purpose of airing stock in stormy weather, and is furnished with a straw rack for feeding them. The barn is calculated for a farm of from 100 to 200 acres of good land.

MR. CHARLES S. SARGENT'S BARN, BROOKLINE, MASS.

The barn of Mr. Charles S. Sargent has become well known. Figure 35 shows the east side of the barn, the down-hill side, with the cart entrances to the manure cellar and wagon shed. Figure 36 shows the arrangement of the cellar, which, aside from the usual appliances of a farm barn, has a steam boiler for cooking hay, etc. Figure 37 is the main floor, containing six box stalls, and stabling for ten cows. The cow room, which is ceiled on the walls and overhead with varnished pine, and has its windows protected by green blinds, is, without being extravagant or "fancy," very neatly and perfectly adapted to its uses. The mangers are of Cottam's patent, much used in England, consisting of two iron feed tubs, with an iron water trough between them for each pair of

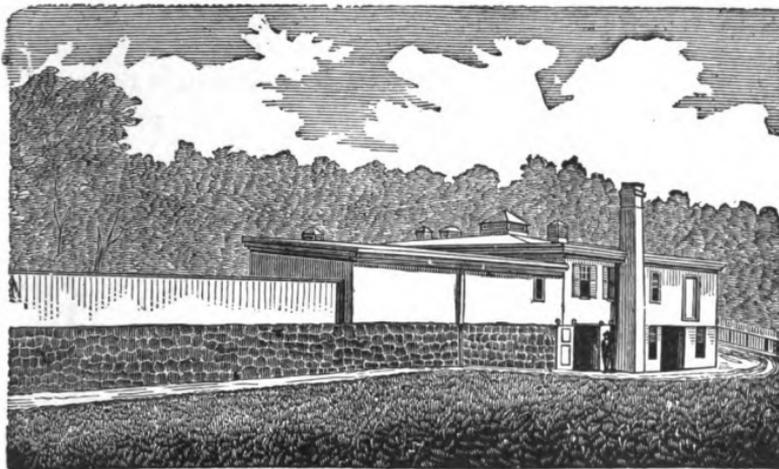


Fig. 35—ELEVATION OF MR. CHARLES S. SARGENT'S BARN

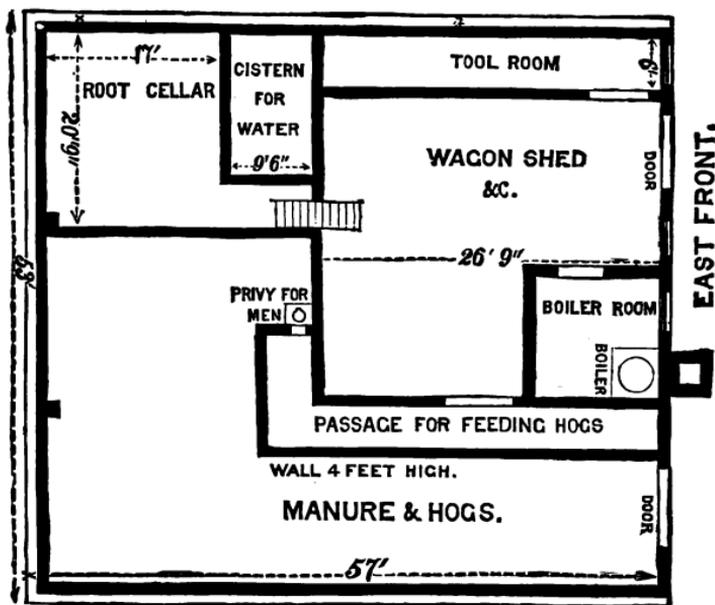


Fig. 36—BASEMENT OF MR. SARGENT'S BARN

cows. A low partition separates each double stall from its neighbor. The box stalls are fitted with rocking mangers, which move back and forth through the partition, so that feed can be supplied from the passageway. This barn is a capital model for any amateur, small, or

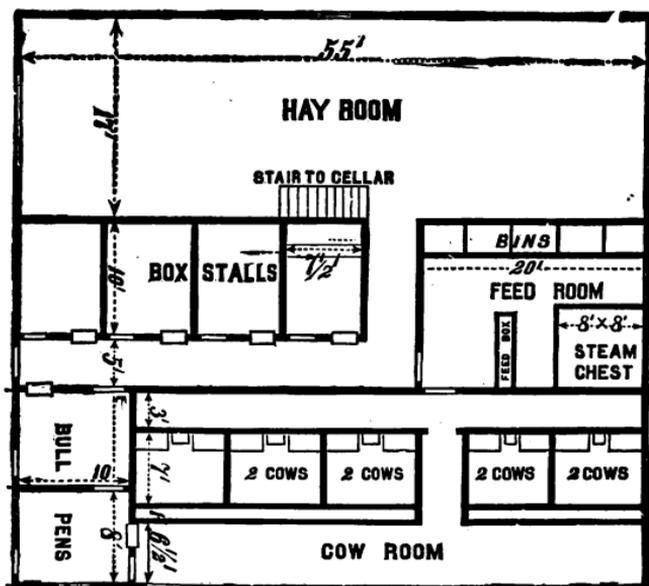


Fig. 37—PLAN OF MAIN FLOOR OF MR. SARGENT'S BARN

"fancy" farmer to follow, as it has all the conveniences needed and none of the ornaments that one too often sees on barns of its class. It is good, cheap and useful.

#### A CHEAP BUT CONVENIENT BARN

A small barn, well arranged, is often more serviceable than a larger and more costly one. On many farms stock is kept in a poor shed or given no shelter at all, the owner feeling that he cannot afford to build a barn. In a few years the loss caused by shrinkage of milk, additional

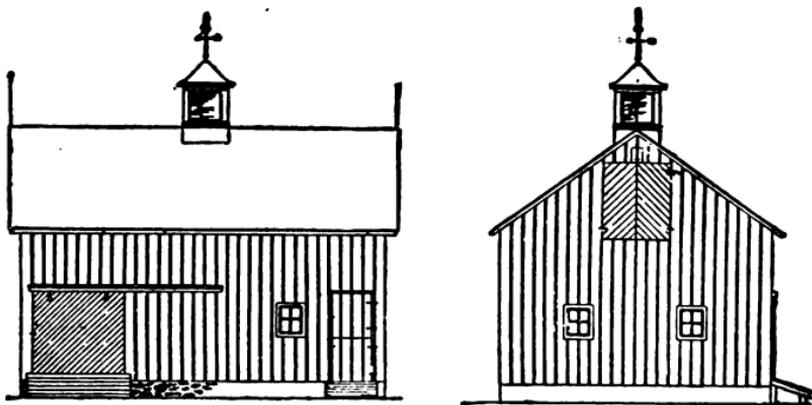


Fig. 38—FRONT AND END ELEVATIONS

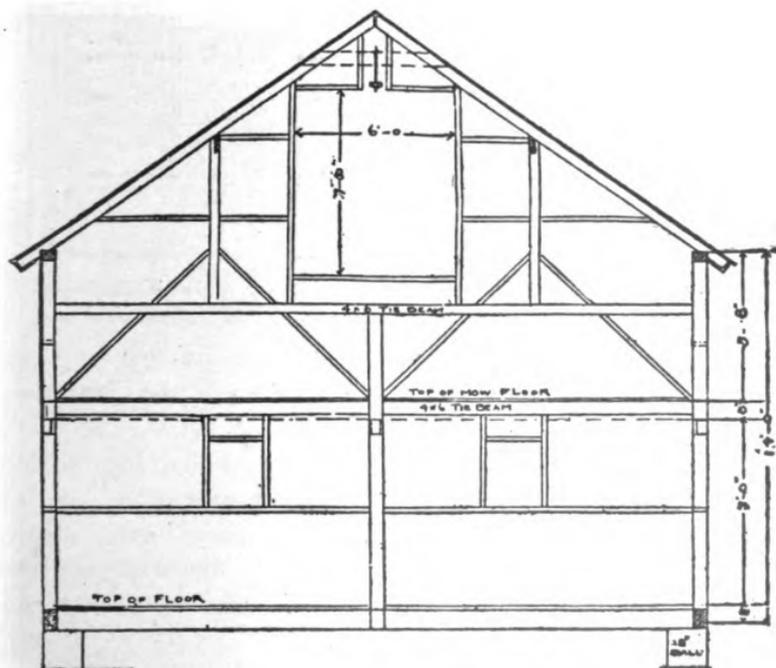
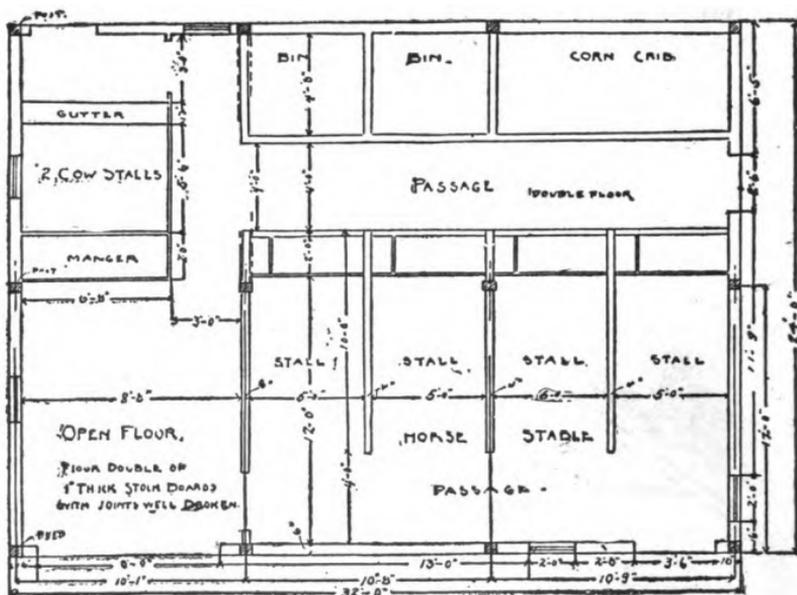


Fig. 39—END ELEVATION OF FRAMING

feed to keep stock warm, damage to exposed feed and to farm machinery will amount to more than the cost of a structure built according to the plans presented in Figures 38, 39 and 40 by Teeple & Brandt of Champaign, Ill.

This barn will hold four horses, two cows, and has bins for corn, oats and mill feed on the first floor, besides an



FIRST FLOOR PLAN.

Fig. 40—FLOOR PLAN OF A CONVENIENT SMALL BARN

open floor eight feet eight inches by twelve feet, which can be used for storing machinery or any other similar purpose. The mow will hold hay, sheaf oats, straw, shredded fodder, etc. The opening is directly over the passageway and the feed is thrown down where it can readily be put into the mangers.

The frame of the barn is mortised and tenoned together with the exception of the braces, which are sawed

to fit snugly and are spiked securely in place with twenty-penny nails. The cost of material is \$191.83. To this must be added \$100 more to cover the cost of carpenter work and laying of the stone. If the farmer can do a part of the carpenter work, the cost of the barn can be still further reduced. In many instances a farmer with his grown sons can aid materially in this direction, and it is always advantageous to acquire a handy use of tools for just such work. The cost of nails, door hangers, hinges, etc., is much the same in all parts of the country, while in some sections it will be found necessary to allow a little more for the lumber.

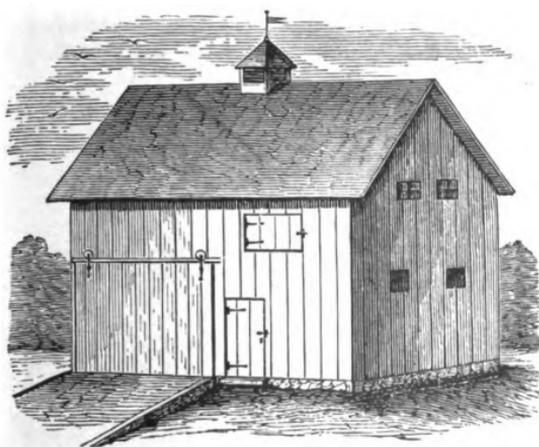


Fig. 41—A SMALL CHEAP BARN

A PLAN FOR A SMALL BARN

There are many small farmers, villagers, gardeners, etc., who wish only barn room enough for a single horse and carriage and a cow. To such, the requirements are cheapness and durability, combined with convenience; and with these points in view, a plan, Figure 41, is given of a

small barn, designed by Prof. G. T. Fairchild, late of the Michigan Agricultural College. The engraving gives a view of the barn from the front; while plain in its con-

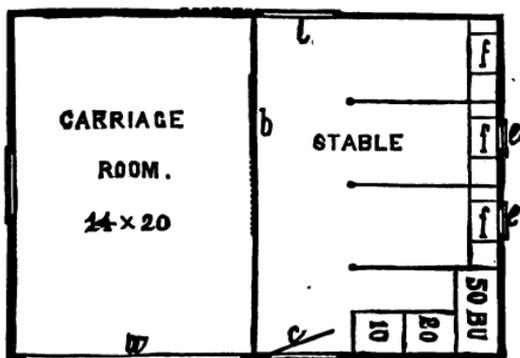


Fig. 42—GROUND PLAN OF BARN

struction, it is pleasing in outline. The first floor, Figure 42, is twenty by twenty-eight feet, and eight feet between joints. A large sliding door, *a*, nine feet wide,

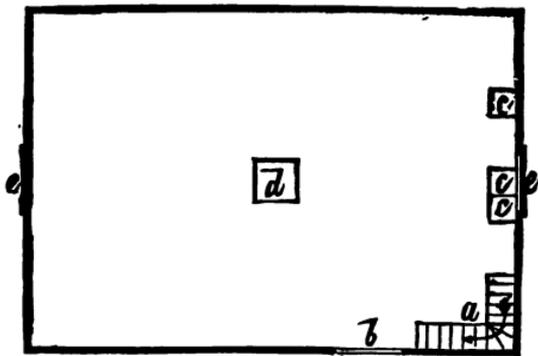


Fig. 43—THE LOFT

admits the carriage with the horse attached, which, when unhitched, is led through the sliding door, *b*, into the stable. The small stable door, *c*, opens by hinges inward, while

the back door, *d*, opening to the manure yard, moves upon rollers. Two small windows, *e, e*, give sufficient light to the stable. The hay racks and feed boxes for the stalls are shown at *f, f, f*, each having a hay chute leading from the floor above. The grain bins are neatly arranged under the stairway, these being three in number, ranging in capacity from fifty to ten bushels. The second story, or hay loft, Figure 43, is six feet from floor to plates, and gives ample room for the storage of hay and straw. The stairs are in one corner, *a*, and out of the way; *b*, the door for the admittance of hay and straw; *c, c, c*, ends of the hay chutes; *d*, ventilator; *e, e*, windows. The ventilator serves the purpose of a chute for throwing down the straw used for bedding. It has a number of openings for this purpose at various heights, including one at the bottom for cleaning out the dust, chaff, etc., which are constantly accumulating in the loft.

The cost of this barn will vary according to the locality and the price of lumber, etc. The estimate for it in Michigan was \$300, above the foundation, with two coats of paint; but in most states the lumber would cost more than in Michigan, and the estimate would be correspondingly increased.

## ANOTHER SMALL BARN

The barn, the outside appearance of which is shown in Figure 44, in its arrangements, obviates the necessity of going behind the horses when feeding, which is often desirable, as in families having no hired help, the feeding is sometimes intrusted to children. The ground floor, Figure 45, is eighteen by twenty-four feet, eight feet between joints. The carriage room, *C*, is thirteen by eighteen feet, with sliding doors ten feet wide. The horse is led through the door *D*, from the carriage room to the stable. The box *E*, containing food, connects by two spouts with

grain bins in the loft. The hay chute is shown at *S*, and is between the mangers. The harness closet, *H*, is placed under the stairway. A window, *W*, gives light to the

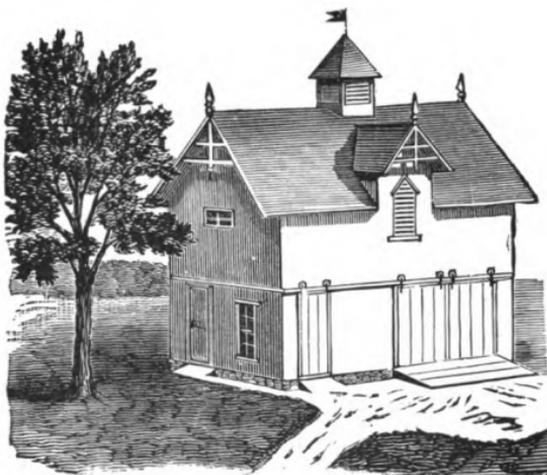


Fig. 44—A SMALL BARN

feed rooms and the stalls. The loft, Figure 46, is six and one-half feet high to the plates, and with a three-quarter pitch to the roof, there is ample room for hay and straw.

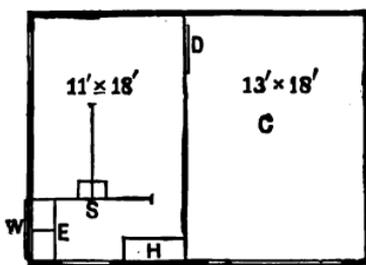


Fig. 45—FLOOR PLAN OF BARN

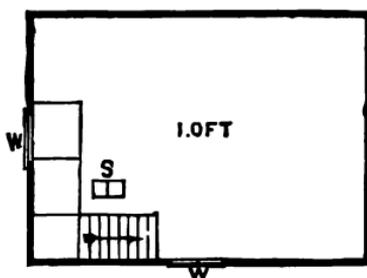


Fig. 46—PLAN OF THE LOFT

The barn is built of hemlock, sided with seven-eighth-inch dressed boards, twelve inches wide, and battened. It cost, complete and painted, in the neighborhood of \$200.

## PRACTICAL ENLARGEMENT OF OLD BARN

It is quite a common practice to build low, shed-roofed additions to the sides of barns when it is desired to secure more room. This gives the desired addition of ground floor space, but does not secure added storage room that could be secured as well as not, and at almost no added cost, were the additions made according to the plan suggested at the right in Figure 47. Here the roof is extended down over the addition without a break, making a better looking building and one much more serviceable than by the common plan. The space in the tops of the



Fig. 47—TWO WAYS OF ENLARGING OLD BARN

additions opens into the scaffolds, or the second floor space of the old barn, and gives so much more added storage capacity.

The cuts given in Figure 48 show a very practical method of enlarging a barn whose capacity has become too small. At the left is seen the common form of barns, with the driveway lengthwise, straight through the middle—an extravagant use of space. At the right is shown two “shed-roof” additions placed upon the ends, the roofs being made continuous with the newly constructed additions to the old roof. The feeding floor and driveway is thus changed to a crosswise position of the barn, taking less space and affording greater room on either side for stock and fodder. If the barn has a second floor the new arrangement will afford much greater

space above, while the whole of this space above the main floor will be finely lighted from all sides. Though the remodeled barn is changed greatly in appearance, the additions are of a nature to make the expense comparatively light.

A plan frequently followed in enlarging a barn is to shove out the end and side, and to cover with a flat tin roof connected with the former building at the plate. This gives floor room and some room for hay and grain, but there is nearly always a scarcity of mow room, and this style of enlargement does not permit of storing away much hay under the low roof. It is depth and height which compact hay and vastly increase the capacity of the barn.



Fig. 48—THE OLD AND THE ENLARGED BARN

A few years ago F. G. Homan of New York had occasion to enlarge his barn, which was twenty-six by forty feet, with a double-pitch roof. He wanted more room for both stalls and fodder. He added fourteen feet to the width, thus making the barn forty by forty feet, but instead of putting on a shed roof he lowered one side of the shingle roof, and, sliding it onto the new plate, raised it to the same pitch as before, and then connected the two sections with a nearly flat tin roof, forming an end view like the one shown in the left side of Figure 47. The dotted line indicates the former shape of the barn. He has never been able to raise enough to fill this barn. There seems to be no end to its capacity, for the addition

is practically in the center and is forty by fourteen by twenty-four feet. The expense of the alteration was \$184.

REMODELING AN OLD BARN

In enlarging the farm work and dairy at "The Pines," B. Walker McKeen of Fryeburg, Me., found that the old barn, Figure 49, thirty-six by forty-eight feet in size, was not large enough. The timbers were sound and the roof was well covered. A silo was needed first, so that was built as a separate building, twelve feet from the north side of the barn. One end of the barn was thirteen feet from the ell of the house, and the next move was to put a joint thirteen feet wide and four feet longer than the

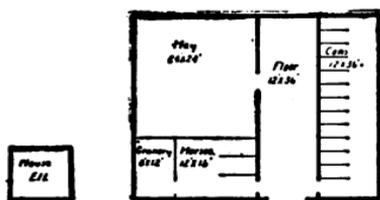


Fig. 49—OLD BARN

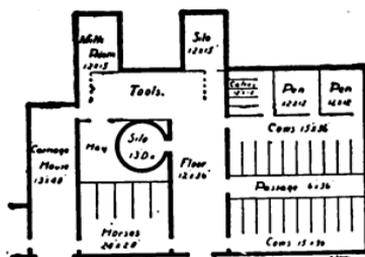


Fig. 50—BARN REMODELED

north end of the barn in that space. The first floor is a carriage house, and the second floor a workshop and grain room, while the third floor is used for a corn chamber. The carriage house opens on one side into the horse stable and on the other side into the ell of the house.

The next move was to put two joints of twelve feet each onto the other end of the barn, the first floor being designed for cows, and the second for the storage of hay. This addition, together with the twelve feet next the main floor, gave a space thirty-six feet square. Through the center of this space from the main floor to the end of the

barn was made a feeding floor six feet wide, and on each side of this floor a tieup for cows. In this way there was obtained seventy-two feet of room for tying the animals, and each tieup was fifteen feet wide.

A lean-to was then run from the four-foot extension the whole length of the north side of the barn, filling the space between the barn and the silo. The thirty-six feet of tieup space next the lean-to addition was left without siding, and the lean-to was divided into three pens, each twelve feet square. This gives a space of thirty-six by forty-eight feet for the cattle. It is shut off from the main floor of the barn by three sliding doors—one at the end of the feeding floor, and one at the end of each tieup. It is well supplied with windows of good size. The old barn would hold but nine cows; this holds twenty very comfortably. The horse stable in the old barn was also remodeled and later a round silo was built in a portion of the large hay bay. Floor plan of the barn as remodeled is shown in Figure 50.

## CHAPTER II

### *CATTLE BARNS AND STABLES*

#### COMBINED STOCK AND HAY BARN

The new barn of P. H. Reed of Aroostook County, Me., Figure 51, is seventy-five by seventy-eight feet in size, and forty feet from floor to peak. It contains room for



Fig. 51—NORTHERN MAINE STOCK AND HAY BARN

a large amount of hay, some tools, and a herd of Shorthorn cattle. Three large box stalls, see Figure 52, are provided for bulls, and stanchions for about twenty head. The cattle side of the barn is floored over, and hay is put

above the stock. A large space between the cattle and the main floor is thus provided for the storage of wagons, tools and grain. All hay and grain are handled with horse forks, and after the mows are full to the plate, poles are

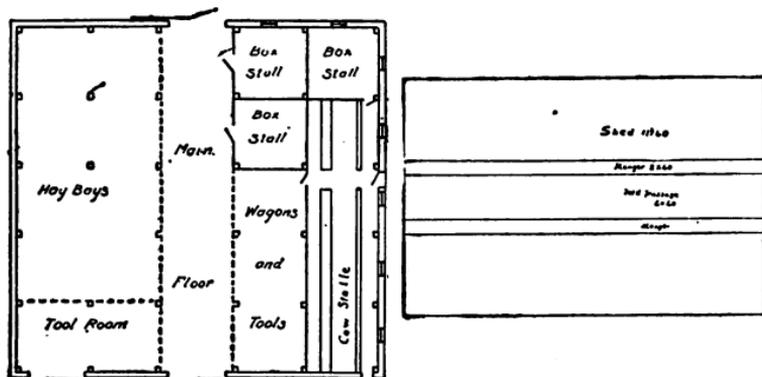


Fig. 52—P. H. REED'S BARN Fig. 53—FLOOR OF CATTLE BARN

placed across the main floor for scaffolds. At the left of the large barn is the granary, and at the right sheep barn and house.

#### A BARN FOR FEEDING LOOSE CATTLE

A barn thirty or thirty-two feet wide is the most convenient size for feeding loose cattle. It can be made of any length desired. The posts may be either sixteen or eighteen feet high, and the roof constructed with long and short rafters, and braced so as to make it self-supporting. This does away with the cross-ties and permits working a hay fork to advantage. Hay stored above is thrown through chutes into the central feeding alley, as shown at the left in Figure 54, and thence placed in two long mangers, Figure 53, in which grain may also be fed. The openings to the barn may be at the ends or sides, and wagons can be driven through to remove the

manure. No floor other than hard clay is necessary where cattle run loose.

With a thirty-foot barn, the long rafters should be sixteen feet and the short rafters ten feet. If we enclose an eighty-foot court on three sides with this building, making the back side thirty-two feet wide, we will have space for 300 tons of alfalfa hay. A self-feeder, as shown in the cross-section at the right of Figure 54, may be used. The continuous chute is thirty inches wide and

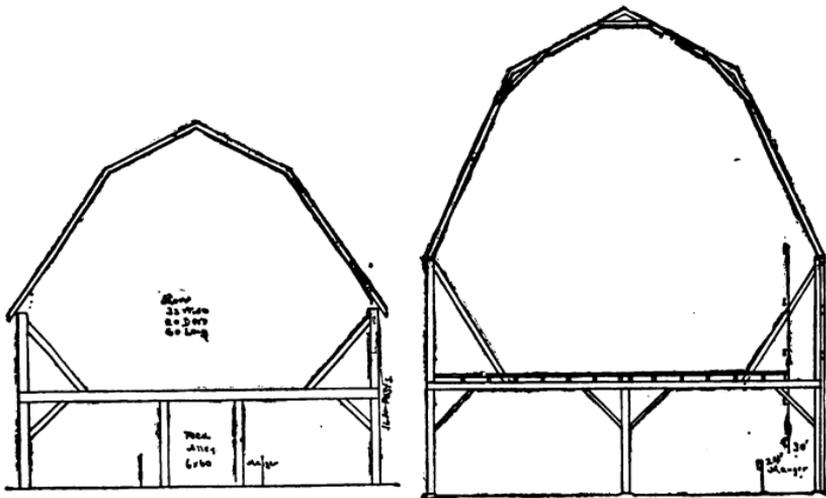


Fig. 54—BENTS OF BARN FOR CATTLE FEEDING

the manger four and one-half feet wide. The chute reaches within two inches of the top level of the manger. Doors in the chute admit of hay being thrown in at any level. No permanent mangers should be put in a barn of this construction, but good, strong feed-racks three and one-half by eight feet can be set where convenient and readily moved. The side opposite the manger can be left open, if desired, but gates should be arranged so that the cattle can be shut out when putting in ensilage, for instance.

## A CIRCULAR BARN FOR FEEDING CATTLE

Circular barns, also those containing from eight to sixteen sides, are theoretically much cheaper to construct than square or oblong buildings, because they cover the greatest area with the least material. In practice, however, the construction of circular barns presents some features which add to the expense of building them, so



Fig. 55—BEEF FEEDING BARN AND SILOS

that they have been many years in coming into favor. A number of such barns have been built in the west and are giving evident satisfaction. The barn of N. Martin of Oswego, Ill., is used for feeding beef cattle. It has two silos attached, as shown in Figure 55. The basement

is used for cattle and the superstructure for the storage of fodder.

Two straight double rows of stalls extend across the barn, those on the inside being, of course, considerably shorter than those in the middle. Large doors are provided so that a horse and wagon may drive through to clean out the gutters. Chutes are arranged over the feeding alleys, so

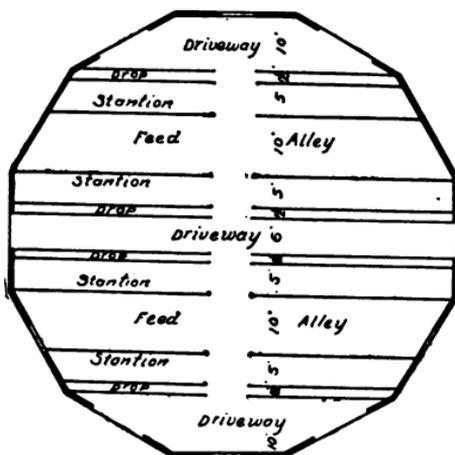


Fig. 56—GROUND PLAN

that the feed is dropped in front of the cattle and distributed with the least amount of labor. Figure 56 shows the interior arrangement.

#### A DECAGONAL CATTLE BARN

The ten-sided cattle barn of John C. Baker of Manhattan, Ill., shown in Figures 57 and 58, is rather novel, but decidedly convenient. As Mr. Baker is a lumberman, as well as a stock-raiser, he has opportunity to procure lumber cheaply and so has used an abundance of material in his buildings. This barn is eighteen feet on each side,

or 180 feet around it. It contains eighteen box stalls, nine by twelve feet, with a door into each stall from the inside, also a window in each stall. These stalls are suitable for a cow and calf or two or three head of smaller cattle. There is an octagon of stanchions in the center which holds sixteen head of cattle. This barn is twenty-two feet to eaves. Lower story outside wall is packed with hemlock two by fours laid flat. The stalls are made

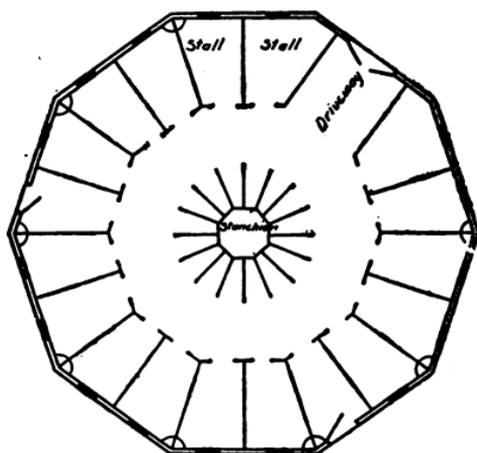


Fig. 57—ARRANGEMENT OF CATTLE STALLS

of two by fours packed solid, two and one-half feet high, and then one is left out every other time and blocks put in, leaving the walls of the stall more open. The upper three feet of stalls is put in with the two by fours four inches apart. Mr. Baker writes:

“I cannot see any way this barn can be better for its size for breeding stock. The upper story is fourteen feet high and I drive into it. We clean out with a cart and drive in when the cattle in the center are let out. This barn is sided with shiplap and painted. We have chutes for feeding from above. One rack does for two stalls.

They are built into the stall and outside walls and the lower two feet is furnished with one-inch iron pipe for racks and feed box which runs across next to outside wall.

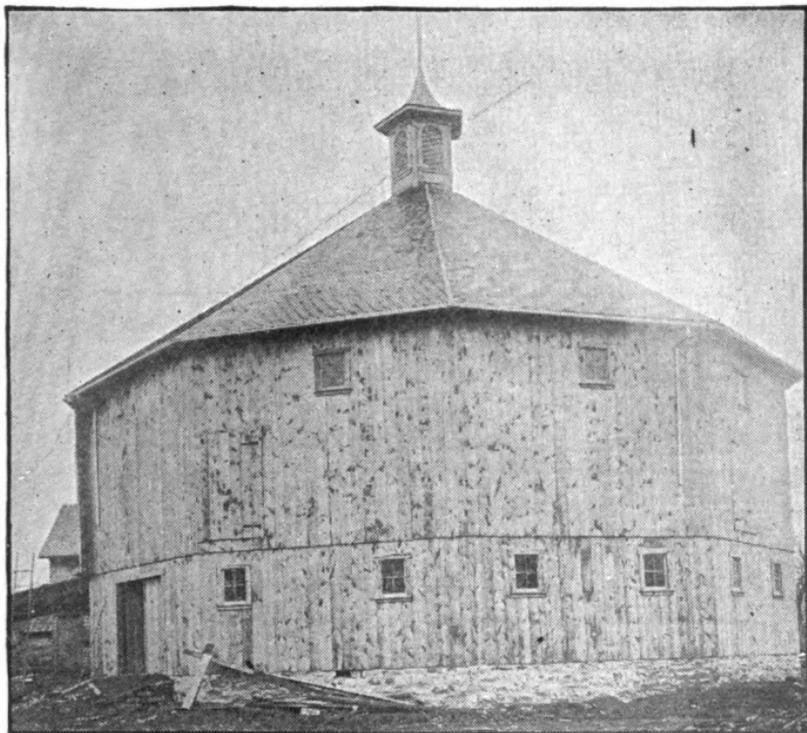


Fig. 58—AN ILLINOIS BREEDING CATTLE BARN

This barn is for cattle only. In two places I have outside doors out of stalls. There are inside doors also."

#### SUGGESTIVE PLAN FOR A STOCK BARN

A Dakota farmer wants a plan for a general farm barn, the dimensions to be fifty by 100 feet. Frank Ruhlin of Ohio has prepared three plans, all of the same

outside dimensions. In Figure 59, Fig 1 and Fig 2 are where there is no bank, and it is not necessary to bridge in order to enter the second floor. It is possible to drive into the basement and elevate the fodder and feed to the second floor by horse power, such as hay forks. Fig 3 is where there is a bank, so that a load can be driven in onto the second floor. Plans 1 and 2 could have a bridge or bank at the end of the barn, so that wagon can be driven to second floor.

Fig 1 and Fig 3 are devoted entirely to stock, while Fig 2 is a general purpose barn, with space for tools,

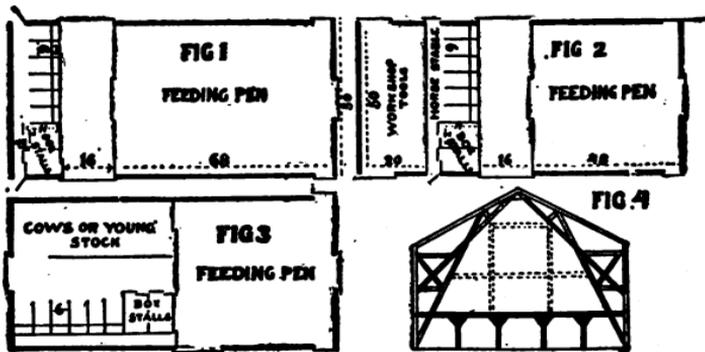


Fig. 59—PLANS FOR A DAKOTA STOCK BARN

farm machinery and shop. Fig 4 shows a cross-section of the barn at one of the bents. The height of basement should be nine feet. The plans are for stone as high as basement, with timber above, but the frame could be made all the way from the ground on the same principle. The side posts can be of any desired length. The plan is for side posts sixteen feet to eaves.

In building the framework, use two-inch plank for all heavy timbers, nailing them together and using bolts in a few places. Six horse stalls, with two box stalls for sick animals, are sufficient for work horses on a farm

with a barn of that size. In Fig 1, the large part of the barn without any division is for cattle or sheep, as the owner may choose. Put in feed mangers and partitions at owner's option. Chutes should be made where most convenient. The large feeding pen is fifty by sixty-eight feet. Fig 2 is the same as Fig 1, except that it is more of a general purpose barn, twenty feet being taken off the end for tools and farm machinery. There is a door from the stable into this part for convenience. The large rolling doors on the feeding pens in both plans are for driving in to remove manure. They are twelve feet wide.

Fig 3 has the same number of horse stalls, but they are arranged along one side, owing to there being no general driveway through it. The other side, marked cows or young stock, is so situated that it can be cleaned out at the same time as the horse stable. The other end of the barn is for feeding cattle or sheep, as in the other two plans. If this is to be made a general purpose barn, the machinery, tools and shop can be put on the second floor. The framework is made according to timber used. There should be eight bents for the 100 feet arranged to suit the openings. The posts, as shown in Fig 4, should not be more than ten feet apart. Above the basement, the frame is made self-supporting, so there are no inside timbers to bother.

These are good basement plans for a practical barn, and so inexpensive that almost any farmer can utilize them. Actual figures cannot be given that would apply to all localities. The dotted lines in Fig 4 show extra braces in the end bents. These are put in to keep the ends from being pushed out. As to grain bins, they are not marked in any of the plans. They are a matter of choice with different persons.

## A RHODE ISLAND CATTLE BARN

The illustrations, Figures 60, 61, 62, 63, are of a cattle barn on Dr. C. F. Heyward's farm at Newport, R. I. It has stalls for twenty cows, four oxen and two horses, and will stow about ten tons of hay in the bays, and, in an emergency, five more on the threshing floor. It is intended to keep the main store of hay in a hay barn already standing and in Dutch hay covers. On this place, there

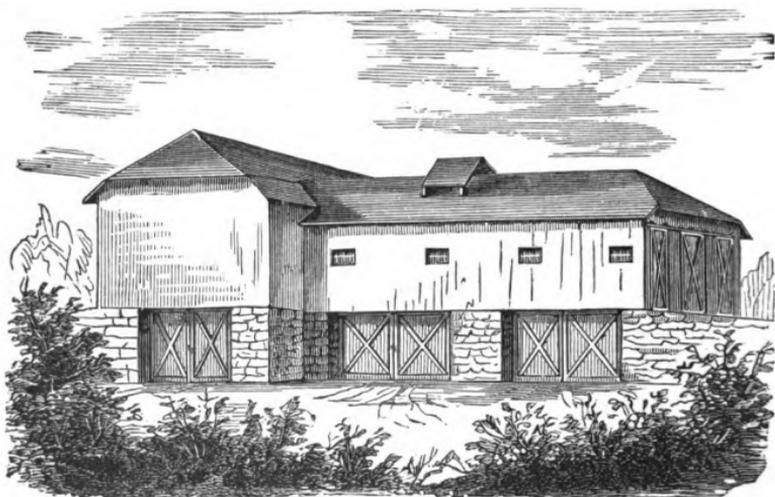


Fig. 60—PERSPECTIVE VIEW OF BARN FROM THE REAR

being a large amount of pasture land, it is not intended to soil the stock, and the object has been only to furnish comfortable quarters for the cattle, where they may be conveniently fed and milked with the least expense possible. Everything is built in the plainest manner, and as cheaply as permanent usefulness would allow. The cost of the building, including cellar, foundation walls, etc., was about \$1500. Figure 60 gives a perspective view of the barn, and Figure 61 a cross-section.

The barn stands sideways against a gentle slope, the fall being about five feet in thirty-six feet—the width of the barn. A small amount of artificial grading brings the cattle floor on one side, and the manure cellar on the other, to the ground level. Under the cattle and horse stalls there is a large cellar for manure, with two wide entrances for carts. Beneath the threshing floor there is a root cellar, and under the principal hay bay a storage room for plows, harrows, etc. The general arrangement of the cattle floor and hay room is shown in

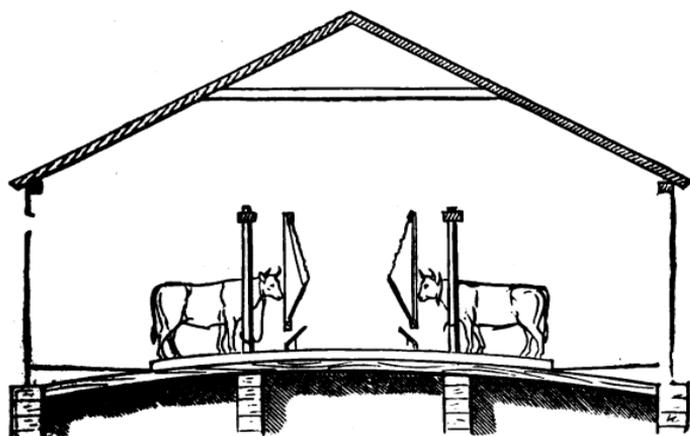


Fig. 61—SECTION OF BARN

Figure 62. The ox and horse stables open into a small yard, separated from the cow yard. The animals have access to the latter through the doors at the end of the building. The feeding passage is not wide enough for a cart, but allows a team to pass, when unhitched from a loaded cart or wagon, standing upon the threshing floor.

The features of this stable are the arched floor and the arrangements for tying and feeding. The main timbers supporting the floor are twenty-eight feet long, running across the building. There are two of them, one about

one-third the distance from either end of the cow room. These are supported each by two ten-inch chestnut tim-

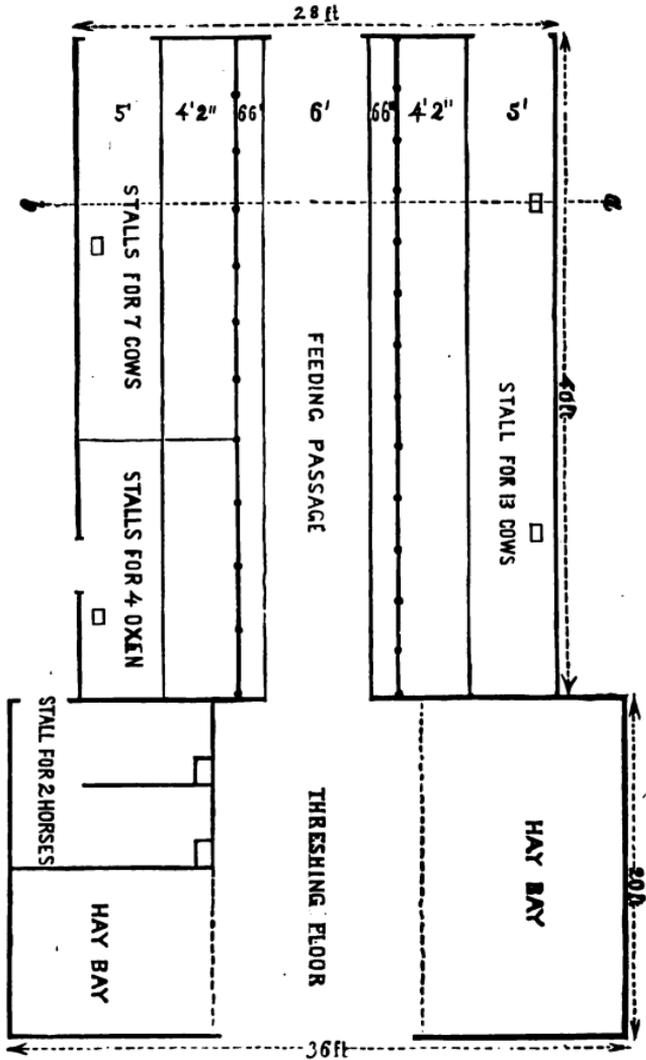


Fig. 62—PLAN OF FLOOR OF BARN

bers, resting on foundation stones, and standing under the lines of the upright posts to which the cattle are tied.

Before these were put in, and after the outside of the building was finished, the cross timbers were screwed up in the middle as much as they would bear, having a crown of about six inches, giving an arch-like form to the floor—the middle of the feeding passage being six inches higher than the outside of the passage behind the cattle. The floor joists were then notched in to these timbers and to the end sills, to a uniform depth, as far back as the rear of the floor on which the cattle stand. At this point a drop of four inches is given by spiking a

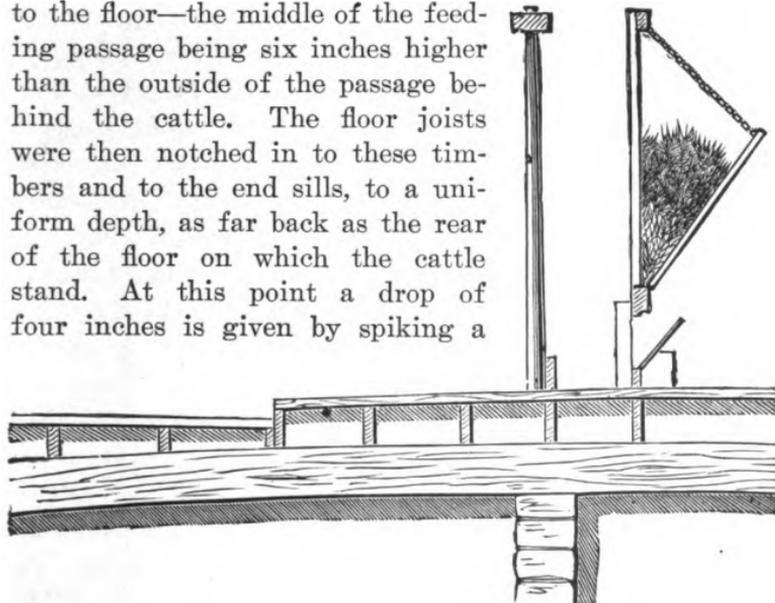


Fig. 63—SECTION OF STALL WITH FEEDING APPARATUS

scantling against the floor joists. From this point the passage floor rises to the side of the building. This gives good drainage, simplicity, and sufficient strength. The construction of this floor and of the feeding apparatus is shown in Figure 61, the details being more clearly set forth in Figure 63. There are no partitions between the cattle, save the bars which separate the oxen from the cows. The feed rack consists of strips of Georgia pine, three inches wide and one inch thick. In front of it there is a shutter three feet wide, hinged at the bottom, which may be turned flat against the slats when hay is not being fed, or may be dropped back the length of the chain which supports it when necessary

## A WESTERN CATTLE BARN

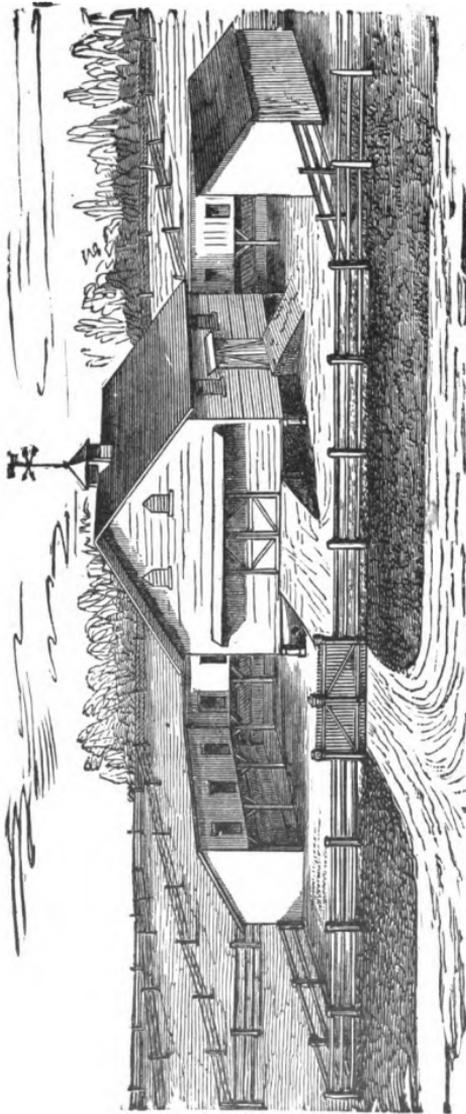


Fig. 64—A WESTERN CATTLE BARN

The barn and sheds shown in the engraving, Figure 64, are well adapted for the keeping of a large number of cattle in an economical manner. The barn is wholly appropriated to hay and grain; the yard is spacious, and surrounded on three sides with sheds, either closed or open, in which the stock is kept. The barn is raised three feet from the ground and rests on posts of brickwork. The space thus gained is used as a shelter for those hogs which have the run of the yard. The yards are well littered with straw and the remains of the corn fodder fed to the stock, by which means a large quantity of manure is accumulated. The plan here given

is equally well adapted to a large or small farm, as it may be extended at will to accommodate any required number of cattle.

#### A SECOND WESTERN CATTLE BARN

Figure 65 presents a plan of a stock barn, costing from \$1500 to \$2000. To feed cattle profitably, they need to be comfortably placed, kept quiet, with every facility for getting in and out of their stalls, and to have no an-

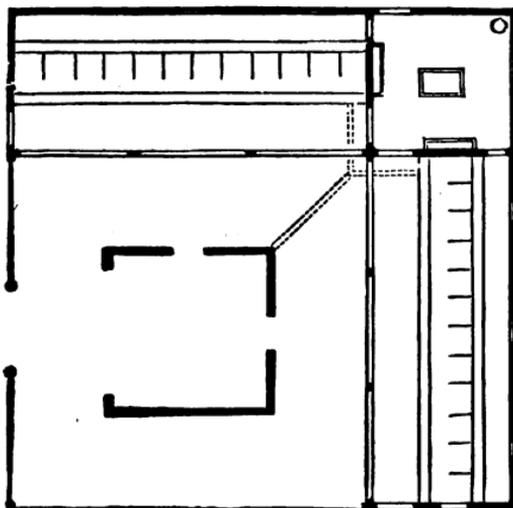


Fig. 65—PLAN OF A WESTERN CATTLE BARN

noyance or excitement. In this plan there is a vast saving of work of a disagreeable character through the winter, and when the manure is moved in the spring, it is in far better condition than if it had been exposed to the snow and frost for several months. A cattle barn should always be laid out with this object in view.

Figure 65 shows the ground plan of the barn. It is made in two wings, facing the northeast and northwest. At the north corner is a square room, which may

be used as a store room, feed room, or for any other purpose. From this room passages run right and left, from which the cattle are fed; these ought to be about six feet wide. There should be as many windows in these passages as will give needful light and ventilation through the stable. The stalls with racks or feed troughs opening into the passages are in the rear, and the doors from the stalls open into the yard. These doors should hang upon rollers, and when pushed back at least one-half of the front of the sheds should be open. Figure 66

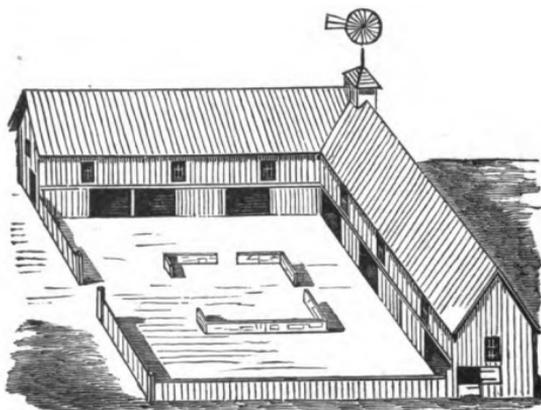


Fig. 66—ELEVATION OF BARN

shows the elevation of the sheds and the arrangement of the yard. The yard will face the south and east, and should have a manure vault in the center, into which drains, shown by dotted lines, Figure 65, carry off the liquids from the stable. The yard may be fenced in, and feeding racks may be placed around it, in which in fine weather fodder can be given to the stock. The upper story is for storing hay, and at the center of the building a windmill should be erected to pump water for the stock from a cistern or well beneath, or it could furnish power to cut feed if necessary. These extra conveniences will

more than pay for themselves in the course of one season, in the saving of labor and in the increased growth of the stock. A trough of water might run through every stall, so that the cattle can be watered when required, without being removed or unfastened.

## COVERED STALLS FOR CATTLE

The use of covered stalls for feeding cattle and preserving manure is becoming very general among the better class of English farmers. Occasionally they are adopted by farmers in this country with the best re-

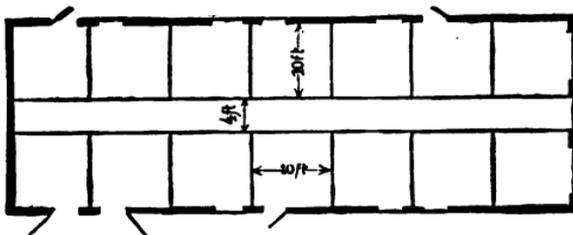


Fig. 67—PLAN OF STALLS

sults. Figure 67 shows the ground plan of a shed containing fourteen stalls, each ten feet square, with a passageway in the center four feet wide. Figure 68 shows the elevation of the building with the arrangement of the doors. It is of two stories, the upper one being used for the storage of straw, hay or roots or the preparation of feed. Figure 69 shows the interior of the building, with some of the stalls upon one side. With these views, the following short description will be more readily understood. The structure here given is seventy feet long by twenty-four feet wide, having seven stalls upon each side. It is built of plain boards and scantling, and one of the cheapest character will answer every purpose as well as

the most costly building, the shelter and preservation of the manure being the chief objects in view. There is a door at the rear of each stall divided into upper and lower halves, so that the upper one may be opened for air and ventilation. There is a large door at both ends of each row of stalls, and the divisions between the stalls are made of movable bars. These bars being taken away, a wagon may be driven through the building from end to end for the removal of the manure. The floors of the stalls are sunk three feet below the surface. Here the cattle are fed and well bedded with straw. If the straw

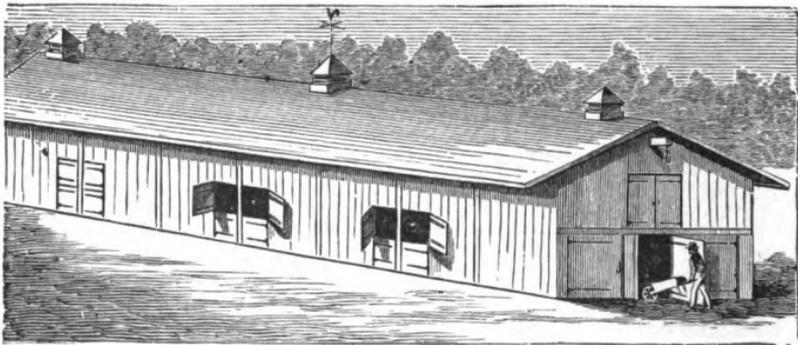
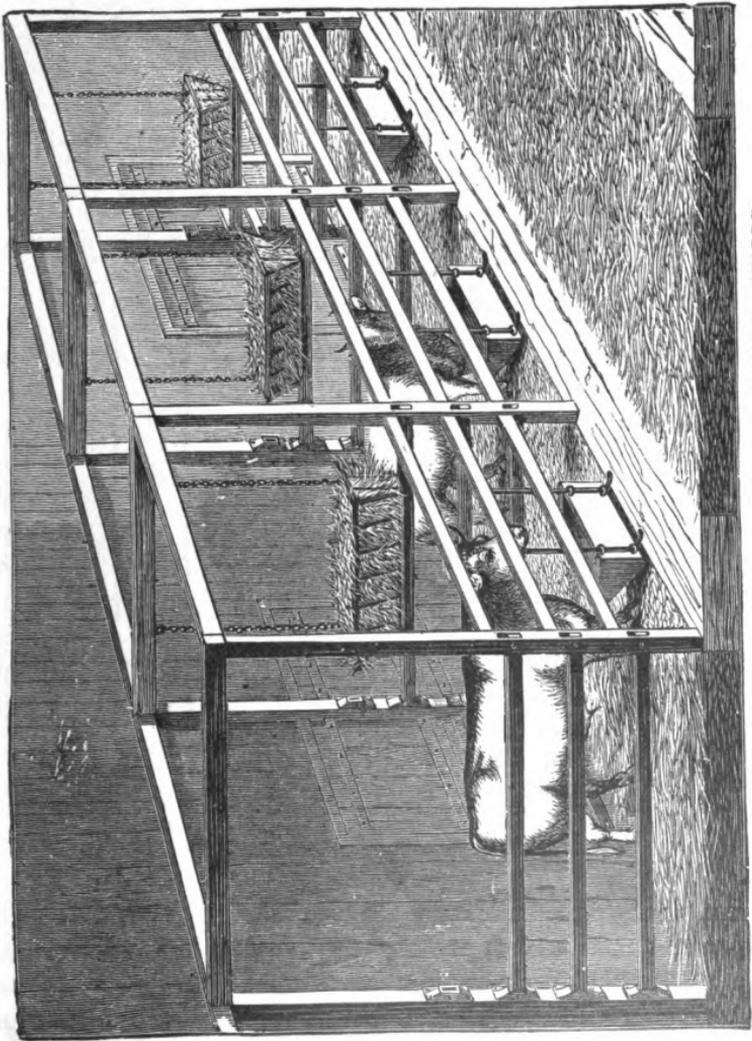


Fig. 68—ELEVATION OF COVERED CATTLE STALLS

is cut into lengths of at least three inches, the manure is so much the better for it. The litter and the manure remain in the stall during the whole winter, and as they gradually accumulate and the floor rises, the bars are raised. Each bar fits into sockets in the posts of the building, and is held into its place by pins. The feed trough is made to slide up and down, upon iron bars, as may be needed. There is also a rack slung from the roof or ceiling above, between each pair of stalls, for long straw or hay, which is given once a day to the stock.



**Fig. 69—INTERIOR OF COVERED CATTLE STALLS**

## CHEAP CATTLE SHEDS AND BARN

Much money is wasted in building sheds and barns of needlessly heavy timber. No timber should be larger or stronger than is sufficient to hold up the roof, and four by four studding, or posts, will do this. Where strong winds prevail, much may be saved by having the buildings low. Indeed, there is a saving anywhere, by having everything as near the ground as possible. The common

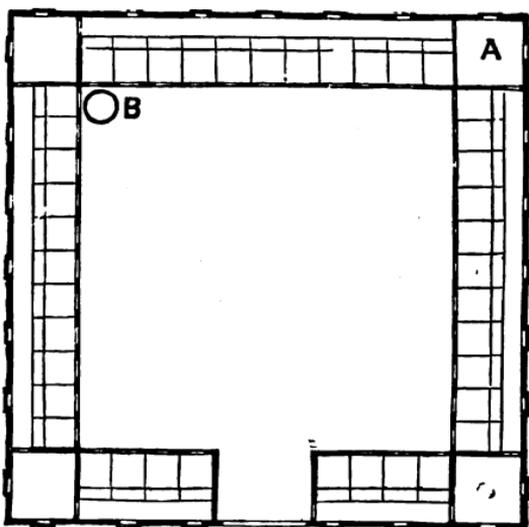


Fig. 70—PLAN OF CATTLE SHED

idea that high buildings are the cheapest because roof space is thus saved, is erroneous, and it should not be forgotten that a three-story barn must necessarily have a very strong and heavy frame to support its own weight, as well as the side thrust and weight of its contents. A studding two by four inches will be strong enough for a hay shed eight feet high at the eaves, while one sixteen feet high will spread, and sometimes burst, with six by six timbers. Thus it may very often be found better to take

up more ground, and make twice or three times as much roof surface, than it would be to save in floor and roof space, by building higher. The plans here given are of cattle sheds, recently built at a cost of only \$15 per head of the cows sheltered, and for comfort and convenience they are all that can be desired. To accommodate ten cows in a shed costing \$150 is often more desirable than to build a barn costing \$1500 that will supply no more room. Where economy must be very closely considered, this matter is well worth studying, and the sketches presented will furnish a very good text for it. Figure 70 shows a plan of a shed having forty-one box stalls, each six by eight feet, and separated by boarded partitions four and one-half feet high. The shed is nine feet high in the front, seven feet in the rear, twelve feet wide and ninety or 100 feet long. The roof is of boards. The frame is made of posts set in the ground, with a two by four-inch plate and girths of the same size where needed. There is a feed passage which traverses the whole length, leading from a room in one end, *A*, Figure 70, for preparing the feed. There is a feed trough in each stall. A bar or pole is fastened along the whole range of stalls, eighteen inches from the top of the front partition, by which the cattle are prevented from approaching the front too closely, and mounting the feed troughs, or putting their feet into them. The cows are kept loose in the stalls, unless otherwise desired, in which case they can be fastened to rings screwed to the sides of the stalls. A cistern, which collects the water from the roof, is made at *B*. The front of each stall has a double door, so made that the upper part may be left open for ventilation. Ventilating apertures may be made above each door, for use in cold weather. The sheds are arranged in a square, with a gate at one side for the entrance of wagons into the interior yard. The yard will give room for exercise, and racks may be provided in it, for feeding green fodder, hay

or straw. The plan is admirably adapted for the soiling system of feeding, and the making of a large quantity of manure, while forty or fifty cows are provided with

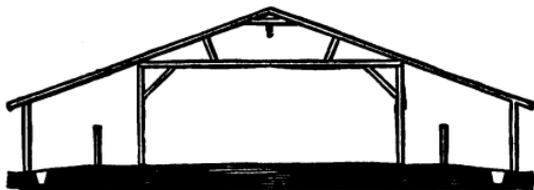


Fig. 71—SECTION OF BARN AND STABLE

comfortable room, at a cost of \$600 or \$750. In many cases the value of the manure saved by soiling cattle in such a shed will repay its whole cost in one year.

#### CHEAP BARN AND CONNECTING STABLES

Figure 71 shows a section of a cheap barn and stables connected. The building may even be brought lower at

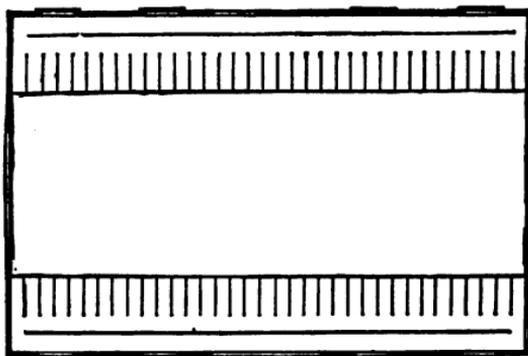


Fig. 72—PLAN OF A CATTLE BARN

the eaves, and provide pens for pigs and calves, or sheep, or open sheds for tools, etc. In this way it is protected from sweeping winds, which can have but little effect

upon it. The central space is used for storing hay or grain, or for threshing, and the side spaces for stabling cattle. Three and one-half feet in length of floor space will accommodate two head, so that a seventy-foot barn will hold forty head, and provide abundant room for the crop of 100 acres, at a cost of about \$10 per running foot. Light timber only is needed, and rough posts set in the ground will make the basis of the frame. The plan of the building is shown in Figure 72. It is arranged to be seventy feet long and fifty feet wide, with the central space twenty-six feet, and the wings each twelve feet; wide doors are made at each end, and also through the center, and the stanchions or stalls in the center are movable.

#### A TEMPORARY CATTLE SHED

A farmer in Greenvale, W. Va., made a shed for cattle which is to serve him until he can build a good barn. The

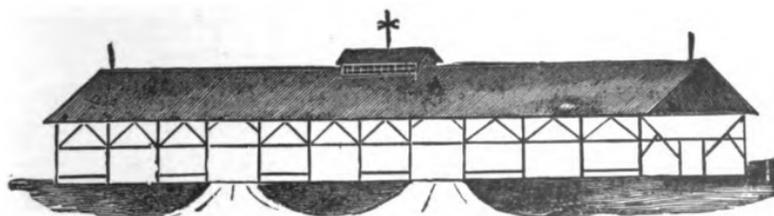


Fig. 73—PERSPECTIVE VIEW OF CATTLE SHED

shed is 111 feet long by twenty-six feet wide, and a cistern receives the water from the roof. The posts are fourteen feet long, and there is a space above for holding forty tons of hay, and a room below, seven feet high, which will accommodate sixty sheep, twenty calves and twenty other cattle. The frame consists entirely of poles and posts which were cut in the woods, and put up without hewing. The plates, rafters, etc., were sawed. One side and two ends are boarded up; the rest is

covered with clapboards. The cistern is so arranged that the water will run out into a trough until it is empty, without having to draw or pump it. Figure 73 gives a view of one side of the shed. The side braces

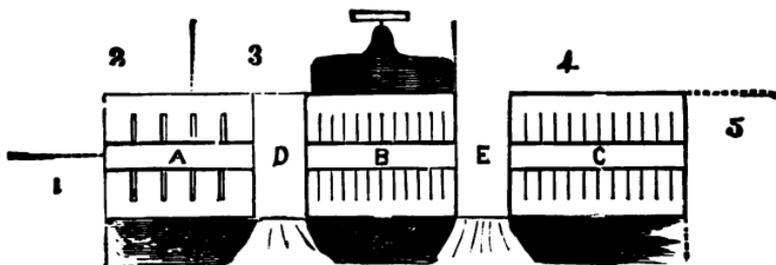


Fig. 74—GROUND PLAN OF CATTLE SHED

are poles eight feet long. They rest at the foot on the cross piece at the middle of the post, and are halved in and spiked to the post, and the upper end supports the plate in the middle. Figure 74 shows the ground plan, on which 1, 2, 3, 4, 5 and 6 are lots opening into all the fields on the farm; 7 is the cistern, A is for sheep, B and

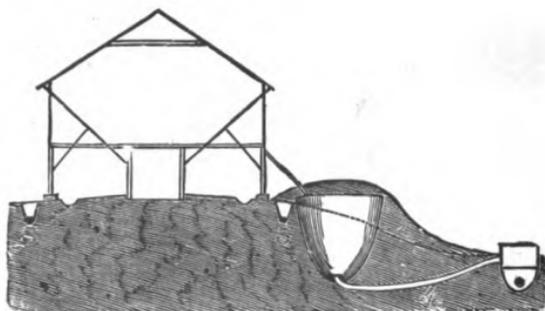


Fig. 75—DIAGRAM OF BENT

C are for cattle, and D and E are driveways. Figure 75 shows the end and middle bents. The long brace is halved into the inside post, in the joist, and in the top of the outside post, and fastened with sixty-penny spikes at each place.

## A COMBINED COW SHED AND PIGPEN

Figures 76 and 77 illustrate a combined cow shed and pigpen belonging to Mr. F. E. Gott, Spencerport, N. Y. It consists of an open shed, with a box pen for the cow on one side, and the pigsty on the other—the whole shed being twenty feet long and fourteen broad, and all covered by one roof. It is constructed of hemlock lumber, and should not cost over \$50. The outward appearance of the shed is shown in Figure 76. The posts in front are twelve feet in height, and the rear ones

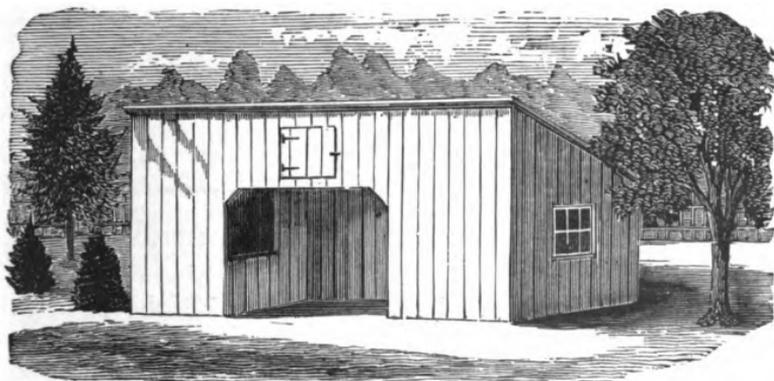


Fig. 76—FRONT VIEW OF COW SHED AND PIGPEN

eight. The boards are put on vertically, and battened on the joints. The roof is made of rough boards laid double, and breaking joints, so that it will not leak. The box for the cow is eight by ten feet, six feet and four inches high, and has a feed passage four by eight feet adjoining it. The middle portion of the building is an open shed, seven by fourteen feet, and is used for storing muck, protecting the manure heap from the rains, etc. The pigpen occupies the left end of the building, and is separated from the central or shed portion by a low partition, while the cow stall is boarded up to the roof.

The floor, being six feet and ten inches from the ground, provides storage room between it and the roof in which to put hay. It would be better to have the posts two feet higher, thus providing a loft in which over a ton of hay could be stored. The ground plan of this cheap and

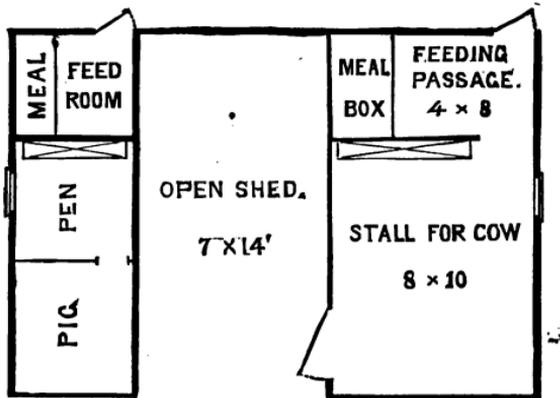


Fig. 77—PLAN OF COW SHED AND PIGPEN

convenient building is shown in Figure 77, the position of the doors, meal boxes, open shed, feed rooms, etc., being given.

#### IMPROVING OLD STABLES

There are thousands of old and poorly constructed stables, sheds and the like all over the northern states in which cattle are kept during the winter. These are often so cold that the ground freezes solid. Such shelter is very inadequate and results from a lack of building material in many of the prairie states and also neglect of farmers to provide comfortable stables even when the material is at hand. On all farms where grain is raised these stock barns can be made comfortable with the straw. If it can be baled so much the better. Place a layer of bales on the inside of the barn wall just as you

would lay brick, omitting of course the mortar. When the top is reached place a board or rail on the top bales to keep them in place.

If it is impracticable to have the straw baled it can still be used with good results. Build a fence as high as the wall of the building five or six feet outside of it and have it made comparatively tight by placing the poles or boards used not more than one foot apart. Fill in the open space between the fence and the building with straw and tramp it down as solidly as possible. If flax straw can be used this makes the best kind of filling. It is impossible for the wind to blow through this, and the stable will be as warm as need be.



## CHAPTER III

### *DAIRY BARN*S

#### A MODEL DAIRY BARN

The buildings for a dairy need not be elaborate or expensive, but should be such as will give thorough protection to the cows and their feed, and so arranged that the work can be done conveniently with the smallest amount of time and labor. They should be well lighted and ventilated and need to be warmly built. In Farmers' Bulletin 151 of the United States Department of Agriculture, by S. M. Tracy, a description of a model barn is given, which is illustrated in Figure 78. There are serious objections to having hay stored over the cow stable, both on account of making the stable too low and because of the great amount of dust and litter which usually sifts through onto the cows and into the milk pails, while the feed itself is apt to become tainted by the odors of the stable. Better ventilation can be obtained and better health can also be secured with a one-story structure.

Whether the stable is a separate building, or the basement story of a barn, the general plan and arrangement of the stable may be the same. The stable should be at least thirty-two feet long and of the desired width. It makes little difference whether the cows face the center or the outside. In the upper diagram of the cut of a single story building, the cows face the outside, with an eight-foot driveway through the middle, to allow the use of a wagon in cleaning. The feeding alley, *A*, is three

and one-half to five feet wide; manure gutter, *E*, is two feet wide; stalls seven feet deep, of which the manger, *D*, is two feet wide and stalls, *C*, five feet. This may be reduced to four feet six inches, or even less, for animals of the smaller breeds or cows below medium size. Four box stalls, twelve feet square, are at one end. The width of the stalls should be be from three to four feet, varying with the size of cows, and kind of stall used.

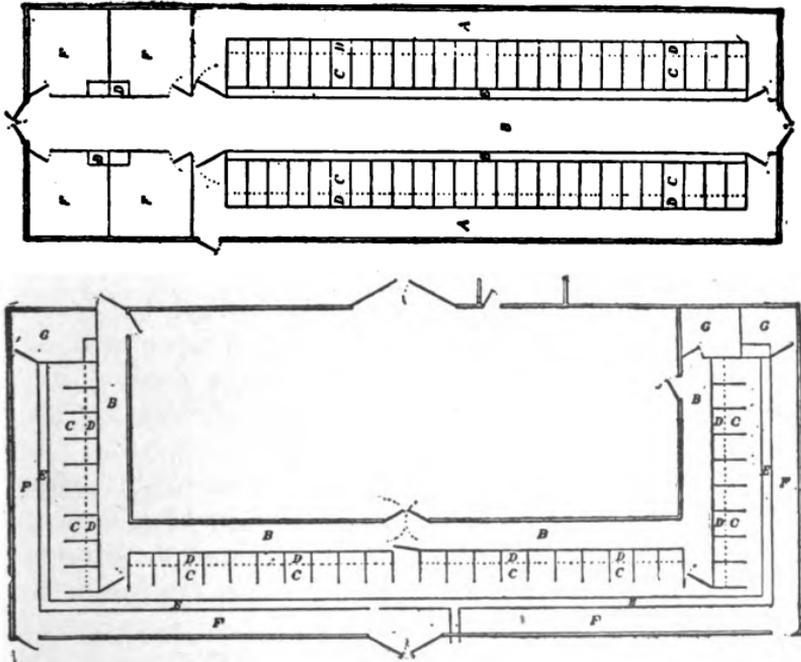


Fig. 78—GROUND PLAN OF A MODEL DAIRY BARN

This plan may be varied by making the stalls face the central passageway, an arrangement preferred by many where the stable occupies the lower story of a barn. Twenty-five or more stalls may be placed in each row, but when more than double that number is desired, it is

usually desirable to make the building cross, X, or T shape, with the different wings meeting at the grain room.

Another plan that is frequently adopted for a dairy and feed barn combined, is to construct lean-to sheds for the cow stables along one side and one or both ends of the hay barn, with a feeding alley next the barn wall, as shown in the lower part of the cut. There should be convenient doors for egress and ingress to both barn and stable. This barn is thirty feet wide and seventy-five feet long, with cow sheds sixteen feet wide. The feeding alley is four feet, passageway, *F*, next the outer wall, four feet, manure gutter, *E*, and stalls and mangers, *C* and *D*, the same as in the other barn.

The best floor, and in the long run the most economical, is one built of concrete. At any rate, the manure gutter and a foot on each side of it should be built of concrete. Bricks set on edge and bedded in cement are suitable for this purpose. The floor may be made of plank, but heavy clay mixed with gravel and well tamped down will do nearly as well. The stalls should have a slope of not more than two inches from front to rear, and for the manure gutter, one inch to twenty feet is sufficient. The bottom of the manger should be from three to six inches above the floor of the stall, and the manger large enough to hold the feed. It may be one foot wide at the bottom, two feet at the top, and one and one-half to two feet deep.

#### MODERN AND SANITARY COW STABLE

In the dairy and stock judging barn of the Wisconsin Agricultural College at Madison the cow stable is in a wing of the main barn. The floor is made of Portland cement and crushed granite, with a slightly sloping surface leading all water used in washing or scrubbing to the sewer drains. The manure gutters behind the

cows are sixteen inches wide, with the bottom sloping three-fourths of an inch to the rear side and one and one-half inches of slope toward the center of the stable where a trap can be opened connected with a sewer to be used only in flushing out the stable with water. The floor of the cow stalls is raised four inches above the other parts of the stable floor, including the walk behind the cows, making the manure gutter eight inches deep on the side to the cow and only four inches deep on side to the

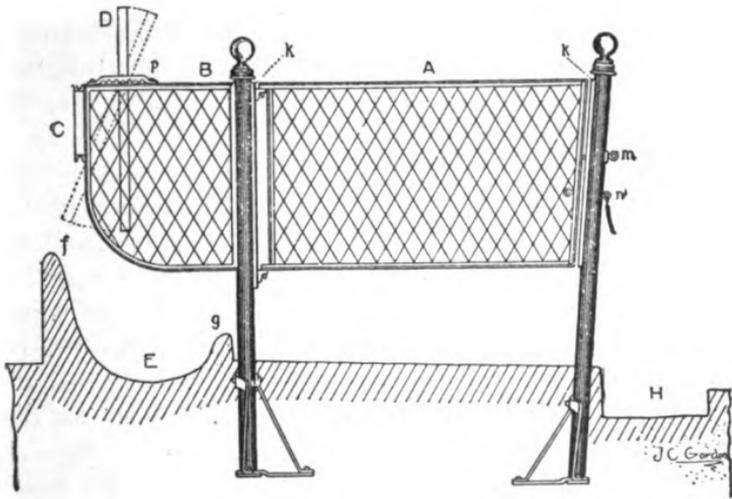


Fig. 79—CROSS-SECTION OF IMPROVED COW STALL

passage behind. This gives all the advantage of a gutter eight inches deep and at the same time facilitates the removal of the manure, and lessens the liability to danger from cows stepping suddenly into a deep trench as they pass onto or back from the platform on which they stand.

The mangers are built up from and composed of the same material as the floor. A cross-section of the floor and mangers of the cow stable is shown in Figure 79. The side of the manger next to the cow, *g*, is eight

inches high and three inches thick, rounding down into the bottom as shown at *E*. The front side of the manger, *f*, is sixteen inches high and built in a similar manner. This manger is two feet and six inches wide and reaches from one end of the stable to the other. It is used both as a feeding manger and as a watering device. It may not be out of place to here state that this means of watering cows is just as convenient and satisfactory as any of the individual watering devices, while it is more cleanly and wholesome. The water flows into the manger at either end from a pipe, and as the mangers

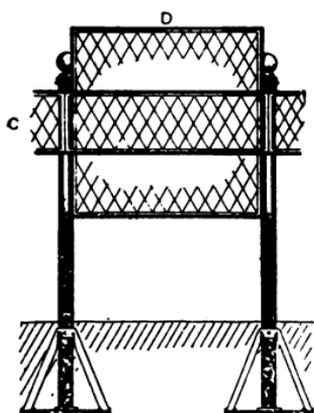


Fig. 80—FRONT VIEW OF  
COW STALL

slope toward the center from both ends it is very readily drained into the sewer by opening a valve after the cows have had sufficient time to drink.

The stable is arranged for thirty-six cows in stalls, eighteen on either side of the center passage, with the two rows of cows facing each other. The center passage is ten feet wide, so that a team may be driven through to feed green crops taken directly from the fields. The stalls are constructed of gas pipe posts

with framework of gates and panels of channel-iron supporting a mesh of No. 7 woven steel wire. Figures 80 and 81 show how the posts are anchored in a cement foundation. The letter *C* indicates the framework extending the length of each row of stalls to support the front part of the side panels and give them rigidity. *D* indicates the swinging panel which may be moved (see *p*, Figure 79) to suit the length of the cow, forcing a small cow to stand well back in her stall so that the droppings are received into the manure gutter and

not on the floor of the stall. The side panels of the stalls are hinged to accommodate the milkers and allow the cows to pass out without backing over the manure gutter.

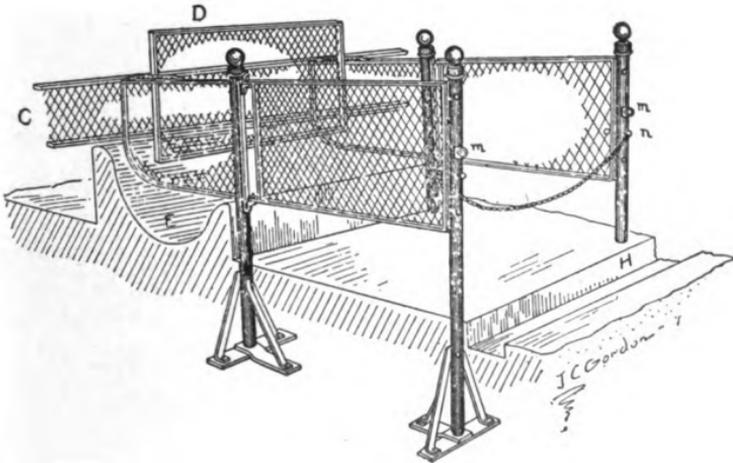


Fig. 81—PERSPECTIVE VIEW OF IMPROVED COW STALL

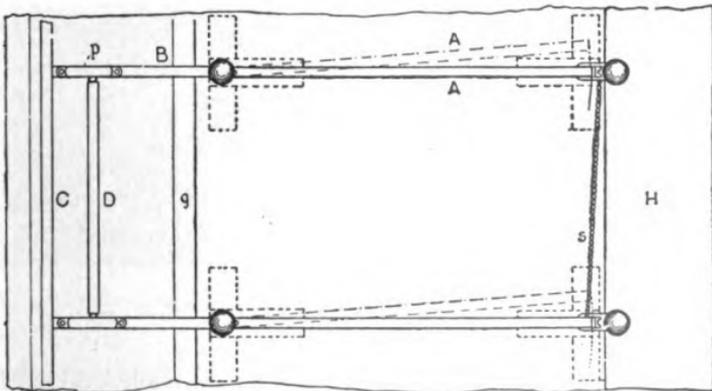


Fig. 82—FLOOR PLAN OF IMPROVED COW STALL

Figure 82 shows the floor plan of cow stall and Figure 79 a cross-section of cow stall and stable floor, showing

location of manger and manure gutter: *A*, gate; *B*, front side panel; *C*, framework supporting side panel; *D*, swinging panel; *E*, manger; *f*, *g*, sides of manger; *H*, manure gutter; *k*, *k*, gate bars; *m*, pin arranged with a spring for fastening gate; *n*, eye for chain; *p*, arrangement for moving swinging panel.

#### A SANITARY COW BARN

The cow barn of William Burgess of Trenton, N. J., shown in Figures 83 and 84, is fifty by thirty feet, con-

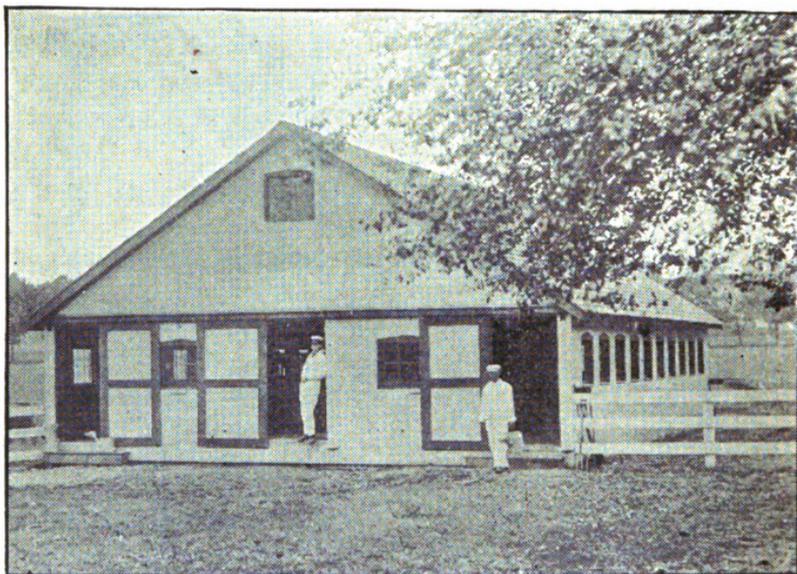


Fig. 83—A SANITARY COW BARN

taining two rows of stanchions, fifteen on each side. The feeding floor runs between. The feed trough is of cement, and is slightly pitched to one end. This also acts as a water trough, which is flushed three times a day, making the same perfectly clean before feeding.

There is nothing in the way of feed or hay in the building. In a separate building, close by, is a feed room and place for keeping the barn implements. The milk house, cooling and sterilizing departments are 150 feet from the barn in a separate building. The silo and fodder lofts are 200 feet from the cow barn, connected with the same by a tramway. The barn is lighted by ten windows on each side and three at each end. The

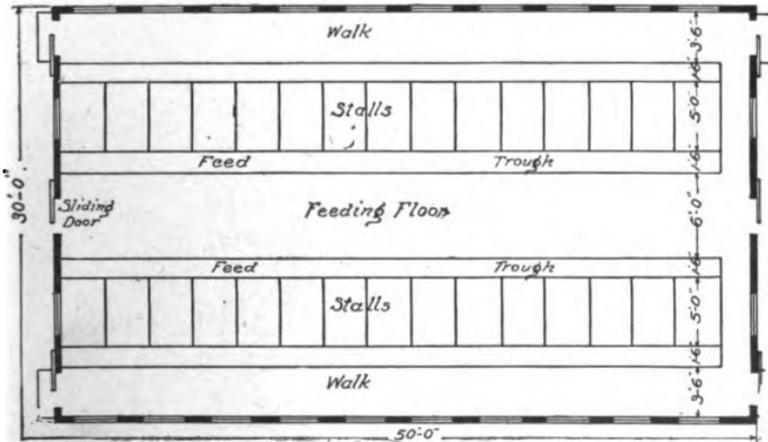


Fig. 84—FLOOR PLAN OF A SANITARY COW BARN

entire surface of the barn is flushed and scrubbed every day, keeping it in a perfectly sanitary condition.

#### AN ILLINOIS DAIRY BARN

The dairy barn of H. A. Browning of Elgin, Ill., Figures 85 and 86, is sixty by seventy-two feet, and has a stone basement which is eight feet high in the clear. The posts of barn above basement are eighteen feet high. The frame is built of fine timbers, mostly eight by eight inches, sills and plates six by eight inches, rafters two by six inches, braces four by six and four by four inches,

girths four by six inches. The barn is sheathed outside with ten-inch shiplap siding. The barn will stable eighty-two cows and has besides two large box stalls. The basement has two driveways, four rows of stanchions, and three feeding alleys. The stable is ceiled overhead and has a complete system of ventilation. The entire basement has cement floors.



Fig. 85—AN ILLINOIS DAIRY BARN

The barn above basement has room for over 100 tons hay, feed room, grain bins, grinding and stalk cutting machinery, but no silos. The small building shown in Figure 85 is a milk house and is not attached to barn. This building is fourteen by twenty-four feet, has a cement cooling vat that will hold forty eight-gallon cans, cement floor, and is supplied with water from a cistern

and well located on higher ground and piped to vat. The barn cost about \$2500 to build.

#### A TEN-SIDED DAIRY BARN

A dairy barn decagonal in form, each of the sides being sixteen feet, was built by P. H. Monroe of Plainfield, Ill., and is shown in Figures 87, 88 and 89. The basement is eight feet in the clear, and the studding for the

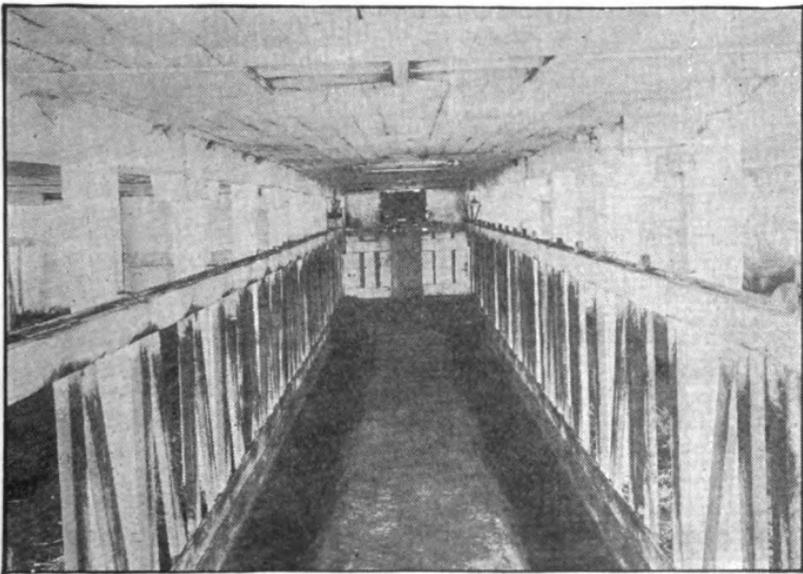


Fig. 86—INSIDE AN ILLINOIS DAIRY BARN

two upper stories twenty-four feet. The studding is of pine two by six inches, joists two by eight, beams and posts two by eight and two by six. It is covered with drop siding. The silo is built of two by fours, spiked together edgewise. There is a concrete walk six feet wide behind the cows, sloping two inches from wall to rear end of platform, which is of board flooring. The

basement is ventilated by a chute shown near *d* in Figure 88, which extends to dormer window in loft. Fresh air is admitted by four openings in the side wall of basement stable. The basement will accommodate twenty-five cows and bull, and the temperature in the coldest weather never falls below fifty degrees. In the basement

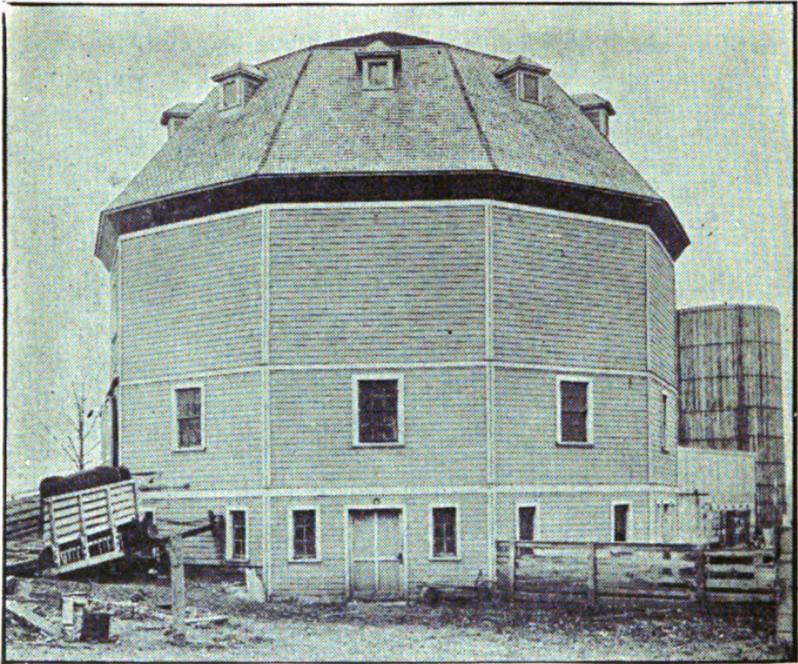


Fig. 87—TEN-SIDED ILLINOIS DAIRY BARN

plan, Figure 89, *a* is the walk, *b* platform for the cows, *c* mangers, *d* feeding alley, *e* meal and bran bin, *f* feed alley and trolleyway for silage, *g* calf pens, *h* shed for young cattle, *i* silo sixteen feet in diameter by thirty-two feet high. *S* shows the location of joists and beams supporting the floor above. In the plan of the first story, Figure 88, are shown the five horse stalls, and *d* is the space for storage of

vehicles and other farm implements. The dotted line shows the location of beams supporting the floor above. The space above this is used for the storage of hay and fodder.

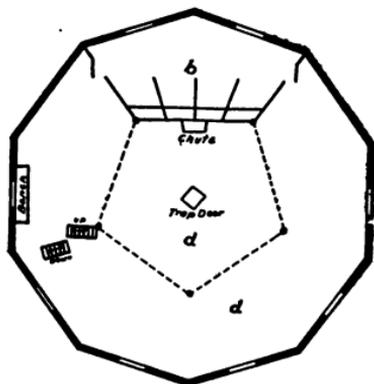


Fig. 88—SECOND FLOOR PLAN

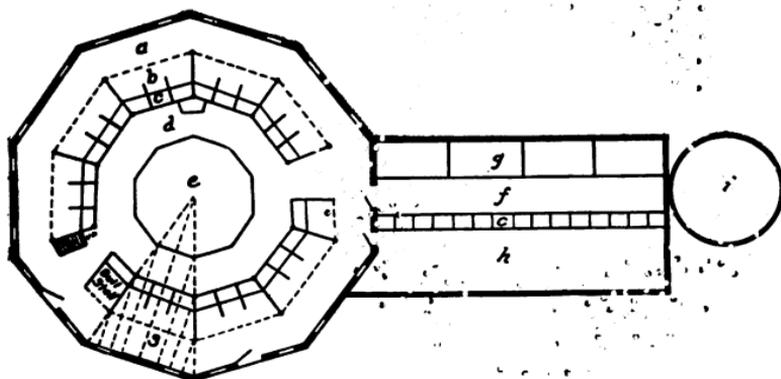
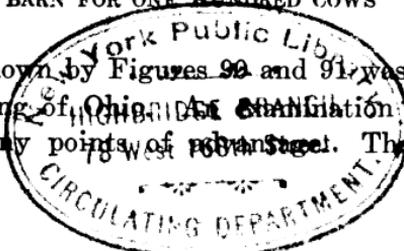


Fig. 89—BASEMENT PLAN OF ILLINOIS DAIRY BARN

BARN FOR ONE HUNDRED COWS

The barn shown by Figures 88 and 91 was designed by Joseph E. Wing of Chicago. An examination of the plans will show many points of advantage. The barn is to



hold 100 cows with some of their calves, heifers, calving cows and bulls. There must then be nearly 100 stalls and a number of box stalls as well. The box stalls must be of easy access to the other stalls, for often it is desired, especially with cows of the beef breeds, to allow calves to go to their mothers periodically and back again to their quarters. There is need of abundant light and air and of convenience of feeding and cleaning out. All these things are well embodied in this plan. And it is not an expensive barn to build, considering the room in it. Then there is the neat sunny open court which can and should be extended by building either an open shed or a high

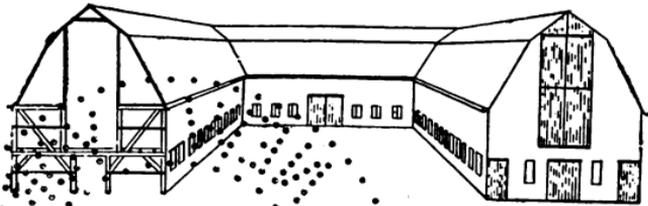


Fig. 90—PERSPECTIVE VIEW OF 100-COW BARN

tight board fence, continuing the west wall on down to shut off the too rough breezes. In this court there is a large cement water trough. Many do not consider the plan of watering in the stable the best under ordinary conditions and think the little airing the cows get stepping out to water is good for them and profitable in the long run...

Hay is taken in at three points, at each end of the ell and at the center of the connecting wing. This driveway will be closed in winter or when hay is not being put in, and feed rooms or one feed room and one large box stall made therein. A hoist here takes up grain and ground feed to bins over the driveway. It would be an excellent plan to erect a grinding and pumping windmill here, and architecturally it might be a help

to erect over this doorway and bin room a gable like the others, only carrying it up a little higher, which would give more room and light above.

The only criticism of this plan is that it is a bit narrow, thirty feet, but with the manure carriers and feed carriers in use nowadays one need not drive either before or behind the cows. Windows should be put in with sashes

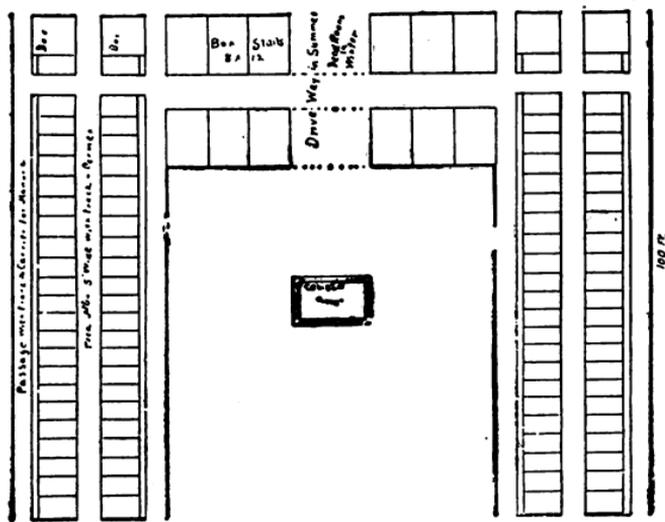


Fig. 91—FLOOR PLAN OF 100-COW BARN

almost continuous, three feet high, hinged at the bottom edge and opening inward at the top, a whole row all turned at one movement of a crank, a shaft with arms thereon running through to operate the affair. A ventilating system as described on Page 106 should be arranged for.

#### COMBINED DAIRY AND FRUIT FARM

In the Annapolis valley of Nova Scotia, John Donaldson recently built a circular roofed barn, which is a combination of stock barn and apple house, as the

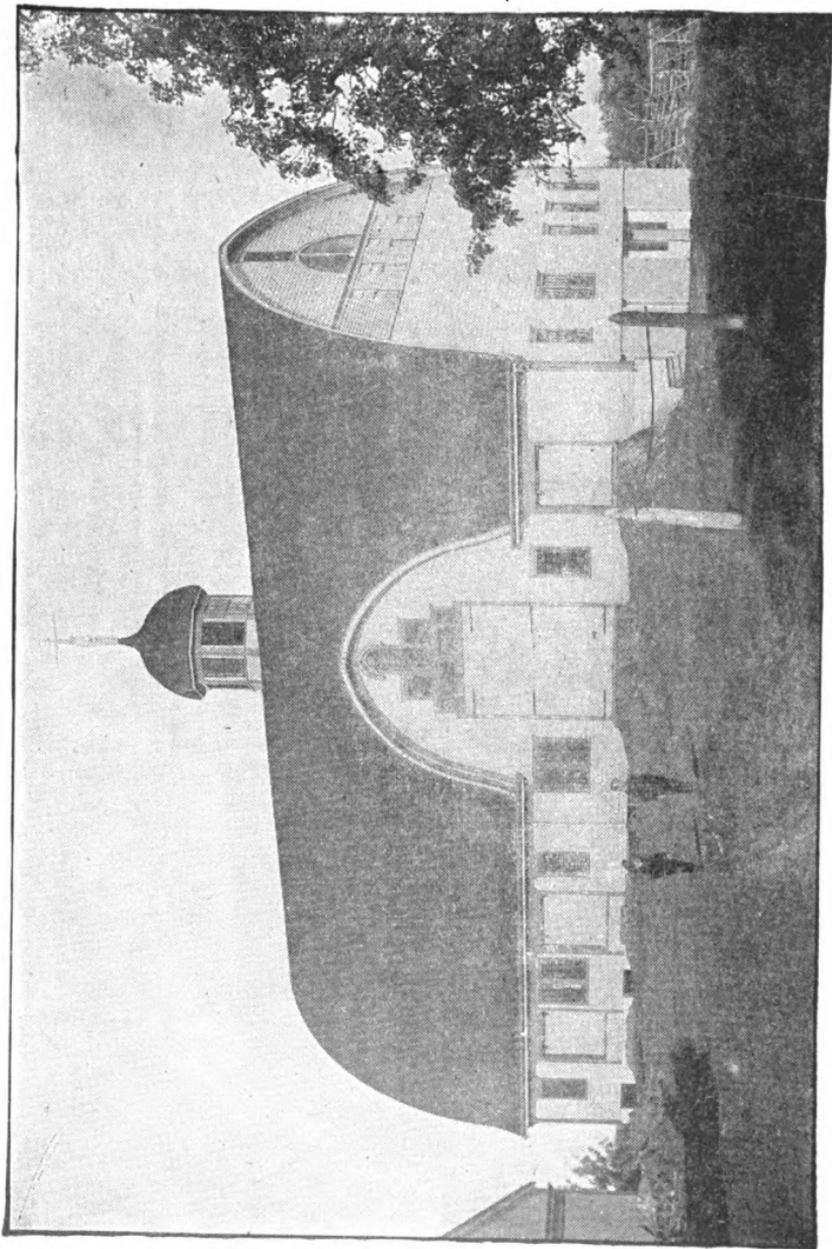


Fig. 92—NOVA SCOTIA DAIRY AND FRUIT BARN

accompanying plans, Figures 92 and 93, show. He claims that the circular roof is a cheap roof in construction, and it certainly has great storage capacity underneath. The barn, which is fifty-two by ninety feet in size, has no hay in the first story or basement, yet has a capacity of 200 tons. There are no cross timbers inside of the roof, which makes it very convenient in mowing away the hay.

The basement walls are of solid concrete, as is also the inner wall surrounding the apple cellar. The walls are fourteen inches thick at the bottom and taper to ten inches at the top, with a height of eight feet. It took 110 barrels Portland cement and sixty-two loads gravel

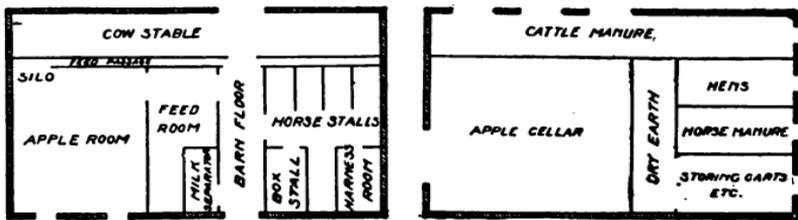


Fig. 93—MAIN FLOOR AND BASEMENT PLANS OF NOVA SCOTIA BARN

to construct them. The labor cost of building the cement walls was \$70 and the total cost about \$380. The outside doors nearly all slide, and the stable doors are fitted with patent hangers which make them very tight. The stables are sheathed throughout, well ventilated and furnished with plenty of light. The building is well lighted throughout, for there are 630 panes of glass in the building, the smallest being eight by ten inches in size. The barn cost complete about \$3000.

A good water supply has been put in. A windmill forces the water into a large tank over the horse stable. The cow stable is supplied with basins which are always

full of water. A good herd of Jersey cows are kept. Mr. Donaldson has three ends in view in keeping stock. They are the converting of raw material on the farm into marketable products, as a means of supplying fertilizer and as a direct source of farm income.

As the plans show, in Figure 93, a large space in the barn is devoted to the storage of apples, which constitute one of the chief sources of farm income in the Annapolis valley. The apples are largely packed by the growers on the farm, and the packing season extends over several months of the year. Thus the packing of apples and the feeding and milking of dairy cows furnishes plenty and profitable employment during the long winter months. The storage of everything under one roof facilitates work and also reduces the expense of keeping up farm buildings.

#### MODERN ADDITION TO A DAIRY BARN

The New Jersey Experiment Station built a frame structure thirty-eight feet long by thirty-two feet wide, projecting at right angles from the main barn. It is one story high, the loft connecting with the second story of the main building, so that coarse foods can easily be transferred to the feeding floor of the new structure.

The plan of the main floor is shown in Figure 96. The ceiling is sheathed with matched lumber. The floor is made of Portland cement and coarse gravel (one part to eight) three inches thick. This is covered with a layer of Portland cement one inch thick, making the total thickness of the floor four inches. The manure gutters are sixteen inches wide and five inches deep. A slightly sloping surface in the stalls and gutters leads all water to the trap doors, where it is conducted to cemented tanks below.

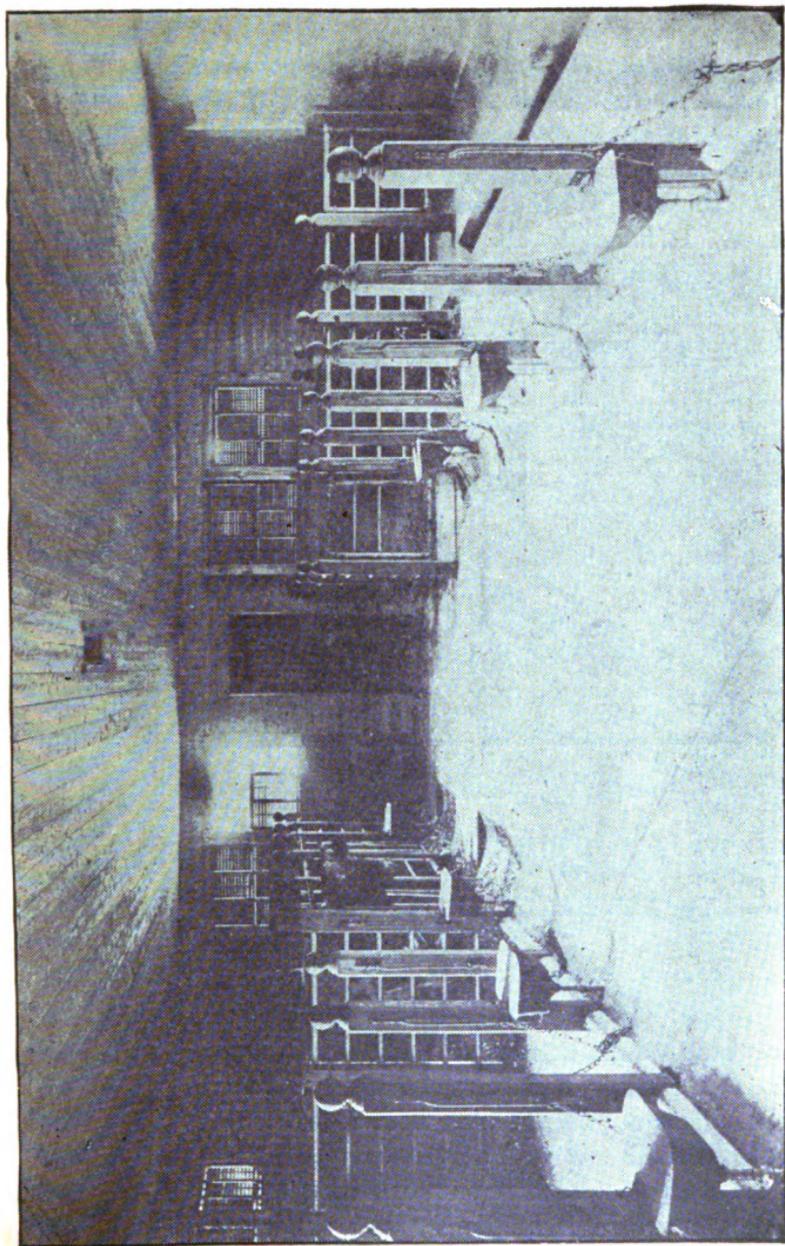


Fig. 94—INTERIOR OF COW BARN, NEW JERSEY EXPERIMENT STATION

The mangers are built in and composed of the same material as the floor. A cross-section of the floor and mangers of the stable is shown in Figure 95. The depth of the manger is three inches in the center, rounding up to the level of the floor. The width is one foot ten inches. It is used only as a feeding manger, the water being supplied in individual basins, which work automatically.

The stable contains thirteen stalls in two rows, which

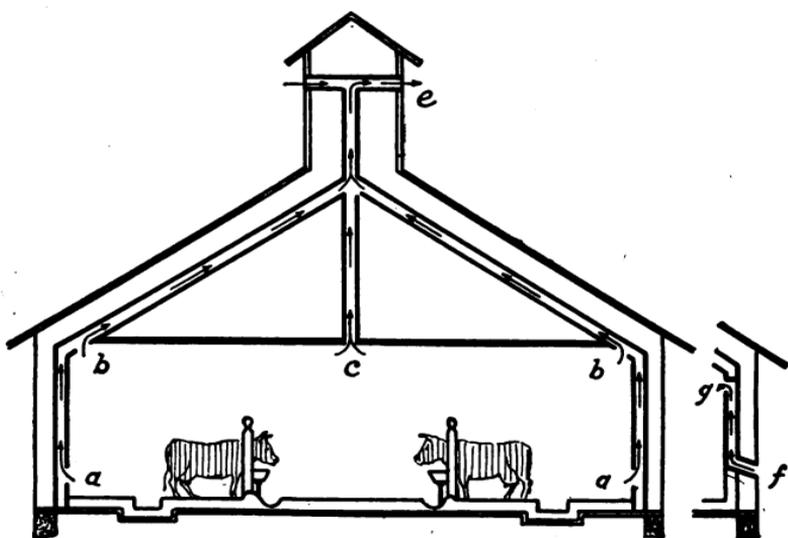


Fig. 95—CROSS-SECTION OF FLOOR AND STALLS

face each other, besides two special stalls for bulls and two box stalls, which may be used either for calves or older animals. The feeding floor is seven feet wide. The two bull stalls, as well as the calf pens, are constructed of spruce posts, with framework of gas pipe, Figure 94. The cows are fastened simply with a bow chain, attached on either side to a spruce post five inches in diameter. The bull stalls are connected with outside pens, twelve

by twenty-six feet, where the animals are turned out every day for exercise.

Under the barn is a basement divided into two rooms, one of which is used for storing wagons and farm tools,

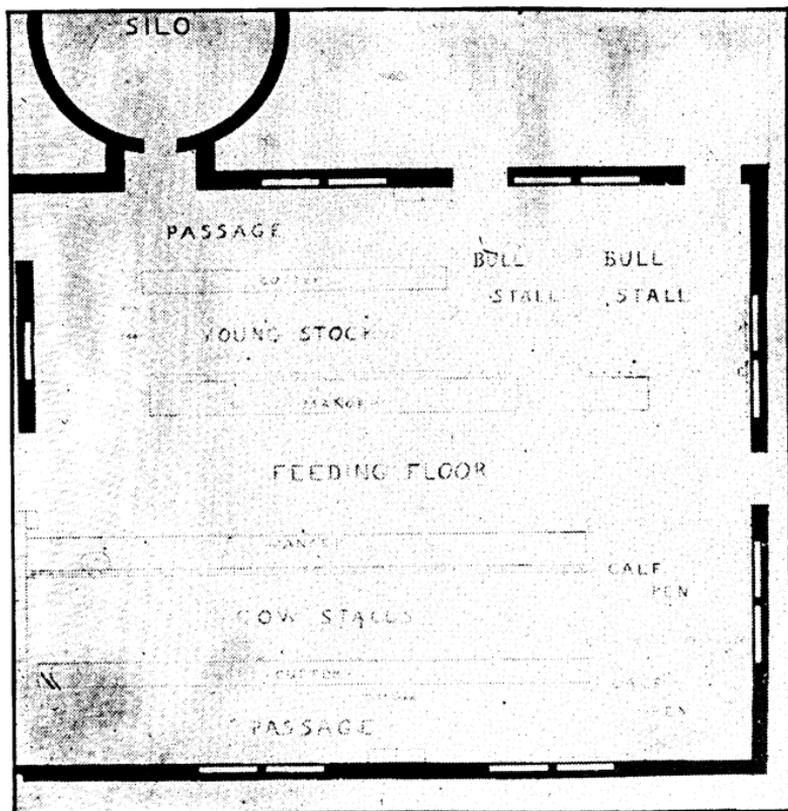


Fig. 96—FLOOR PLAN OF DAIRY ADDITION

while the other contains the manure pits. These pits are frequently cleaned, but the cement floor above prevents odors from reaching the main floor; hence the arrangement is a sanitary one.

The system of ventilation originated by Prof. King was used in this barn, and is shown in Figure 95. A single ventilating flue, *DE*, rises above the roof of the barn, and is divided below the roof into two arms, *AAD*, which terminate near the level of the stable door, *AA*. These openings are provided with valves, which may be opened and closed at will. Two other ventilators are placed at *BB*, to be opened when the stable is too warm, but are provided with slides, to be closed at other times. *C* is a direct ventilator, leading into the main shaft and opening from the ceiling, to admit a current of warm air at all times to the main shaft, to help force the draft. The ventilating shafts are made of matched boards carefully placed, so that the flue is air-tight. They are six by sixteen inches and open into a chamber above the roof, three feet square. The fresh air enters the stable on either side of the barn, as shown in the plan at *FG*, and the foul air is sent out at *AA*.

The silo is circular in form, twelve feet inside diameter and thirty feet deep, with a brick foundation ten inches wide, carried six feet below the surface of the ground. The bottom is cemented and is five feet below the sills, which are made of two by six-inch studding, cut on the slant of the radius of the silo circle, imbedded in mortar and toe-nailed together. The plates are made in the same way and spiked to studs, which are two by six, and eighteen inches apart. The lining consists of two thicknesses of half-inch boards (the inner layer of pine and the outer one of spruce), with tarred paper between, painted inside with gas tar and gasoline, mixed in the proportion of two to one. The siding consists of one layer of inch hemlock boards, nailed to braces between studs and covered with cedar shingles. Holes bored between each stud and covered with wire netting permit a circulation of air between the siding and lining, which aids the preservation of the latter. The structure is

roofed with dormer window for filling and with ventilating cap, and is joined to the barn by a passage, also roofed. The silo is emptied by means of the "Schlichter method" of continuous opening, the silage dropping through a chute two feet square, upon the floor of the passageway, from which it is conveyed to the mangers of the animals.

#### AN ORANGE COUNTY, N. Y., COW STABLE

A portion of the cow stables, built on at the north end of the barn, on an Orange County, N. Y., dairy farm, is

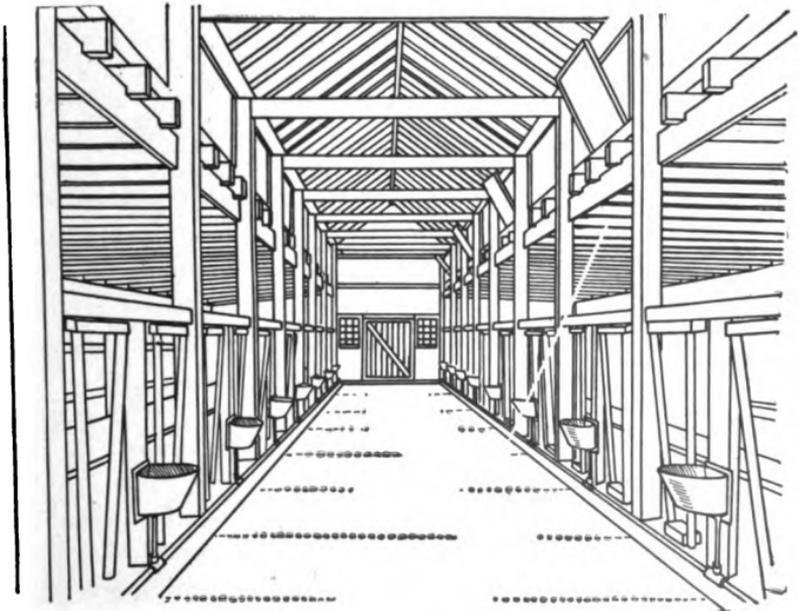


Fig. 97—INTERIOR OF ORANGE COUNTY COW BARN

shown in Figure 97. The feeding floor is ten feet wide and each side twelve feet for stable. The main barn is sixty by forty feet, the cattle barn sixty by thirty-four feet, with a milk room on the west side twelve feet square. The cow stable is a one-story structure, with a fourteen-

foot monitor roof, five window ventilators on each side overhead, three doors at the north end (two for cattle to enter), a smooth, clean floor, the Buckley basin watering device, regulated by a tub of water in the milk room, Smith's swing stanchions, and a manure gutter in rear of cows.

The labor of ventilation, watering, feeding and cleaning the stables is here reduced to a minimum. The main barn is packed full of hay annually. It also con-

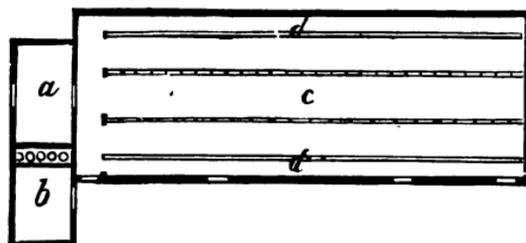


Fig. 98—PLAN OF BASEMENT

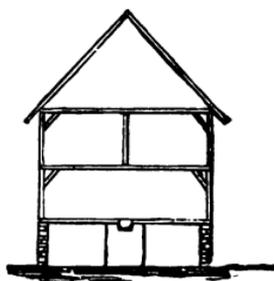


Fig. 99—SECTION

tains stables for six horses, bedding material for cows and feed. A circular silo, forty feet in diameter and high to hold 150 tons, opens into the main barn.

#### A WESTCHESTER COUNTY, N. Y., DAIRY BARN

The general style of one of the best dairy barns is shown in the four illustrations which follow. It belongs to Mr. Edward B. Brady of Westchester County, N. Y. Figure 100 represents the elevation of the barn. It is situated upon the side of a hill, in which the basement stable is placed. This basement is of stone, and nine feet high. The barn is twenty feet high above the stables, eighty feet long, and forty-eight feet wide. The yard is surrounded with a stone wall, and a manure pit is dug under the center of the building, large enough to back a

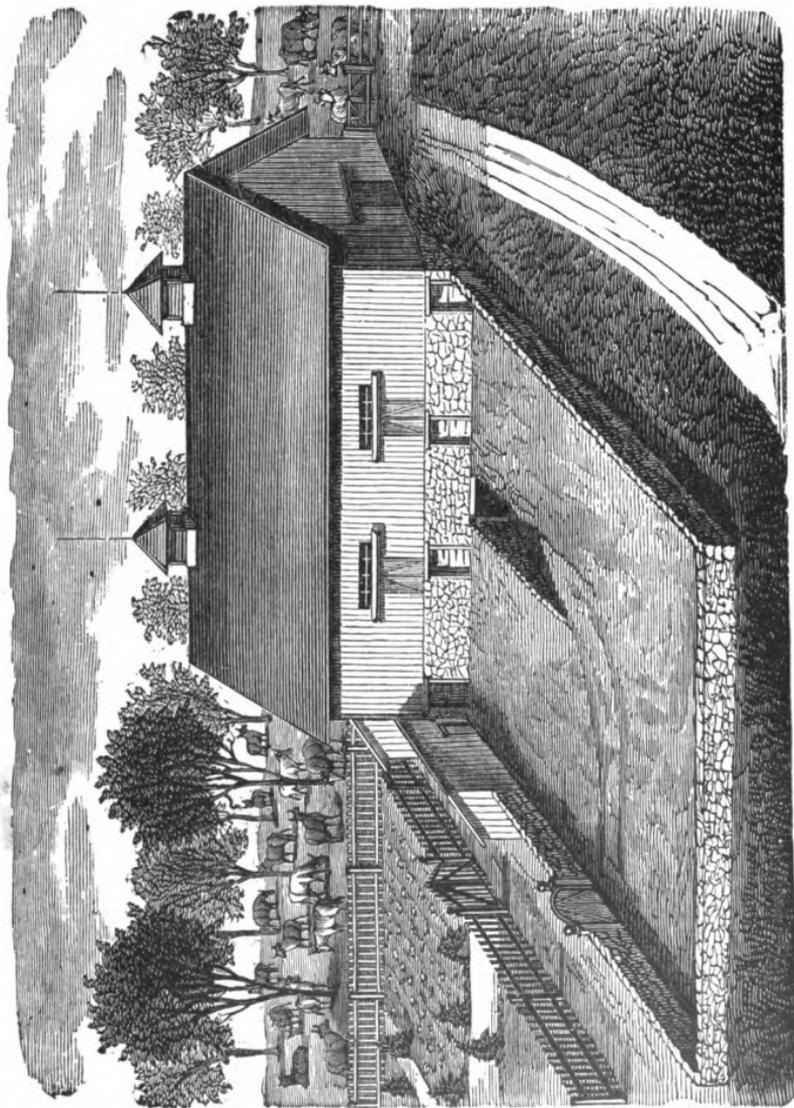


Fig. 100—A WESTCHESTER COUNTY, N. Y., DAIRY BARN

wagon into. The basement has four doors, and is amply lighted and ventilated. The floor is divided in the center by a wide feed passage, upon each side of which are stanchions to hold the cows. There are no feed troughs, but the feed is placed upon the floor before each cow. The stanchions are made of oak, are self-fastening by means of an iron loop, which is lifted by its beveled end as the stanchion is closed—falling over and holding it securely. The space between the stanchions for the cow's neck is six inches. Each cow has a space of three feet, and there are no stalls or partitions between them. The floor upon which the cows stand is four and one-half feet wide.

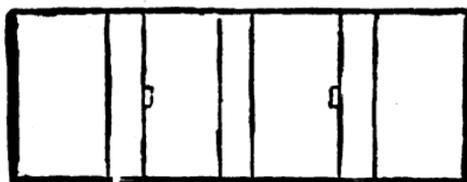


Fig. 101—PLAN OF FLOOR

To the rear is a manure gutter, eighteen inches wide, and six inches deep, and behind the gutter a passage of three feet and six inches—in all giving a space of fourteen feet from the center of the feed passage to the walls upon either side. This is shown in the plan, Figure 98, in which *a* is the grain pit, *b* the spring house, *c* the feed passage, and *d* the manure gutters. The same is seen in cross-section in Figure 99. The barn floor, shown in Figure 101, has four bays and three floors. Two of the floors have sliding doors, opening into the barn yard, and spacious windows above them, as seen in Figure 100. Chutes are made in the floors, by which hay is thrown down into the feed passage. These also serve for ventilation, in connection with the cupolas upon the roof.

## ANOTHER ORANGE COUNTY, N. Y., DAIRY BARN

The accompanying engravings illustrate a milk dairy barn, belonging to J. E. S. Gardner of Orange County, N. Y. The barn is 110 feet long, thirty-two feet wide, twenty feet high, with a basement nine feet high. The building is on a slope, facing west. In front is a pit for preserving brewers' grains, thirty feet long, nine deep, and sixteen wide. The interior arrangements are very convenient. Figure 103 shows the main floor. There

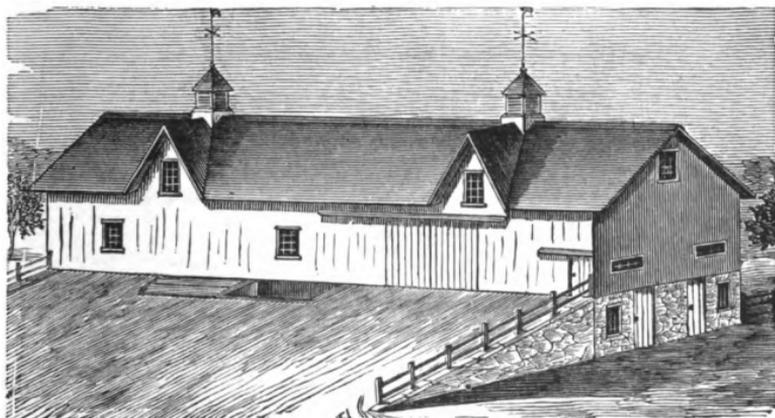


Fig. 102—VIEW OF AN ORANGE COUNTY, N. Y., BARN

are six horse stalls, sixteen feet long, with a manure chute in the center, leading to the manure pit in the basement beneath; a driving floor, twenty feet wide, with stairs and feed room, and a hay mow, seventy-two by thirty-two feet, with hay chutes leading to the feeding floor below. Figure 104 shows a plan of the basement, in which are thirty-six stanchions along the center, with doors at each end. In front of the cows is an alley, sixteen feet wide, for feeding, through which a wagon can be driven from end to end. Behind the stanchions is a

standing platform for the cows, with a drop fifteen inches wide, then a walk of three feet, and a manure pit seven and one-half feet wide and four feet deep, with a cement floor. In the rear are several sliding doors, one in each

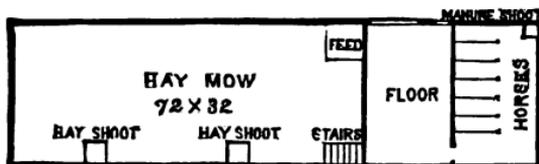


Fig. 103—PLAN OF MAIN FLOOR

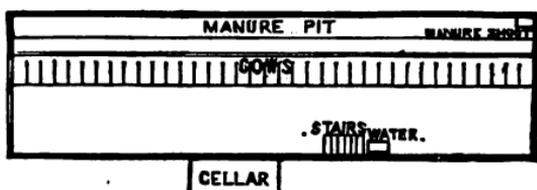


Fig. 104—PLAN OF BASEMENT

bent, for removing manure. The pit for grains is covered with railroad iron and flagging. A perspective view of the barn, showing its situation, is given in Figure 102.

#### AN EXTENSION DAIRY BARN

A cow barn that can be easily extended as the herd may be enlarged will be found very convenient by many. The size of a herd is frequently restricted by the accommodations afforded by the barn, and when an increase might otherwise be desirable, it is found objectionable on this account. It is not always possible to pull down one's barns to build larger, but when it is convenient to add to them at either end, increased room can be gained with but little outlay. A dairy barn is herewith illustrated

that can be extended to any desirable limits without changing the plan. In these days of steam, and all kinds of machinery, there is no difficulty in using long, narrow buildings, for, with the hay fork and the hay carrier, the forage can be readily stored in the longest barn and dropped wherever it is desired, without trouble, and by using a tram road and light feed cars, 300 cows can be fed from a central feed room as easily as thirty can be in the old-fashioned way. Figure 105 is the plan of a cow barn that will be found as convenient for a small herd of twenty or thirty cows as for one of ten times

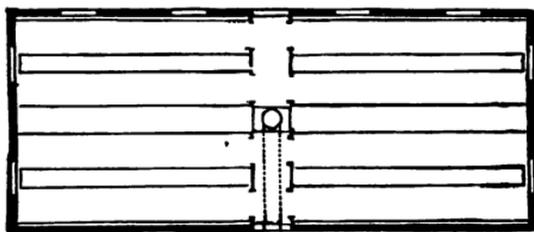


Fig. 105—PLAN OF DAIRY BARN

that number. The building may be twenty-four or forty-two feet wide. The plan shown is forty-two feet in width, and accommodates two double rows of cows. If room for only one double row is desired, twenty-four will answer, but thirty is better. The plan gives a central passage for feeding, six feet wide, with a tram roadway laid down in it. On each side of this are the double rows of stalls, with a feed trough for each. The floors on which the cows stand are seven feet wide, which gives room for a gutter behind each row, and for a feed trough four feet wide, divided lengthwise into two by a sufficiently high partition, each part being two feet wide. The feed is readily thrown into these troughs from the central passage, along which the feed car can be drawn by a small horse, or be pushed by a man. A turn table is provided

in the center of the passage, to admit of a car being brought with empty milk cans from the wash house in the rear, or with the full ones to the milk house after milking. The doorways are made very capacious, and the doors are double; the doorways may be left open during the summer, the doors being fastened back against the wall. The upper floor is kept for hay, fodder and feed; these being placed at each end, leave the center open and free for cutting and mixing the feed. Here should be a fodder cutter and a large mixing box, in the

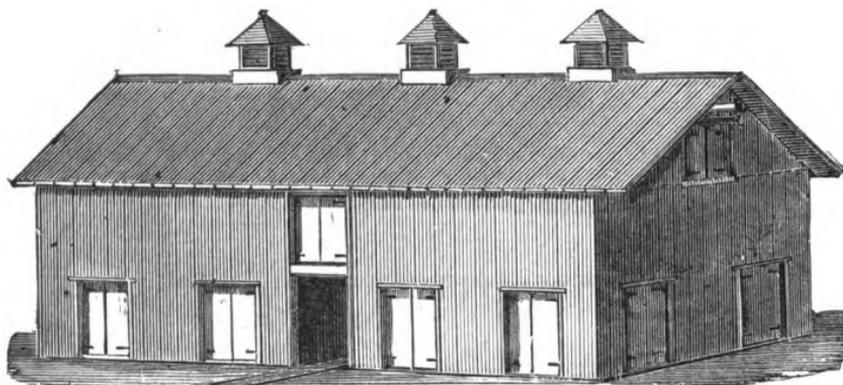


Fig. 106—VIEW OF DAIRY BARN

side of which there should be a spout to carry feed to the car on the floor below. If the food is steamed, the boiler can be kept in a rear building, not shown in the plan, the steam being carried to an engine, which would work the fodder cutter, and the steamer, both on the upper floor. This would be preferable to having the boiler in the main building, and would avoid much risk from fire. In Figure 106 is shown the elevation of the building. The central door above is for the admission of feed to the bins. A door is provided at each end for unloading fodder, a hay fork and a hay carrier being used for the unloading. There should be ample ventilation provided by means of

shafts, and these can also be utilized for dropping hay to the floor beneath. When an extension is desired, it is only necessary to add a bent or two at each end, carry out the roof and floor, and remove the ends.

#### ENLARGING A BARN FOR DAIRY PURPOSES

A common barn can be easily and cheaply changed into a dairy barn of large capacity by employing such a plan as that shown in the perspective view of Figure 107. Two wings, fifteen feet wide, with shed roofs, are extended out at right angles from each side of the old barn at one end. The interior arrangement is shown in the floor plan on the left. A feed car, with a track, is arranged for

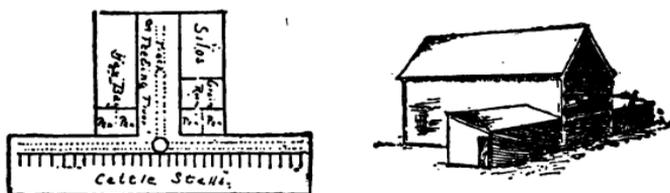


Fig. 107—GROUND PLAN AND PERSPECTIVE OF ENLARGED BARN

the feed floor and the feeding alley in front of the cows. A double silo, grain room and calf pens, with lofts over them, occupy one side of the barn proper, while calf pens and a hay bay occupy the other side. Thus the main barn is used mainly for the storing of feed, while the addition is given up to the stalls. The expense of such a plan will be very much less than would be entailed by the building of a new barn, or even a lengthening of the old one, while the plan shown herewith gives a much more convenient arrangement than could otherwise be had.

An enterprising Pennsylvania farmer recently decided to abandon general farming and make a specialty of dairying. This necessitated additional quarters for the cows

and they were put on as an ell to the old barn in the way shown in Figure 108. The addition is one-story, with an abundance of light, and is devoted entirely to stalls, the feed being stored in the main barn and brought to the addition on the second floor from the second floor of the barn. It is then put down into the mangers by



Fig. 108—PENNSYLVANIA  
BARN

chutes. The addition has two rows of stalls facing a feed floor. Where a cellar can be provided under the addition the manure can easily be disposed of. Otherwise it must be wheeled out each day to a manure shed. Space in the

barn proper is reserved for the rearing of calves.

#### NEW STYLE CALF PENS

The ordinary calf pens in barns are dark, gloomy places, wholly unsuitable for the growth of calves. Let in the light by taking down a part of the high board sides and replace it with one-inch heavy wire poultry netting, as shown in Figure 109. With the small mesh calves will not get their feet through it. The pens will thus be made much more light, cheerful and wholesome.

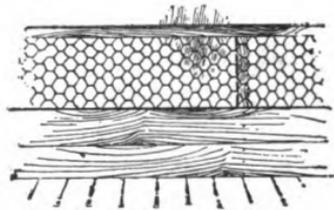


Fig. 109—WIRE CALF  
PARTITIONS

#### CEMENT FLOORS FOR COW STABLES

Much more durable than wood and more cleanly when properly made are cement floors. The construction of these is simple, yet a few principles must be carefully

followed. Excavate to the proper depth and level the floor. Fill with from two to four inches of concrete made by mixing small or crushed stones or gravel with cement. The gravel must be free from earth, else the cement will not stick. One part cement to six parts of coarse material is sufficient for the foundation. Mix the two together,

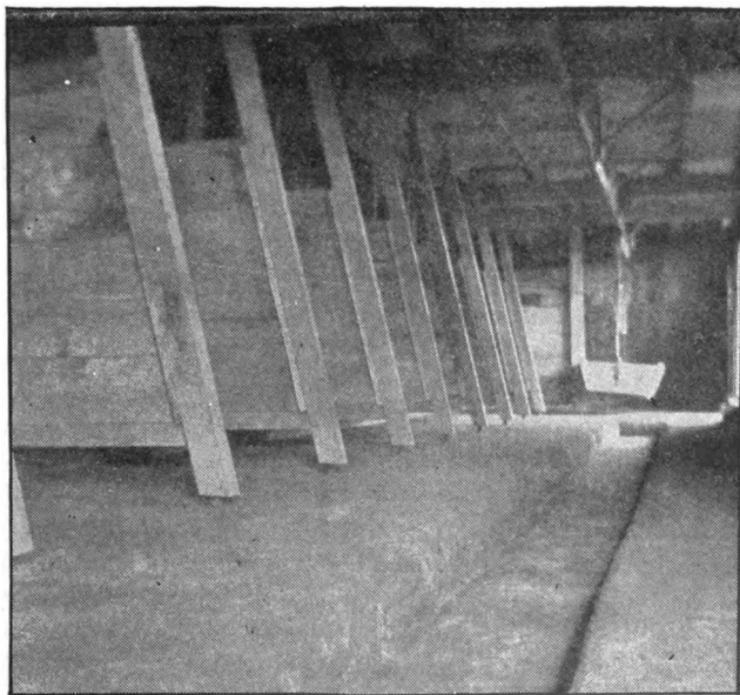


Fig. 110—SHOWING PARTITION AND CEMENT FLOORS

then wet with water, and, after spreading, pack it down with a rammer.

The finishing coat should be made of sharp, fine sand and Portland cement, using two parts sand to one part cement. It is absolutely necessary that the sand be free from earth. Lay the finishing coat in sections in order to get it smooth and of uniform thickness. Begin at

one end of the building, and three or four feet from the side, lay down a strip of scantling one inch thick. Fill this space with cement and smooth it off with a board float. If a steel trowel is used, it will make the surface so smooth that cattle will slip on it. Next remove the strip and lay another section three or four feet wide, and so on until the floor is completed.

The floor should be kept wet and allowed to dry slowly, when it will be much harder and will not crack as if dried quickly. In Figure 110 the gutter is made of cement and the edges next the cows are rounded to prevent breaking. Many use two by six-inch joist for the edge and set it in cement, as it will not wear out where the cows stand. To hold partitions, before laying cement, set a wooden block or drive in an iron rod. Iron is better, for it will not rot out. One-inch pipe cut fifteen inches long is suitable for this purpose.

#### THE HOARD STALL FOR DAIRY CATTLE

This stall, Figure 111, was perfected by ex-Governor W. D. Hoard of Wisconsin, one of the most eminent dairy authorities of this country. After many years of experimenting with different kinds of stalls and fastenings, he has adopted this one. A closely boarded partition about four feet high forms the front of the stall. Each cow has three and one-half feet in width. The floor is made tight and there is no drop in the rear of the cows, except the thickness of one plank, which is the double floor of the stall. The feeding rack is constructed for two purposes: (1) To contain any hay or roughage that may be fed the cow. The slats are put on wide enough so the cow can easily get her nose between them. (2) To force the cow when standing to stand with her hind feet in the rear of the cross bar across the stall floor.

In constructing the feeding rack nail a two by eight-inch piece of scantling edgewise against the board partition.

This constitutes the bottom of the rack and should be placed about forty inches from the floor. Place the top scantling about two feet from the partition. This makes the feeding rack eight inches wide at the bottom and two feet wide at top. In the center of the bottom scantling fasten a ring to tie the halter to. Fasten the cow

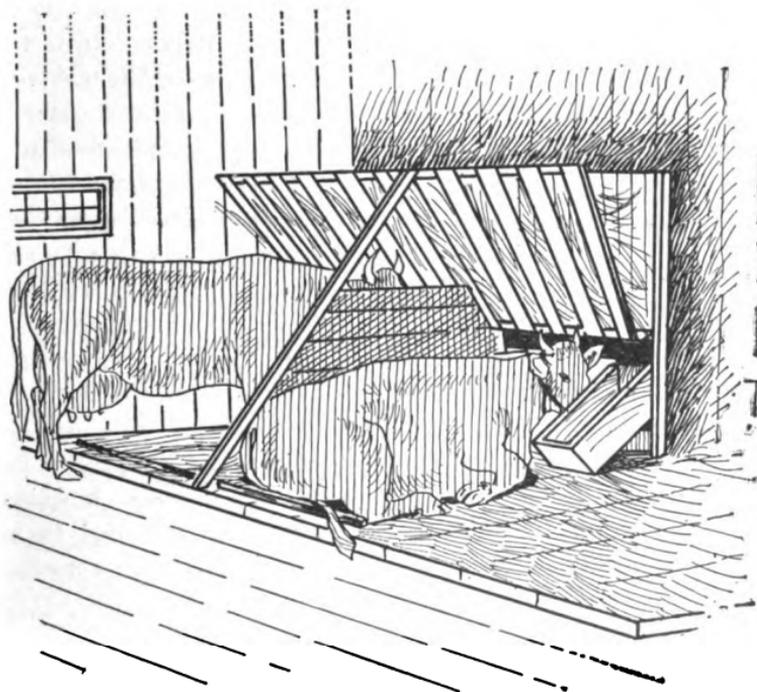


Fig. 111—THE HOARD DAIRY STALL

with a common web halter, she wearing the head piece all the time; the halter end of the rope has a safety snap to fasten into the ring of the halter under the throat. To prevent the cow from getting loose it is well to divide the end of the rope into two strands each six inches long and put a snap in each, fastening both into the ring when tying the cow.

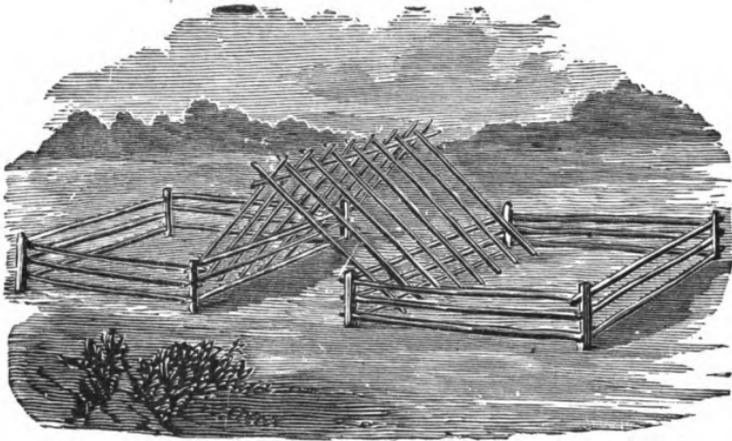
The grain and ensilage box is placed on that side of the stall opposite to the one the cow usually lies on. If she lies on her left side, place the grain box on the right side, as seen in the engraving. This box is large enough to contain the ensilage and grain feed, and is reached by an opening in the partition. It is best to have the feed box slant down toward the cow, so that all the feed will easily work down to the end nearest her. The box should be long enough to extend from the partition into the stall as far as the upper part of the feed rack projects and about eighteen or twenty inches wide and sixteen inches deep. If placed sufficiently slanting, the feed will easily work down to the lower end next the cow, so that she will not need to bring her hind feet onto her bedding in order to reach the contents of the box.

In placing the bar across the stall bring the cow's head squarely up against the feeding rack; then just forward of her hind feet nail down a two by three-inch scantling. Fill the space forward of the bar with bedding, which, being without waste, will last till entirely worn out. In this way each cow has her bed in true proportion to her length. It should be made fresh once a week, however, for the sake of health. This stall is commended to all dairymen who are looking for a clean, comfortable method of stabling dairy cows.

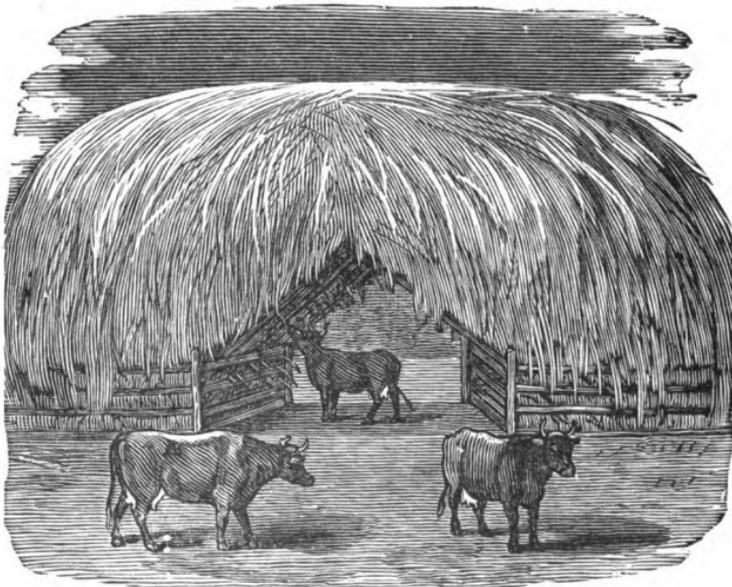
## CHAPTER IV

### *CATTLE SHELTERS*

With winter come the piercing winds, the intense cold, and, unless well protected, the greatest suffering that the farm animals experience during the whole year. It is the season when to keep the stock warm is no less a matter of economy than to keep them well fed; in fact, they are fed in a great measure to keep up the animal heat, the food serving much the same end that coal does to the furnace. This being true, it is reasonable to infer that an animal will require less food to maintain the proper temperature of the body were it warmed in part by other means. The inference is a true one, as thousands of experiments show; in fact, it goes without questioning that farm stock, when sheltered from the cold of winter, require considerably less food to keep them in a good, thriving condition than do those animals that are continually exposed to the weather. Shelter then has much more in its favor than simply the humane side, which alone is enough to warrant the comfortable protection of animals. There is an appeal to the pocket as well as to sympathy in the lowing of the shivering herd. All farmers, and especially those in the newer portions of the west, do not have stables for their cattle or snug sheds for their sheep. Stock raisers are called upon to make the winter as comfortable as possible for their animals, with the limited means at their command. Sheds of poles with roofs of straw are extensively used, and with profit.



**Fig. 112—PENS AND FRAME OF ARCHWAY FOR A SHELTER**



**Fig. 113—THE ARCHWAY UNDER THE STACK COMPLETE**

## AN ARCHWAY SHELTER

An archway shelter, under, or through a straw stack, is an inexpensive and valuable device for stock protection. The skeleton frame of such a one is given in Figure 112. It consists of two rail pens, of the ordinary sort, for the bottoms of small stacks, placed near enough together so that the archway of poles can be made between them, in the manner shown in the engraving. The lower end of each pole is set a short distance in the ground, resting near the middle on the top rail of the pen, crossing its neighbor pole from the other pen, and fastened to it with wire at the top and also to the rider. Over this structure the straw stack is built, and when finished has the appearance shown in Figure 113. In this way a snug shelter of considerable size can be made beneath the stack, under which the cattle gladly take refuge in stormy weather. The structure is a permanent one, the rails and poles remaining, if necessary, from year to year, or, if taken down, to be rearranged again in a short time, just before the threshing is done. Such an archway shelter would not be out of place in many a well-kept barn yard. If the stack is a long one, a double archway may be made, and each will save many steps in doing the work of the barn yard.

## A CHEAP SHELTER FOR COWS

A farmer and his boys can put up a decent stable at a cost of \$3 to \$4 a cow. To be sure, such a stable will not look as large and pretentious as a \$400 or \$500 barn, but it will do just as well for awhile. If cheapness is to be the watchword, here is a plan given by S. M. Henderson of Illinois that will help many a poor farmer. If good posts are to be had get them nine feet long. Suppose you have four cows. Build your stable eight feet

wide, sixteen feet long and seven feet high. The posts will be just about four feet apart all around the building. Spike two by fours on top for plates. Nail on girths at the ends of the building and side up with twelve-inch boards. Instead of siding up the two sides, make a door for each cow to enter her stall on one side, while the other side is for the manger. This manger may be made three feet wide and three feet deep, either flaring or straight. Remember now, that this manger is outside the stable, as shown in Figure 114. The depth of manger next to the cow should be about two feet. Now hinge a

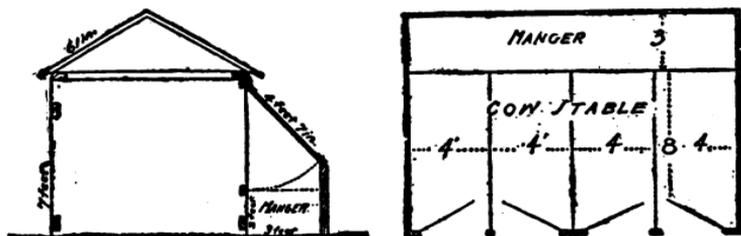


Fig. 114—END VIEW AND GROUND PLAN

big door up next the plate, letting the lower end rest on outside of manger. This makes a flaring side to the stable. To get hay or fodder into the manger, or to clean the same, raise this big door and hook it up with a big, strong hook to a post set especially for the purpose. Make the stalls four feet high.

Now for the roof. A ten-foot two by four cut through the middle will make a pair of rafters. Nine pairs, spaced two feet, are sufficient. The ends of the manger may be sided up if desired, and the swinging side or door never let down lower than the outside of manger. This door may be cut into two sections if too heavy to handle. If good posts cannot be had to set in the ground use sawed

posts and set the building on blocks or stones. In this case drive half-inch iron pins in bottom ends of posts and fit them into holes bored or drilled into the foundation.

## BUILDING STRAW BARN

In the Dakotas and Minnesota the common practice is to burn the straw, and in many states further east much straw is also burned or allowed to waste. This can be readily worked up into barns. The neatest way to build a straw barn or to line one is to bale the straw and build walls of it, just as if so many large bricks were being used, until the height of the wall is reached, as seen



Fig. 115—TWO STYLES OF STRAW BARN

at the left in Figure 115. Then with poles or scantlings for rafters, cover with straw or slough hay, and a very warm barn will result. Provision must be made for doors and windows, as desired. Leave a hole the proper size for a window and nail up a casing to fit it. One-inch material will do for the window casing, but two-inch is better for the door casings, as they must be stronger, to support the weight of the door.

With more work and a larger outlay for lumber or poles, as warm a house can be built from unbaled straw, as shown at the right in Figure 115. To do this, set two rows of posts firmly in the ground, two and a half feet apart (inside measure). Let these enclose a space the size of the building desired. Set them three to four feet apart

in the row, and board up with fence boards or poles placed on the inside of the posts and ten to twelve inches apart. Tie the two rows of posts together by nailing crosspieces at the top so there will be no spreading. Then fill the space, a few inches at a time, with straw and tread it down or tamp with a heavy timber. Put on a roof as described above. Cut out holes for the windows and doors, case them up, and the result will be a comfortable stable. Many a barn built of lumber and costing a considerable sum of money is not so warm as a straw or sod barn.

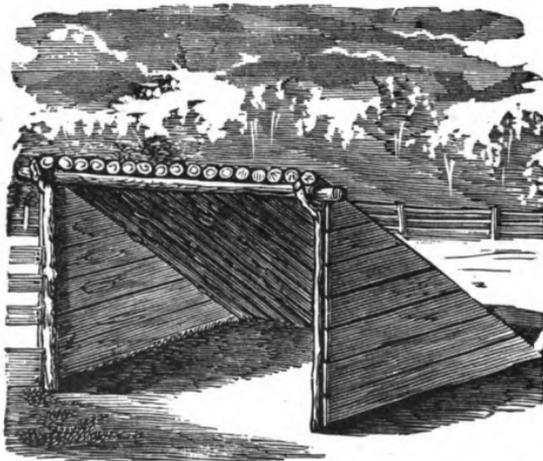


Fig. 116—SHELTER OF POLES AND BOARDS

#### CHEAP TEMPORARY SHELTERS FOR STOCK

Whenever it is found practicable, the shelter should be located upon the east or south side of a forest, or a hill, in order that the force of the bleak winds may be broken as much as possible. A cheap shelter may be made of poles, as shown in Figure 116, covered with straw or refuse hay. Two crotched posts, eight feet in length, are set two

feet in the ground, and from twelve to twenty feet apart. These are connected at the top by a strong pole, upon which rest the upper ends of other poles, twelve or fifteen feet in length. The ends of this shelter are boarded up as shown in Figure 116. A warm and comfortable shelter is illustrated in Figure 117. Six strong posts are set in the ground, forming the corners and sides of an enclosure, about twelve by fifteen feet, and six feet high. These are boarded up on three sides, and roofed with strong



Fig. 117—SHELTER COVERED WITH STRAW

planks or poles; the whole is overlaid with straw. The covering is best and most economically done at threshing time, by building the framework in the barn yard. A cheap board shelter is shown in Figure 118. In making one after this plan, fourteen feet wide, the highest part should be eight feet and the lowest about five feet, using sixteen-foot boards for roofing, which will project upon each side. The roof can be of matched lumber, or rough boards battened. Almost any farmer is enough of a mechanic to construct such a shelter, and it will be found serviceable as well as neat in appearance.

It often happens that those who have the most improved barns and other outbuildings desire to feed for a few months an extra number of sheep or cattle,

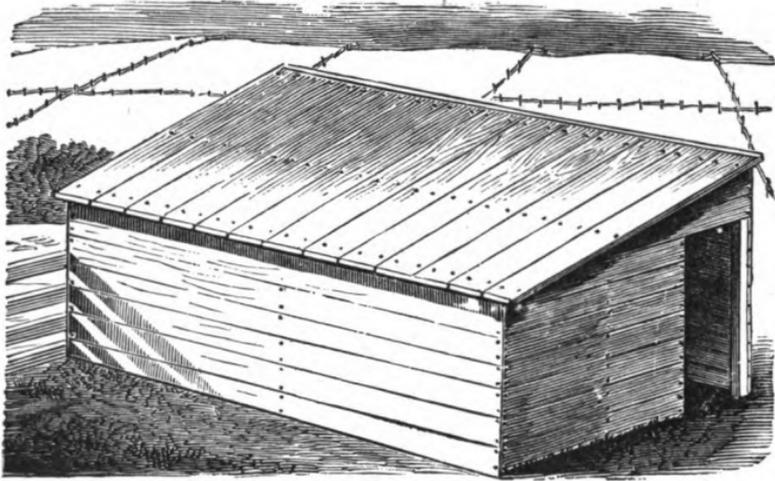


Fig. 118—CHEAP BOARD SHELTER

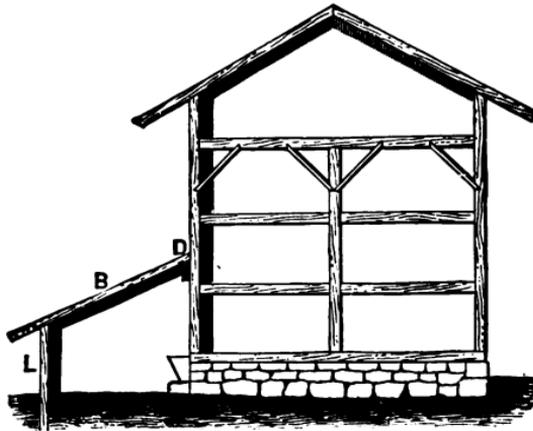


Fig. 119—SHELTER ADDED TO BARN

but have not sufficient convenient shelter. This may be provided by a temporary addition to a large building, as in Figure 119, in which *L* is a post set in the ground, *B*,

board roof, and *D* a post of the main building. This structure can occupy the end or side of a building, as may be most convenient, and may be so arranged that hay and grain can be fed directly from the large building without passing out of doors. The only trouble with shelters of this kind is, farmers find them so convenient, that they are tempted to let them remain for years, and so become permanent instead of temporary. Unless they are constructed of a material, and in a manner not to detract from the appearance of larger buildings, they should be removed as soon as they have served the immediate purpose for which they were erected.

#### OTHER STYLES OF TEMPORARY SHELTERS

Two cheap and convenient shelters are shown in Figure 120. The square shelter is suitable for all kinds of live



Fig. 120—CHEAP, TEMPORARY CATTLE SHELTERS

stock, and is adapted only for summer use. Four posts are set in the ground and two posts placed on top of these. On this are laid square edged boards with slant enough to carry off the water. Boards are also nailed on two sides to give shelter from the prevailing winds. The A-shaped shelter can be made a movable affair. It is adapted only for small animals, like sheep or hogs. Two crotched sticks are set in the ground and a rail laid in the crotches. A couple of old doors will answer for the sides, using care to drive two or three sticks each side in the ground

to prevent them from spreading apart and falling on the animals. A cleat or wire should be nailed over the top to hold them together in high winds.



Fig. 121—CATTLE SHED COVERED WITH HAY



Fig. 122—CATTLE SHELTER FOR THE PLAINS

#### CATTLE SHELTERS ON THE PLAINS

In the far western grazing regions, where the natural protection of ravines, groves of timber, etc., it is not avail-

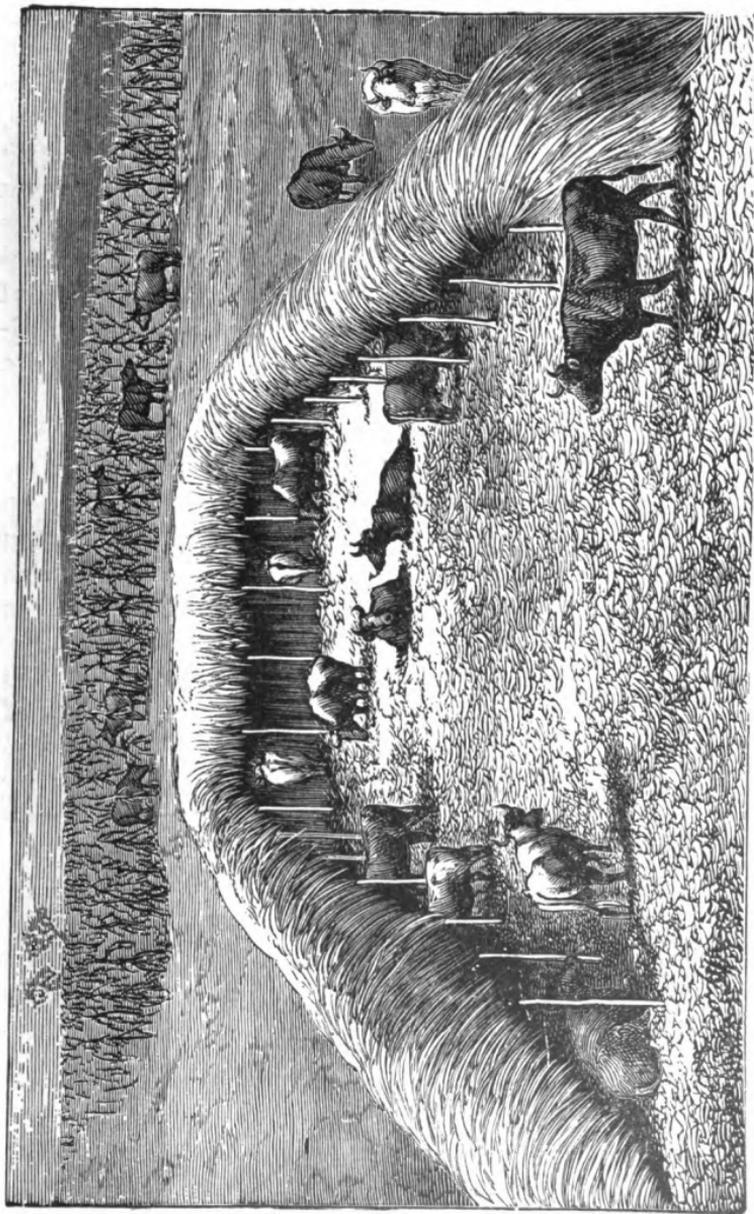


Fig. 123—STRAW SHELTER FOR CATTLE

able, shelters of the kinds shown in Figures 121, 122 and 123 may be provided. Poles are set in the ground in rows sixteen feet apart, and twelve feet apart in the rows. Cross beams or poles are spiked to these to hold a frame of lighter poles, and others, placed sloping, are laid upon the north side, as shown in Figure 121. Piles of hay are spread over these frames, as seen in Figure 122. They furnish at the same time shelter from storms and feed for the protected animals. A large number of these shelters are often made on the range, and some of them are hundreds of feet in length, and so curved as to protect from northwest and east winds. One of these large three-sided enclosures is shown in Figure 123. After a severe storm the shelters are fixed up by packing more hay on the sloping poles, to furnish feed for the cattle, and when the next storm comes the shelters are acceptable both as a source of food and for protection. Those who have traveled over the large cattle ranges of Kansas, Nebraska, Colorado and Wyoming must have often been struck with the skill displayed in the construction of shelters.

## CHAPTER V

### *SHEEP BARNs AND SHEDS*

#### A MINNESOTA SHEEP BARN

The sheep barn, Figure 124, at the Minnesota Experiment Station at St. Anthony Park, Minn., built in 1894, is of frame construction. Posts are two by four inches, twelve feet long, covered up on the outside with drop siding. The inside is sheathed with flooring only part way up in the lower story. The first story is eight feet in the clear, and is used for housing the sheep. The upper story, four feet clear at the plates, is used for storage of fodder. A hay track runs through the entire building. There is ample room to store forty tons of forage and bedding. The floor is of dirt except the feeding alley through the center, which is planked over, Figure 125. A silo at the end of the barn affords storage room for thirty-five tons of silage and is found to be a very useful part of the equipment. It is made of three by four-inch plank, beveled on the inner edges. These are held together in stave fashion by iron hoops. The part of the silo that is covered by the barn has one thickness of staves and is kept perfectly tight. The exposed portion of the silo is furred out with inch strips, covered with flooring and paper, and shingled over that. A root cellar is also provided under the feed room, large enough for storing twenty to twenty-five tons of roots.

#### A BARN FOR EARLY LAMBS

For a sheep barn in which to winter ewes due to lamb from January to April, the plans of one shown in Figures

126 and 127, designed by Prof. John A. Craig of Iowa, are well adapted for this purpose. When allowed to remain in a pasture over night, sheep are found to seek the highest knoll to sleep upon. Such places are dry and well ventilated. Experience has taught the shepherd that these are the two most essential things in choosing a place to house sheep. A sheep barn usually must be near the other farm buildings to be convenient for the owner, but in so far as that require-

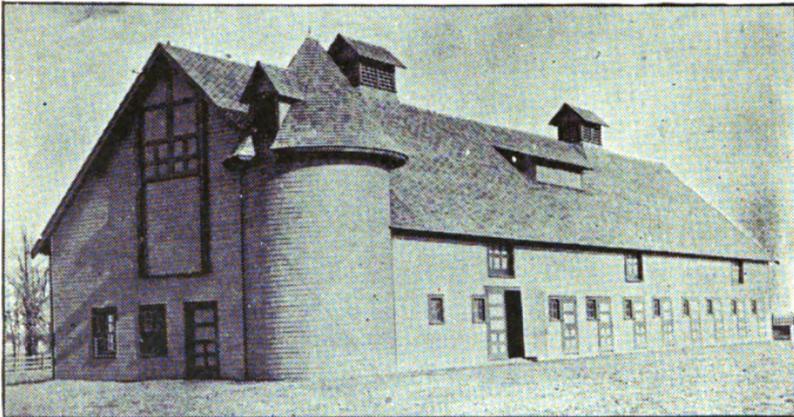


Fig. 124—MODERN SHEEP BARN IN MINNESOTA

ment allows a choice, select the highest, driest land available.

The only way to have a sheep barn dry is to secure good natural drainage and to provide ample means for ventilation. The chief errors in providing for ventilation in barns are the lack of sufficient means for changing the air and provision for partially closing the ventilators when extremely cold weather occurs and when high winds prevail. In addition to the above, another mistake is frequently made by arranging the ventilation so that drafts of air will pass directly upon the sheep.

Sunshine is a good thing to provide in abundance, as it proves a great stimulant to early lambs and seems to give them vigor and strength, while older sheep evidently enjoy it and no doubt are benefited by it. In building a barn, ample provision for storing hay or other forage should be made, as it costs comparatively little to add a few feet in height to a building when a mow floor and roof will be required anyway.

A good-sized lambing pen will be needed. The lambing pens should be arranged with enough partitions, stationary and movable, to accommodate several ewes at a time. They should be placed adjoining the shepherd's room so

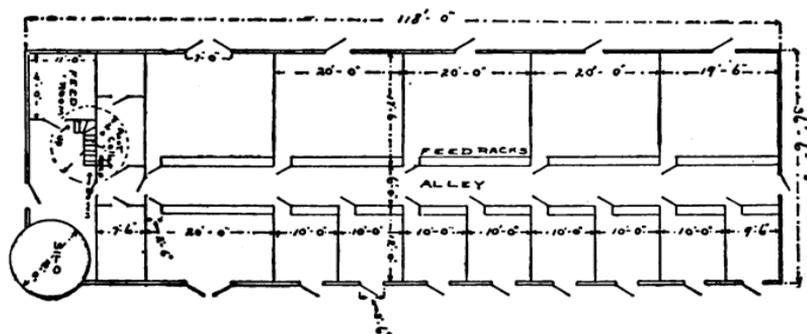


Fig. 125—FLOOR PLAN OF MINNESOTA SHEEP BARN

that his stove can be utilized in warming them, should they require it. Lambing pens allow a ewe to be alone with her lamb for several hours after its birth. Build the lambing pens heavy and strong so that the temporary partitions will be well supported by them and so breeding rams may be safely kept in them when they are not needed for ewes and lambs.

Do not neglect to provide a room for the shepherd, as you can then reasonably expect him to stay with his flock during the night if there is likely to be need of him. It will enable him to take a weak, cold lamb to the fire and to give it warm milk, which will save the life

of many a lamb if they can be supplied when needed. This barn plan economizes outside wall space. One feeding alley serves for two sets of pens. Each pen will accommodate twenty-five ewes, allowing about fourteen square feet to each. One and one-third feet at the feed rack is sufficient space for each ewe. The plan also allows the feed racks to constitute the partitions between the pen and the feeding alley, which has the further

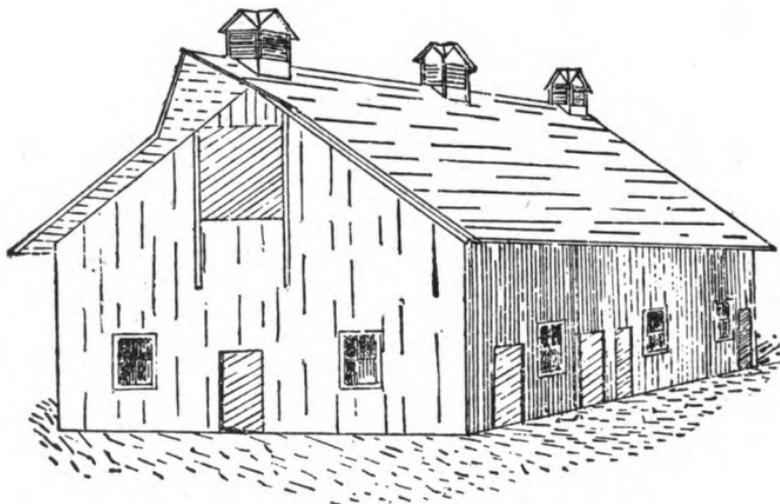


Fig. 126—THE COMPLETED SHEEP BARN

advantage of making the feed manger very convenient. The feed chutes are arranged at each end of the four-foot alleyway so that hay can be dropped through them into a very convenient place for feeding it to the stock. The division into four pens holding twenty-five ewes each will be found very convenient, as that will allow the ewes to be divided into four groups and fed according to their respective needs.

A good feature of this barn plan is its ventilating tubes, which are arranged to carry the air up to and out at

the cupolas. The tubes are made by nailing inch boards together in the form of boxes or tubes, which follow the roof under the sheathing and open into the cupolas. At the bottom of the tubes a sliding or tilting shut-off is arranged so that the degree of ventilation can be gauged according to the nature of the weather and the number

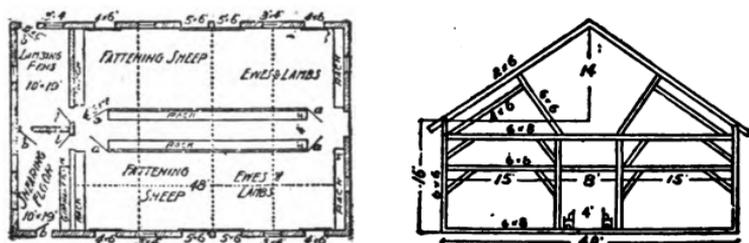


Fig. 127—GROUND PLAN AND END VIEW OF FRAME

of animals housed. A hay door is arranged at the end of the barn so that hay may be carried in upon a track with a fork or with slings.

#### BARN FOR RAISING WINTER LAMBS

Raising winter lambs has become an important industry. It is necessary for this purpose to have a barn that can be kept warm. A sheep barn and fixtures to accommodate 100 ewes are represented in Figures 128 and 129, which give a perspective view and ground plan. The ground floor is divided into six pens, each sixteen feet square, with a four-foot alley extending through the middle. Each pen will accommodate sixteen to eighteen ewes. The alley *H* is necessary in feeding the animals and as a playground for the lambs, for without such exercise they would not develop properly. The fold should be nine feet high and either boarded on the outside with matched lumber, or battened on the

inside and lined with sheathing paper. The posts are twenty feet. At the end of the second floor opposite the hay door a grain room is partitioned off, with stairs, *E*, leading to it from below. It contains three bins, for various kinds of grain used. As this is mixed by weight, scales are placed here. After it is mixed, the grain is thrown in a chute to be spouted below as needed.

In the center of the second floor is an opening five feet square over the square marked *D*, over which is placed a

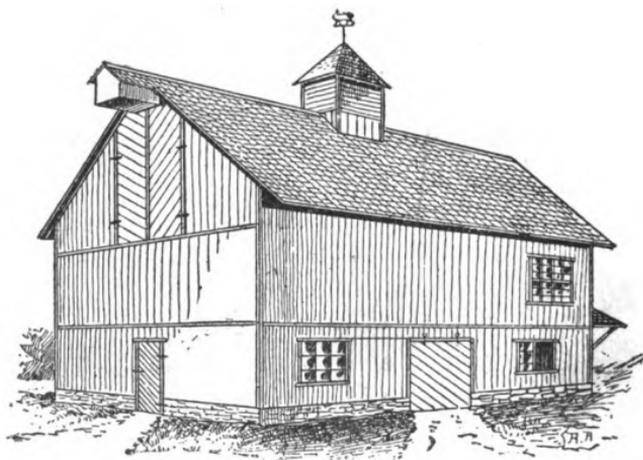


Fig. 128—PERSPECTIVE VIEW OF SHEEP BARN

closed, pyramidal fodder chute and foul-air escape five feet square at the base and four at the apex, which reaches the cupola. The chute has doors in the side through which to throw down fodder. The windows of the fold are made to slide, and by the use of them and the chute the atmosphere is kept at the right temperature, which is about fifty degrees. A slide, made to be worked from overhead in the fold, opens or closes the draft in the chute. The hay loft is reached through doors in the partition of the grain room. A stairway and platform

at the end of the building (not shown in the engraving), on the outside and adjoining the grain room, facilitate replenishing the bins with grain.

Double racks, *A*, are the division fences between the pens. The bed pieces of these are scantling two by four inches set edgewise. They are beveled on the lower edges and the rack slats are nailed to the beveled faces. The slats are two feet ten inches long, placed three inches apart, and the rack spreads two feet ten inches at the top. The bottoms of the bed pieces are eighteen inches from the ground. Feeding troughs are fastened to the racks at the lower ends of the slats. For convenience in filling, the alley ends of the racks are left open. The

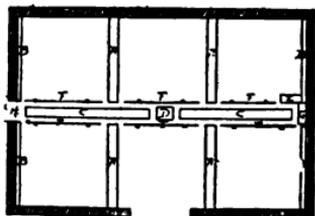


Fig. 129—GROUND PLAN

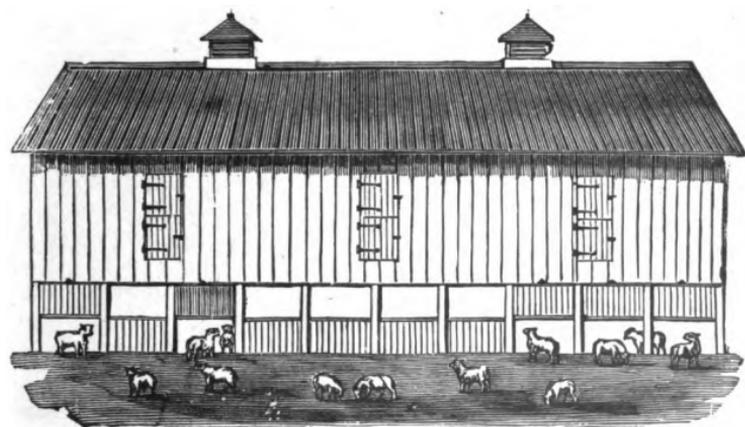


Fig. 130—FRONT ELEVATION OF SHEEP BARN

other ends of them abut against the walls of the building. There are movable troughs, *C*, in the alley for the lambs, which reach them through openings under or at the sides of the alley ends of the racks. In the end

pens half racks, *B*, are spiked against the ends of the building. This system of racks and troughs economizes space better than any other. The alley fences are three feet high and wired loosely to posts driven in the ground. The pens are kept well bedded, and the manure should be frequently removed.

Unless sheep are carefully provided for, there is sure to be trouble and loss in the flock. If it was figured up

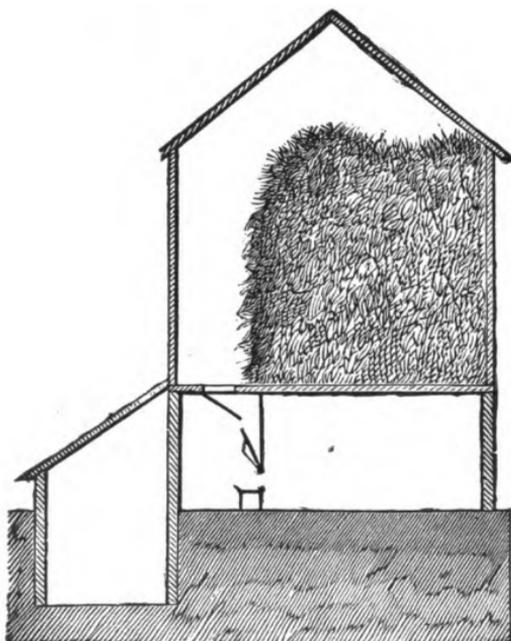


Fig. 131—SIDE SECTION OF BARN

how much money may be made yearly by good care out of \$100 invested in sheep, as compared with the profit from \$100 invested in cows, or a mare, the balance would generally be in favor of the sheep. During the winter season, the keeping of sheep requires much care and skill, and, with a large flock, but little success can be had without a good sheep barn. Such a barn, having many

conveniences both for the flock and their owner, is here illustrated. It consists of a barn, shown in Figure 130, about twenty feet wide, sixteen feet high from basement to eaves, and as long as is desirable. This is intended to store the hay or fodder. The posts, sills and plates are all eight inches square, and the girths and braces four inches square. The beams, two by ten, are placed sixteen



Fig. 132—DOOR

inches apart, and cross-bridged with strips, three inches wide. The hay is piled inside, so that a passageway is left over the feed passage below, in which there are trap doors. The hay is thrown down through these doors,

and falls upon a sloping shelf, which carries it into the feed racks below; see Figure 131. The basement under the barn is eight feet high, and is of stone on three sides; the front is supported by posts, eight inches square, and eight feet apart. Between each pair of posts, a door is

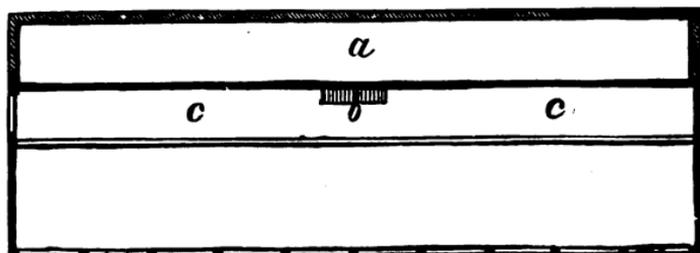


Fig. 133—PLAN OF BASEMENT TO SHEEP BARN

hung upon pins, Figure 132, which fits into grooves upon the posts, so that the door may be raised and fastened, held suspended half way, shut down, or removed altogether. By this contrivance at least half the front of the basement must be left open, whether the sheep be shut in or out. The floor of the basement is slightly sloping

from rear to front, so that it will always be dry. Figure 133 gives the plan of the basement. The feed passage is shown at *c*; the stairway to the root cellar at *b*, and the root cellar at *a*. Figure 131 gives a section of the whole barn. The hay loft is above, and the passageway and the doors are shown, by which the hay is thrown down to the feed racks below. The sloping shelf, by which the hay is carried into the feed racks, is also seen. Below the feed rack is the feed trough for roots or meal. A door shuts off this trough from the sheep at the front, while the feed is being prepared, and when it is ready, the door is raised, and held up to the feed rack by a strap or a hook. The feed rack is closely boarded behind, and this back part, which is in the feed passage, slopes toward the front, so as to carry the hay forward to the bottom. The front of the rack is of upright slats, smoothly dressed, two inches wide and placed three inches apart. The boards of the feed trough are smoothly dressed and sandpapered, and all the edges are rounded, so that there is nothing by which the wool may be torn or rubbed off from the necks of the sheep. The root cellar is at the rear of the basement, and is reached by the stairs already mentioned. A barn, large enough to accommodate 100 sheep, may be built for about \$500 to \$600.

#### SHEEP SHEDS AND RACKS

Sheep that are not being prepared for market do not thrive well during winter, unless they have exercise and a well ventilated shed. Such a building may be of any height, but the floor need not be more than six feet from the ground, which gives a large amount of storage room for hay. The floor should be of matched boards, or the cracks should be otherwise closed up to prevent hay seed or chaff from dropping upon the wool. The front of the shed is boarded to within a few feet of the ground, leav-

ing that space open, that the sheep may go in or out when they please. The feeding rack is placed round three sides of the shed, and slopes forward so that the sheep can consume the last mouthful of hay contained in it. It is made so high that the sheep cannot reach over the front of it and pull the hay out over each other's wool. Three and one-half feet is the right height for large sheep. The slats are placed three inches apart, which prevents the sheep from pushing their heads through, and wearing the wool from their necks. Everything about a sheep

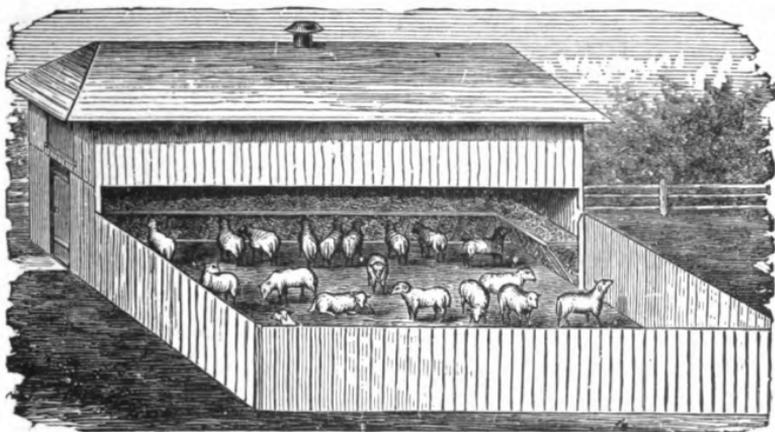


Fig. 134—SHED, PEN AND RACK FOR SHEEP

pen should be smooth, leaving no rough splinters to catch and tear the wool. The pen and yard should be kept well littered. This shed, shown in Figure 134, is arranged especially to keep the wool clean and free from hay seed, clover heads and dust, and that the sheep may be outdoors or indoors as they wish, and according to the weather.

#### SHED FOR SOILING SHEEP

When it is desirable to keep sheep in yards near the barn, for the purpose of soiling, a structure can be made as follows: A green paddock of about an acre is divided

by fences into four parts, as shown in the illustrations. A partly open shed with feed racks all around it is placed in the center. For fifty sheep a building twenty feet square is amply large. A door from each quarter of the paddock opens into this shed. As one quarter is used, the doors opening to the other are closed.

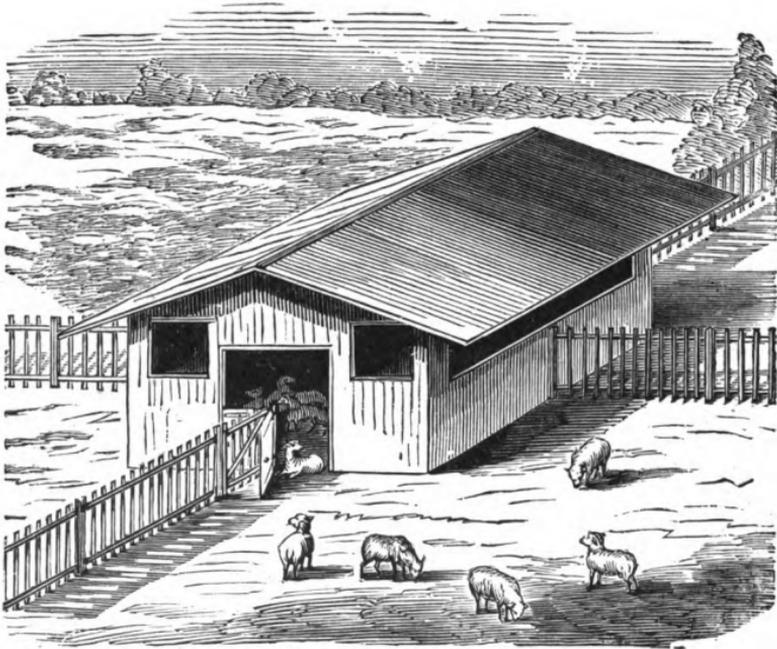


Fig. 135—A SHED FOR SOILING SHEEP

Figure 136 shows the yards with the shed in the center. The outer gates are at *a*, opening into the lane. The gates, *b, b*, lead into the rear quarters. The doors of the shed are at *c, c*. Figure 137 shows an enlarged view of a plan of the shed. Figure 135 gives the elevation of the shed, with a large double doorway closed by half-doors, and open at the top. There are also large open

windows, so that the shed is airy. There is no provision for water in the yards, and this is the best plan, as the yards are kept dry, and it necessitates at least so much

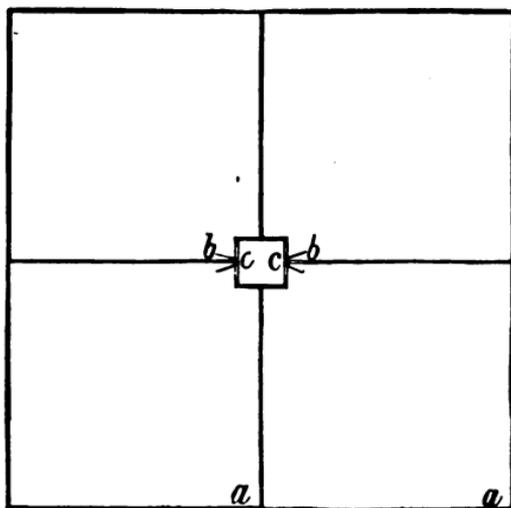


Fig. 136—PLAN OF SHEEP YARD

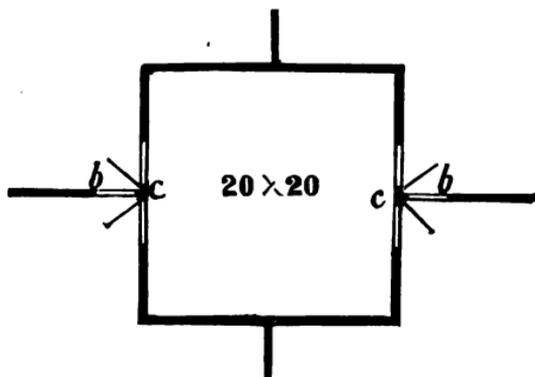


Fig. 137—PLAN OF SHED.

exercise as will be derived from driving the sheep to water twice a day. The change of yards is needed to keep them dry and free from mud in wet weather. The crops

that may be usefully fed in such a yard are rye, clover, grass, rape, mustard, peas and oats, barley and tares, turnips, or any others that are used when sheep are fenced by hurdles.

VIRGINIA SHEEP BARN

A Virginia sheep barn, which possesses many conveniences, is shown in the accompanying plan, Figure 138. The yard, *a*, is 100 feet square, divided by a hurdle fence

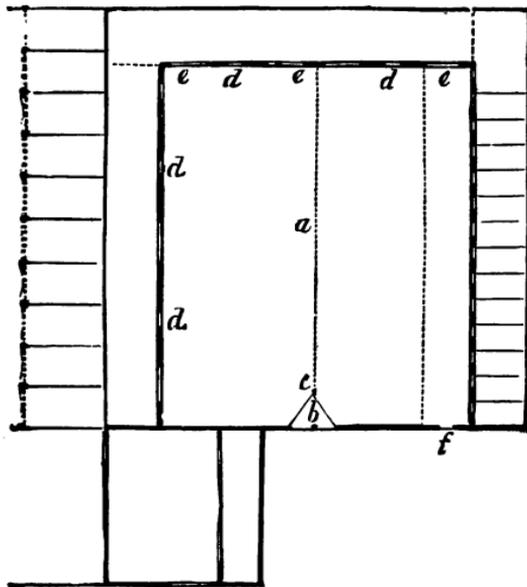


Fig. 138—VIRGINIA SHEEP BUILDING

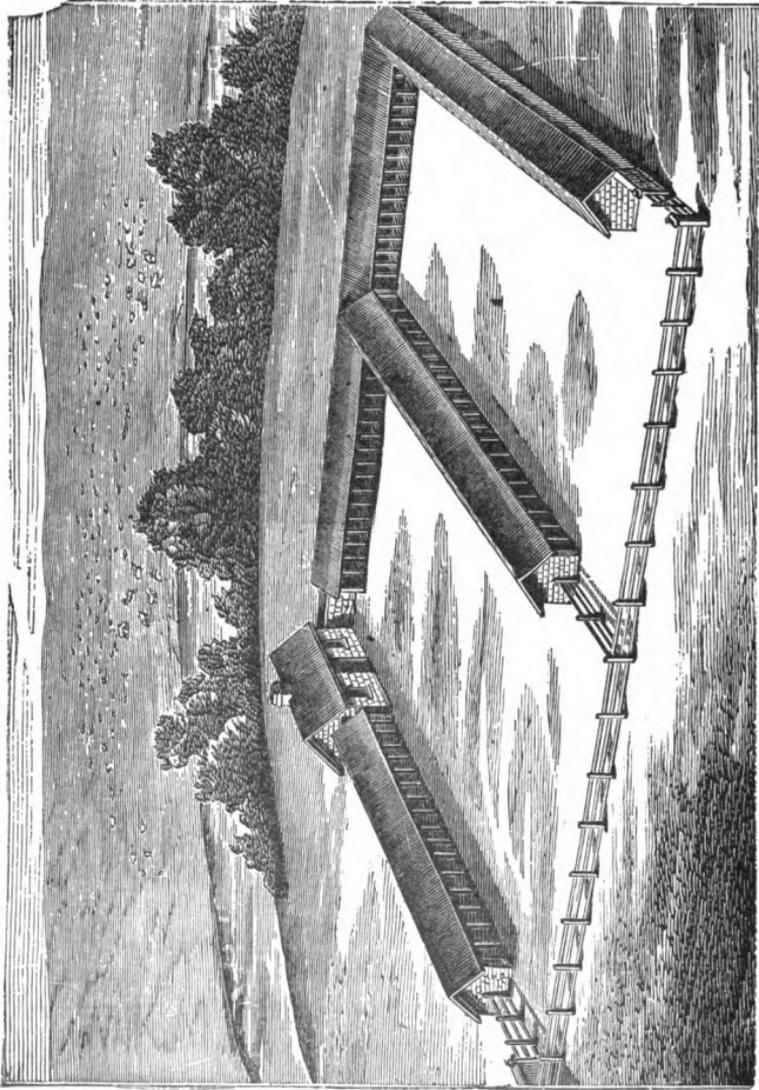
(shown by the dotted lines) into as many portions as may be desired. The entrance is at *b*, where there is a gate hung upon a post, *c*, in such a way as to open or close each half of the yard. The yard is enclosed on three sides by a shed, ten feet high to the eaves, with a double roof. The ground floor, seven feet high, is appropriated for sheep pens, and the three feet above for a

hay loft. The shed is twelve feet wide, and has a row of separate pens, six feet wide, upon the north side. On the other sides there are narrow doors for the sheep, seen at *d, d*, and sliding shutters, *e, e*, eight feet long, and three and one-half feet high, which are also used for entrances to the shed. The yard is closed at the front by a fence ten feet high. There are no outside windows, and but two doors, and only one of these, that at *f*, is locked from without, so that the turning of one key on the outside secures the whole from trespassers. There is a second yard 150 by 135 feet, upon the south side of the sheep yard, with an open shed facing the south, and divided into pens nine feet deep, for cows or sheep, and a pigpen thirty-five feet square, at the southeast of the sheep yard. These sheds are made of inch boards, nailed up and down upon the framework, and the roof is of boards with sufficient pitch to shed rain perfectly.

#### A KANSAS SHEEP SHELTER

The shelter or corral represented in Figure 139 is one built by Mr. George Grant of Victoria, Kan. The walls are of stone, covered with a peaked roof. It is square in shape, with sides about 570 feet long. A commodious house of two stories is built at one corner, for the shepherds.

Another plan of a shelter is given in Figure 140—that of Mr. W. B. Shaw of Syracuse, Kan. As at Victoria, the buffalo grass here furnishes the chief pasturage. The shed is made of cotton-wood poles and coarse hay from the river bottom, and surrounds an enclosure 200 feet long by 100 feet wide. We see the stackyard for hay at *a*; the horse barn at *b*; the poultry house at *c*; the water trough and pump, operated by a windmill, at *d*; the sheep-



**Fig. 139—MR. GEORGE GRANT'S SHEEP CORRAL, VICTORIA, KAN.**

fold at *e*, and the feeding yard with hay stacks and racks, at *f*. Around the feeding yard are sheds with a single roof sloping outward.

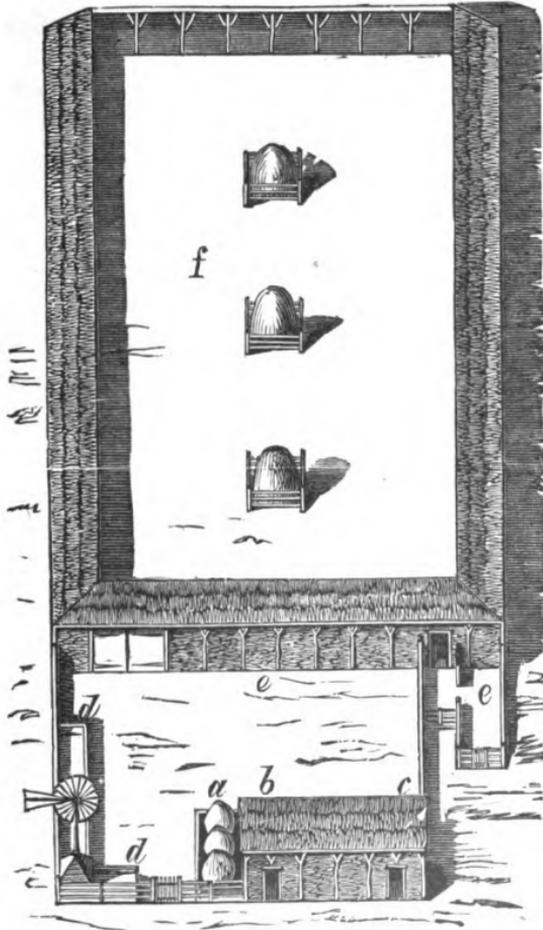


Fig. 140—SHEEP SHEDS OF W. B. SHAW, SYRACUSE, KAN.

A COMBINATION SHEEP BARN AND HOGPEN

Where one wishes to change from general farming to live stock keeping, there is often a lack of proper build-

ings. Figure 141 shows an inexpensive way of converting a small barn into a commodious building for sheep and hogs, and providing ample space for necessary feed. Sixteen-foot additions are built on each side of the barn. One side may be devoted to sheep and the other to hogs.

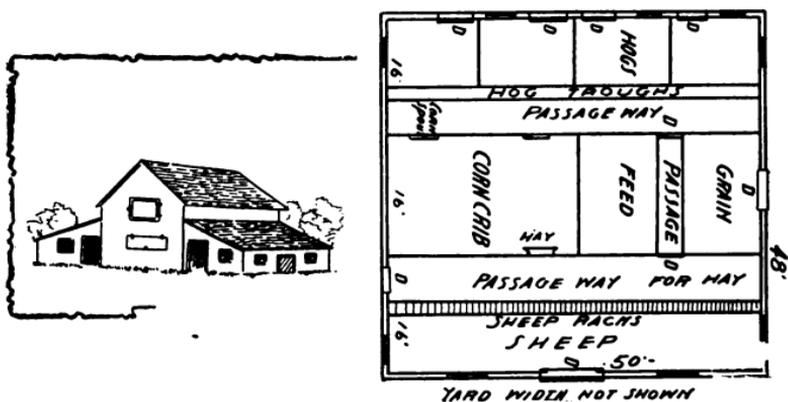


Fig. 141—COMBINED SHEEP AND HOG BARN

A passageway is left next the old barn to use in feeding. The main part may be divided as it is the most convenient

#### A SHEEP FEEDING BARN

There are many old farms about the country that are being utilized as sheep farms, sheep now being increasingly profitable as stock and exceptionally well fitted to bring up an old run-down farm. On most of these old farms there is now a small barn—too small to be used for any serious sheep farming enterprise. The plans seen in Figure 142 show how such old barns can be fitted up cheaply to accommodate a large flock of sheep. Side wings are built at an angle as shown, an alleyway being left for a track on which the feed car runs. The main barn is used for the storage of hay, fodder and grain.

The buildings form a sheltered yard in front, which will be especially useful in winter. Of course, if desired, the wings could be attached at right angles to the barn, but this would not afford the excellent sheltered yard. A perspective view of such a barn and the ground plan are shown.

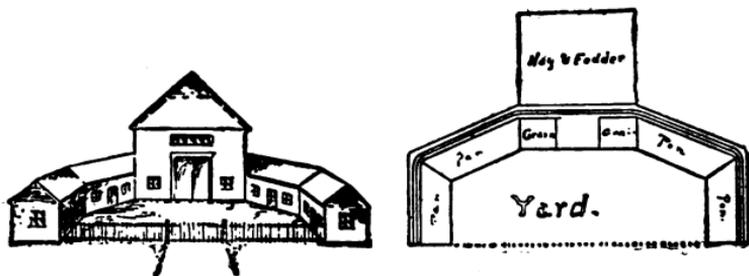


Fig. 142—CHEAP BARN FOR SHEEP FEEDING

#### SHEEP SHELTER ON THE PLAINS

The climate of the western plains is arid and exhilarating, the soil dry and porous, the herbage short, sweet and nutritious. Aromatic plants, which are healthful for sheep, abound, and the main obstacle which has hitherto presented itself, to interfere with the complete success of those who are engaged in sheep raising, has been the snow storms which have overwhelmed the flocks. Ordinary buildings are frequently out of the question, both from want of material, and the funds wherewith to erect them. The flocks may be sheltered from the driving tempest of snow or sleet by means of walls which are semi-circular in shape, and consist of stones roughly laid up, or of sods cut from the plains and piled five feet high. The outside of the curve is always placed toward the north or northwest, the direction from which the prevailing storms blow. Where the flocks are small, a few

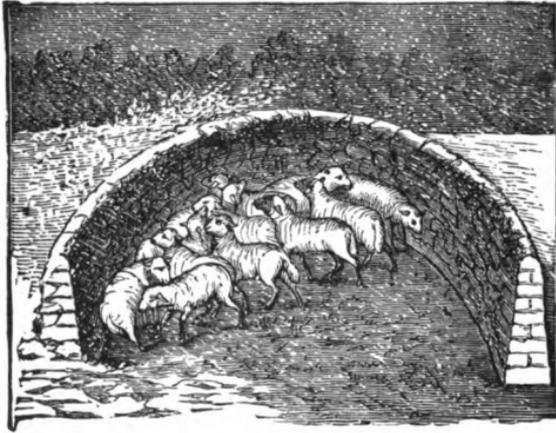


Fig. 143—SEMI-CIRCULAR SHEEP SHELTER

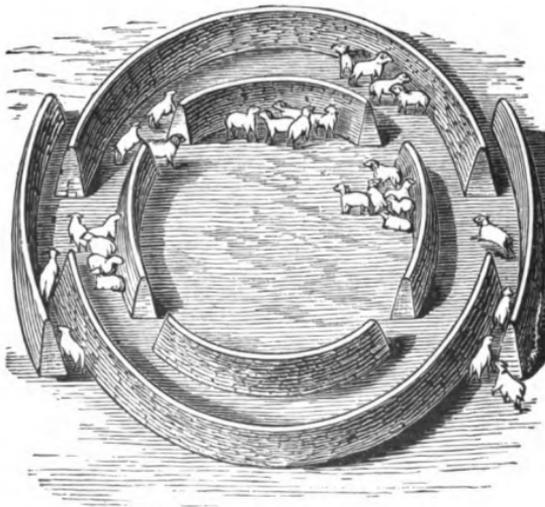


Fig. 144—CONCENTRIC SHEEP SHELTER

walls are sufficient, scattered about in convenient and accessible places, generally where the configuration of the ground gives additional shelter, as, for instance, on the southern slope of a hill, or where a grove helps to break the force of the storm. One of these semi-circular shelters is seen in Figure 143. Figure 144 shows a more elaborate one, suitable for larger flocks, and also designed as a protection against storms from whatever direction they may come. This latter shelter consists of two half-circles, with entrances flanked and protected by other walls, so that the flock is harbored on all quarters. Very often an inner circle is built, which again adds to the protection and increases the amount of shelter.



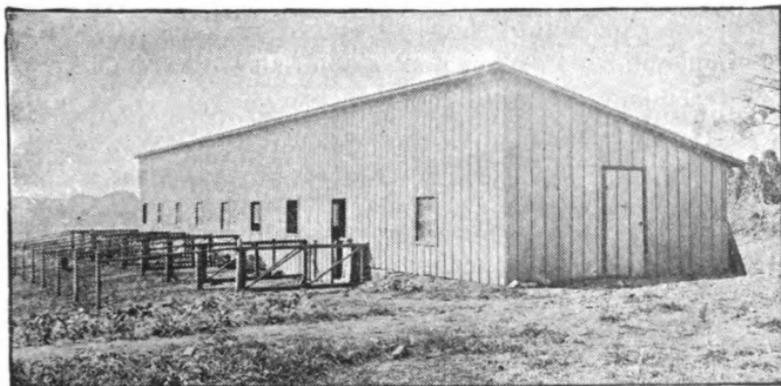
## CHAPTER VI

### *PIGGERIES*

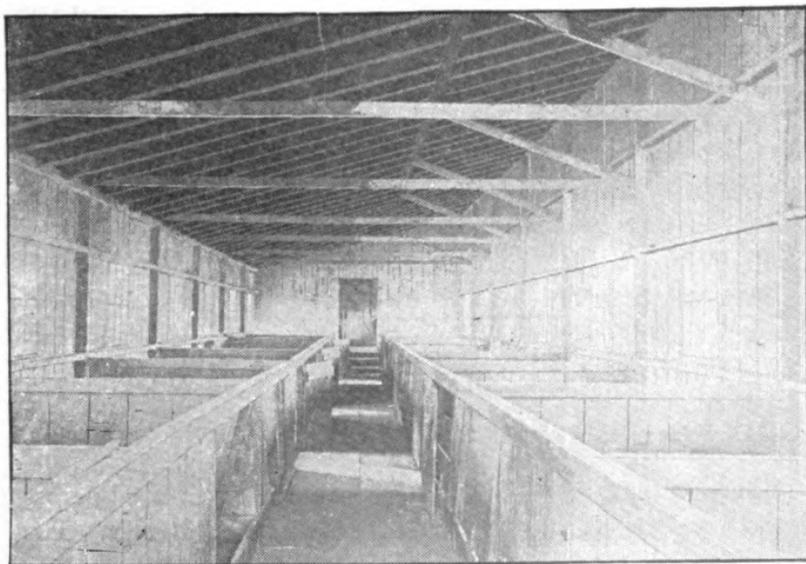
Because swine are blessed with keen appetites, strong digestion and hardy constitutions capable of resisting a great amount of neglect and ill-usage, they have been, and in too many instances are yet, the worst used animals kept for the profit of man. And, as if to add to the abuse, their endeavors to make the best of ill-treatment have been charged to the account of their natural uncleanliness; and the idea that wholesome meat cannot be made by feeding animals with garbage has caused pork to become the horror of dietetic reformers, who pronounce it unfit for human food. It were as wise to condemn the use of milk, and to pronounce cows unfit for civilized communities, because some individuals persist in confining them in filthy stables and dosing them with distillery slops. In his native state, the hog is as dainty in his tastes as other animals, and his lair is found in a dry situation, well cushioned with clean leaves, unsoiled by any neglect of his own. It would be within the mark to say that in most instances twenty per cent of saving can be effected in food, and in additions to the manure heap, by a well regulated building for the accommodation of swine.

#### A SERVICEABLE AND WELL ARRANGED PIGGERY

The hog barn recently built by the Tennessee Agricultural College at Knoxville, shown in Figures 145, 146, 147, 148 and 149, may well serve as a model for those who want a serviceable, cheap and well arranged piggery. The barn is eighteen by eighty feet, with a



**Fig. 145—HOG HOUSE AT TENNESSEE AGRICULTURAL COLLEGE**



**Fig. 146—INTERIOR OF TENNESSEE HOG HOUSE**

feed room in one end sixteen by eighteen feet and sixteen pens seven by eight feet, and a four-foot passage down the center. Eight of these pens are intended for fattening animals and are of sufficient size to accommodate four or

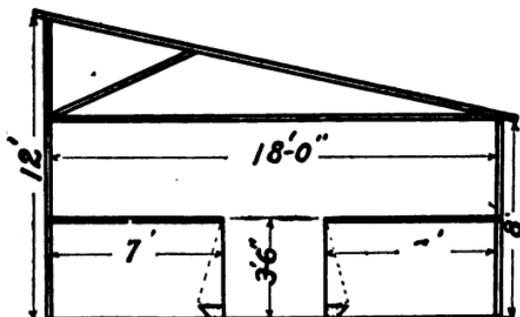


Fig. 147—CROSS-SECTION SHOWING CONSTRUCTION

five large hogs. The feeding troughs are stationary. Hinged gates are swung from above directly over them, so adjusted that the feeding can be done from the outside. The doors to the pens are four feet wide and opposite each

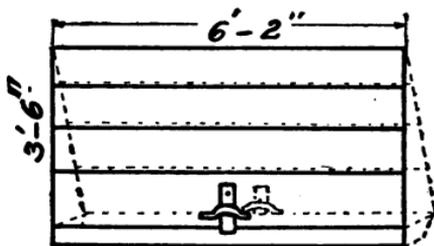


Fig. 148—SWING DOOR

other, so that, if desirable, hogs can be transferred across the passage to the open yards without any difficulty. The building is capable of housing and caring for a large number of hogs where a breeding herd is maintained, or it would be equally useful and advantageous on a farm

where pork production was the chief end in view. The completed building cost \$400.

The dimensions are as follows: Length over all, 100 feet; length of pens, eighty-two feet; feed room, floored, eighteen feet square; floor in pens and feeding alley, width, ten feet; width of doors to pens, four feet; height of pens, three feet six inches; length of feeding trough, five feet nine inches; width of feeding trough, ten and one-half inches; windows alone on north side and windows above, with doors below on south side, containing glass, two feet ten inches by three feet four inches; four by six-inch

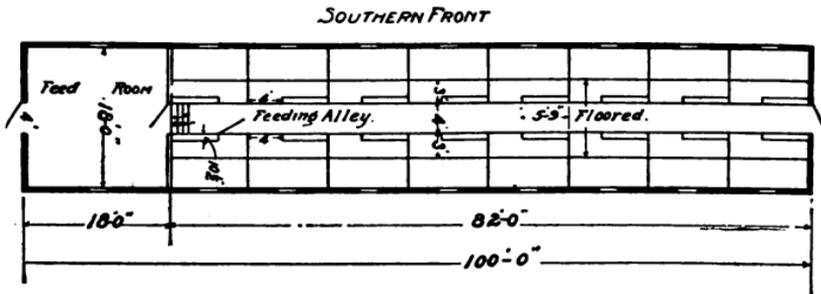


Fig. 149—GROUND PLAN OF TENNESSEE PIGGERY

sills, two by six-inch rafters, two by four-inch studding, seven-eighths by ten or twelve-inch siding, seven-eighths by two-inch strips for battens and a matched room for feed room. The pens are ten feet three inches by seven feet in size.

#### A BRICK PIGGERY FOR COLD CLIMATES

The hog house of the Minnesota Experiment Station at St. Anthony Park, shown in Figures 150 and 151, is built of brick and is 102 feet in its longest dimensions by twenty-eight feet wide. A wing to be put on the east end in the near future will be used for feeding experiments or for breeding pens if necessary. The walls are

nine inches thick, being made out of ordinary building brick, with an inch of air space in the center. This has proved a very satisfactory wall, and seems to be frost proof. The house is dry and well ventilated during the winter. The ceiling is eight feet in the clear and good storage room is provided above for straw and feed.

The pens are eight and one-half by eleven feet, with solid partitions between them of two-inch planks, dressed, and painted. The fronts are made of heavy wire mesh, giving good light and aiding materially in ventilating the

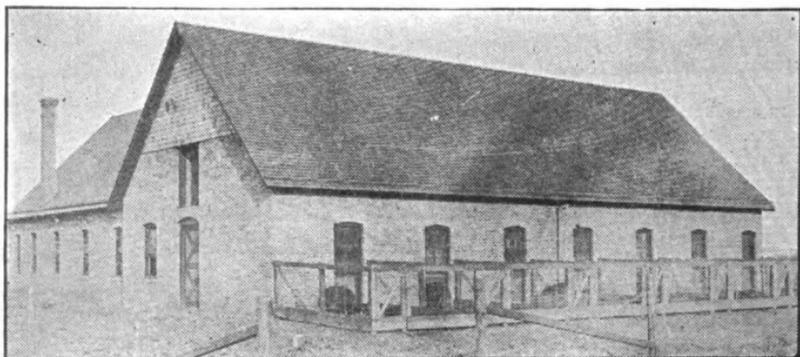


Fig. 150—HOG BARN AT MINNESOTA EXPERIMENT FARM

building. The floors are cement, except in the corners of the breeding pens, where a nest five by six feet has been left with a dirt floor. This is to guard against rheumatism in the winter time, and is satisfactory except that the hogs sometimes root up the nest considerably. A few of the pens have been paved with brick within two inches of the top of the floor, and bedding kept over that. For summer this is entirely satisfactory. A slight raise in the floor around the outside of the nest prevents the water running into it and insures a dry nest always.

Immediately over each nest and opening into the loft is a trap door a foot and a half square. During warm

weather and even in the winter time this is left open to provide good ventilation and make a convenient way of getting bedding into the nest without littering up the house. Sliding doors at the outside connect with brick paved yards that are on a slightly lower level than the cement floor. The aim has been in the construction of the house and yards to make them easy to disinfect and

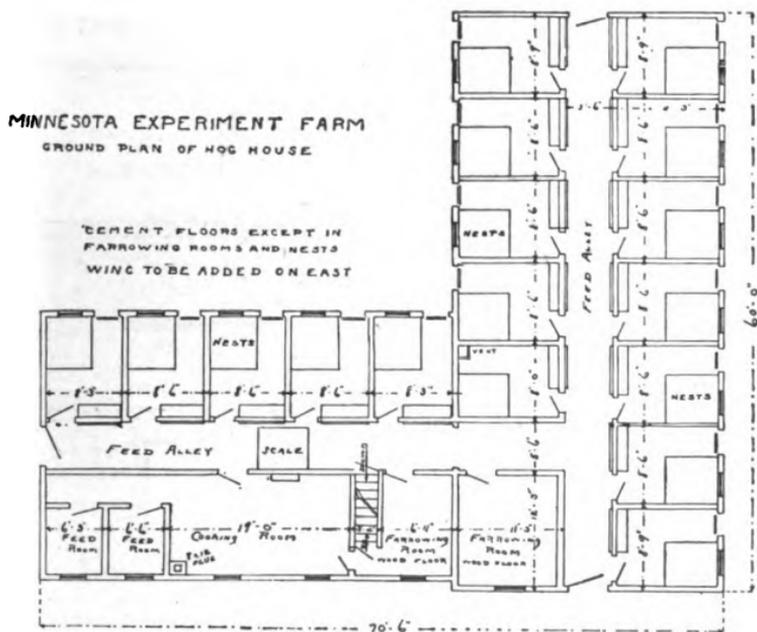


Fig. 151—GROUND PLAN OF MINNESOTA HOG BARN

clean. This can be done by turning water on the floor in the feeding alley and washing out over the brick paved yards. The feed rooms are convenient to the pens, and in consideration of the addition to be made to the house they are centrally located as may be. A scale in the middle of the feeding alley makes a very convenient place for weighing hogs at any time, and in connection with the feeding experiments and records of growth made, which

are always kept at this station, could hardly be dispensed with. Steam is conducted to the cooking room from the central plant, so that hot water or steam may be had when wanted. There is a root cellar beneath the farrowing pens and feed room, which is a very useful feature of the building.

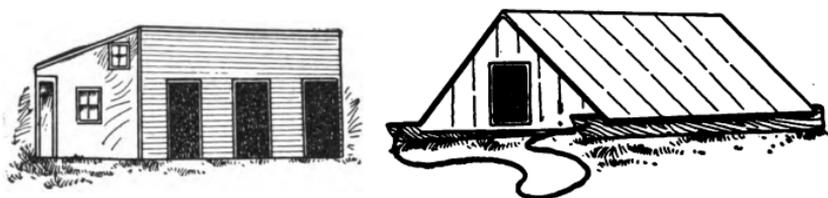


Fig. 152—WINTER AND SUMMER HOGPENS

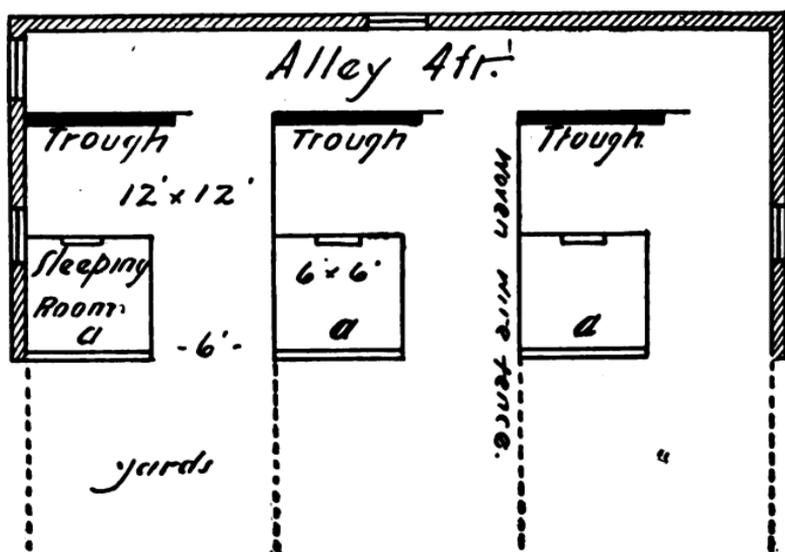


Fig. 153--GROUND PLAN OF TWENTIETH CENTURY HOG HOUSE

#### TWENTIETH CENTURY HOGPENS

The plans of hogpens shown in Figures 152 and 153 are largely original with J. A. Macdonald of Prince Edward Island. They comprise a movable house six by

six feet, which can be placed anywhere on the farm during summer, and drawn into a partially open shed for winter quarters. With chain attached these small houses may be drawn by a horse anywhere. The front and back sills are raised two inches above lower edge of the side sills so as not to obstruct when moving from place to place.

The large building, half the front of which is open, as in Figure 152, is required for winter and spring. The small houses are drawn from their summer stands in the pasture fields through the six-foot open front of each pen and put in place as shown for a sleeping room. In

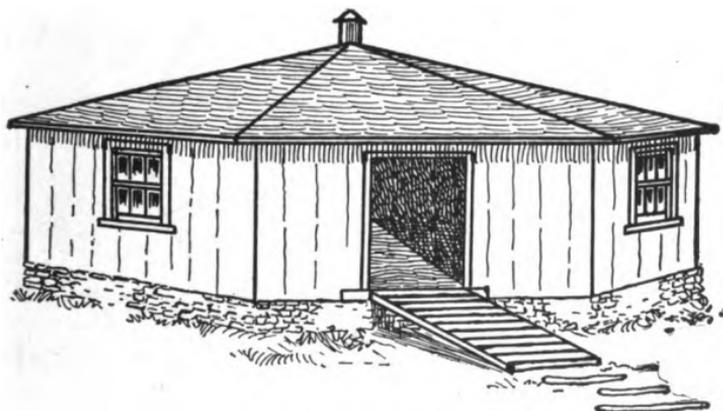


Fig. 154—TEN-SIDED WISCONSIN HOG HOUSE

this large building or shed the floor should be of cement, but it does well without any floor except for the alley. Strong woven wire fencing divides the pens and extends out to form yards. A feed room attached to shed would be an advantage. These small six-foot houses make a much better sleeping place than an ordinary pen, and are also the best for sows to farrow in.

#### A SATISFACTORY HOG HOUSE

A ground plan and elevation of the hog house of A. N. Portman of Stockbridge, Wis., built in 1894, are shown

at Figures 154 and 155. It is an ideal one. The chimney is directly behind the ventilator and cannot be seen in the picture. It is halfway down the roof. Here he can feed fifty to sixty hogs of all ages in fifteen or twenty minutes. The house is forty feet in diameter, sides ten feet long and six feet six inches high to ceiling. The rafters from each corner run to the center, and those between are spiked onto the main rafter. There is a ventilator sixteen inches

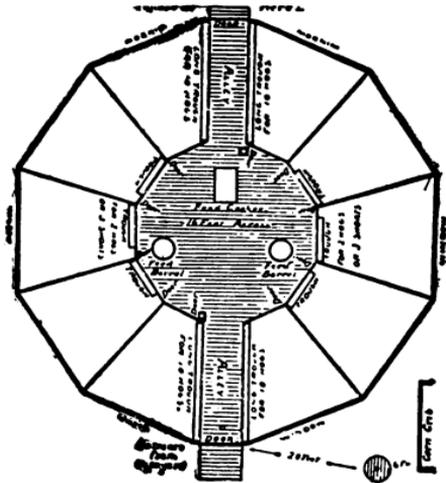


Fig. 155—GROUND PLAN

square in center, slatted on four sides to keep rain and snow out and to let out steam, etc., which may gather. A large trap door is directly over the cooker. It is opened when water is taken from the tank and all steam goes out direct. After the water handling is done the trap door is closed up and all heat is kept in. This door is three by six feet.

#### MOVABLE HOGPENS

Movable or portable pens are very desirable for hogs. They can be taken to a field where it is desirable to turn

the hogs to pasture, and made to provide sleeping quarters. Small pens are also very desirable for sows about to farrow. They can be placed in small fields or in different portions of a large field, and a sow confined in each one. A good pattern of a movable hogpen is shown at the left in Figure 157. It is six by twelve feet in size, four feet high in the rear and six feet in the front. The sills are two by four-inch, which are mounted on two by eight-inch joists that are rounded at each end so they may be drawn easily with a pair of horses.

E. W. Brown, a well-known western hog raiser, keeps about fifty sows and breeds the old sows twice a year. The



Fig. 156—WIGWAM HOUSE

gilts, however, are allowed to farrow but once the first year and twice thereafter. He keeps only five or six hogs together in one lot and uses the wigwam house, of which he has several kinds, one of which is shown in Figure 156. These houses are built eight by eight feet square. The floor is on two by four-inch runners. Lum-

ber for the roof is eight-foot stuff put on weather board fashion. The house is about seven feet high in the middle, the roof coming down to the floor on the outside. There is a door and a window in front and a door in the rear, so that when both doors are open the cool breeze blows through and the hogs enjoy it hugely. When the old sows farrow two of them are placed in one house, and by means of partition board the interior is arranged so the pigs will not be hurt. As soon as the pigs are old enough so there is no danger of their being crushed, they are given the run of the entire house with a fourteen by fourteen-foot yard. Here they are left until they can make good use of grass and then they are turned to pastures.

At the right in Figure 157 is shown an improved A-shaped hogpen, the improvement consisting in the shoes that allow it to be moved from one place to another, in the swinging door at the end, and especially in the hinging of the side, which permits it to be raised and the interior cleaned out whenever necessary. When the side swings down again into place the upper end fits up under the short boards at the top. This house need not be more than five feet high from ground to peak, and with it the hogs can be moved about from one feeding ground to another as desired. Use single boarding, but have



Fig. 157—TWO TYPES OF MOVABLE PENS.

the boards tongued and grooved, and well covered with paint. The building will then be water-tight and will last for years. Make the floor space of a size to accommodate the number of hogs to be kept.

#### FEEDING PEN FOR FATTENING HOGS

Feeding floors are becoming more and more popular among western stock raisers, and as there is so much at stake in feeding hogs no effort should be spared to keep them healthy. When the hogs are fed on the ground there is great danger of inviting disease. A feeding floor, therefore, is very desirable. To insure perfect healthfulness it should be three or four feet above the ground, so that perfect ventilation is secured and the harboring

of rats and mice made impossible. The floor can be made of inch lumber and any desired size. A strong board fence must be put up all around it to prevent the hogs being crowded off and injured.

At one end of the pen an approach should be built up to the gate, which can be closed while the feed is being placed on the floor. At the other end of the floor a crib or pen is located in which the feed is stored. The floor must be cleaned after each feeding. Put a long-handled fork through the middle of a board about three feet long and six inches wide. With this the cobs and uneaten portion of the feed can be quickly pushed off.

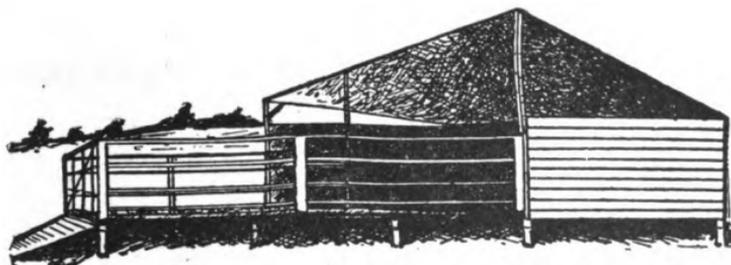


Fig. 158—COVERED FEEDING FLOOR

Hogs should never be fed unclean material. Figure 158 illustrates the arrangement of the feeding floor and feeding pen. This floor is partially under roof.

#### PLAN OF A PIGGERY

Figure 159 represents the elevation of a piggery. The main building is twenty-two by fifty feet, and the wing twelve by sixteen feet. It is supplied with light and air by windows in front, ventilators on the roof, and by hanging doors or shutters in the upper part of the siding at the rear of each stall or apartment. These last are not seen in the engraving.

Figure 160 shows the ground plan. The main building has a hall, *H*, six feet wide, running the entire length. This is for convenience of feeding and for hanging dressed

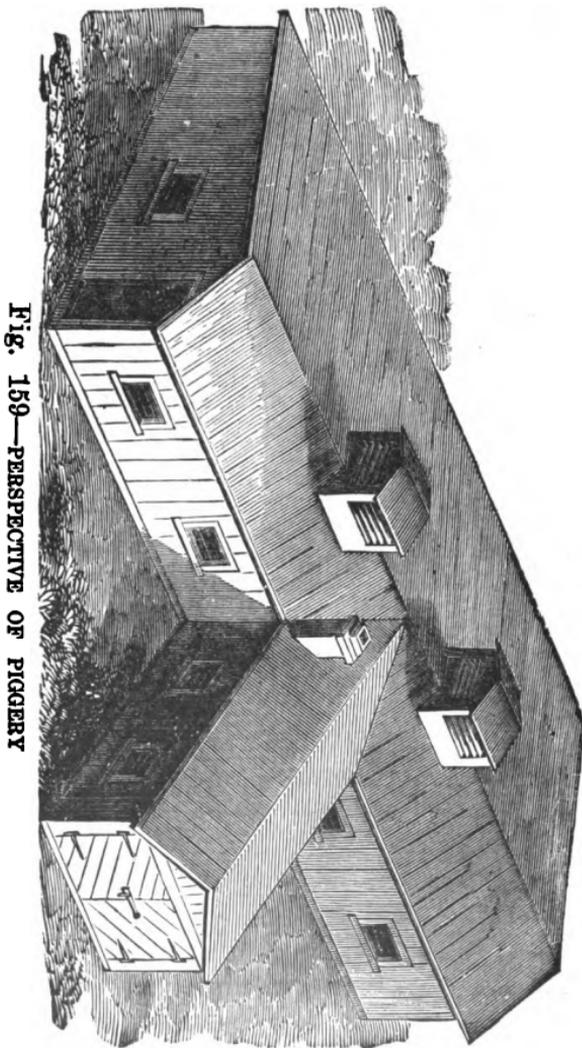


Fig. 159—PERSPECTIVE OF PIGGERY

hogs at the time of slaughtering. The remainder of the space is divided by partitions into apartments, *A*, *B*, for the feeding and sleeping accommodation of the porkers;

these are each eight by sixteen feet. The rear divisions of the apartments, *B, B*, are intended for the manure yards. Each division has a door, *D, D*, to facilitate the removal of manure, and also to allow ingress to the swine when introduced to the pen. The floors of each two adjoining divisions are inclined toward each other, so that the liquid

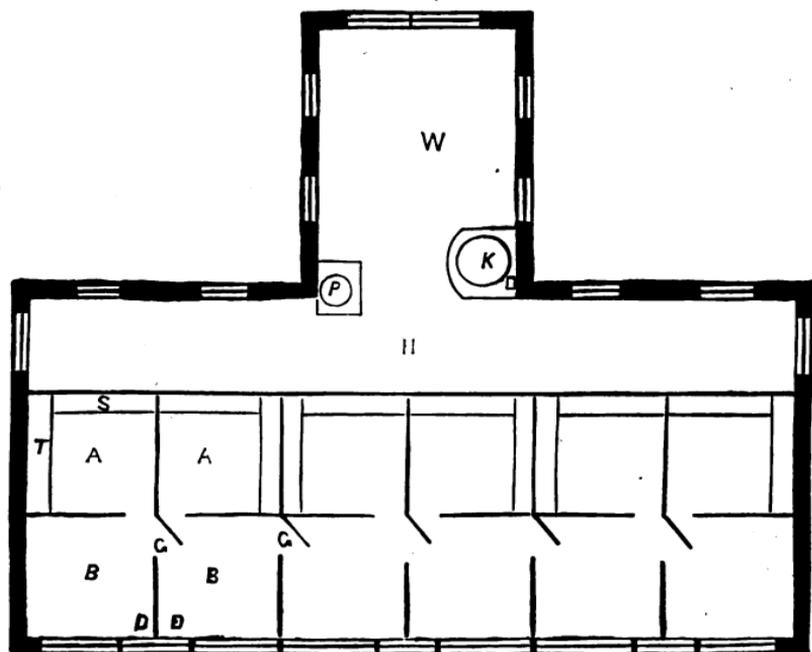


Fig. 160—GROUND FLOOR OF PIGGERY

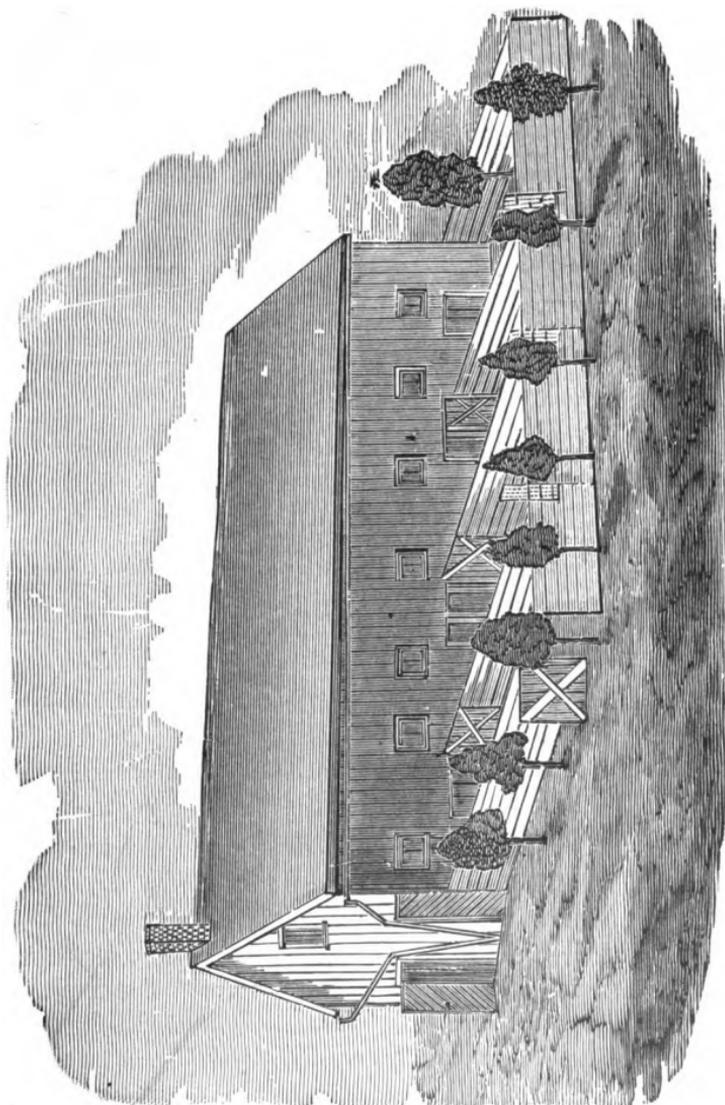
excrement and other filth may flow to the side where the opening to the back apartment is situated. Two troughs, *S, T*, are placed in each feeding room. That in the front, *S*, is for food, *T*, for clear water, a full supply of which is always allowed. This is an important item, generally overlooked; much of the food of swine induces thirst, and the free use of water is favorable to the deposition of fat.

The wing, *W*, is twelve by sixteen feet. This answers for a slaughtering room. In one corner, adjoining the main hall, is a well and pump, *P*, from which, by means of a hose, water is conveyed to the troughs. At the opposite corner, *K*, is a large iron kettle, set in an arch, for cooking food, and for scalding the slaughtered swine. In many localities it would be a desirable addition to have this wing built two stories high, the upper part to be used for storing grain for the hogs. A cellar also should be made underneath the piggery for receiving roots.



Fig. 161—FRONT PARTITION OF PIGGERY

An excellent arrangement, shown in Figure 161, is adapted to facilitate the cleaning of the troughs, and the transferring of the hogs to the main hall at slaughtering. The front partition of each apartment, *F*, is made separate, and hung so as to be swung back and fastened over the inside of the trough, *T*, at feeding time, or when cleaning the trough. It may also be lifted as high as the top of the side partition, *H*, when it is desired to take the hogs to the dressing table. Triangular pieces, *E*, *E*, are spiked to each front partition, and swing with it, forming stalls to prevent their crowding while feeding. These pieces are supported, when the apartment is closed, by notches in the inner edge of the trough, made to receive them.



**Fig. 162—VIEW OF MR. CURTIS' PIGGERY**

## A CONVENIENT FARM PIGPEN

Herewith are given the plans and a view of a convenient pigpen, upon the farm of the late Colonel F. D. Curtis of Charlton, Saratoga County, N. Y. The building, shown in Figure 162, is forty-eight feet long, twenty-two feet wide and twelve feet high. There is an upper floor over the pens, which is used as a store room for meal, corn, etc., and a cellar beneath, used for storage of roots, and for cooking and preparing food. There is a cistern in the cellar, into which water from the roof is collected, and a pump, by which the water may be run into the

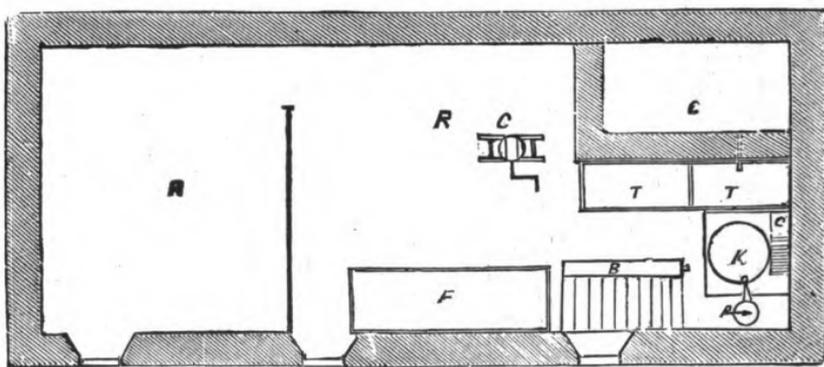


Fig. 163—PLAN OF CELLAR OF PIGPEN

feed kettle, or to the pens above. The arrangements are made with a view to the convenient handling and feeding of the stock, as well as to the most perfect sanitary conditions. The building is warm enough to prevent freezing in the coldest winter weather, so that young pigs, if desired, may be reared without difficulty, even during winter. The outer and inner walls, and the floor of the upper room, are all of matched boards. The floor of the pens is double, there being first a floor of hemlock boards, with matched joints, put together with hot pitch. The whole of this floor is thoroughly coated with hot coal tar, and a second floor of one and one-half-inch hemlock plank,

with matched joints, also filled with tar, is finally laid down. This gives a floor that is not only very durable, clean and wholesome, but it is perfectly waterproof, and prevents any drip of moisture into the cellar. The cellar floor is shown in Figure 163. At *R, R*, are bins for roots. The roots are unloaded into the bins through the cellar windows, by means of spouts which direct them into the bins below. At *F* is the feed box; at *T, T*, feed tubs for mixing feed; at *C*, the cistern; *P*, the pump; *K*, the kettle, set in brick, with chimney behind it. At *B* is a spout, also seen in Figure 164, by which meal is dropped from the upper floor to the feed box, the kettle or the

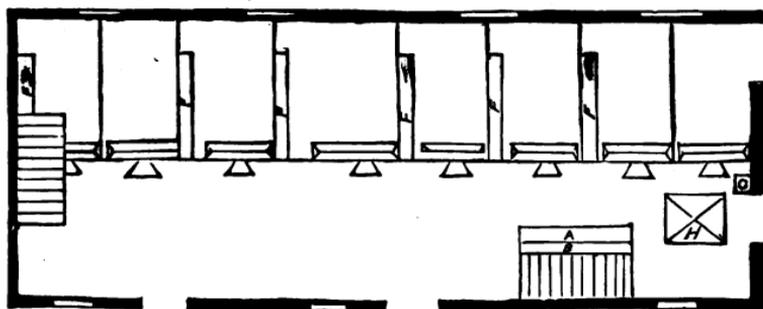


Fig. 164—PLAN OF MAIN FLOOR OF PIGPEN

feed tubs; at *C* is the root cutter. The whole of the cellar floor is covered with cement. The main floor is shown at Figure 164. The pens are seen arranged on one side. Each one is provided with a fender, *F*, for the protection of young pigs against being overlaid by the sows, and a cast iron feed trough, having a spout which projects through the front, for the purpose of carrying feed into the trough. At *H* is a hatchway for hoisting meal or corn into the room above; *A* is a spout to bring feed from above. This building has been found very convenient in use, and it is so arranged that it may be extended, if desired, to accommodate a larger number of animals.

## MR. CROZIER'S PIGPENS

Mr. William Crozier of Beacon Stock Farm, Northport, L. I., has a long range of piggens. The elevation, Figure 165, the ground plan, Figure 166, and a view of the inte-

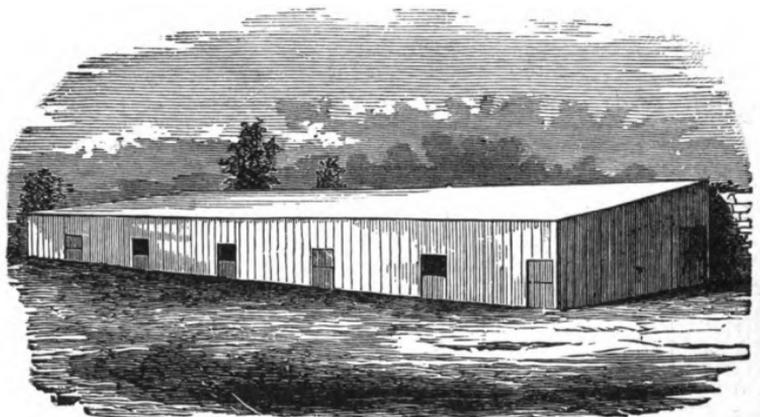


Fig. 165—FRONT VIEW OF PIGGERY

rior of the building, Figure 167, show the simple arrangement. The building is placed against a bank, which has a brick retaining wall that answers as the rear wall of the building, and is nine feet high. The building is sixteen

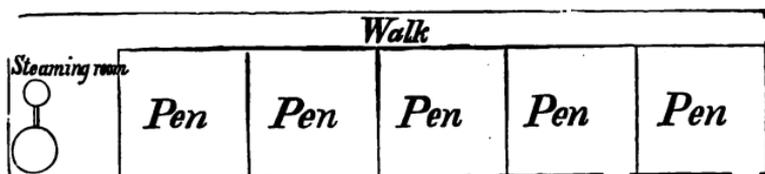


Fig. 166—PLAN OF PIGGERY

feet wide, with the front side six and one-half feet high. The pens, see Figure 166, are ten by twelve, and three feet high, with a four-foot walk at the rear of them. The doors, of which each pen has one opening into the yard,

are in halves. The upper half may be left open to admit light and air, while the lower half is kept closed, if it is desired, to prevent egress. At one end of the building is a room furnished with apparatus for steaming food. The feeding is done from the walk, the food being placed in small portable troughs, which can be readily cleaned.

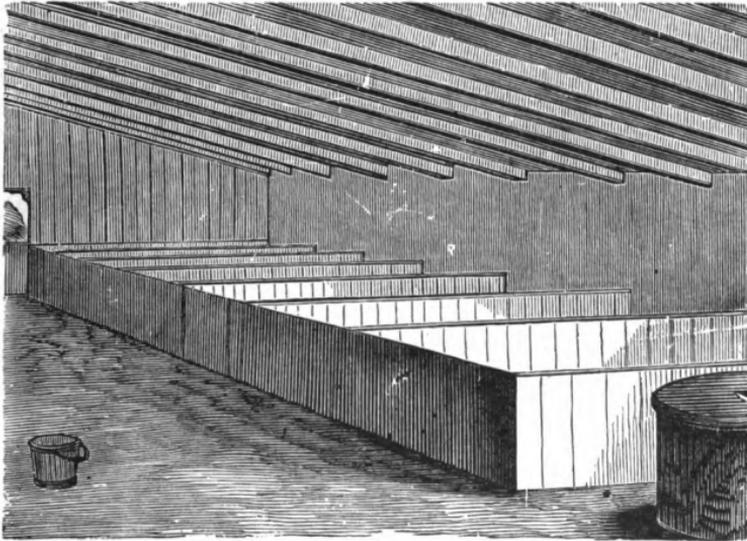


Fig. 167—INTERIOR OF PIGGERY

#### A COMFORTABLE PIGPEN

The plan, Figure 168, combines the requisites, with many of the conveniences, of a desirable pigpen. The engraving shows one complete pen with its divisions. A row of these pens may be built as a long shed, and the description of one will answer for all. The pen is twenty feet long from front to rear, by eight feet wide. The posts at the front are ten feet high, and at the rear seven feet. A feed passage runs along the front of the pens, shown at *a*. The feeding and sleeping apartment is shown at *b*. At *c* is a passage which also runs along the

whole building, but which, when closed by the doors, *d*, makes the passage a part of the yard, *d*. The feed passage, *a*, is three feet wide. The feeding place, *b*, is ten feet deep by eight feet in width; the passage, *c*, is three feet wide, and the yard, *d*, four feet, making the whole space of the yard seven by eight feet when the passage is closed. When the passage is opened the door, *d*, closes the opening from the yard into the feeding place, and the occupants of the pens are shut up. Any pig that may have to be moved from one pen to another can then be

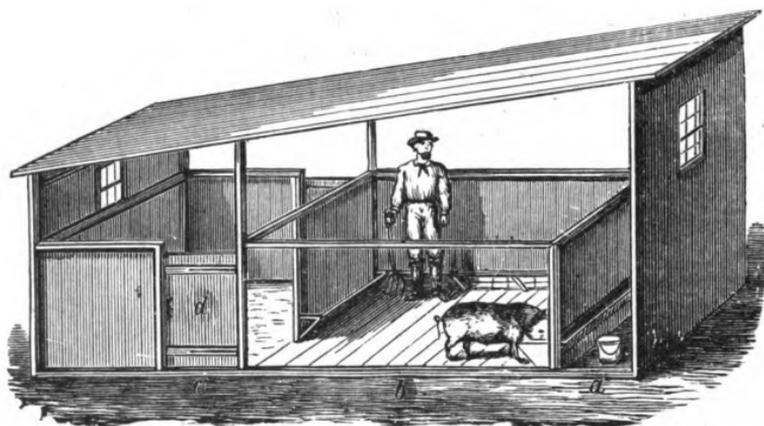


Fig. 168—PLAN OF PIGPEN

driven without any difficulty wherever it may be desired. A swinging door in the rear may be made to allow the pigs to pass in or out of the barn yard or the pasture, if one is provided for them. But generally it will be found better to have the pens built upon one side of the barn yard, so that the pigs may be used to work up any materials for manure or compost that may be at hand for the purpose. The floor of the pen should be, in part at least, of plank; that of the yard may be of pavement, of cobble-stone or of cement, but should be so laid that it cannot be torn up. A tight roof should cover the

whole, and sliding windows at the rear and front will provide good ventilation. This is very important for the comfort of the animals in hot weather. The floor of the pens should slope backward at least two inches in ten feet, and the yards ought to be well drained. A bar is fixed around the bottom of the pen about six inches above the floor, and projects about six inches from the side, for the purpose of preventing the young pigs from being overlaid by the sow and smothered. A large quantity of waste material may be worked up in these yards, and will add much to the comfort and cleanliness of the pigs. The framework of these pens should be of six by six timber for the sills, four by four for the posts, and two by four for the girths and tops and bottoms of the partitions. The whole quantity of lumber needed for one complete pen would be 1200 feet, consisting of eighty linear feet of six by six timber, sixty-one linear feet of four by four posting, and seventy-seven linear feet of two by four scantling, 104 feet surface of two-inch plank, and 500 feet of boards if the roof is of shingles. A row of ten of these pens, making a building eighty feet long, able to accommodate fifty or sixty pigs, would cost about \$350 completed.

#### PENS AND YARDS FOR 150 HOGS

The pens are built in a range on each side of a central feed house, shown in the corner of Figure 169. This house is a two-story building. In the upper part feed is stored, to be cooked or prepared on the lower floor. A stairway in one corner leads to the upper story. Opposite to the stairs, and at the right of the doorway, is a pump connected with a cistern, which receives all the flow from the roof. The water is shed from the rear of the roof, so that none escapes into the yard. A hose is connected with the pump, which serves to convey water into the feed troughs in both wings of the pens, for cleansing them and

to supply the animals with drinking water. Opposite the pump is the boiler or the mixing vat. As a boiler will be found indispensable at times, one should be provided at the outset, as it may be used for soaking or otherwise preparing food when not needed for heating purposes. A passageway leads on either hand from the feed room down the row of pens. The arrangement of the pens is illustrated in Figure 170; the passageway is at *a*, the feed trough with spout at *b*. The troughs are protected by

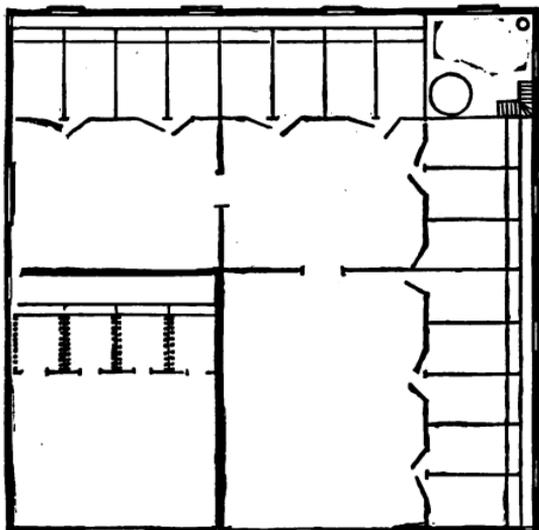
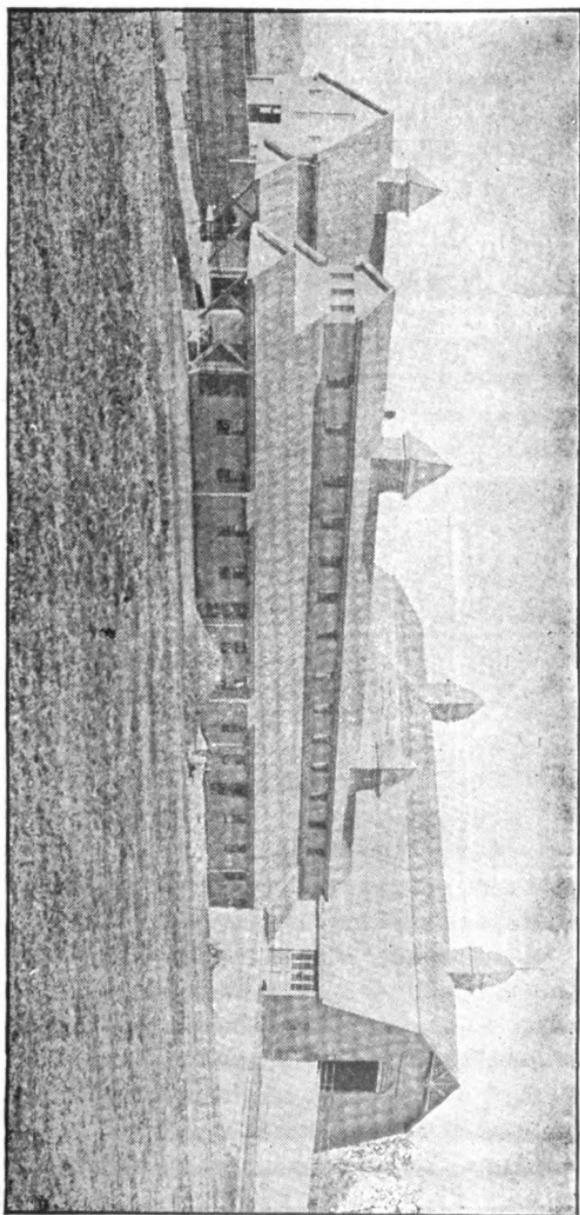


Fig. 169—PLAN OF PIGPENS

cross strips fastened from the partition wall to the edge of each, as shown by the dotted lines, so as to prevent the hogs from lying in them. At *c* is a sliding door, by which access can be gained from pen to pen all through the range when necessary for the purpose of changing or otherwise managing the occupants; at *d* is a slatted ventilator fixed in the wall over each door, also shown in Figure 172. The yard and pens shown in the left-hand lower corner of Figure 169 are for brood sows with pigs,

FARM BARN AT MASSACHUSETTS AGRICULTURAL COLLEGE





which are kept separate from the rest of the herd. The pens are arranged as the others, with the addition of safeguards for the young pigs placed around the walls, about eight inches above the floor and six inches from it, and attached to it by means of iron straps. See Figure 171. These are to prevent the pigs from being crushed by the sows when they lie down, as is often the case when no protection is furnished. At Figure 172 is seen the elevation of one wing of the range with the feed house. The shed is made from twelve to sixteen feet wide, twelve feet high in front and eight feet in the rear. Each pen should be at least eight feet wide, which would give from sixty to 100 square feet, accommodating five or six pigs. Sheds

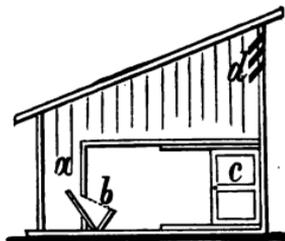


Fig. 170—SECTION OF PEN



Fig. 171—SAFEGUARDS

100 feet long, with yards covering the included ground, would give room for a herd of 150 pigs. The front doors of the pens are made double, shutting against each second post, and opening from each other. One fastening answers for all the four doors; this consists of a semi-circular piece of hard-wood plank, which turns on a bolt. When at rest it falls so as to fasten the four doors, and can be turned right or left in an instant to open either pair. This should be secured firmly with a strong bolt having a large head. The floors of the pens may be made of hydraulic lime concrete, thoroughly saturated with gas tar. Such a floor is always dry, clean and perfectly impenetrable either by vermin or by the swine. An occasional dressing of hot

gas tar will keep lice and fleas at a distance, and thus promote the health and growth of the herd. Another method of making the floor is to use double hemlock plank, laid so as to break joints, and saturated with hot gas tar. This is water and vermin proof, and also saves all the liquid manure. To do this most effectively, the floor is sloped for two or three inches, and a slightly hollowed gutter conveys the drainage into the outer yard, which should be paved with cobble stone or cemented, if possible, or otherwise well bedded with litter or other absorbents. The best absorbent is dry swamp muck; when this cannot

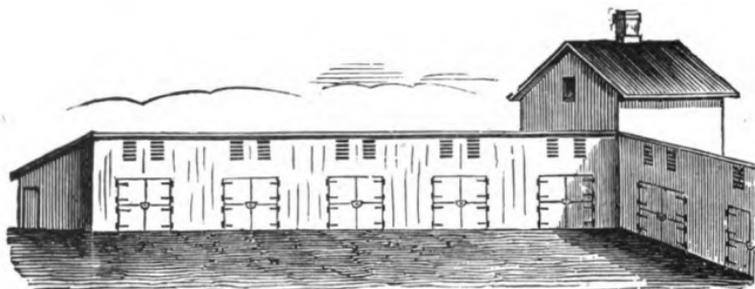


Fig. 172—EXTERIOR VIEW OF PENS

be provided, hard-wood sawdust, sand, dry earth or litter from the stables may be kept in the yard. This should be turned over and well mixed.

#### ANOTHER PORTABLE PIGPEN

Where a single family pig is kept, provision for changing the locality of the pen is often necessary. It may be placed in the garden, at the time when there are waste vegetables to be disposed of, or it may be penned in a grass lot. A portable pen, with an open yard attached, is seen in the accompanying illustrations. Figure 173 presents the pen, the engraving showing it so clearly that no description is needed. The yard, seen in Figure 174, is

placed with the open space next to the door of the pen, so that the pig can go in and out freely. The yard is attached to the pen by hooks and staples, and both of them are provided with handles, by which they can be lifted and carried from place to place. Both the yard and pen

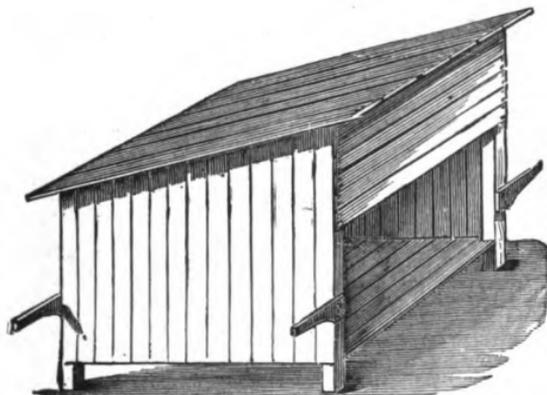


Fig. 173—A PORTABLE PIGPEN

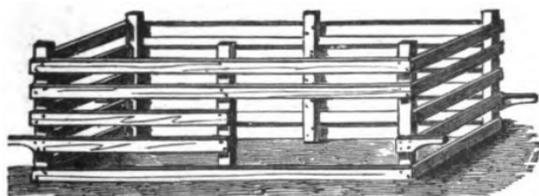


Fig. 174—YARD TO PORTABLE PIGPEN

should be floored to prevent the pig from tearing up the ground. The floors should be raised a few inches from the ground, that they may be kept dry and made durable.

#### PIGPEN, HEN HOUSE AND CORN CRIB COMBINED

The accompanying engravings present plans for erecting in a hillside, under one roof, the three important farm buildings named above. The pigpen shown in front view, Figure 175, is constructed of stout framing, and

where it comes in contact with the hillside is protected by dry stone walls. The roof of the sleeping room, *B*, Figure 176, forms the floor of the hen house, *G*. To prevent the dirt from one room being thrown into the other, the door of communication between them is raised six inches from the floor, and an inclined plane with a cleat is placed on either side to make it easy of ingress

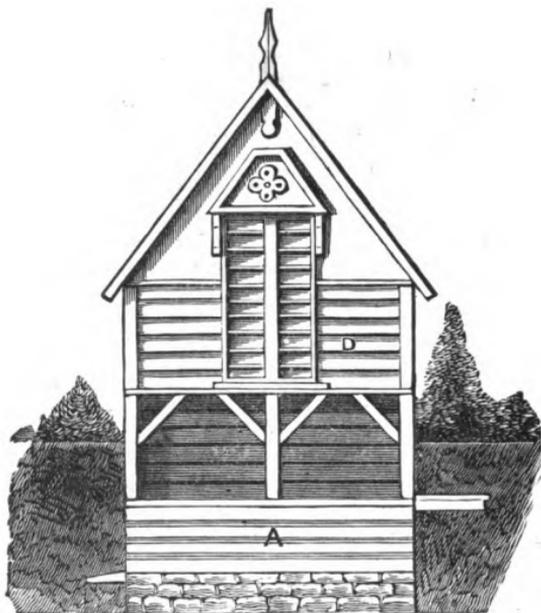


Fig. 175—FRONT VIEW OF PIGPEN, ETC.

and egress. The feeding room, *A*, is protected from the weather by the corn loft floor and the overhanging eaves. The hen house is situated immediately over the sleeping room of the pigpen. It is ventilated by a wire sash window at *H*, and provided with perches eighteen inches from the floor at the lowest point, and nest boxes on two sides, which are reached by doors on the outside, each door being a hinged plank the entire width of the build-

ing. By this arrangement of the nests, the room need not be entered in quest of eggs. The roof of the hen house forms an angle of about forty degrees; this being also the floor of the rear of the corn crib, it aids by its slope in readily filling the crib. The corn crib is approached at the rear, where a slatted door, corresponding with the large slatted front window, gives sufficient ventilation

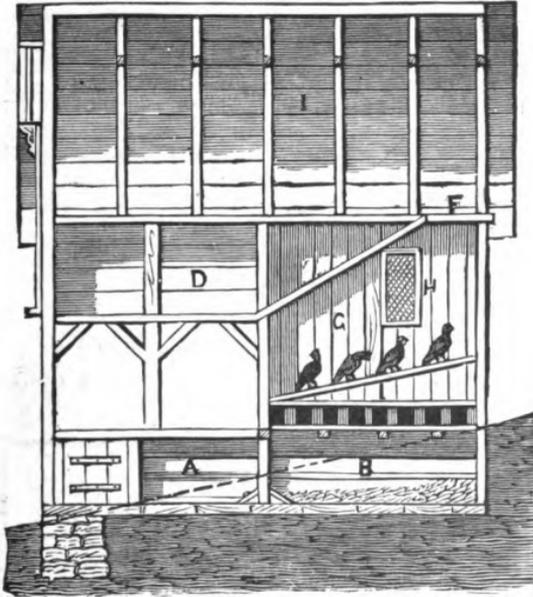


Fig. 176—SECTIONAL VIEW OF BUILDING

for the corn. At *F* is the platform from which to fill the crib. The building is ten feet wide by fifteen feet in length, but may be made larger if desired.

#### A PIGPEN AND TOOL HOUSE

A pigpen with the upper part arranged for the storage of small tools, seed sowers and cultivators is here given.

The upper floor, seven feet high, is open over the passage, as shown in Figure 177, which is a section of the inside of the building; there is a stairway provided at the end of the passage. The larger tools are taken up

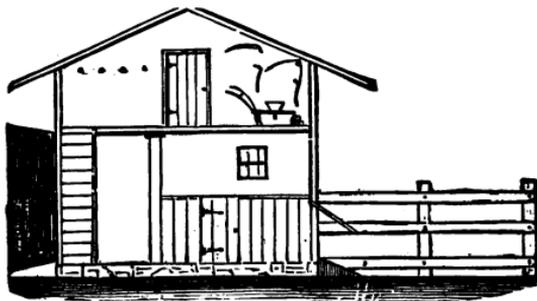


Fig. 177—END AND SECTIONAL VIEW

through a door at the end of the building. The pen itself has some conveniences which may be mentioned. The plan of it is given in Figure 178. The pens are arranged on one side of the passage, with doors opening

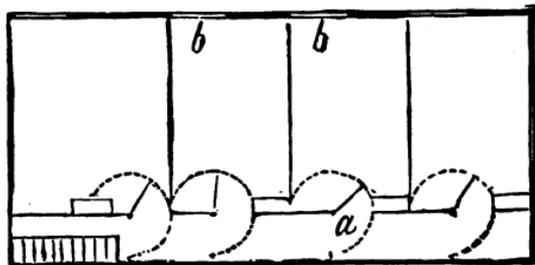


Fig. 178—THE GROUND PLAN

into it, so as to reach across and close it when necessary. It is thus easy to get access to each separate pen or from one to another. The doors swing both ways, either into the passage or into the pen as shown at *a*; swinging doors, at *b, b*, give access to the yards.

A CHEAP PIGPEN

The plan here presented is of a convenient pigpen that will cost less than twenty-five dollars, exclusive of labor. Nine posts of cedar or chestnut are set one foot in the ground, and project as far above the surface. They are arranged as in

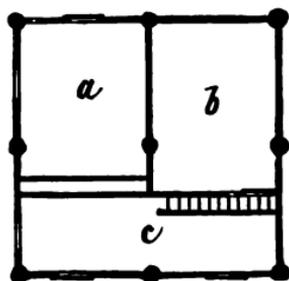


Fig. 179—PLAN OF PIG-PEN

Figure 179. Four by four-inch sills are laid upon the posts, with a cross sill in the center, and halved together at the joints. No wall posts are used, the stout boarding being made to serve the purpose.

The structure is eight feet each way, or can be made when

built to suit the ordinary length of boards. To put up the walls begin at the bottom, fastening on the corner boards first, and nailing their edges firmly together. Two by four-inch strips serve as plates. Two by six-inch floor beams are laid upon

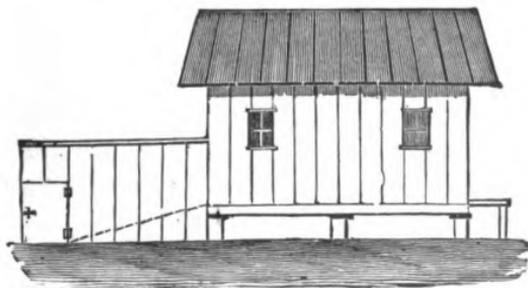


Fig. 180—VIEW OF PIGPEN .

the sills, sixteen inches apart, and the floor upon these. Two by four-inch rafters are placed four feet apart, upon which three twelve-inch boards are laid, one at the peak, one at the eaves and one between these

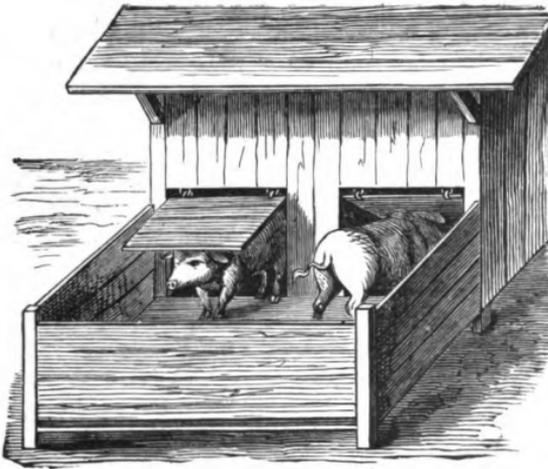
two. The roof boards proper, eight feet long, are put on lengthwise of the rafters and battened. Spaces for the doors and windows should be left or cut in the boards as they are nailed on. There should be two small windows, placed as thought most desirable. The interior division should be as shown in Figure 179. The feeding place is at *a*, in which is a trough, with a sloping board in the passage, *c*, by which to pour in the slop. A sleeping room is at *b*, the partitions of which should be four feet high. A few loose boards will be required for a floor in the loft to make a space for storing corn for feed. The building is raised one foot from the ground for the sake of avoiding rats and other vermin. A sloping gangway leads to the yard, into which it is convenient to have a gate from the outside.

#### SELF-CLOSING DOOR FOR PIGPEN

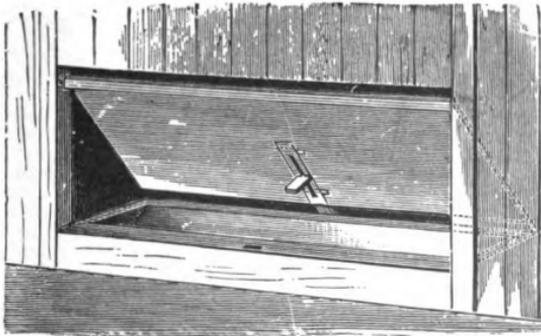
A warm, dry pen is necessary for the health and comfort of a pig. Cold and damp induce more diseases than are charged to these causes. Neither the winter snow nor the spring and summer rains should be allowed to beat into the pen. But the difficulty is to have a door that will shut of itself and can be opened by the animals whenever they desire. The engraving, Figure 181, shows a door of this kind that can be applied to any pen, at least any to which a door can be affixed at all. It is hung on hooks and staples to the lintel of the doorway, and swinging either way allows the inmates of the pen to go out or in, as they please—closing after them. If the door is intended to fit closely, leather strips two inches wide should be nailed around the frame of the doorway, then as the door closes it presses tightly against these strips.

#### A SWINGING DOOR FOR A PIGGERY

The illustration, Figure 182, is of a swinging door for a piggery, which is intended to be used in connec-



**Fig. 181—SELF-CLOSING PEN DOORS**



**Fig. 182—A SWINGING DOOR FOR A PIGGERY**

tion with a feed trough. The engraving shows a portion of the front wall or partition of the pen. The door is hung upon hickory pins set into the frame, one upon each side. It may be easily swung back, so as to permit access to the trough for pouring food into it, and at the same time close it against the pigs. The door is held in place by a bolt sliding in a slot, when in either position, as shown in the engraving. In a piggery, the pens would be most conveniently arranged on each side of a passageway, with feed troughs opening into the passage, by doors of the style here described.



## CHAPTER VII

### *POULTRY HOUSES*

Poultry houses may be expensive buildings—or suitable accommodations that answer the purpose equally well can be very cheaply made. The essential requisites are a warm, dry, well-lighted and ventilated shelter, that will insure comfort in winter, with convenient arrangements for roosts, feeding space and nest boxes. In winter light and warmth are of the first importance. Fowls will neither lay nor keep in health when confined in cold, wet and dark apartments. Windows facing the south or southeast, large enough to admit the sun freely, should be provided, and made to open so that a free circulation

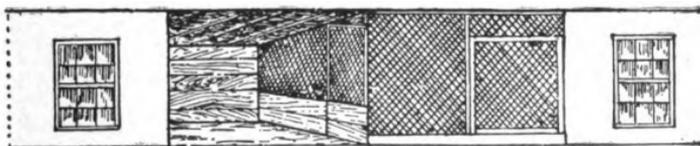


Fig. 183—OPEN FRONT SCRATCHING SHED HOUSE

of air can be secured in summer. They should be placed about eighteen inches from the floor, which will give the best light in winter, and should not be too large. While glass admits much heat in the daytime, it radiates as much at night and makes the house too cold.

#### SCRATCHING SHED HOUSES

The latest idea in building poultry houses is to provide an open shed attached to the roosting room, in order that the fowls may have a place for exercise in the open air

during the winter months. If the floor is kept covered with several inches of straw, chaff, leaves or other light, dry material, and the whole grain is scattered in this, the fowls will get abundant exercise in scratching for their feed. This keeps them warm as well as busy, and

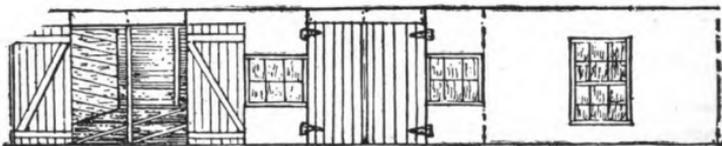


Fig. 184—CLOSED FRONT SCRATCHING SHED HOUSE

they are healthier for it. They also lay more eggs, and for breeding purposes the eggs are more fertile.

It costs rather more to build a house of this character, but many practical poultry keepers hold that the extra return pays a good profit on the investment. Many styles of such buildings have been put up. The best plan is to

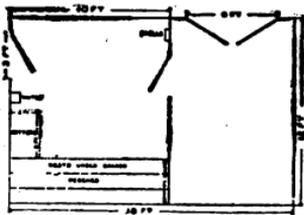


Fig. 185—GROUND PLAN

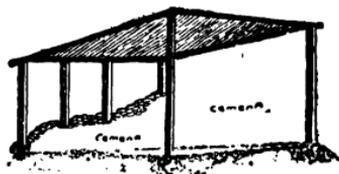


Fig. 186—CONCRETE HOUSE

plan an open shed at the end of the house, then two roosting rooms, followed by two scratching sheds and another roosting room.

There are various methods employed to enclose the front of the shed during stormy and very severe cold weather. Some use screens, which are hinged at the top and let down. These are covered with oiled muslin, which allows

some light to enter. Others employ swing doors to enclose half the shed and side up the other half, putting in a large window. Figures 183 and 184 show the two styles.

In Figures 185 and 187 are shown the style of houses built by the Massachusetts Agricultural College at Amherst. These houses are twelve by eighteen feet, having a roosting room occupying ten feet of the space and scratching sheds the balance. Two doors with large windows are used to close the open shed when needed. The

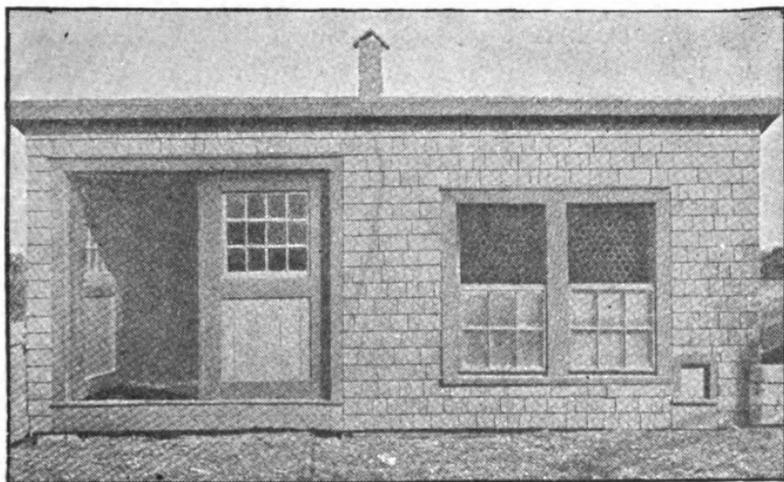


Fig. 187—A MASSACHUSETTS SCRATCHING SHED HOUSE

house is thoroughly well built, being sided with inch boards and covered with building paper and then shingled. Such a house will easily accommodate twenty-five to thirty fowls.

#### CONCRETE POULTRY HOUSES

E. W. Geer of St. Francois County, Mo., has solved the problem of eggs in winter, and sound, unfrosted combs in the spring. He has accomplished this by means of

concrete poultry houses that are free from dampness in the most rainy seasons, and as warm inside in the coldest days as a cellar. See Figure 186. Where building materials, such as stones, sand, cement and lime, can be easily and cheaply had, such a building can be erected at a cost not greatly exceeding a wooden house. Make the necessary excavation and lay the foundation. Set studding for uprights four inches wider than the width of the wall; plumb the studding and fasten securely with stay-laths.

On the inside of each stud place a one by two-inch strip, and against this put one-inch boards fifteen to twenty inches wide, which will make the two sides of a box in which the wall is to be laid. Drive a nail near the top edge of the board through it and the one by two-inch piece into the studding. When a section of the wall is laid and has set, pull out this nail, knock out the one by two-inch piece and raise the board, fastening it as before. Continue in this way until the wall is completed.

A wall eight inches thick is heavy enough for all small buildings, such as chicken houses, pigpens, etc. The mortar is made as follows: In a large, flat box slake a barrel of good stone lime, using plenty of water so that it does not burn. Let this stand for several hours until thoroughly slaked and cooled, then mix with it twelve barrels sharp sand or gravel, and one-half barrel Rosendale cement. This should be made to the consistency of mortar. Unless some cement is used the chickens will pick out the mortar. The cost will depend largely on the price of material and labor and vary from three-quarters to two cents per cubic foot of wall.

#### A MOVABLE POULTRY HOUSE

On the majority of farms where grain is raised there is more or less wasted each year that nothing but a fowl will pick up. This often happens in wheat fields. The

hen house shown in Figure 188 is designed to meet the demand for a movable house, and was gotten up by a practical Michigan poultry raiser. The house is built as light as the necessary strength will allow. The length is twelve feet and a little less than six feet wide in the clear. The height from the sill to eaves is five feet, and seven and one-half feet from sill to gable. The door is six feet high and two feet wide.



Fig. 188—POULTRY HOUSE ON WHEELS

The house is sided with matched stuff, without any inner ceiling; the floor is single, also, as it is designed purely for warm weather use, though the owner has no trouble in keeping Cochins in it during the winter time. The roof is tarred paper, which is painted once a year. The rear wheels are from an old mowing machine; the

forward ones from a grain binder truck. The rear axle is a heavy iron rod securely bolted to the bottom, while the front axle is of wood.

### THREE-PEN HOUSE

The house shown in Figure 189, which is unique, compact, economical and convenient, is particularly adapted to a city or village lot. It is neat and ornamental and is recommended for the fancier who wishes to make special matings or keep two or three breeds. It can be built ten by twelve feet or larger if desired. The sides may be of plain

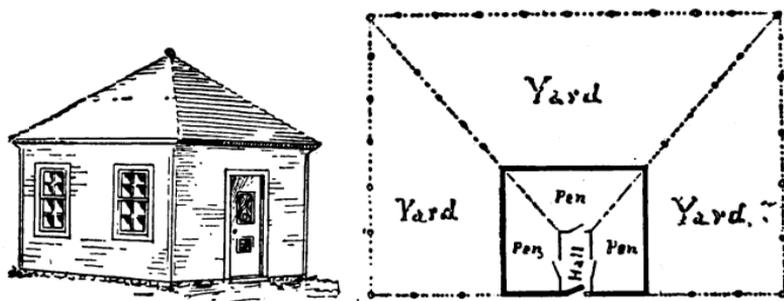


Fig. 189—CONVENIENT HOUSE FOR THREE FLOCKS

clapboards or of shingles laid over matched siding with paper between. The roof is also shingled and can be surmounted with a small cupola for a ventilator. The pens and yards are divided as shown. A house of this shape ten by twelve feet would easily accommodate thirty fowls, although eight in each pen would undoubtedly prove more satisfactory.

### A CHEAP AND CONVENIENT POULTRY HOUSE

The plan, Figure 190, of a poultry house will be found convenient when two varieties of fowls are kept, yards being made in front of each compartment for an out-door

range, when it is necessary to keep them in confinement. The ground plan, shown in the figure, is ten by twenty-nine feet; apartments for fowls ten by twelve feet; *A*, outside door; *B*, hall, to provide for storing feed, giving access to the nests without entering the apartments in

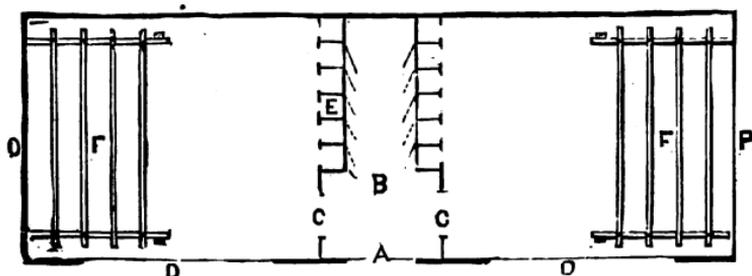


Fig. 190—GROUND PLAN OF A POULTRY HOUSE

which the fowls live. Slatted gates, six and one-half feet high, are placed at *C*; the space above the gates, and above the nest boxes, should be slatted to allow circulation of air. Large windows are in the side at *D*, *D*; nest

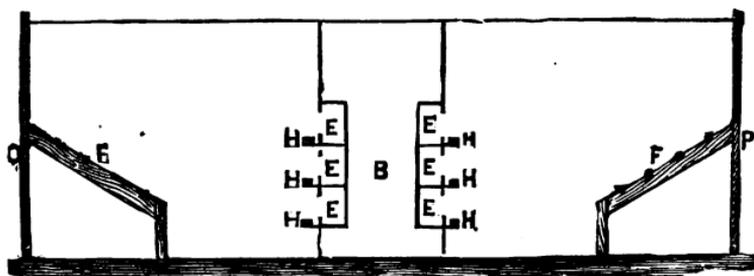


Fig. 191—VERTICAL SECTION THROUGH THE HOUSE

boxes at *E*, and roosts at *F*. The back nests are four feet high; front nests, two feet; with large Asiatic fowls, the roosts should be made nearer the floor. If but a single variety is kept, the hall and compartment at one end will answer the purpose, and the door, *A*, Figure 190, opening

at one side, may be placed at the end. Figure 191 shows a section through the middle of the house—from *O* to *P*, in Figure 190. The slats in front of the nest boxes are marked *H*; other letters as in Figure 190. The front elevation, nine feet high, is shown in Figure 192. The doors, *G*, *G*, for fowls, are near the main door, *A*, and within reach from the hall, so that one can readily close them without going into the fowl apartment. An opening with a sliding shutter that can be partly or entirely closed from the alley may be made over the main door, *A*, for the purposes of ventilation. The nest boxes may be

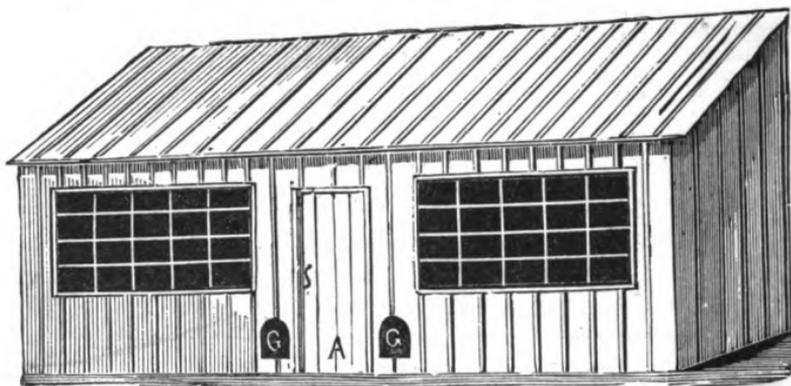
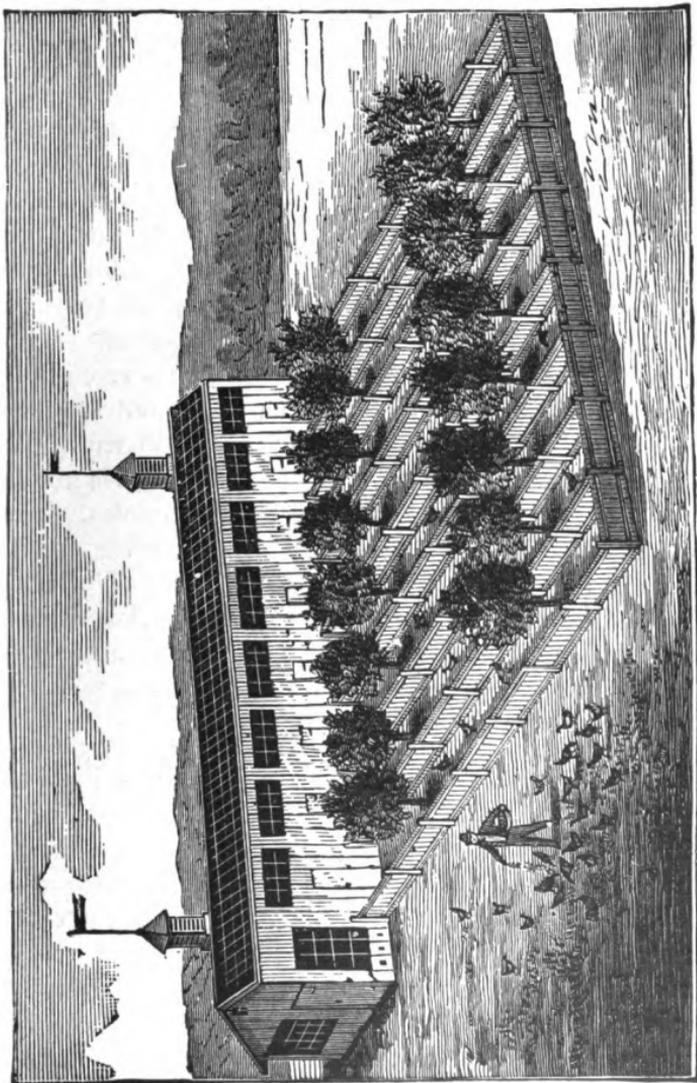


Fig. 192—FRONT VIEW OF POULTRY HOUSE

one foot wide and sixteen inches high. For convenience in cleaning, the nest boxes should be made in sections, so that they can be readily taken apart. The architectural finish of the exterior is a matter of taste, and may conform to that of the surrounding buildings. Poultry houses are frequently made as a lean-to against other buildings, but, all things considered, it is best to have them apart, and by themselves. They are not desirable near the horse stable, as vermin are liable to get on the horses unless care is constantly exercised in their extermination.



**Fig. 193—AN OHIO POULTRY HOUSE AND YARDS**

## AN OHIO POULTRY HOUSE

The engraving, Figure 193, represents the poultry house of Mr. J. H. Kemp of Germantown, Ohio, which the owner regards as cheap and convenient. It was built upon a raised bank, and has a trench around it which keeps the interior always dry. The house is seventy-two feet long and twelve feet wide, and is divided into nine apartments, each eight by twelve feet. Eight varieties of fowls were kept in it when the owner was actively pursuing operations. The runs, as shown in the foreground, are eight by seventy feet, and each one has two plum trees in it, which furnish both shade and fruit; the plums, it is said, are not injured by insects. There is no room lost by alleys or passages inside of the house; entrance is gained by doors which pass into each pen and run. To preserve cleanliness, every part of the building is made accessible, and ventilation is secured by two cupolas. The rear part of the house is five feet high, and the front, which faces the south, is eight feet in height. There is a stout roof of glass on the south side, and a large window, furnishing abundant light to each apartment.

## ANOTHER CHEAP HEN HOUSE

The house, Figure 194, is ten feet wide and twelve feet long. A passageway four feet wide runs along the south side, in which are windows; this is formed by a partition three feet high, which extends from near the door to the rear, and supports the lower side of a sloping floor, that rises to the eaves on the north side. The roosts are fixed above this sloping floor, and the droppings of the birds fall upon the floor, which, being sprinkled with plaster, they roll down, or are easily scraped off. There is a ledge at the front edge, which prevents their going to the floor. Under this sloping floor the space is divided by a partition, making a nest room about six feet square,

and a setting room five by six feet, which is also used for a storeroom for grain, eggs, etc. This setting room is entered by another door and lighted by a pane in the

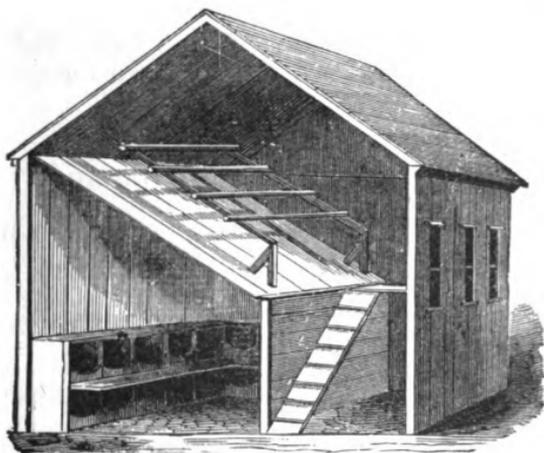


Fig. 194—SECTION OF HEN HOUSE

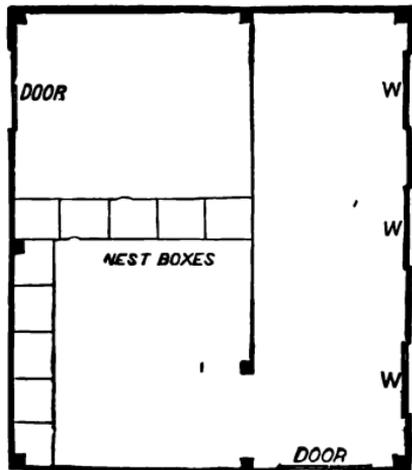


Fig. 195—PLAN OF HEN HOUSE

gable end. The nest boxes slide through the partition into the setting room, but there is no access for the fowls, except when sitting. At these times hens are moved, if

they happen to be in boxes, against the side building, and made to occupy those in the partition. The back end of the four-foot passageway, Figure 195, is used as a feeding floor, and here stands the water fountain. The use of plaster on the sloping floor under the roosts is excellent. Nothing can be better, but fine, dry road dust, swept up on a hot day, is very good.

#### POULTRY HOUSES FOR FOUR VARIETIES

To keep several kinds of poultry in one building, but in different yards, is sometimes troublesome to the inex-

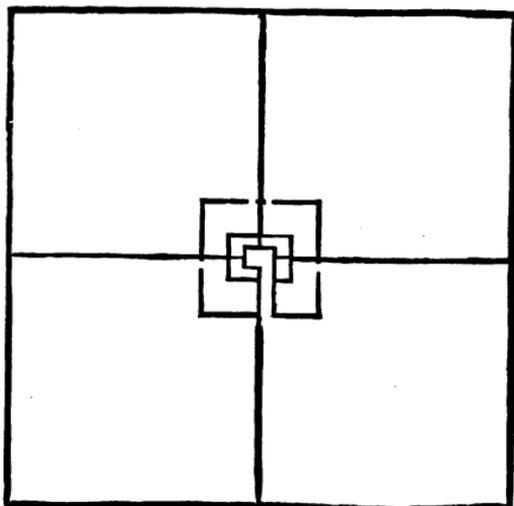


Fig. 196—PLAN OF HOUSE AND YARDS

perienced fancier. It is necessary to be done, however, if each variety is to be kept pure. A method of arranging a poultry house for four varieties is shown in Figure 196. There is a square yard, divided into four parts by cross-fences, and a house in the center, also divided into four apartments. The division and outer fences should be sufficiently high to prevent the birds from flying over

them; wire netting six feet high would be required for the lighter varieties. Five feet high would be ample height for the heavier kinds, as the Asiatic fowls or Plymouth Rocks. Doors and windows are made in each apartment,

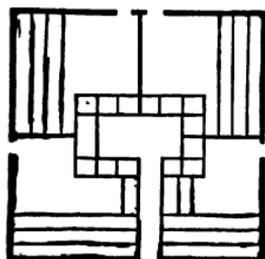


Fig. 197—PLAN OF  
ROOSTS

as may be desired. A passageway is made from the front gate to the yard, which leads to a central room, as shown in Figure 197. Around this central room are the nests, which are reached by small doors opening into them. Roosts are put up in each apartment, as seen in Figure 197. For the large fowls, low roosts should be used, as they cannot reach high ones without a ladder, and in

dropping from the latter they are apt to suffer injury. A roosting frame for some Light Brahmas is shown in Figure 198. It is made of chestnut strips two inches square, with the edges of the upper part rounded off somewhat, to make them easy to the feet of the fowls. Three of these strips are fastened to frames made of the same

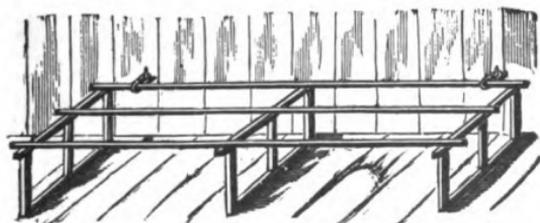


Fig. 198—LOW ROOSTS FOR HEAVY FOWLS

material for supports. The whole is fastened to the wall by rings fixed in staples, so that it can be turned up and held against the wall by a hook. It is twelve feet long, three feet wide and sixteen inches from the floor. This is frequently too high for some of the heaviest of

the fowls, which have to be provided with stools upon which to step up to the perches. A poultry house suitable for keeping several kinds separate is shown in Figure 199. Originally this was made for a kennel, but it is perfectly well adapted for poultry. Its peculiarly French appearance gives it a picturesqueness which, with many persons, would rather add to its attractiveness than other-

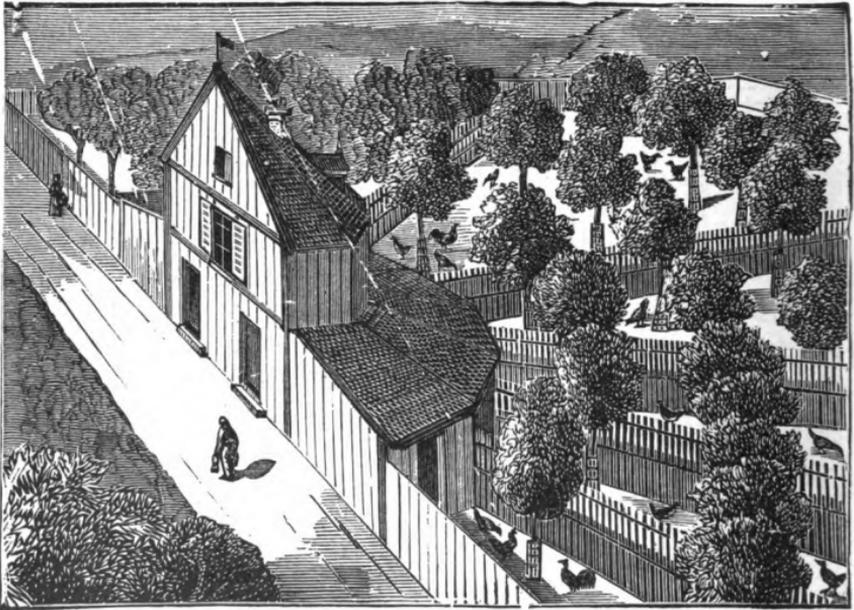


Fig. 199—HOUSE AND YARDS FOR SEVERAL BREEDS

wise, but the style of the building may be varied to suit any circumstances. It is divided into a number of apartments, each leading into a yard, which is planted with fruit trees. The yards radiate fan-wise from the building, and occupy a square piece of ground. The apartments communicate with the front of the building, and a room may be there made from which each can be reached.

## POULTRY HOUSE FOR A NUMBER OF BREEDS

The plan, Figure 200, is of a compact and convenient house for small stocks of fancy and other fowls. The length of the building is forty-five feet and its width ten feet. It is divided into nine apartments, each five feet wide. The house is entered at one end, as shown in the figure, and a passageway two feet wide extends through it on the north side. See Figure 201. The interior parti-

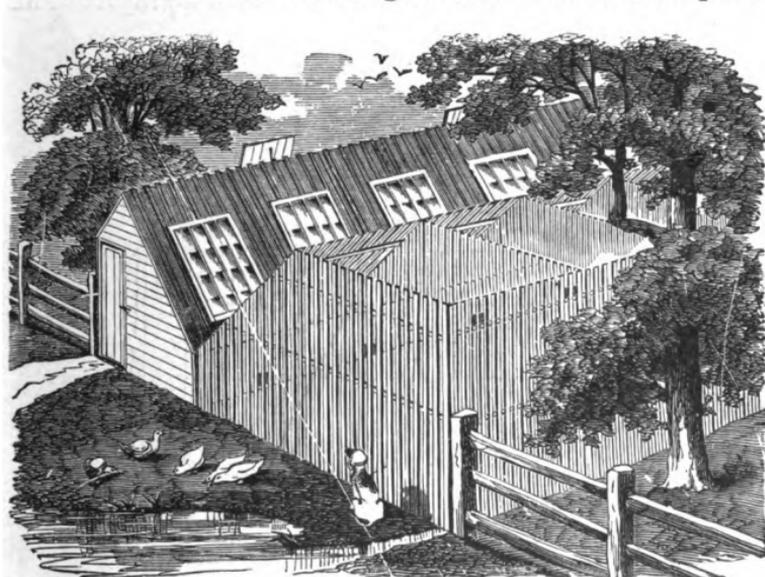


Fig. 200—POULTRY HOUSE FOR A NUMBER OF BREEDS

tions, including the long one, are of one and one-half by one-inch pine strips; the outside is entirely of one-inch hemlock boards battened. The roof is pine flooring, tongued and grooved, and for each apartment a three and one-half by six-foot hot-bed sash is set in the roof. The posts which support the ridge of the roof are eight feet long, the front wall or side being only two and one-half feet to the plate. The yards are much longer than is possible to show in such a small picture as Figure 200, and

are five or ten feet wide. The paling surrounding them is of one and one-half by one-inch strips. A brook runs through the yards, affording an abundance of fresh water, which is a great source of health, and of success in raising fowls. The floor of the house is a dry gravel bed, covered with sand. The roosts are low, as represented in Figure 202. They are made of round sticks, about two inches in diameter, and, beneath them, troughs of two boards nailed together, catch all the droppings. The

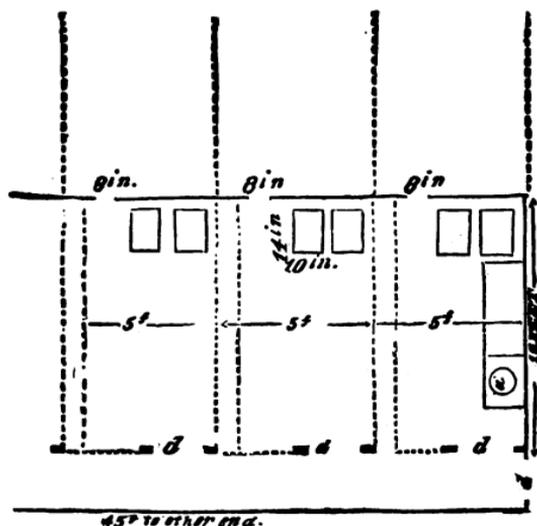
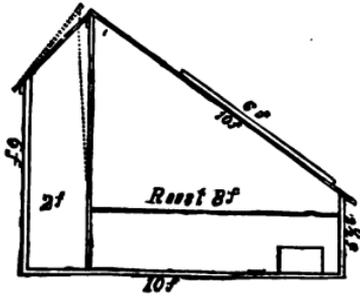


Fig. 201—GROUND PLAN OF THE POULTRY HOUSE

nests and feeding boxes stand upon the sand, and are frequently moved to prevent food getting under them, or the ground becoming moist, and affording a harbor for insects. Ventilation is secured by openings in the short pitch of the roof. No rafters are needed, as the roof is sufficiently stiffened by the cross-partitions. The doors by which the different apartments are entered are two feet wide, made also of strips, and all are furnished with locks, so that

when the owner is absent, the feed boxes and water vessels, if the fowls are shut out of the yards, may be filled from



the passageway, and no one can interfere with either the fowls or their eggs. A lock on the outer door makes all secure at night. The slant of the paling forming that part of the yard fence against the house is given to it in order that it shall not cut off the sunlight from the windows. As the house

Fig. 202—SECTION OF HOUSE

is arranged for nine varieties, where fewer are kept two or more apartments may be thrown together, and thus larger flocks can be accommodated.

AN INCUBATOR CELLAR

Many insurance companies will not allow the use of an incubator in the house; hence in order to make one's insurance policy good, it is necessary to run the machine in another building. The ordinary outbuilding is too poorly constructed to allow the successful operation of an



Fig. 203—CROSS-SECTION OF INCUBATOR CELLAR

incubator, as an even degree of temperature cannot be maintained. Even the best incubators, with the most delicate regulating apparatus, will not work where the tem-

perature varies from twenty to thirty degrees between day and night, as it will do in some outbuildings.

An incubator room partially underground is desirable, because it is easier to control the temperature in such a building. The sides and roof should be made double with a good air space between, and well insulated with building paper. Windows and doors should likewise be made double. Figure 203 shows a cheap and easily constructed incubator room built upon the surface of the ground, yet surrounded by earth which is banked up against its stone walls. It is banked on three sides, leaving one side unbanked for the entrance door and a window. This side should preferably face the east or west. A room eight or ten feet square will hold several incubators.

#### A PRACTICAL BROODER HOUSE

The average farmer does not wish to go to the expense of a hot water system for brooding early chickens, but

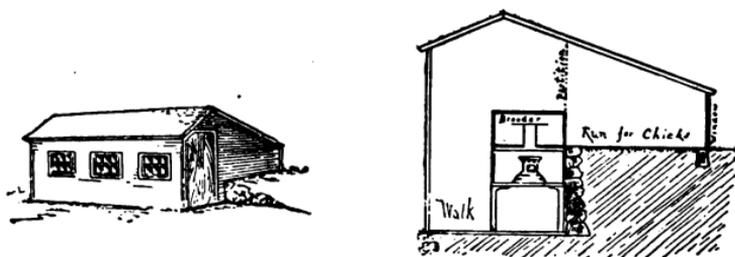


Fig. 204—VIEWS OF A BANK BROODER HOUSE

there are many who would like an economical plan for brooding a few hundred early chickens. Figure 204 shows a house built against a bank that can be twelve feet or more in length. The cross-section shows exactly how the homemade brooder is located, with respect to the run for the chicks. Set on legs as it is, the attendant does not have to stoop over his work, and with the

raised run for the chicks, they are brought on a level with the brooder, so they can easily run in and out.

This run is coated with gravel and cemented. The brooder is three feet square. Allow six feet for each brooder and pen and you have three feet at the end of each brooder—sufficient space to give access to each pen, which can be cleaned from the walk with a short-handled hoe or rake. The house is twelve feet wide, the walk or alley six and the run six. The top of the brooder is hinged, to give easy access, and the partition in front of the runs is tight, to keep in the warmth that is produced by the sunshine coming in at the window. If a bank of earth is not at hand, earth can be heaped up to form a bench on which to locate the runs, or the walk may be sunk.

#### A CHEAP AND ECONOMICAL BROODER HOUSE

The plan of a brooder house as built and run by J. R. Little of Sulphur Springs, Mo., is shown at Figure 205. The ideas embodied in this house are new, novel and economical, having proven to be an excellent system for brooder houses.

Any cast iron furnace front of suitable size—a large stove front, preferably with upper and lower doors—will answer for constructing the furnace, which is built in the ground, sixteen to twenty inches wide and long enough to take in four-foot cord wood. If coal is to be used the furnace need not be so long by half. The flue extends from the furnace the entire length of the house to a pipe or chimney outside, is bricked at the sides and covered with galvanized sheet iron, on which is filled in about six inches of coarse sand. Fine sand will not give so good results.

Individual tastes and resources, together with the location and purpose in view, can all be consulted to advantage in the planning and constructing of the runs. The

chicks from the incubators are put over the furnace and moved toward the other ends of the house as they grow, to make room for new hatches. The sand is placed in a trench, about two feet wide, six inches deep and the entire length of the house, and directly over the flue, which latter should be about two or two and a half feet from the back or lower end of the house. One of the

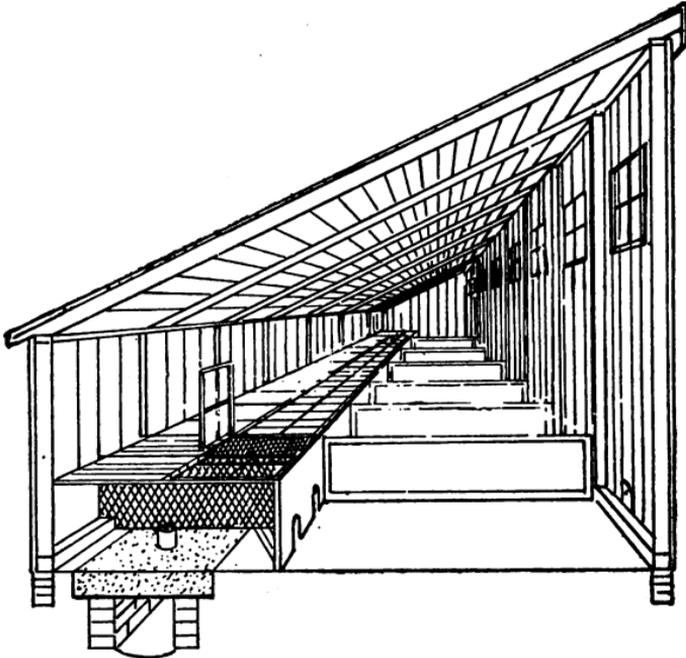


Fig. 205—INTERIOR OF BROODER HOUSE

best and essential features of this system is the ventilation. Fresh air from the outside passes through pipes in the sand, where it is heated before passing into the hovers through upright branch pipes, one in each hover. The vitiated air finds its way out through a three-inch opening, left between the front or upper wall plate and the roof sheathing, the entire length of the building.

With a practically air-tight furnace front a medium-

sized cord-wood stick laid on a bed of coals and hot ashes will maintain a steady and efficient heat in the hovers for twelve hours in cold weather. Ordinarily, up and down boards weather boarded, having light tarred paper between them, make the cheapest and best walls. Tarred paper should also be put on the sheathing before laying the shingles. For a house eight feet wide, back wall three feet and front wall seven feet high and fifty feet long, the material should not cost more than fifty dollars, and usually less.

#### SMALL HOUSES FOR POULTRY

Small houses are often desirable in order to mate up a few birds for breeding purposes or in which to place a

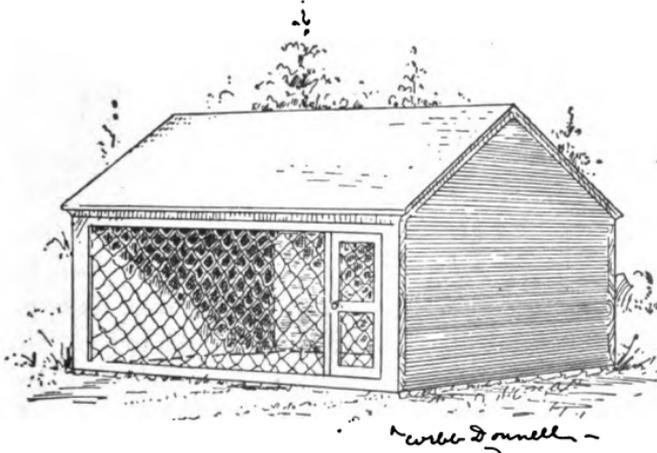


Fig. 206—SUMMER HOUSE FOR POULTRY

brooder with young chicks. After the chicks are a few weeks old the brooder can be removed, roosts put in and the chicks left there all summer safe from vermin and thieves if the doors are locked at night. The window should be replaced with a wire netting screen. Several houses of this kind in use by the West Virginia Experi-

ment Station are six feet square, six feet high in front and four feet high behind. They are constructed of planed and grooved hard pine, which costs there seventeen dollars and fifty cents per thousand feet. The frame is composed of hemlock two by fours.

The cost of these little houses is approximately as follows: 206 feet flooring for floor, sides and roof, \$3.50; sixty-five linear feet of hemlock two by fours, \$1; one window, \$1; roofing, \$1.75; nailing together, \$1.50; total, \$8.75. About fifty chicks are put in a brooder in each of these houses and allowed to remain until the chicks have no further use for it. It is then removed and perches nailed up for the chicks. If the cockerels are sold as soon as they are ready for market, the houses are large enough to accommodate the pullets until they are placed in laying houses in the fall.

#### CHEAP SUMMER SHELTER FOR CHICKS

Growing chicks can be kept in a most vigorous condition by having pure air at night. Shut up in close coops they cannot have this. Get them to roosting out of doors as early as possible, but provide a shelter for the roosts. This can be made very cheaply by putting up a rough board and stake

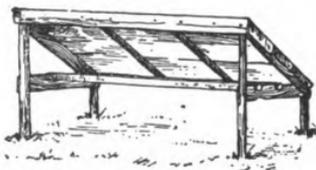


Fig. 207—CHEAP SHELTER

frame, as shown in Figure 207, and covering it with tarred paper, tacking lath on the outside, over each rafter. This will protect the chicks from showers in the night, but will not shut out any pure air. A better, but more expensive shelter is also shown in Figure 206. This consists of a single boarded building of any size desired, having the front of wire netting. If the door is closed and locked at night the chickens are

safe from thieves or vermin. Such a house is suitable for turkeys in cold weather, as they are healthier when kept out of doors rather than in a closed building.

#### A PLACE FOR PIGEONS

Pigeons need the least care of any poultry and raising squabs is agreeable and profitable work. To raise them on a large scale, a proper loft must be constructed. A suitable place for them is on a floor, in the top of a barn. The size of a loft does not matter, one fifteen by thirty

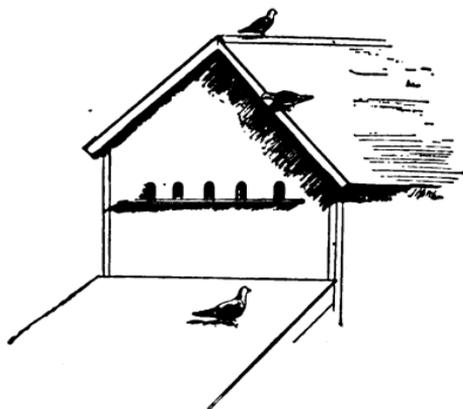


Fig. 208—PIGEON LOFT

feet is large enough. Get high enough and away from rats and cats. Cut small holes in the south side of the loft, as shown in Figure 208, and place an alighting board on a level with the bottom. Nail boxes for nests along the sides.

#### DUCKS AND DUCK HOUSES

There is a satisfactory profit in raising ducks; but the conditions must be favorable, and these include a water-run, either a stream or pond, in which the ducks can gather food, and a house conveniently arranged for

securing the eggs. Young ducks are best raised with only enough water to drink, but breeding stock does much better with a place to swim. A house may be made for them on the bank of a pond adjoining a brook in which there are abundance of water cresses and other food, both vegetable and animal. The water cress is eaten with avidity by ducks, and has myriads of snails and other water animals upon it. A plan of a house is shown in

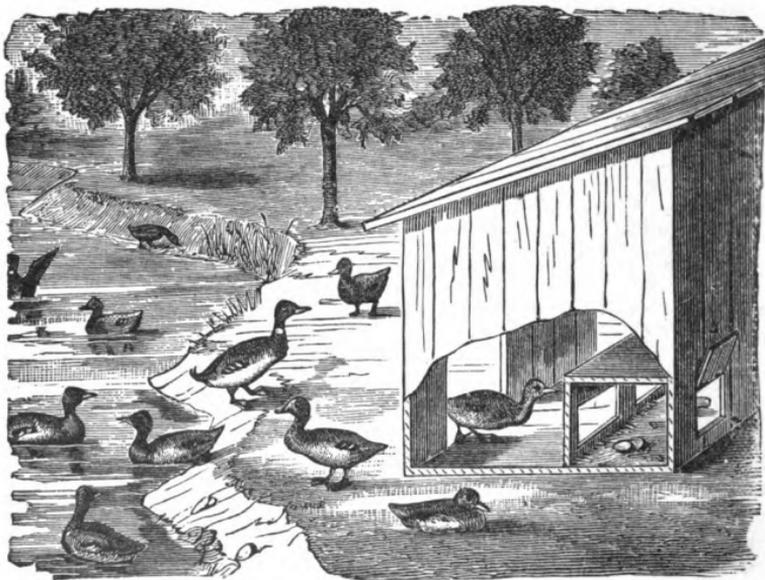


Fig. 209—VIEW OF A CONVENIENT DUCK HOUSE

Figures 209 and 210. For fifty to 100 ducks it should be thirty feet long, twelve feet high, and from four feet high at the front to six or eight feet in the rear. Entrance doors are made in the front, which should have a few small windows. At the rear are the nests; these are boxes open at the front. Behind each nest is a small door through which the eggs may be taken. It is necessary to keep the ducks shut up in the morning until they

have laid their eggs; a strip of wire netting two feet high will be required to inclose a narrow yard in front of the house. Twine netting should not be used, as the ducks put their heads through the meshes and twist the twine about their necks, often so effectively as to strangle themselves.

#### THE VENTILATION OF POULTRY HOUSES

The principle of the King system of ventilating barns is best for poultry houses. In this the ventilator extends to within a few inches of the floor, and goes out at the

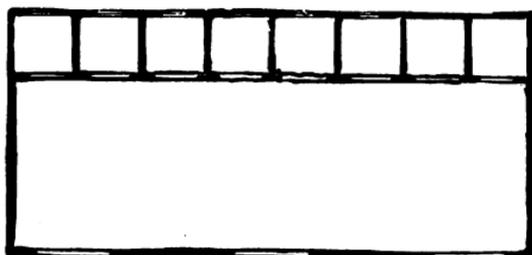


Fig. 210—GROUND PLAN OF THE HOUSE

highest point in the roof. It is unnecessary in poultry houses to provide for the admission of fresh air, as enough, and generally too much, comes in around the doors and windows. If a poultry house is constructed so thoroughly as to keep out the cold, and ventilation is not provided, there is great liability of its becoming damp, particularly if a large number of fowls are confined.

A ventilator should be provided to carry out the moist air and yet not remove at the same time all warm air. If the opening is at or near the roof, it will take out the warm air, but if the ventilating shaft is brought down near the floor, it will only remove the foul air unless too large for the house.

The cheapest and best ventilator is built of two boards six inches wide, and two boards eight inches wide. These

are nailed together to make a shaft six inches square, inside dimensions. If the building has a roof sloping one way, set this shaft at the front of the house, and allow it to extend one foot above the roof. Bore some inch holes in the top to allow the air to escape and cover it to keep out the rain. Provide a slide in the shaft to open and close in order to control the ventilation. Near the roof cut out a piece one foot long and then replace it in a manner which will close the shaft tightly, yet allow of its being opened readily to take out the warm air during hot weather. Do not use a tin or metal pipe for a ventilator, as it will collect the moisture on the inside during cold weather and prove very unsatisfactory.



## CHAPTER VIII

### *CARRIAGE HOUSES AND HORSE BARN*

#### COMBINATION HORSE AND CARRIAGE BARN

The horse barn of the Massachusetts Agricultural College at Amherst also provides room for tools and machinery. A barn of this style would give plenty of carriage room for a private stable if the space was used for wagons instead of tools. The elevation and floor plans shown in Figures 211 and 212 need little description. There are ten ordinary stalls with patent stall basin and floor, iron mangers and hay racks, and four large box stalls similarly equipped. Access to this portion of the stable is gained through the large door toward the east end, which in the illustration stands open. Opposite this is a corresponding door on the north side, so that one can drive directly through. Hay is put into the loft through large trap doors above this passage by means of a horse fork. The building also contains a small room for tools, a repair shop, also harness rooms, closets, etc. There is an open hitching shed, and in the basement ample room for vehicles or machinery. The roof is of steel.

In the tool room are individual tool closets for the permanent workmen, in which they keep their tools. The large door in the west end leads into the repair room, which runs the full length of the building. This is provided with bench, vises, portable forge, anvil, etc. In the loft directly above is space for the storage of lumber or other material. The large doors at the west end open into the basement, which is about forty feet square. The stable is finished with hard pine.

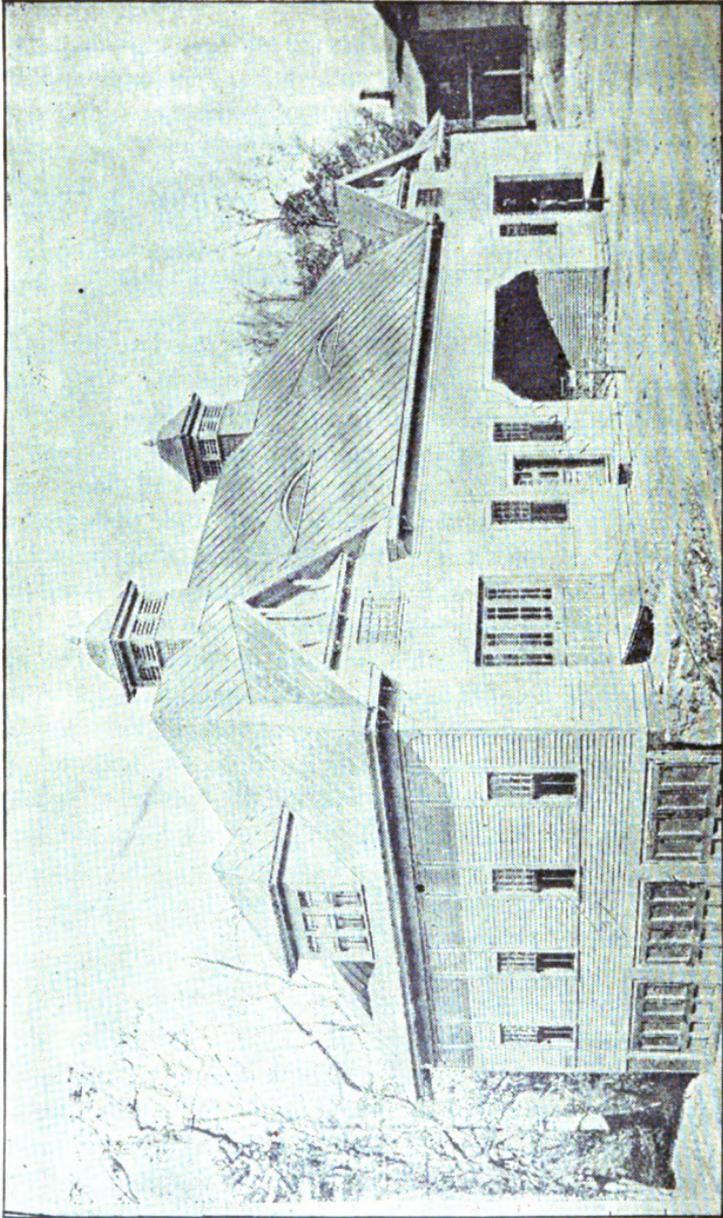


Fig. 211—HORSE BARN AT MASSACHUSETTS AGRICULTURAL COLLEGE

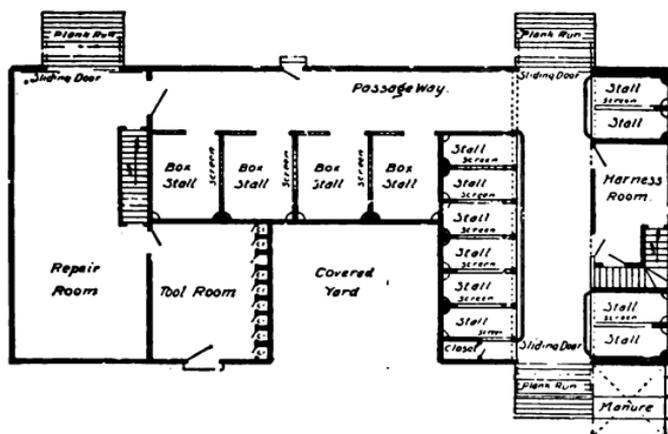


Fig. 212—FLOOR PLAN OF A ROOMY BARN

#### STABLE FOR A VILLAGE LOT

A building twenty-five by thirty-five, or twenty-five by fifty feet, is of good size for a village stable, where two or three horses are kept. Figure 213 shows a very good barn for this purpose. The small window over the door, through which hay is usually pitched with difficulty, is in

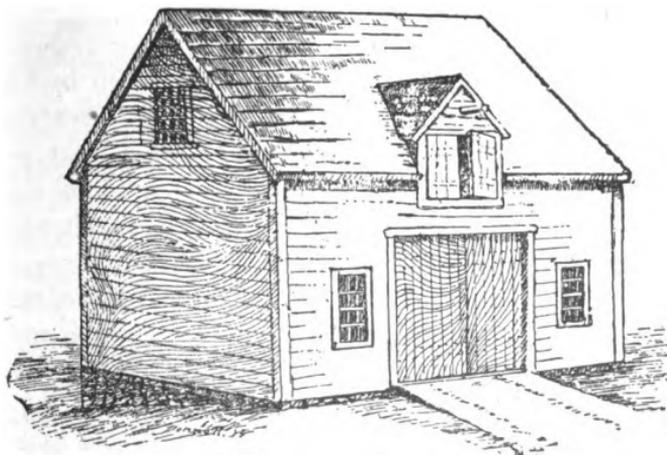


Fig. 213—A SMALL CARRIAGE HOUSE

this case of generous size, and the small gable in the roof adds to the attractiveness of the building. A box stall ought to be provided in every stable and should be at least eight feet square, but eight by ten or ten by twelve feet is much better if the space can be spared. The box stall may take the place of the extra stall that ought always to be provided. The carriage room should be partitioned off from the stable with a tight board partition and a separate room ought to be provided for harnesses and blankets. The floor plan is shown in Figure 214.

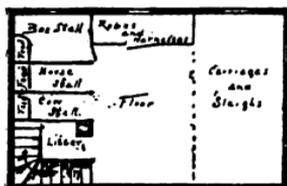


Fig. 214—FLOOR PLAN

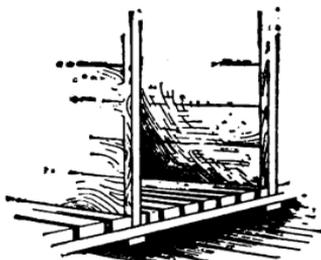


Fig. 215—FLOOR OF STALL

#### STALLS FOR HORSES

A well arranged box stall for horses is shown in Figure 216. The upper portion consists of iron rods extending from the top of the sides to a railing two feet above. The front is provided with screen doors. The stall is nine by four and one-half feet and the manger is twenty-one inches from front to back. An iron feed trough for grain occupies one end of the manger, indicated by dotted lines at *G*. The remainder is taken up by the hay box at *H*, the bottom of which is shown by the dotted lines. A door in front allows for cleaning out the feed box and opens to a closet. The box stalls are also provided with the iron rods for a top finish, so that a person

can easily see into them without entering. The interior exposed woodwork is varnished, making a neat and substantial finish.

Where mares are kept a tight floor in the stall is not especially inconvenient, but with geldings the case is otherwise. For them such a floor as is shown in Figure 215 is best suited for keeping their coats from becoming stained. The stable floor beneath the flooring of the stall should slope a little so that the liquids that run through the openings in the stall flooring will be conveyed down

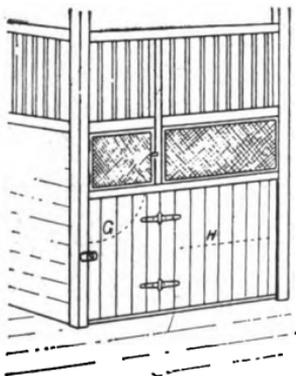


Fig. 216—BOX STALL

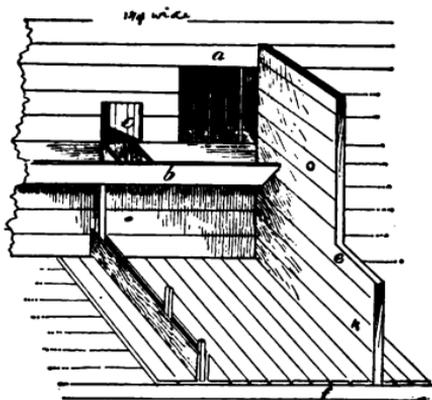


Fig. 217—OPEN STALL

behind the stall, where they may be absorbed in the litter. The pieces of which the stall floor is made may be five inches wide, laid one-half inch apart. They are shown farther apart than this in the cut in order to make the matter plain. There should be four cross bearings under the stall floor if two-inch stuff is to be used.

Of the many forms of horse stalls, the one shown in Figure 217 has perhaps the most good points. All stall floors should be laid lengthwise of the stall. The boards should extend the full length of the stall. When badly worn they can be changed end for end and if turned over

much extra wear is obtained. Soft wood, like pine or even elm, is superior to oak. There is less danger of the horse slipping when he gets up.

The most important part of the stall is the hay rack and manger. When the hay is thrown into a deep manger where the horse has free access to the entire quantity, he tosses and mixes it over many times to select the most desirable portions. Often a large share of it is thrown from the manger to the floor. In the illustration the manger, *b*, is only fourteen inches wide at the bottom, and one foot high. It is made from two-inch oak plank, with a strip of well-worn wagon tire nailed on the upper edge.

The hay rack at *a* is outside the stall. It should be two and one-half to three feet wide and eighteen inches deep. If fodder is fed from above, the chute should extend up to the floor. The wooden gratings are at least eight inches apart, so that the horse may easily pass in his head up to the eyes if need be, but by making the bottom of the rack pitch at a sharp angle toward the manger all litter, seeds, etc., will fall into the manger. In this form of rack the horse grasps a mouthful of hay, pulls it from the rack and holds it over the manger while eating. It is plain that all loose particles fall into the manger and are eaten at leisure. The uneaten portion in rack is not mused over. The feed box at *d* is made in usual manner. If horses are in the habit of throwing out the grain nail a strip over the edge of box, letting it project inward about one inch. By the use of a door at *c* the grain is fed without entering the stall.

The form of stall division is important and the one shown is O K. The shoulder at *e* (too low in engraving) is very convenient to hang a blanket on or to temporarily lay the brush or currycomb on or even parts of harness. For easy cleaning of stable the floor boards in rear of stall should run in the direction shown at *f*, as the sweep-

ings are usually disposed of at one end of stable, and are more readily pushed lengthwise instead of crosswise of a board floor.

#### A COMBINED CARRIAGE AND TOOL HOUSE

The accompanying engravings give plans of a carriage, wagon and tool house in one building, suitable for a large



Fig. 218—PLAN OF WAGON HOUSE

farm. The structure may be sixteen or eighteen feet high to the eaves, which will give a space of nine feet in the clear for the lower story, six feet in the clear for the granary at the walls, and ten or eleven feet in the

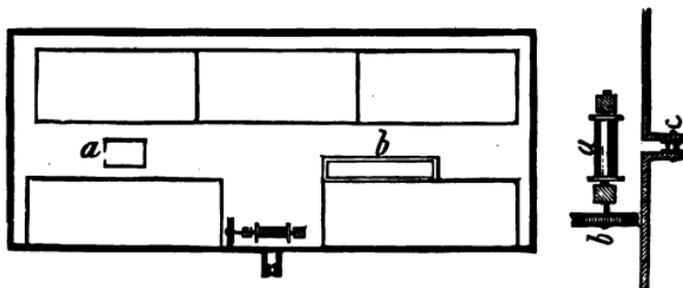


Fig. 219—PLAN OF THE UPPER FLOOR, AND HOIST

center between the bins. It should be at least twenty-four feet wide, and forty-eight feet long, to give ample space for moving about in it. The wagon and cart room is at one end, and twenty-four feet square, as shown in

the plan, Figure 218, to contain three wagons and a cart. The doors of this portion slide upon rollers, and are in three divisions to facilitate the movements of the wagons in or out. The carriage house is in the center, with the entrance at the front. Here is room for two carriages, and a tool house adjoining, with entrance at the end opposite to that of the wagon house. In the carriage

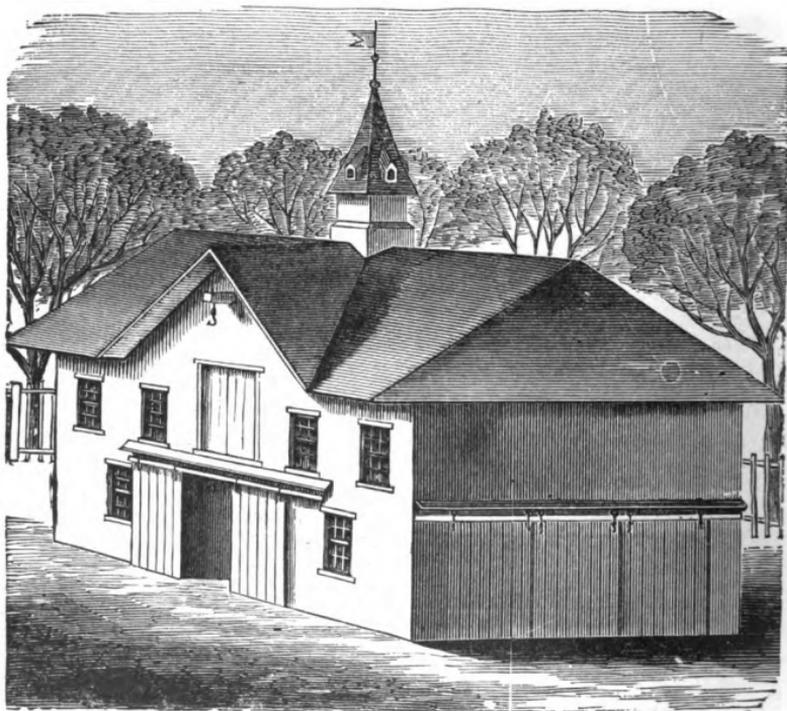


Fig. 220—VIEW OF COMBINED WAGON AND TOOL HOUSE

house there should be a well and a force pump furnished with a hose, for the purpose of washing off the carriages, and the floor should be made slightly sloping each way to the center, with a gutter there to carry off the water to the rear. The upper floor may be reached by a stairway outside, or from the inside, as may be most convenient.

The plan of the bins in the granary is given in Figure 219. On one side are the three grain bins, and on the other, two lathed bins for corn in the ear. Between these is the hoisting wheel and door. The plan of the hoist is shown in Figure 219; *a* being the winding barrel, *b* the pulley wheel, with an endless rope hanging upon it, and *c* the pulley in the cathead. The hoist is supported by hangers fastened to the roof timbers and the plate. Figure 220 shows the elevation, which may be changed to



Fig. 221—ILLINOIS HORSE BARN

suit the wishes or the means of the builder. Here it is made perfectly plain, in order to be the most economical.

#### A TWENTY-SIDED HORSE BARN

In Figures 221 and 222 is shown a twenty-sided horse barn built by John C. Baker, a lumberman and stock-raiser of Manhattan, Ill. The barn is sixteen

feet on a side, 320 feet around it and  $102\frac{1}{2}$  feet in diameter. It contains eighteen box stalls fourteen by sixteen feet in size around the outside and fourteen single stalls eight by twelve feet in the center. Through the barn is a driveway fourteen feet wide. The box stalls are for stallions, mares and colts and are built of hemlock two by fours laid flat and spiked together solid. The feed rack, which is built into the outside wall, is also of two by fours. There is a window in each

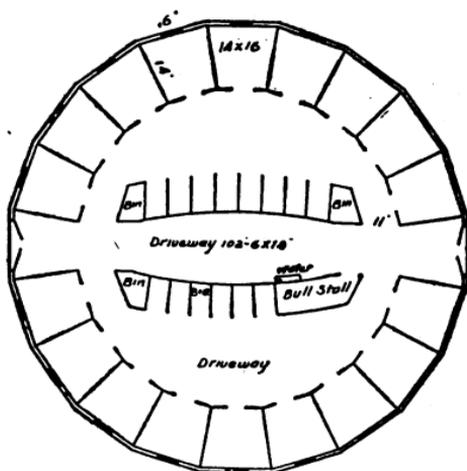


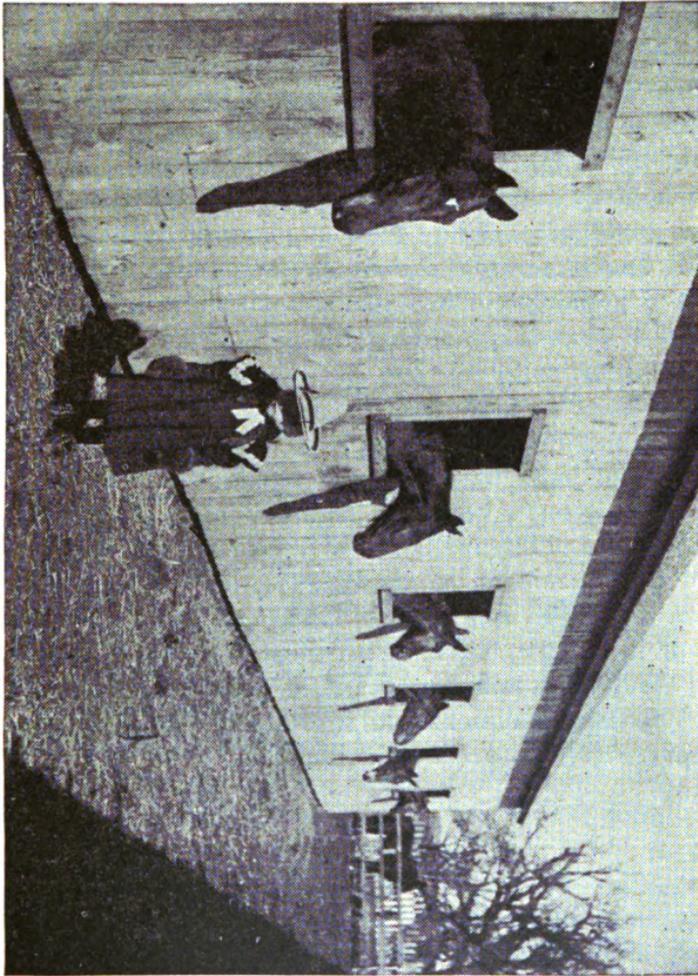
Fig. 222—FLOOR PLAN OF ILLINOIS HORSE BARN

stall, also an inside door. An outside door in two stalls makes four ways to get out. The upper story is twelve feet high and contains room for 200 tons hay, 5000 bushels oats and some room left. A ten-sided cattle barn built by Mr. Baker is shown on Page 65. He writes of them:

"I find these barns all that I could desire. They are warm in winter and cool in summer, and I notice one good thing about them is that drafts never blow onto

the stock as in oblong barns or square barns. They are very convenient for feeding, but they must be seen to be appreciated."

Fig. 223—ZACH MULHALL'S OKLAHOMA HORSE BARN



A CHEAP AND CONVENIENT HORSE BARN

A part of the large horse barn on the farm of Zach Mulhall in Central Oklahoma is shown in Figure 223.

Mr. Mulhall's barn is so arranged that each horse has a box stall and thus enjoys comparative freedom. This is necessary in the raising of high class horses. Most of the stables are one story in height, with room for considerable hay and grain. It is not necessary in this section to have as warm barns as in other localities, but in Oklahoma and similar latitudes, barns are as necessary in summer as in winter, because the heat is intense during July and August, and flies are often bad. Unless horses are kept in during the day at such times, they will lose flesh rapidly in fighting flies. By properly ventilating the barn and darkening the windows and doors during the day, a properly constructed horse barn is a fairly comfortable place, even during the most disagreeable seasons of the year.

The barn as here arranged has a double row of stalls with a central passageway in the middle. Many barns have been built with a single row of stalls, having the roof projecting several feet to afford protection from sun and storms. The stalls are arranged with a door cut in two in the middle, so that the upper door may be left open for light and air and the horse be still confined. Such barns are much colder in winter than those like Mr. Mulhall's, and more work is required in caring for and feeding the horses than where there is a central passageway with stalls on either side.

## CHAPTER IX

### CORN HOUSES AND CRIBS

Whatever temporary expedients the grower of Indian corn may resort to for storing his crop, he at last comes to a crib as a prime necessity. The rail pen is a very insecure inclosure, much exposed to damage from the storms, and an invitation for any thief to plunder. Storing in the garret is a very laborious business, and unless spread very thin, the corn is very liable to injure by

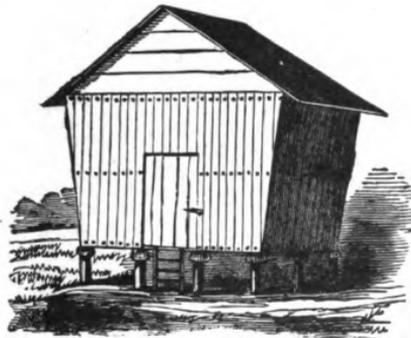


Fig. 224—CONNECTICUT CORN HOUSE



Fig. 225—TIN PAN ON POST

mold. Spread upon the barn floor, it is always in the way, and free plunder to all the rats and mice upon the premises. Corn is more liable to injury from imperfect curing than any other grain that we raise. Wheat, oats, rye, barley and buckwheat are easily cured in the field, so that a few days or weeks after cutting they can be threshed there, and immediately stored in bins or sent to market. But Indian corn has a much

larger kernel, and grows upon a thick, stout cob, from which it takes months to expel the moisture after it is fully ripe.

#### THE CONNECTICUT CORN HOUSE

Figure 224 is the common type of the corn house throughout the east. It sits upon posts covered with inverted tin pans, Figure 225, to make it inaccessible to rats and mice. These posts are a foot or more in diameter, and two or three feet from the surface of the

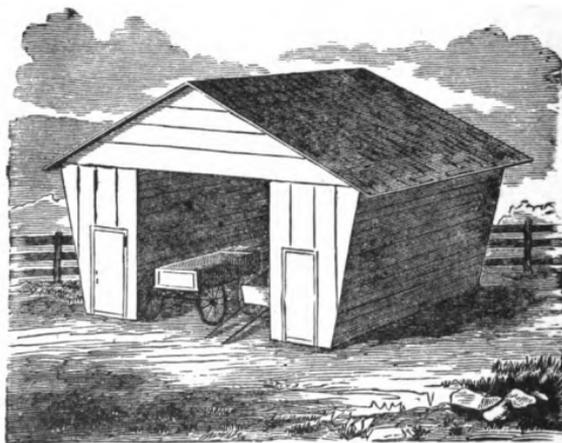


Fig. 226—TWO CRIBS ROOFED OVER

ground to the bottom of the building. Sometimes flat stones, two or three feet broad, are substituted for the tin pans, but the latter are preferred. The sides of the building are made of slats nailed to sills and plates at bottom and top, and to one or more girders between. The bin upon the inside is made by a board partition, three or four feet from the siding. The boards are movable, and are put up as the crib is filled. The remaining space between the bins is used for shelling corn,

or as a receptacle for bags and barrels, and the back part is sometimes used for a tool house, or fitted with bins for storing shelled corn or other grain.

Figure 226 shows two cribs, with a roof thrown over them to form a convenient shed or shelter for carts, wagons and farming tools. Sometimes the passage is boarded up at one end, and furnished with doors at the other. These cribs are entered at one end by a narrow door, and the whole space is occupied by the corn. They are from three to five feet in width, and give very perfect ventilation to the ears. They have usually a stone foundation, with a sill and board floor above. They are made of any desirable size, and cribs holding from 500 to 1000 bushels are common.

#### AN IMPROVED CORN HOUSE

The waste caused by vermin in the corn crib is frequently very serious. Rats are the especial enemy of the farmer in this respect, and any means whereby their ravages may be prevented, will be productive of a great saving. The burrowing rat, which makes its nest beneath the buildings or rubbish piles, does the most mischief in the corn house, and unless it is so made that there are no hiding places, it is impossible to dislodge the rats from their retreat. The corn house, shown in end view, Figure 227, is made so that it is inaccessible to rats or mice, and there are no hiding places beneath it. It is elevated three feet above the ground, on firmly set posts. The cribs are six to eight feet wide, and of any desired length. For 4000 bushels of corn in the ear, the building should be forty feet long, with cribs eight feet long and twelve feet high. The outside is closely boarded and battened. The floor of the cribs is made of three-inch strips, set an inch and a half apart, to admit a current of air. The space between the cribs is

twelve feet wide, and is closed inside, from the bottom of the cribs to the ground, forming an inside shed, which is not accessible to any farm animals or vermin. This inner shed is closed by sliding doors at each end. The cribs are boarded up inside the shed with three-inch strips placed a quarter of an inch apart, to admit air. The cribs are thus weather-proof on the outside, and by opening the sliding doors, free circulation of air can be obtained in fine weather. Above, the shed is floored

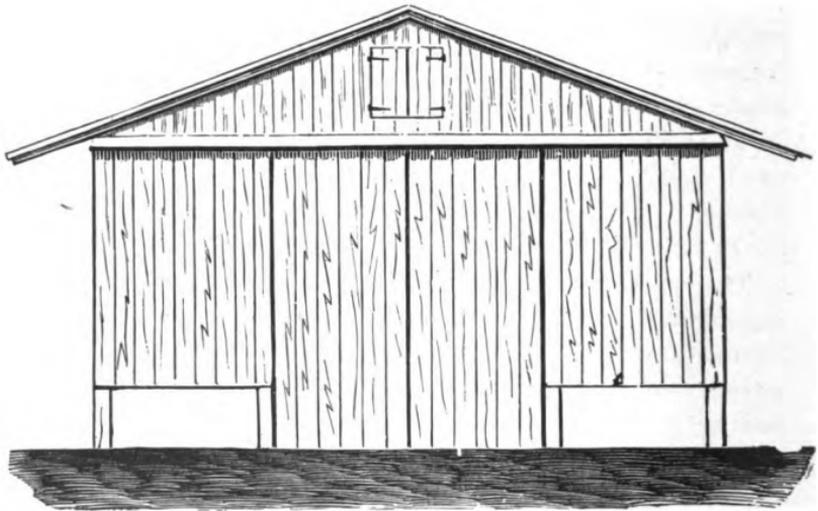


Fig. 227—AN IMPROVED CORN HOUSE

over, forming an apartment twelve feet wide by forty feet long, for storage of corn. A trap door may be made in the center of this floor to hand up corn from below. Any corn that is shelled off from the ears, and falls through the floor, can be picked up by poultry or pigs, and none will be wasted. If desired, lean-to sheds may be built against the sides of the crib, giving valuable room for many purposes. The shed between the cribs will make an excellent storehouse for implements. As many doors can be made in the cribs as may be desired. These should

be sliding doors, and loose boards may be placed across the doorways inside, to prevent the corn resting against them. The roof should be well shingled, and a door made at each end of the upper loft, which may be opened as needed for thorough ventilation.

## WESTERN CORN HOUSES

The accompanying illustrations convey to the reader an idea of the large corn houses, so frequently met with in the great corn-growing west. The one here described belongs to W. S. Wadsworth, Franklin County, Kan. Figure 228 gives a side view of the house, with the end or front in side section. The house is 112 feet long by twenty-eight feet wide, and has a capacity of 18,000 bushels. The manner of storing away corn in a large house like this is an interesting feature. It is done by horse power, which operates a large belt elevator. On the right of the entrance, or floor, of the house, the elevator is seen running from *A* to *B*. This is a strong endless belt of leather, which passes over a pulley, above and below, and has a series of "buckets" attached to its outer surface. The "buckets" or cups are about two feet apart. The pulley, *A*, is connected with one above the letter *D*, and this is turned by a tarred rope, which connects it with the large wooden wheel, five feet in diameter, at the top of the turn post, to which the horse is attached. Thus, by a proper construction of the pulleys, a sufficiently rapid motion of the elevator belt is obtained from the ordinary gait of the horse on the "power." The corn is fed to the elevator cups through a hopper below the floor; shown in cross-section only in Figure 228. The wagon is driven in upon the floor, which is provided with a "dump." A trap door, two and one-half by three feet, is opened at the rear of the loaded wagon. At the same time the floor is so arranged that the whole

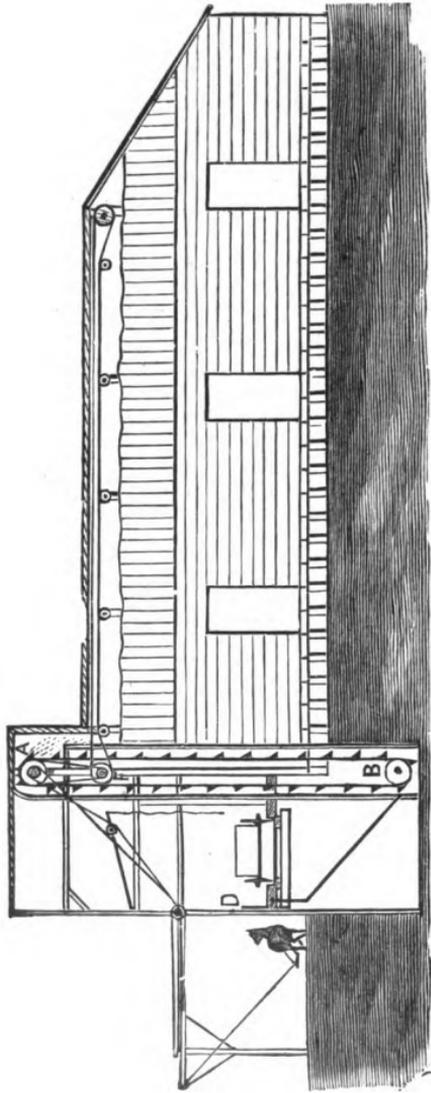


Fig. 228—SIDE VIEW OF A LARGE KANSAS CORN HOUSE

wagon tips back, as shown in side view of Figure 229, and the end board of the wagon box being removed, the corn slides into the large hopper below. It is not necessary to have the whole floor arranged to tip, but simply two narrow sills upon which the wheels must be placed. After the corn is carried from the hopper at *B*, to the top of the pulley *A*, where the cups are inverted, it is thrown upon a long, smooth horizontal

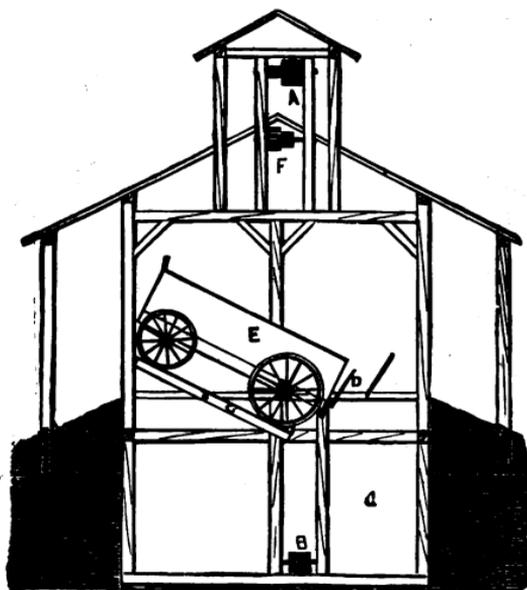


Fig. 229—END VIEW OF MAIN PART

belt, which is run by a cord connecting *A* with the belt pulley at *F*, a short distance below it. This horizontal belt runs the whole length of the storing portion of the house, and just below the ridge pole, as may be seen in Figure 228, a portion of the roof being omitted for the purpose of showing it. This belt may be shortened at any time when the rear of the house becomes filled. A simple sliding chute is used at the

further end of the belt, for the purpose of turning the corn to one side or the other of the house, thus making the distribution of the grain an easy matter. Figure 230 shows a cross-section of the storing room, and gives an idea of the way the sides of the house are braced, by means of ordinary boards, nailed to the sides of the beams which run from the ground to the roof. The house stands on posts cut twenty-six inches long, and set in the ground about one foot, the ground being so raised that no water will run under the corn house.

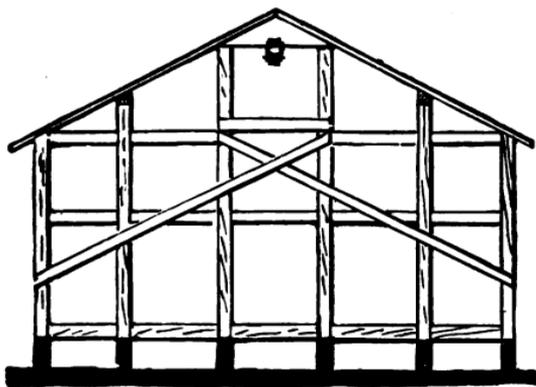


Fig. 230—CROSS-SECTION OF STORE HOUSE

#### ANOTHER WESTERN CORN HOUSE

It will be seen from the engraving, Figure 231, that this corn house stands upon sloping ground, and thus while the roof and floors are level, the floor of each section of twenty feet drops down a step. The entire building is sixty feet in length by thirty in width, and is constructed as follows: It has an alley or cartway running lengthwise through the center, which is ten feet wide at the sills and eight feet wide at the top. On each side of the alley is a crib ten feet wide at the bottom and eleven feet at the top. The outer and inner sides of the cribs are slatted

perpendicularly; the gable ends are close-boarded. Each crib-gable has a door, and sliding doors upon rollers close the cartway at each end. There is a floored loft over the whole, lighted by doors in the ends, which is used for storing grain and agricultural implements. The building rests on fifty-two oak posts, placed on stone bases, set two feet in the ground, and coming six inches above the surface. It is built entirely of native oak and

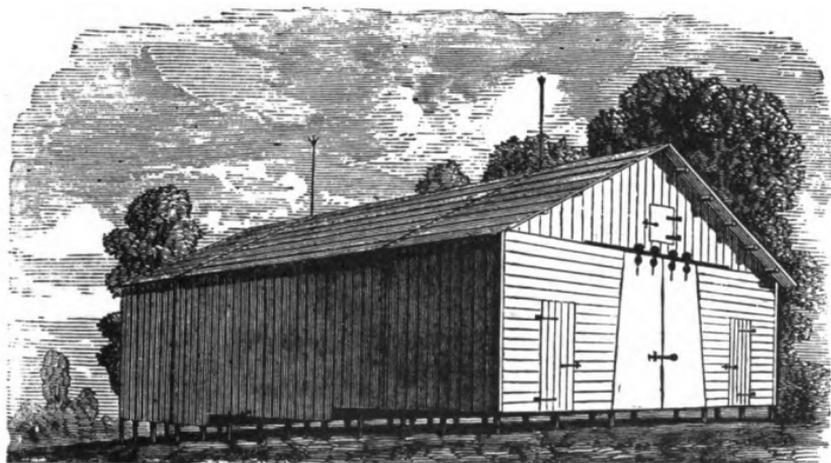


Fig. 231—ANOTHER WESTERN CORN HOUSE

walnut. The posts at one end are ten feet long; at the other, a little over twelve, on account of the slope of the ground. The cribs will each hold 6080 bushels of corn.

#### CEMENT FLOORS NOT SUITABLE

In building a corn crib first get good stone for foundation, and if these are not procurable use brick piers molded in place from Portland cement. On these piers, which should not be more than four feet apart, place two by twelve sills, set up posts or studding two by six, Figure

233, spacing them two feet apart, and spike them to the two by ten floor joists. The floor lies the long way and ought not to be matched. Figure 232 shows the rest of the frame except that the inner studding need not all of it run up to the roof, though each alternate one should do so. Between these double cribs is an excellent place for the wagon and above is a useful scaffold. What the diagram does not show is a set of long braces of two by six, at least twelve feet long, firmly spiked diagonally from

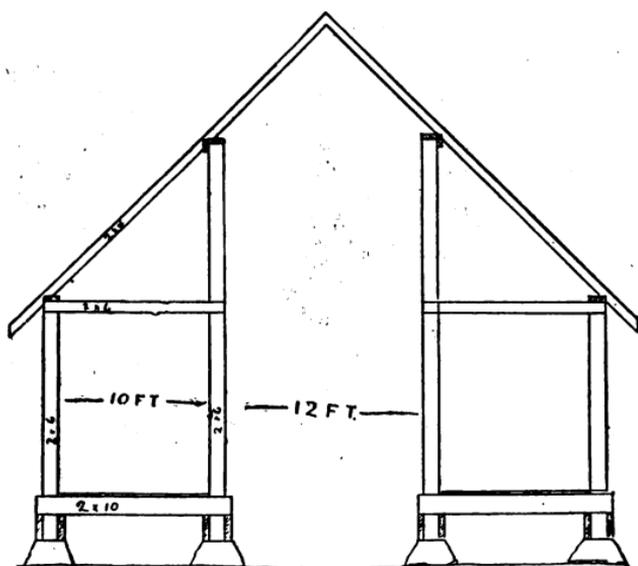


Fig. 232—FRAMEWORK OF CORN CRIB

corner to plate so as to resist wind pressure or weight of grain settling unevenly. Siding need not be matched stuff unless snow blows into cracks of buildings. In many sections it is customary to board up with six-inch stuff and leave the cracks slightly open. This crib is as strong and durable as it need be for any region. The length will depend on the conditions involved. The crib is all of two-inch stuff nailed and spiked together.

This crib will hold about 100 bushels to the running foot of ear corn, filling it ten feet high. The same principle of construction applied to a narrower building, say the bins five feet wide instead of ten, would make a length of forty feet, which would hold about 1600 bushels. As air should be admitted through the bottom it is evident that a cement floor would not do for a corn crib. Cement piers to set the posts on would be excellent and are often used. Have the tinner make pipes of heavy galvanized iron twelve inches in diameter, which should be set on

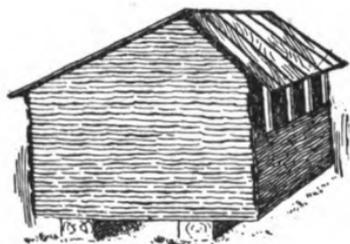
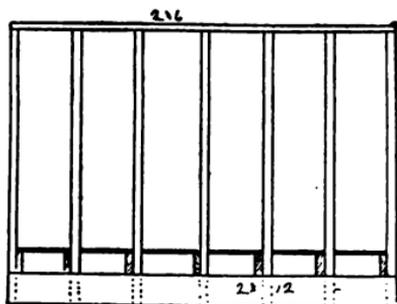


Fig. 233—STUDDING OF CRIB

Fig. 234—SMALL CRIB

flat stones sunk to hard earth in the ground, the pipes filled with cement concrete and the crib set thereon so rats cannot climb them.

## A CONVENIENT CORN CRIB

Figure 234 shows a corn crib which is satisfactory where a small amount of corn is to be kept. It can be made any size desired, but possibly one twenty-five by twelve feet is the most satisfactory. The sides may be made of any kind of rough boards placed about two inches apart, or strips of wood of any character can be used, provided the opening between them is not wider than three inches. The roof is made out of ordinary rough boards

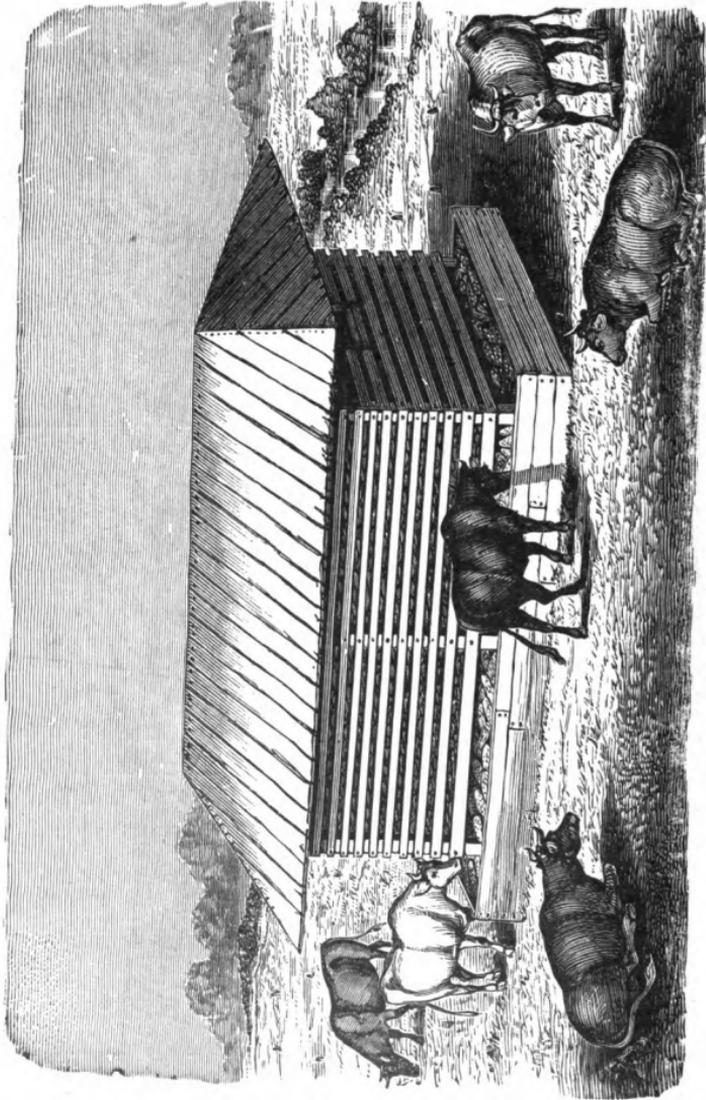


Fig. 235—A SELF-FEEDING CORN CRIB

with battens over the cracks. The crib should be placed at least a foot above the ground, so that it will not harbor rats. The one shown in the engraving is supported by two large sills. Pillars of brick or blocks of wood can be used.

#### A SELF-FEEDING CORN CRIB

In portions of the west, where corn is mainly fed to stock in the open field, a crib may be used which will not only store the corn, but will supply it to the stock as they may need it, without any further handling than merely filling the crib. Corn being very cheap, and labor dear, it is an object to save labor at the expense of the corn. But as hogs are usually kept along with cattle under such circumstances, no corn is lost; what is dropped by the cattle is picked up by the hogs. The crib may be made of logs or planks, but should be strongly built. It is of the ordinary form, but open at the bottom, where it is surrounded by a pen, reaching a foot above the open bottom. The pen is larger than the crib, so as to give room for the stock to reach the corn, and is of a convenient height, or about thirty inches to three feet. The pen is planked over about a foot below the bottom of the crib, and if the space beneath is filled with earth, it will enable the building better to resist, when it is empty, the heavy winds of the prairie. The engraving, Figure 235, shows the form of one of these feeding cribs, which may be made of any suitable size, or of any convenient material.

#### A SELF-DISCHARGING CORN CRIB

A corn crib from which the corn may be taken when wanted, without opening any part of the upper portion, or without the use of a ladder or steps, may be made as shown in Figure 236. The floor slopes from one side

to the other, and its lower margin projects beyond the side of the crib sufficiently to permit of a box in which a scoop or shovel can be used. The projecting part of the floor is made the bottom of a box, that is built upon it, and which is open on the side next the crib, so that the corn will slide into it. A cover is hinged to the box, so that it may be turned up, when corn is to be taken out, as shown by the dotted lines. This cover should be kept locked, for obvious reasons. To facilitate the use of the shovel, the opening into the crib is closed for a space of two feet, either in the middle or at each end. At these

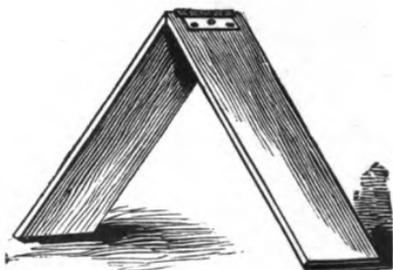
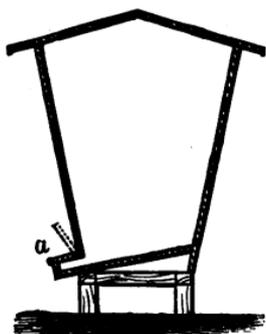


Fig. 236—SECTION OF CRIB

Fig. 237—BOARD RAFTER

closed places there will be no corn upon the floor of the box, so that it will be easy to shovel out the corn. In one part of the west cribs of this kind are in common use, but they are not frequently found elsewhere.

#### A COVER FOR CORN CRIBS

A vast quantity of corn is destroyed or badly damaged by being exposed in open cribs to the rains and snows of the winter and spring. A simple and very cheap method of protecting the log or rail crib, in common use in the western states, is suggested by seeing hundreds of them

filled with corn soaking in the heavy rains of spring. Take two boards six feet long and fasten them together at the end by leather or iron strap-hinges, as shown in Figure 237. They should then be laid across the corn, which is to be heaped up into the center of the crib. As many pairs of these boards are used as may be necessary for the length of the crib, or two pairs for each length of boards, whether that be twelve feet, sixteen feet or

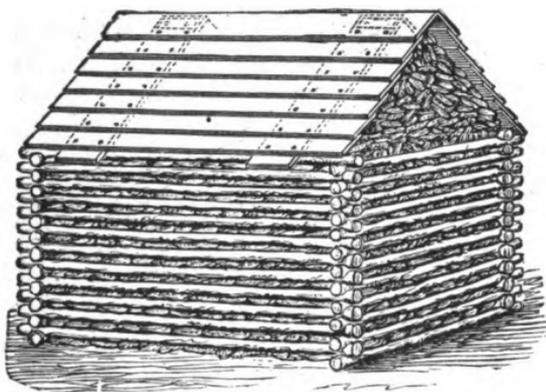


Fig. 238—COVER FOR CORN CRIB

less. Boards are then tacked upon the "rafters" lengthwise of the corn crib, commencing at the lower part, each board overlapping two inches or thereabouts. The nails should be only partly driven in, so that when the cover is to be taken away the nails are easily drawn out with a claw hammer. Figure 238 shows a log crib covered in this manner. It will, of course, be necessary to stay the cover by some means so that it may not be blown off by heavy winds.

## CHAPTER X

### *ICE HOUSES*

#### ICE: ITS USES AND IMPORTANCE

Every year the use of ice increases. It is not merely a luxury, but becomes a necessity so soon as its value is known by experience. As with many other gifts of nature, however, its very abundance causes it to be disregarded; and this mine of usefulness is formed once a year, perhaps almost at the farmhouse door, and allowed to pass away in spring unworked. Ice in the dairy is next to indispensable, for holding milk and cream at a proper temperature and for use in working and keeping butter. This fact is recognized by all well-regulated dairies, and especially in those where high-priced butter is made. Successful dairymen state that the gain in the price obtained for their products by the use of ice many times repays the cost; and in preserving meats, etc., its worth is to be estimated by computing the total value of the things kept from spoiling.

Ice should be cut with a saw or ice plow, not with an axe, into blocks of regular size, so that they will pack into the ice house solidly and without leaving spaces between them. If cut in this manner ice will keep perfectly well, if not more than three inches in thickness; but a thickness of six inches at least is preferable. It should be cut and packed in cold, freezing weather, and if, as it is packed, a pailful of water is thrown over each layer to fill the spaces between the blocks, and exclude the air, it will keep very much better than otherwise. For a day or two before the house is filled it is well to throw it open in order

that the ground beneath it may freeze, and it may be left open for a few days after it is filled, if the weather continues cold. The ice house should be finally closed during cold, dry weather. There are some general principles to be observed in the proper construction of any kind of ice house, and all else is of secondary importance. There must be perfect drainage, and no admission of air beneath, ample ventilation and perfect dryness above, and sufficient non-conducting material for packing below, above and around the ice, by which its low temperature may be preserved. The best packing consists of sawdust, either of pine or hard-wood, spent tan, charcoal powder, or what is known as "braize," from charcoal pits or storehouses, and oat, wheat or buckwheat chaff, or marsh hay.

#### PLAN OF AN ICE HOUSE

A cheap ice house may be made as follows: The foundation should be dug about eighteen inches to two feet deep in a dry, gravelly or sandy soil. If the soil is clay, the foundation should be dug two feet deeper, and filled to that extent with broken bricks, coarse gravel or clean, sharp sand. To make a drain beneath the ice of any other kind than this would be risky, and if not made with the greatest care to prevent access of air, the drain would cause the loss of the ice in a few weeks of warm weather. Around the inside of the foundation are laid sills of two by six plank, and upon this are "toe-nailed" studs of the same size, ten feet long, at distances of four feet apart. Upon these, matched boards or patent siding are then nailed horizontally. A door frame is made at one end, or if the building is over twenty feet long, one may be made at each end for convenience in filling. When the outside boarding reaches the top of the frame, plates of two by six timber are spiked on to the studs. Rafters of two by four scantling are then spiked on to the frame over the

studs, a quarter pitch being sufficient. Or if felt roofing is used, a flat roof with a very little slope to the rear may be made. In this latter case, however, the height of the building should be increased at least one foot, to secure sufficient air space above the ice for ventilation. The roof may be of common boards or shingles, or of asbestos roofing, but it must be perfectly waterproof, and should have broad eaves, to shade the walls as much as

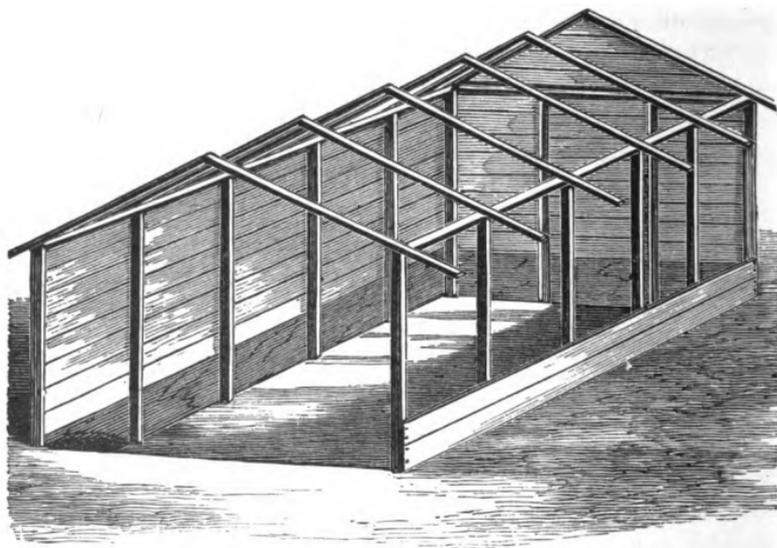


Fig. 239—A FRAME FOR AN ICE HOUSE

possible from the sun's heat. The outside of the building, roof included, should be whitewashed, so as to reflect heat. The inside of the building should be lined with good boards, placed horizontally, the space between the two boardings being filled closely with the packing.

The frame, Figure 239, is closed in on one side and end, and partly boarded on the other side, the front being left open to show the manner of making the frame. A section of the house, filled with ice, is seen in Figure 240; the

lining between the walls is shown by the dark shading. The packing around the ice should be a foot thick at the bottom and the sides, and two feet at the top. There should be a capacious ventilator at the top of the house, and the spaces above the plates and between the rafters at the eaves will permit a constant current of air to pass over the upper packing, and remove the collected vapor. The method of closing the doors is shown in Figure 241. Boards are placed across the inside of the door as the ice is packed, until the top is reached. Rye or other long

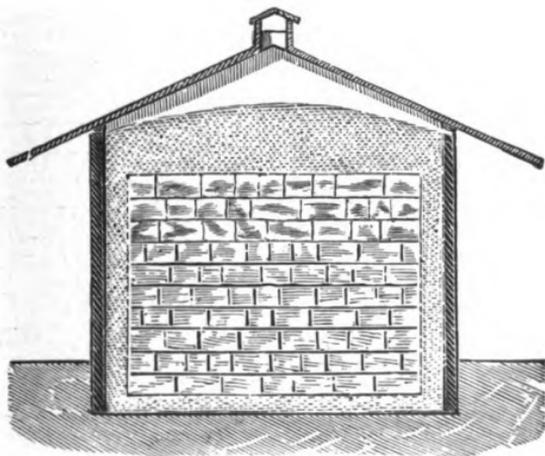


Fig. 240—SECTION OF AN ICE HOUSE FILLED

straw is tied into bundles, as shown in the illustration, and these bundles are packed tightly into the space between the boards and the door. The door is then closed. These straw bundles will effectually seal up the door-space of an ice house in summer as well as the door of a root cellar during winter. When the house is opened in the summer, and the upper packing is disturbed to reach the ice, it should always be carefully replaced, and the door closed up again with the straw bundles. The bundles of straw may be fastened together by means of two or

three cross laths. They can be very readily removed and replaced. The material required for a house such as is here described, twenty feet long, sixteen feet wide and ten feet high, and which will hold over sixty tons of ice, is as follows: Three hundred and twenty-four feet of two by six studding; twelve rafters two by four, twelve feet long; 576 feet of matched boards; 720 feet of boards for lining; 480 feet of roofing boards; 3000 shingles, or 480

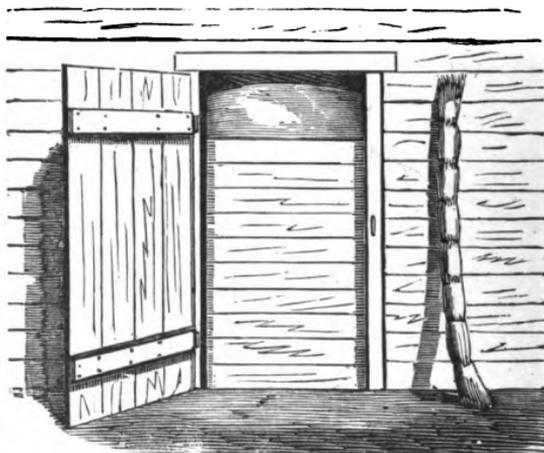


Fig. 241—DOOR FOR ICE HOUSE

feet of roofing boards; one batten door, hinges and nails. About twenty-five wagon loads of sawdust or some other non-conductor will be required for a house of this size.

#### A CHEAP ICE HOUSE

Figure 242 illustrates an ice house that can be quickly erected at a very slight outlay for materials, and at the cost of only a few hours' labor. The size is determined by the length of the planks or boards to be used. Nine posts, rough, sawed or hewn, of suitable length, are provided, and two put up at each corner, as in Figure 243,

resting upon a block of wood or a stone, or set in the ground. The ninth post is placed at one side of the front, to serve as one side of the door. The bottom planks, all around, are nailed to the posts, which may be more firmly secured in place by cleats connecting those at each corner; the front posts are a foot or so longer than the others, to permit of a shed roof. A plate of light scantling secures the tops in place. Now it is ready for the ice. First,

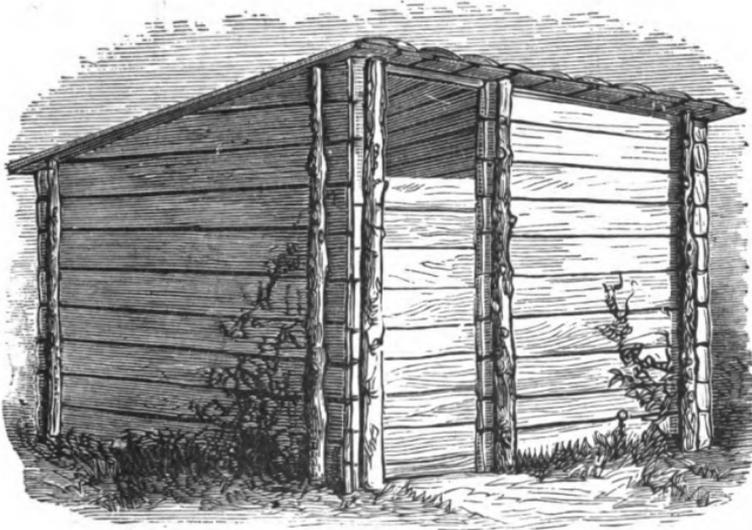


Fig. 242—CHEAP AND PICTURESQUE ICE HOUSE

sprinkle on the ground a layer of sawdust, shavings or cut hay, so that it will be at least six inches deep, when firmly packed down. Then put in the first tier of ice, keeping the blocks a foot away from the plank wall; fill the space solidly with the sawdust or other packing material, *a*, Figure 243; place the second tier of ice; next, put in position more planks, and so on, until the house is filled, storing the ice, and carrying up the wall together, and filling in between with sawdust, etc., as the work progresses. The planks need only be slightly nailed, to keep

them up when the ice is removed, as they will be held in position by the posts without, and the pressure from within. A door, *b*, is made by simply using two lengths of plank on the front side, as indicated by the posts in

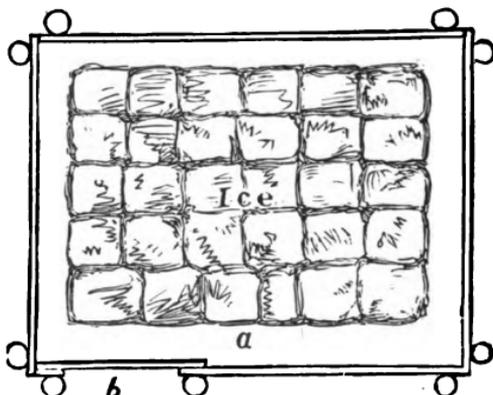


Fig. 243—GROUND PLAN OF FIGURE 244

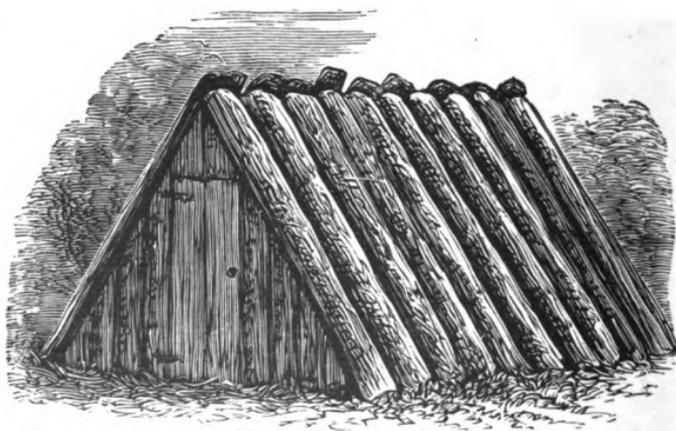


Fig. 244—ICE HOUSE OF DONALD G. MITCHELL

Figure 243. When the house is full a thick layer of the packing material is put on the top of the ice. Drainage is secured by placing the structure on sloping ground. A roof of slabs, a thatch, or anything to keep out rain,

is sufficient. With a little taste this may be made quite pleasing in appearance. Figure 244 represents the ice house on the Connecticut river of Donald G. Mitchell (Ik Marvel), made picturesque by a roof and ends of rough slabs. The main part of the ice room is below the surface of the ground, and may be constructed of stones or timber. Ice houses can have their appearance improved by the free use of climbing vines. These answer not only as an embellishment, but serve a useful end in breaking the force of the sun's rays and keeping the building much cooler than it would be under full exposure. It costs but little more to make the smaller farm buildings tasteful and picturesque in appearance than to have them look ugly and cheap.

## A SMALL ICE HOUSE

The base, Figure 245, is a frame of eight by eight-inch hewn or sawed timber, forming a square, twelve by twelve feet. This is laid on a stone foundation, or on corner posts set in the ground, and filled underneath with stones and mortar if accessible; earthing up will answer. A similar square frame is made for the plates, and this is supported at the four corners with eight by eight-inch posts, eight feet long, and by two by eight-inch studs, say three on each of three sides, and two as door posts on the front side. Figure 246 shows a vertical section through the middle. The outside, Figure 247, is covered with inch boards. Rough pine boards, somewhat knotty, will answer. The cracks may be covered with narrow battening. Inch boards, laid horizontally, line the inside up to the plates, and the eight-inch space between is filled with sawdust. The flooring is simply boards laid upon the ground or upon small cobble stones. The roof is only one thickness of inch boards, with batten pieces over the cracks, and is supported by three hori-

zental strips on each side, laid across rafters. The rafters are scantling, beveled and nailed together at the top, and set into or firmly spiked to the plates. About half of the middle of the ridge is cut out, leaving an opening four or five inches 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 the rain. The doors are of a single thickness of inch boards. The outside boards can be rough, or planed and painted to correspond with the house or other buildings. When filling the house, five or six inches of

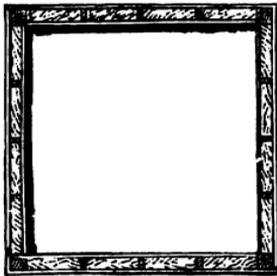


Fig. 245—THE WALLS

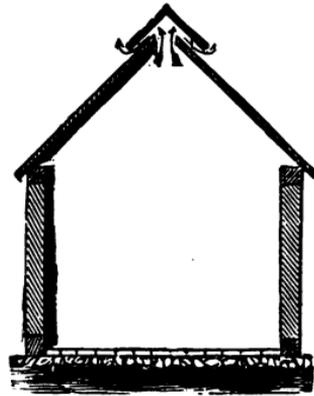


Fig. 246—VERTICAL SECTION  
OF ICE HOUSE

straw and sawdust are put on the floor. The ice is packed solidly on this, but a space of six or eight inches is left on all sides, which is packed in with sawdust. Any spaces or cracks between the cakes of ice are also filled with sawdust. Short pieces of horizontal loose boards support the sawdust inside the door. These are put in as the filling proceeds, and taken out as the ice is removed from time to time. The ice is filled in some distance above the plates, and finally covered over with a foot or so of sawdust. This suffices to keep out the sun and air

heat. Experience proves that this surrounding of sawdust on all sides will keep the ice well during the entire summer season.

Those not having access to lakes or ponds can easily make an artificial pond in a prairie slough, or other depression of ground, large enough to furnish ice for filling a small house like the above. In this house there is a mass of ice say nine feet square, or about two and one-third tons for each foot in height.

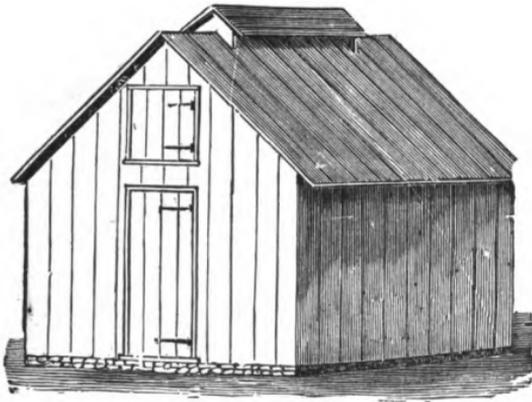


Fig. 247—SMALL ICE HOUSE COMPLETE

#### UNDERGROUND ICE HOUSES

Figure 248 shows an ice house built partly underground. Where the soil is gravelly and porous, it may be built more cheaply than one wholly above ground. The excavation may be made as deep as desirable, perhaps six or eight feet will be sufficient. There must, however, be perfect freedom from surface water, or the house will be a failure. The bottom may be made of a layer of large stones, two feet deep. Upon this smaller stones should be laid, to fill all the inequalities and form a level surface, and there should be placed upon these a layer of coarse

gravel. This may form the floor of the house. The walls, up to a foot above the surface, may be built of stone laid in mortar or cement, and the sill of the upper frame should be bedded in the stone work and cement. The posts and studs, ten inches wide and two inches thick, should be framed into the sill, as in Figure 249—*a* being the sill shown in section, *b* the stud, and *c* the tenon at the foot of the stud, and the mortise in the sill. In Figure

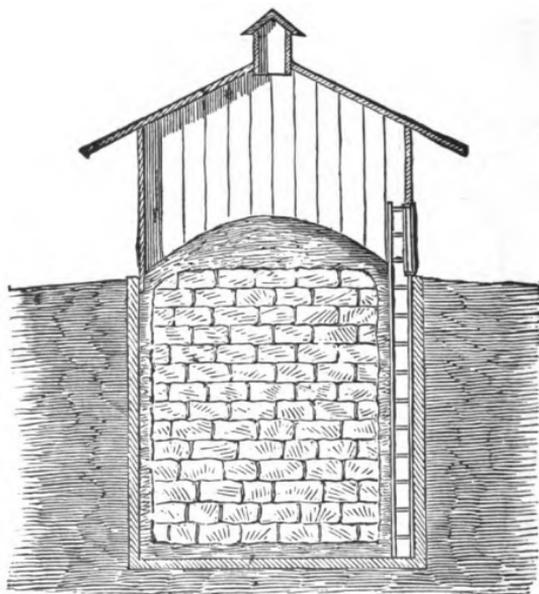


Fig. 248—SECTION OF UNDERGROUND ICE HOUSE

250 the manner of framing the corners is given, *a, a*, being the sills, and *b, b, b*, the studs. One stud is placed at the end of one sill, and another one inch from it, at the shoulder of the adjoining sill. Thus the outer boards may be nailed firmly at each corner, and a good joint also be made inside, by inserting the boards on one side between the two corner studs at *c*. This plan saves the cost of heavy corner posts, and gives equal firmness to the

building. The corner can also be filled with sawdust, making it a poorer conductor of heat than a solid post. For convenience in taking out the ice, a ladder should be



Fig. 249—METHOD OF  
FRAMING

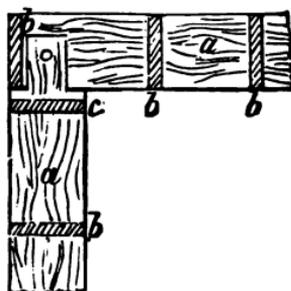


Fig. 250—FRAMING THE  
CORNER

built against the inner wall. This is covered by the packing, when the house is filled, but as the ice is taken out, the ladder is exposed for use.

#### AN ICE HOUSE IN THE BARN

The following is a method of putting up ice in a corner of the barn, without anything more than a few boards and some sawdust. The coolest corner of the

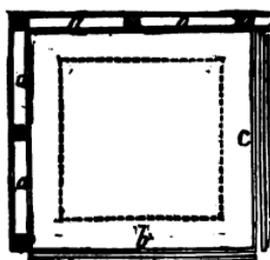


Fig. 251—PLAN OF ICE  
HOUSE IN A BARN

barn is set apart for the ice and a board is nailed to the floor on each side of the corner, or across it. One of these should be just beneath a beam of the upper floor. Some rough boards are tacked to the posts of the barn wall, up to near the top. A batten is then nailed to the floor, one inch from the board; this makes the foundation, the

ground plan of which is shown in Figure 251. The spaces, *a, a*, are filled with sawdust. The ice is then packed in

the space bounded by the dotted lines, a foot of sawdust being placed beneath it. The sawdust is kept in at the sides, *b* and *c*, by upright boards placed against those nailed to the floor and a beam above it, or the board nailed to the beam. When all the ice is in, it is well covered on the top, a space for a door being left in the boarding above the ice. Then a second row of boards is

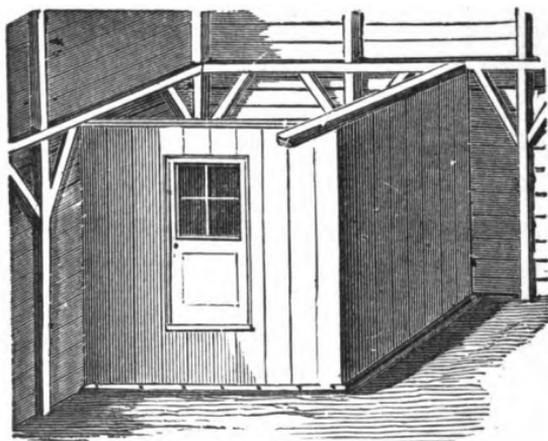


Fig. 252—A VIEW OF AN ICE HOUSE IN A BARN

placed outside of the wall already built, and fastened to it, as may be most convenient, a door space being made to match the inner one. The space between these walls may be filled with cut straw, sawdust, clover chaff or any other non-conducting material, up to the height of the ice within. There is no need of closing the door space; it will be better to leave that open for ventilation. Figure 252 shows the outside of this ice room as it appears from the barn floor. Such a space as this may be easily arranged in many barns.

## A CHEAPLY CONSTRUCTED ICE HOUSE

The house shown in Figure 253 is the cheapest building that can be constructed for storing ice. It may be built as long or short as desired, varying with the amount of ice to be stored. It is not made for beauty, but for service. Evergreens should be planted on each side, as they help to keep the house more cool in hot weather. For its construction, boards sixteen feet long are used, longer or

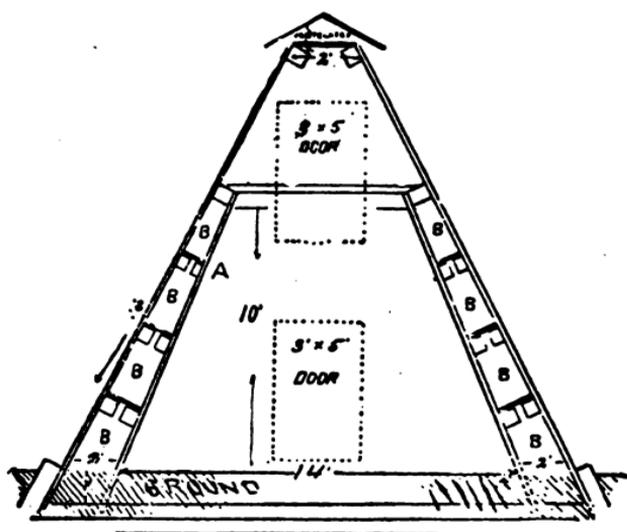


Fig. 253—A-SHAPED ICE HOUSE

shorter according to the capacity desired. The girths may be of two by three or two by four-inch scantling and three feet apart. Shingles are not required. The cracks on the outside may be covered with boards or battened. Such a house will be in serviceable use at least twenty years. The ground should be dug out a foot deep. Two doors may be made, one above the other and each three by five feet. At *A* the boards are cut sufficiently to allow putting

in sawdust. The filling in the spaces *B* is also made with sawdust. The filling is less at the top than the bottom, as the top will be used before hot weather sets in. Being built in this shape there will be no pressure on the sides should the ice melt more at the bottom than the top. An ice house of the dimensions here described will contain about thirty-five tons.



Fig. 254—AN ICE STACK AGAINST A BANK

#### ICE WITHOUT HOUSES

In England, when they have an unexpectedly good crop of ice, the blocks are gathered, stacked up in some favorable place and covered with a thick layer of straw. In that cool climate such stores of ice frequently last the season through; in this country a similar stack might often be made to help out the regular supply. Figure 254 shows one of these temporary storehouses, built against a bank. The ice is shown at *A*. The outer wall, *B*, is of

“fern,” but straw would answer equally well, held in place by boards and braces, as shown at *B*. The stack of ice is covered by a little straw, then eighteen inches of fern, and the thatched roof, *C*, is put over the whole. An ice stack of this kind answers perfectly when placed on an incline so that the water may naturally drain away.



## CHAPTER XI

### *ICE HOUSES AND COOL CHAMBERS*

The principal requisites for an ice house with a cool chamber below it for milk or fruit are: A locality where the ice can be expeditiously placed in the upper part and provision for drainage to carry off the waste from the ice. A hillside is the most convenient position for such a house. The method of construction is the same as for

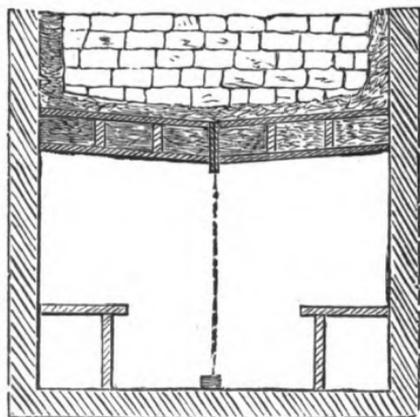


Fig. 255—INTERIOR VIEW OF A COOL CHAMBER

any other ice house, excepting in the floor. The walls are double, and are filled in between with sawdust or other non-conducting material. The roof should be wide in the eaves so as to shade the walls as much as possible, and it will be found convenient to have a porch around the building, on a level with the floor of the ice house. The floor of the ice house must be made not only water tight, but air tight. If a current of air can be

established by any means through the floor of the house the ice will melt away in a very short time. A double floor of matched boards should be laid, tarred at the joints and between the floors. The joists are placed so that the floor slopes from both sides to the center, to collect all waste water from the ice. A channel is made along

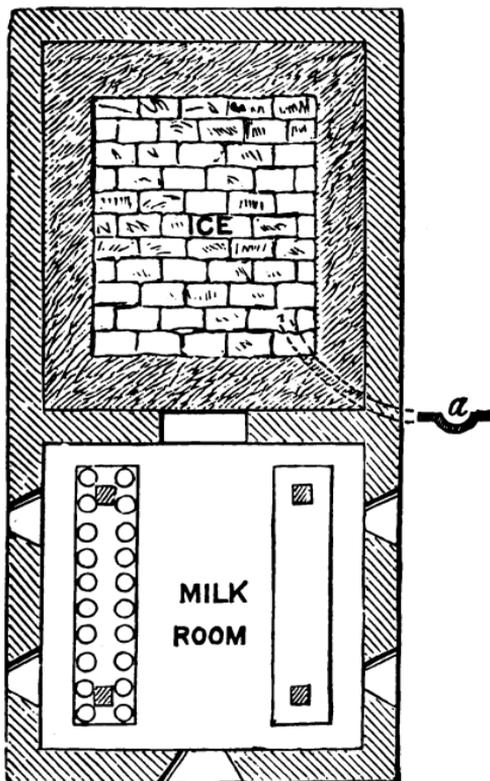


Fig. 256—ICE HOUSE AND MILK ROOM

the center to carry the water to the side of the building, where it passes off by means of a pipe, with an  curve in it, to prevent access of air. Or the pipe may be brought down through the lower chamber and made to discharge into a cistern, where the water is kept al-

ways above the level at which it is discharged from the pipe. The method of this arrangement of the floor is shown in Figure 255, which represents a section through the floor and lower chamber. The shelves are seen in place upon the sides.

Such cool chambers may be used to preserve fruit, vegetables or other perishable matters. Some ventilation

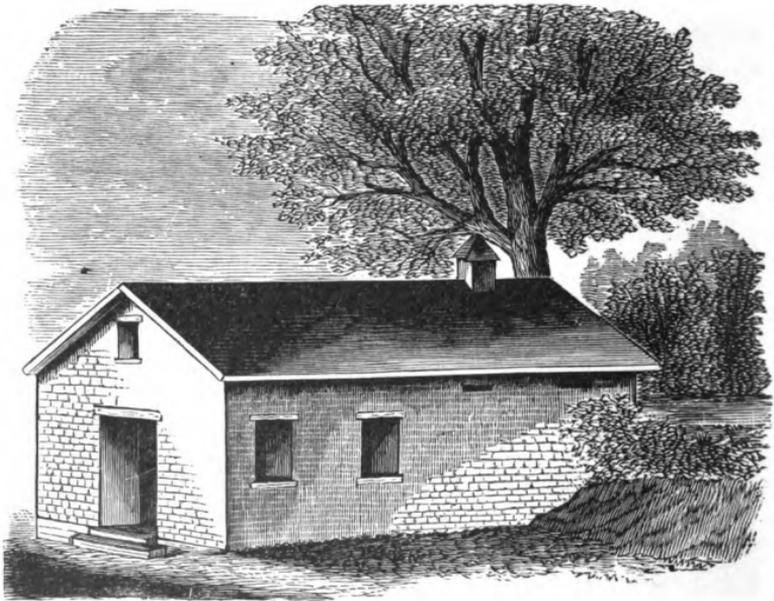


Fig. 257—ANOTHER ICE HOUSE

and circulation of air in them is necessary to prevent mold or mildew, and it would be preferable to build the lower story of brick or stone rather than of wood. The upper part of the building could be built of wood as well as of any other material. A temperature of forty degrees has been maintained in such a chamber throughout the summer, but this can only be done where the soil is very dry and gravelly.

Another plan of an ice house, including an apartment in which meat or milk may be kept cool, is shown in Figure 256. A drain should be made to carry off all water from the melted ice. A piece of lead pipe, bent in the shape represented at *a*, Figure 256, should be made to carry off the water. Any current of air, which would be fatal to the preservation of the ice, would thus be prevented from entering at the bottom. The size of the ice room should not be less than ten feet inside. The walls should be



Fig. 258—ICE HOUSE AND REFRIGERATOR

double; they may be of common boards, battened over the cracks, with a space of ten inches left between them. This space may be filled with any light, dry, porous material. Sawdust, tan bark, swamp moss, chaff or charcoal dust would any of them be excellent material for this purpose. The filling should be carried up to the eaves. The roof need not be double, but it should be tight, and ventilators will be required just below the eaves

and out of the roof, to allow a free current of air through the top of the house. The doorway leading to the milk room requires no door, but simply short boards put across as the ice is built up. The ice should be cut in blocks nearly of a size, and packed away as closely as possible, all crevices being filled with small pieces. Choose cold weather for this business, and open the house so that it may be thoroughly reduced in temperature. The milk or meat room is seen in the lower portion of the plan, with ranges of shelves on each side, and windows also, for ventilation. They may be closed with wire gauze double screens and shutters, to exclude the heat in summer. Figure 257 shows the whole building; it is all the better if shaded by a few large trees. A coat of whitewash over the whole, including roof, would keep the interior cooler, as the heat would be reflected and not absorbed.

#### A CHAMBER REFRIGERATOR

The engraving, Figure 258, represents a section of a building, with a room partitioned off in such a manner that it has ice on three sides and the top, and its floor is below the surface a few feet, in order to take advantage of the coolness of the earth. The double wall of the ice house extends in front of the open room, and the door is protected by a porch. A shallow cellar under the floor of the ice house admits ventilation by the passage of cool air under the ice, and thence off through a flue. The floor and ceiling of the room slope, to secure the necessary drainage.

## CHAPTER XII

### *DAIRY HOUSES, CREAMERIES AND CHEESE FACTORIES*

Perfect control of the temperature of the dairy is a great step gained toward making the best butter. It is only by means of ice, or very cold spring water, that we can keep the most desirable temperature in very warm

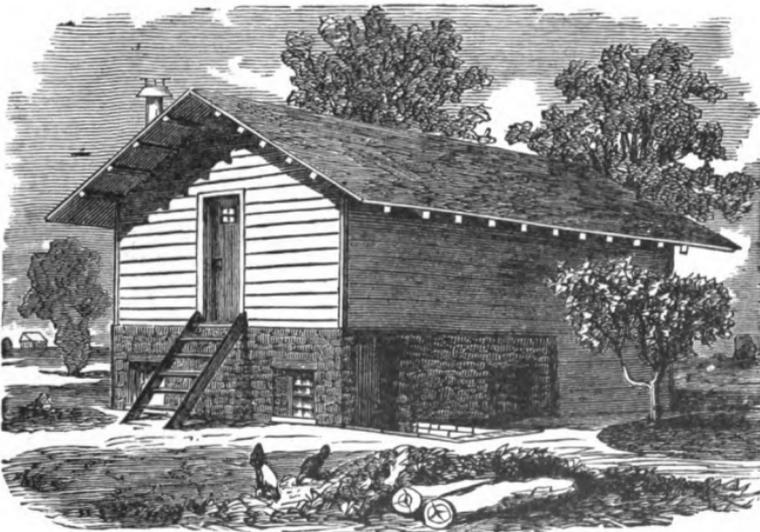


Fig. 259—AN ICE HOUSE AND A DAIRY COMBINED

weather. During much of the year there is little difficulty in maintaining sufficient coolness. In winter the problem is how to keep a dairy warm enough, and not get it too hot. A combination of the dairy and ice house may be made, and is entirely practical.

## ICE HOUSE AND SUMMER DAIRY COMBINED.

The plan proposes an ice house above ground, and a dairy half below. The ice room half covers the dairy, the rest of the dairy being below the cool room, which forms the entrance to the ice house. The exterior walls

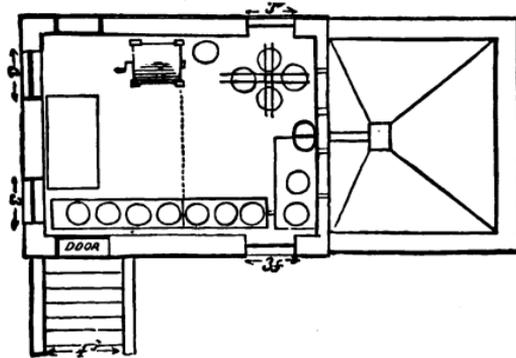


Fig. 260—GROUND PLAN

of the ice house are of wood; those of the dairy are of stone. The floor of each room is laid in cement, with a slope sufficient to carry off the water. The drainage of

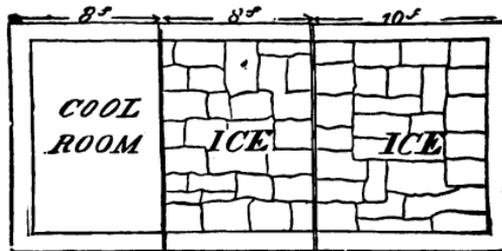


Fig. 261—PLAN OF UPPER PART OF ICE HOUSE

the ice house is collected and made to pass by a pipe into a vessel in the dairy, where the end of the pipe is always covered with water. The water is allowed to flow through shallow troughs in which milk pans may be set. The

amount of water would not be large, but it will be cold, and ought not to be wasted. Its use will not interfere with the employment of water from springs or wells for the same purpose.

The building represented in the perspective elevation, Figure 259, is twenty-eight feet long by fourteen feet wide. The ice room seen in Figures 260 and 261 is ten by twelve feet on the ground, and about twelve by sixteen feet, including the space above the dairy. The sides of the building are nine feet above the ground, and the height of the dairy seven feet in the clear. The outside

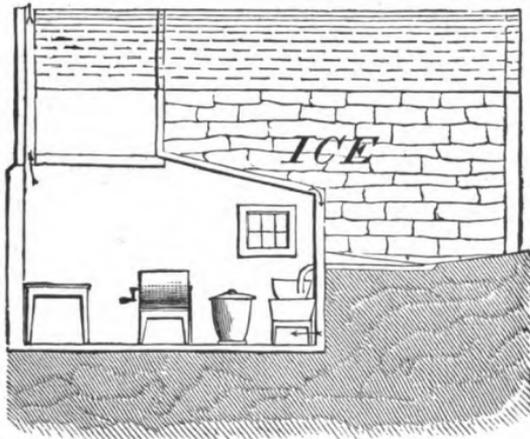


Fig. 262—SECTION OF ICE HOUSE AND DAIRY

walls of the ice house are made of two-inch plank, ten inches wide, set upright, with inch-and-a-half planks nailed on the inside. They are weather-boarded on the outside, and filled with spent tan bark, or other dry, non-conducting substance. The partition wall between the dairy and the ice house, and between the cool room and the ice house, is half the thickness, and not filled, thus forming closed air spaces between the studs. These spaces communicate with the dairy, by little doors near

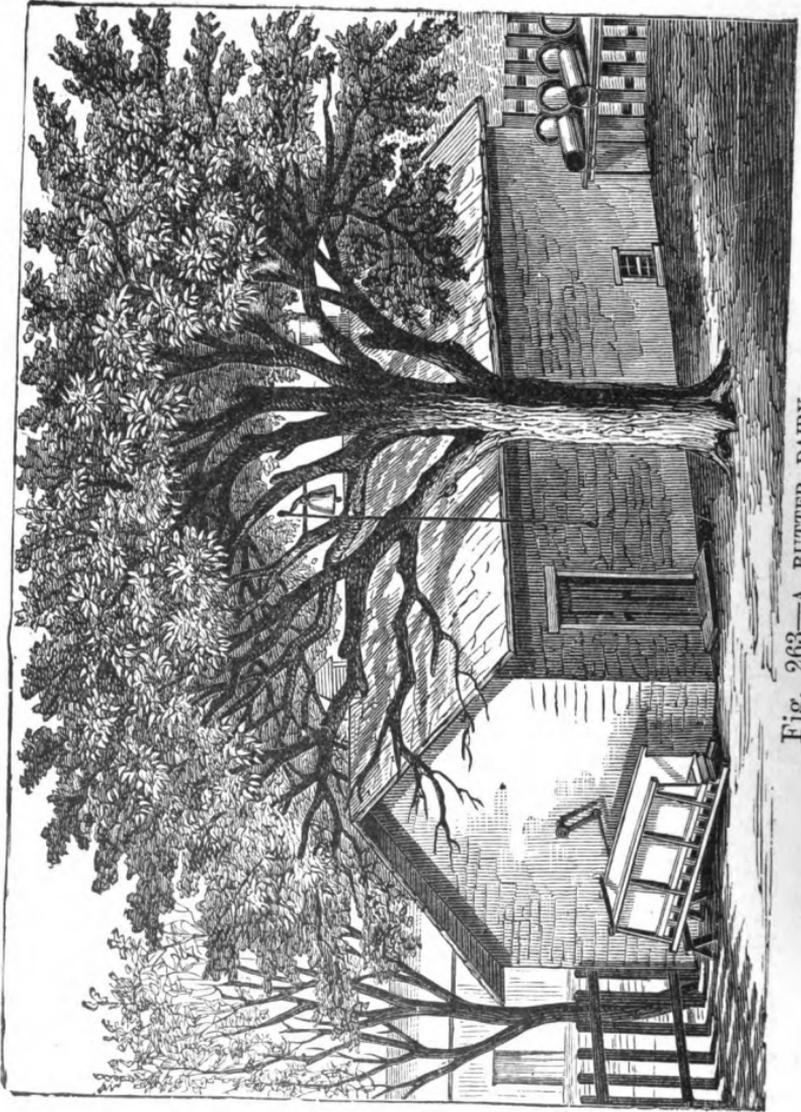


Fig. 263—A BUTTER DAIRY

the floor, and so currents of cold air may be established and perfectly regulated, entering the dairy on the side toward the ice house. These, with a ventilator at the top of the room for carrying off the warmest air, easily regulate the temperature.

#### A BUTTER DAIRY

Figures 263, 264 and 265 illustrate a dairy managed upon the old-fashioned shallow-pan system, the pans used being the common tin ones, holding about ten quarts.

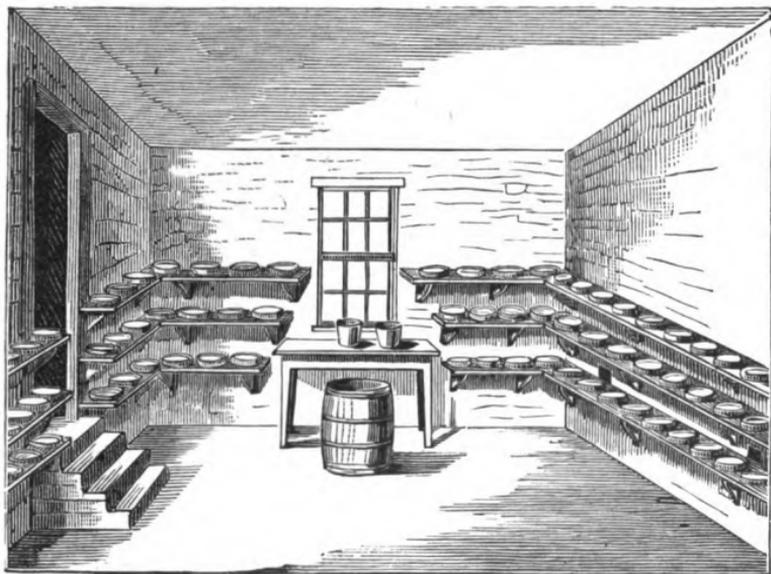


Fig. 264—INTERIOR OF THE MILK ROOM

Such a building is also well adapted for any other system, such as a separator or creamer.

The building should be of stone, or if of wood, built with at least six-inch studs, and closely boarded with joints broken upon the studs and battened, the inside being well lathed and plastered. For thirty cows the size required

would be thirty-six by sixteen feet, and ten feet high; twenty-six feet of it sunk four feet below the ground. The milk room and ice house are placed in this sunken part, the other portion being used for the churning room. Steps lead from the churning room down into the milk room. The ceiling is plastered, and an attic is left above to keep the rooms cool; a ventilator also opens from the milk room and passes through the roof. Figure 263 shows the general elevation of the dairy, which is one belonging

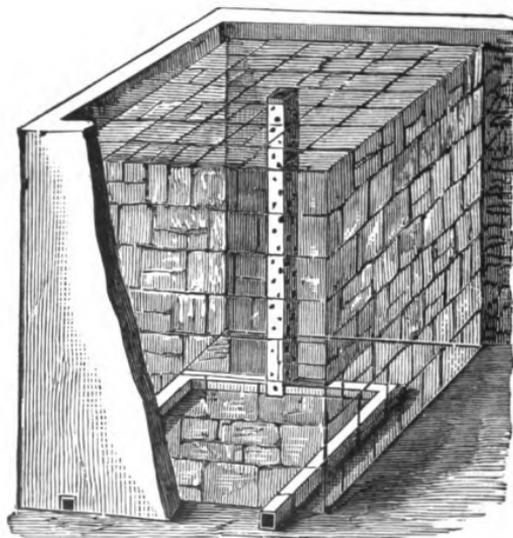


Fig. 265—ICE HOUSE AND PIPES

to a successful dairy farmer in the state of New York. The churning is done by horse power, and the position of the power outside of the building is seen in the engraving. The churning room contains a pump, sink and wash bench.

Figure 264 shows the milk room, four feet below the level of the churning room. There are three ranges of shelves around the room, with a table in the center. In the winter this room is kept at a regular temperature of

sixty degrees by means of a stove, and in summer is cooled to the same temperature by an inflow of cold air from the ice house which adjoins it. This is admitted through two openings in the wall at the right and just above the lower shelf. Figure 265 shows the arrangement of these cold air pipes in the ice house. A tube passes downward through the center of the ice, and at the bottom of the ice branches into two arms, which are made to turn at right angles, and after passing through the ice appear in the wall of the milk room. Whenever desirable, a current of cold air, moved by its own gravity, passes through these pipes into the milk room, filling it, and displacing the warmer air, which is forced out through the ventilators in the ceiling. In this manner the necessary regular temperature is kept in the milk room without regard to the degree of cold or heat which may exist outside. The size of the milk room is sixteen feet square; it has but one window, and that upon the north side.

## A PENNSYLVANIA DAIRY

A building, owned by Mr. E. Reeder, Bucks County, Pa., is shown in Figure 266. It is thirty-four feet long and fifteen feet wide, and stands at a distance from any other building or any contaminating influence. It is divided into five apartments, viz., the ice house, seen at *a*, Figure 267, the milk room, *b*, the vestibule, *c*, with stairs leading to the winter milk room below, and an attic above, for the storage of sawdust for the ice. The ice house is twelve feet square and fourteen feet deep, holding thirty-six loads of ice, or over 2000 cubic feet. It is six feet below ground and eight feet above. The walls are of stone, eighteen inches thick. The frame building above the wall is eight feet high. The lining boards of the ice house extend down the face of the wall to the bottom, making an air space of eighteen inches, which is filled

with sawdust. The ice house is filled through three doors, one above the other, at the rear end. There is perfect drainage at the bottom of the house, with ample ventilation above, and no currents of air reach the ice.

The milk room, *b*, is twelve feet square, and is one foot lower than the ice room. It is divided into two stories of seven and one-half feet each, for winter and summer use.

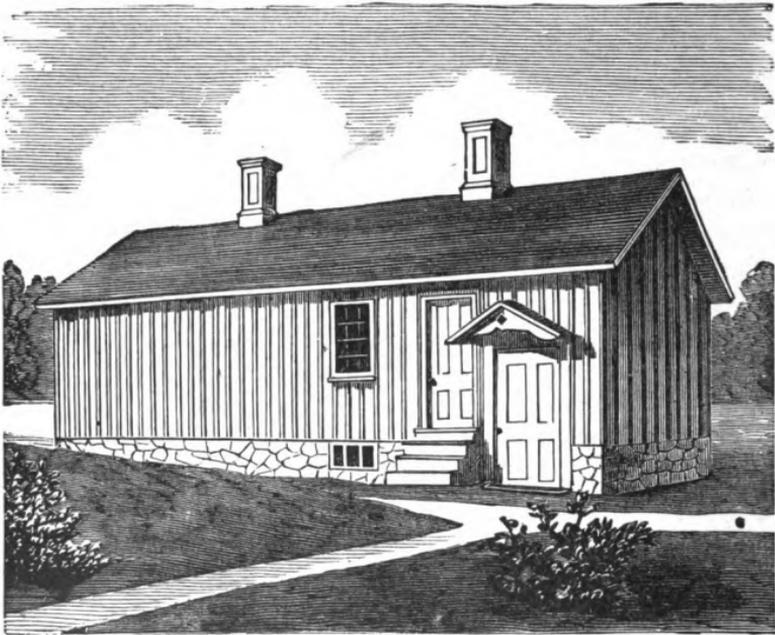


Fig. 266—A PENNSYLVANIA DAIRY HOUSE

A ventilator enters the ceiling of the lower room, and leads to the cupola at the top, furnishing complete ventilation for both rooms. The vestibule, *c*, is four feet wide and eight feet long. Here the milk is strained and skimmed, the butter worked and the pans are stored. The floor is of flagging laid in cement, as is that of the winter or lower dairy. The pool, *d*, which contains ice water, is thirty-six inches long, sixteen inches wide and

twenty inches deep; in this the deep pans and cream cans are immersed. The waste from the ice box, *e*, can be turned into this pool. If the deep can system of setting milk should be practiced, this pool can be lengthened to twelve feet. A drain, *f*, carries off all the waste water from the room. At *g*, Figures 267 and 268, is a cooling cupboard, located in the wall between the ice house and the milk room, six feet high, four feet wide and eighteen inches deep. This is lined with galvanized sheet iron, has a stone slab at the bottom, and two slate shelves fifteen inches wide, on which the cakes of butter are hardened before they are packed for market. A current of cold air can circulate around the shelves, as they

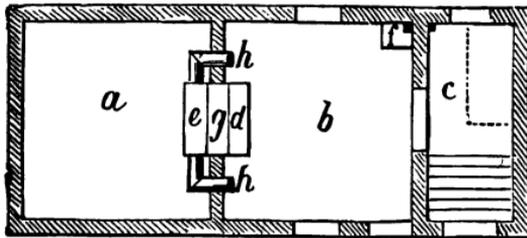


Fig. 267—PLAN OF THE DAIRY HOUSE

are three inches narrower than the depth of the cupboard. There are latticed blinds in the doors of the cupboard, seen at *i, i*, Figures 268 and 269, where the doors are shown as opened and closed. A current of cold air can pass through the lower lattices, and this causes an equal current of warmer air to pass through the upper ones. This warmer air, cooled by contact with the ice box, *e*, passes down and out into the milk room, where a temperature of sixty degrees is easily maintained. By closing or opening these lattices the change of temperature is regulated as may be desired. At *h, h*, Figure 267, are ventilating pipes, which are provided with registers, seen at *r, r*, Figures 268 and 269. These communicate with the air chamber beneath the ice box, and also with

air flues at each end of it. Thus two additional currents of cold air can be created when they may be needed. The windows of the lower milk room are close to the ceiling, and above the surface of the ground outside. They are three feet eight inches high, and are made with outer wire cloth screens, glazed sashes and inner shutters or blinds. The milk room can thus be aired and darkened at the same time, if it is desired. In operating this dairy it has been found necessary to use ten to fifteen bushels of ice weekly, in the hottest weather in sum-

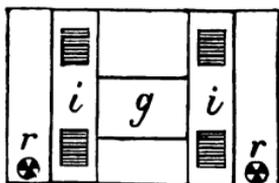


Fig. 268—DOORS OPEN

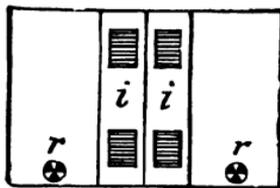


Fig. 269—DOORS CLOSED

mer, the ice box then requiring filling two or three times each week. The air within the milk room has always been dry, so that the floor will not remain damp longer than a few hours after it is washed.

#### A DAIRY HOUSE FOR HOT CLIMATES

Where the summer heat is excessive, to keep dairy premises cool and at an even temperature is frequently a question of grave importance. Where water can be procured and economically applied, there is perhaps no cheaper or more simple plan of cooling a dairy than that adopted by Mr. Henry Fredricks of Australia. Mr. Fredricks has the good fortune to own a hill farm, on which numerous springs of pure, cool, fresh water find their source. Many of these springs are of considerable volume, and have ample fall. One of these Mr. Fredricks has utilized by piping it, and running it on to the top of his dairy

by gravity. As will be observed by reference to Figure 270, a pipe is run up the side of the dairy, and connects with other pipes traversing the roof horizontally. One of these pipes is on the ridge, and another pipe surrounds the building about half way down the roof. Both these pipes are perforated, and the water is forced out on to the roof in small jets and sprays, and runs down and is caught in the gutter, like rain.

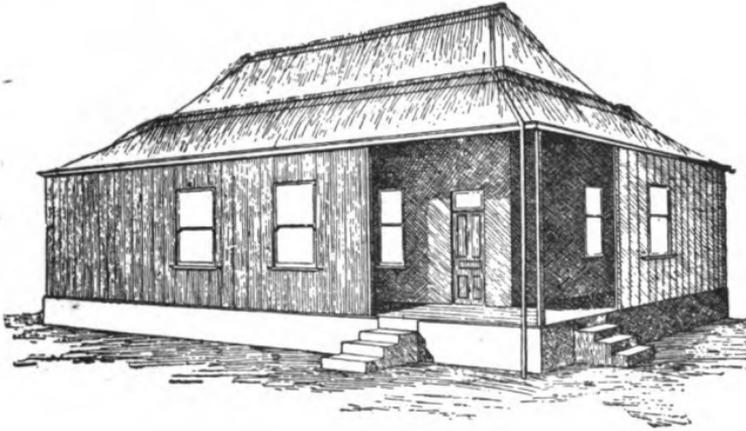


Fig. 270—AN AUSTRALIAN DAIRY

The dairy is constructed on improved principles. It has a double roof, and is virtually double-walled, as an enclosed veranda surrounds it on all sides, and apart from the application of water to the roof for cooling purposes, it is a model dairy in every respect. By its construction, and the means adopted to apply water to the roof, this dairy can be cooled to almost any temperature desirable, in the hottest day in summer, in a very short time. After the water is applied for cooling purposes it is used to irrigate the fields when necessary.

#### A FARM CREAMERY

In Figures 271 and 272 we give perspective and ground plan for a farm creamery, or dairy house, not connected

with other buildings. Dimensions have been purposely omitted, because the general arrangement adapts itself to almost any size that may be required. *A* represents



Fig. 271—MODEL FARM CREAMERY

the main work room, containing separator, *d*, churn, *e*, and butter worker, *f*, with space for ripening tank, sink, table, scales, etc. *B* is the store room or refrigerator with ice box, *g*. *C* is the power room, in which may be located a small engine and boiler, or a one or two-horse tread power.

In locating this building, the double doors opening out of *C* should look to the barn and stable and the opening in the opposite side, from *A*, leads to the house. The dotted

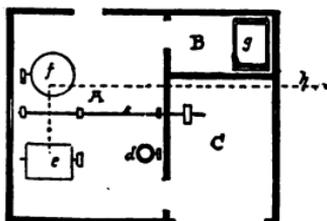


Fig. 272—INTERIOR

line, *h*, represents a pipe for conducting water from a tank in the windmill tower, not only into the building, but with branches leading to the butter worker and churn. Other branches should lead to the ripening tank and sink, when these are located to suit the preference of the parties building. Some would doubtless prefer to locate the sink under the main shaft,

*k*, either against the inner partition, or under the window, between churn and separator. Others might prefer it in the very center of the room, and still others in some other place. If an engine is used for power, pipes should lead from the boiler to the ripening tank, sink, churn and butter worker for delivering steam. It would also be in the line of ultimate economy, if steam is to be used for power, to provide sufficient boiler capacity to furnish steam for heating the building.

If steam is not used for motive power, get a good coal heater, set it in the power room, put in a coil of pipe and arrange to warm the work room with a circulating system of hot water, with pipes and faucets for delivering hot water, wherever it may be needed for use. And then use freely.

There is a windmill shown in the illustration. If you will provide a tank holding ten or fifteen barrels of water—enough for three days—this windmill will do all the necessary pumping. A large tank, conveniently placed for the purpose and arranged to receive the overflow from the smaller one, and the mill, will supply all needed water for stock also.

When it comes to details of construction, there is practically no limit to the variations that might be suggested, but whatever is worth doing at all, is worth doing well. If the building be located on level ground, the foundation should not only go down below the frost line, but it should also be raised sufficiently to allow for enough filling in and grading to provide for drainage in all directions. There should be a slant of not less than one inch to the foot in all directions from the exterior walls. For this purpose, throw out the surface soil from the interior, and refill with broken stone, brickbats, coarse gravel, all so well tamped that it will never settle or give way, and then cover with a cement floor, laid with just a perceptible

incline to a common outlet or drain, laid below frost and well trapped.

The top of the foundation wall should be about four inches above the surface of the ground, after the permanent grade is made, and, if the building is of wood, the successive courses of brick or stone should be battered back so that the top of the wall will be only eight inches wide. A two-inch air chamber in this wall will assist very materially in excluding frost.

For the superstructure, use two-inch stuff, eight inches wide, for sills, laying two courses, breaking joints, and well spiked together. Nail a strip, a scant one inch square, all around the outer edge of the sills, and on the inner side of this set up the studding, two by four inches, flatwise. Cover this studding on both sides with common lumber, brought to a uniform thickness by surfacing, and then cover these sheathing boards, inside and outside, with best quality of inodorous building paper, well lapped at the edges and ends. On the inside set up another row of studding, sheath and paper as before.

We have now two dead air spaces in our side walls, and may apply our outside covering directly over the paper, or, better yet, set up one-inch furring strips and lay the siding on them, leaving the space made by the strips open, both at top and bottom. This will allow a circulation of air and thus prevent the transfer of heat by convection. Use similar furring strips on the inside, and ceil, or lath and plaster, as may be preferred.

The side walls should be not less than ten feet high, and twelve feet would be better, as this would allow more space above the ceiling. And provision for the escape from this space of the heated air under the roof should be made either through the cupola, or, if this is omitted, by a window in either end.

Provide storm windows and door for winter and screens for summer, and there will be a most satisfactory dairy

house, but little affected by the heat of summer or cold of winter. A less satisfactory building can be put up for somewhat less money, but the saving in this respect will be much less than one would be liable to expect.

#### PLANS FOR A CO-OPERATIVE MILK STATION

There is considerable difference of opinion as to the size and general management of a co-operative milk station for farmers in the New York territory. The



Fig. 273—END ELEVATION OF MILK STATION

arrangement of the building at Earlville, N. Y., shown in Figures 273 and 274, is very convenient and the cost of construction low as compared with many other plants. The general floor plan is shown in the line drawing figure, accompanying this. The building is thirty-two by 120 feet, with engine room eight by sixteen feet in addition. The wall is eighteen inches thick and two feet high and laid in the best lime mortar. Piers for

posts under girders and pools should not be less than two feet square. The floor in the engine room is of concrete and plastered with Portland cement. The chimney is sixteen by twenty inches, made of hard-burned bricks and started on a solid foundation the proper height to receive the pipe from engine, and extends four feet above the roof of the main building.

The sizes of timbers are as follows: Ice house sills, four by ten inches; girders, eight by ten; sleepers, two by ten and eighteen inches from centers; joists, two by

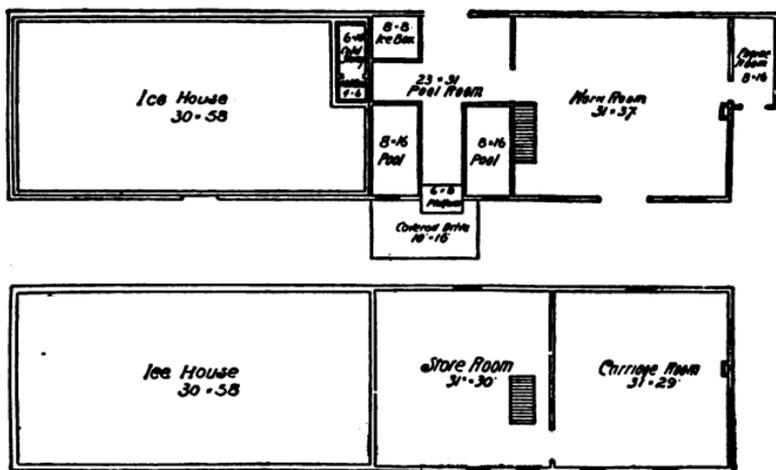


Fig. 274—FLOOR PLAN OF MILK STATION

ten, eighteen inches from centers; posts, six by ten; studding for ice house, two by ten, eighteen inches from centers, twenty feet long; plates, four by ten; posts, six by ten, twenty feet long; studding for work room, two by six, eighteen inches from centers, twenty feet long; posts, six by six, twenty feet; all rafters, two by six, twenty-four inches from centers; roof on ice house, six by six trusses, six by six pier line. The ice house has six rods, three at bottom and three at top. All rafters on work room have collar beams, two by six trussed with

one by six, roof of one-third pitch, covered with Washington red cedar shingles, laid five inches to the weather. The ice house is sheathed with straight-edged hemlock boards, lined with best tarred paper underneath. The whole building is covered with good pine cove siding and lined with tarred paper. The cornice has three members, size fourteen by fourteen inches. Sixty feet of the building is used for the ice house; twenty-two feet for pool room and twenty-eight feet for work room. The floors of the work and pool rooms are laid with one and one-quarter-inch hard pine; in the upper rooms seven-eighths-inch hard pine. There are seventeen windows in the building.

One-half of the second floor is finished with three-eighths-inch hard pine for a curing room. The windows and doors are cased with hard pine and all rooms are finished with the same material. The floor of the work room pitches to center with galvanized iron drain. The pool room is fitted with two cypress pools, eight by sixteen feet, two feet four inches high; one eight by eight-foot ice box with hinged cover on solid foundation. The cold storage room in the corner of the ice house is six by twelve feet. The ice house is fitted with a well-hole four by five feet, with a chute and chair for taking ice. There is a receiving platform for taking in milk and a covered driveway. The inside is given two coats of oil, while on the outside two heavy coats of good paint are applied. Several plants of this character are now in operation and can be built along any line of railroad within the New York city milk territory for \$2500. A building of this sort can be fully equipped for cheese for an additional \$500, making \$3000 in all.

#### A MODERN CHEESE FACTORY

The factory of the Leon C. Magaw cheese company in Crawford County, Pa., is thirty by sixty-eight feet

in size, double boarded and papered on the outside, with a cement floor. The work room is thirty by thirty feet, with a slanting floor that falls about four inches in

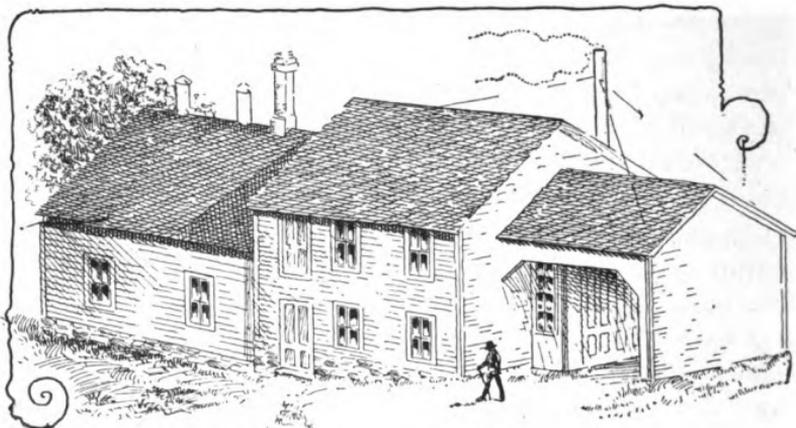


Fig. 275—THE MAGAW CHEESE FACTORY

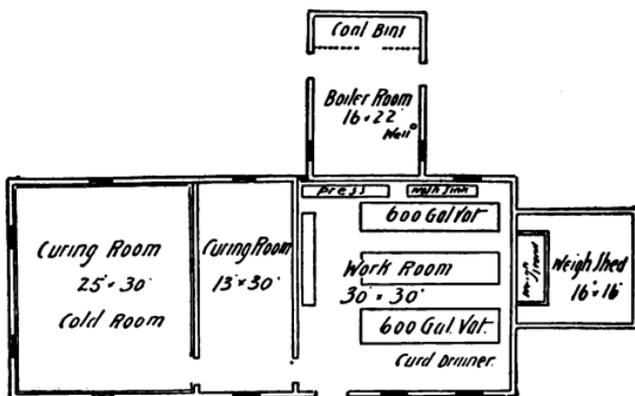


Fig. 276—FLOOR PLAN OF CHEESE FACTORY

twenty-six feet, while the other four feet slants to it, forming a gutter for all slops to run off.

There are two curing rooms. The small one is papered and ceiled on the inside. In this the new cheese is

placed for eight to twelve days, after which they are moved to room No. 2, which is called the cold room. This room was sheathed on the inside, papered on sheathing, put on two by two-inch pieces up and down, papered on those, then ceiled over the paper, thus making two air chambers, one of four inches and one two inches. It was ceiled and papered overhead and filled with saw-dust level with the joists.

Two twelve-inch ventilators run from the ceiling up through the roof. The windows in this room are of two thicknesses of glass. There are also two small openings in the wall in opposite corners, to allow cold air to come in when the night is cooler than the day. The building is also provided with a cold air duct which brings in the cold air below ground to the curing room. Figures 275 and 276 show the exterior and interior plans.



## CHAPTER XIII

### *SPRING HOUSES*

The main points to look at in constructing a spring house are, coolness of water, purity of air, the preservation of an even temperature during all seasons, and perfect drainage. The first is secured by locating the house

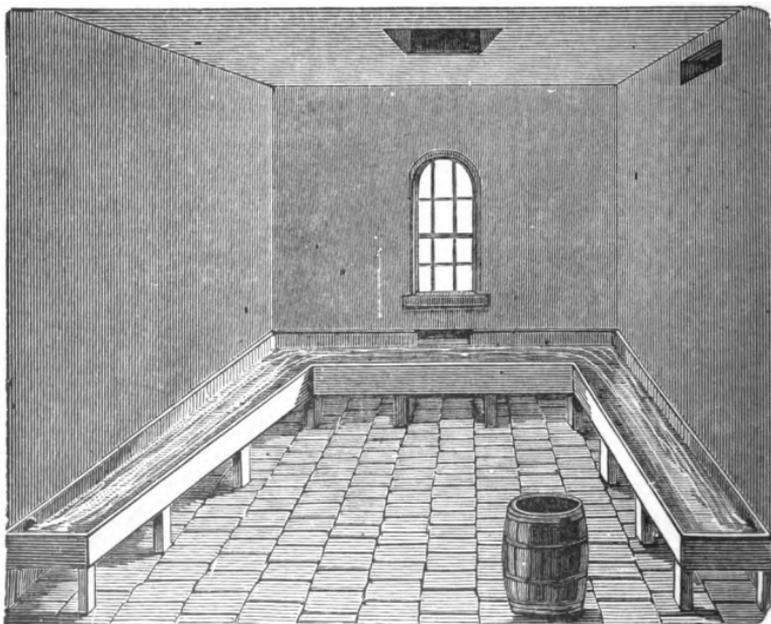


Fig. 277—INTERIOR OF SPRING HOUSE, WITH ELEVATED TROUGH

near the spring, or by conducting the water through pipes, placed at least four feet under ground. The spring should be dug out and cleaned, and the sides evenly built up with rough stone work. The top should be arched over,

or shaded from the sun. A spout from the spring carries the water into the house. If the spring is sufficiently high, it would be most convenient to have the water trough in the house elevated upon a bench, as shown in Figure 277. There is then no necessity for stooping, to place the pans in the water, or to take them out. Where the spring is too low for this, the trough may be made on a level with the floor, as in Figure 278. The

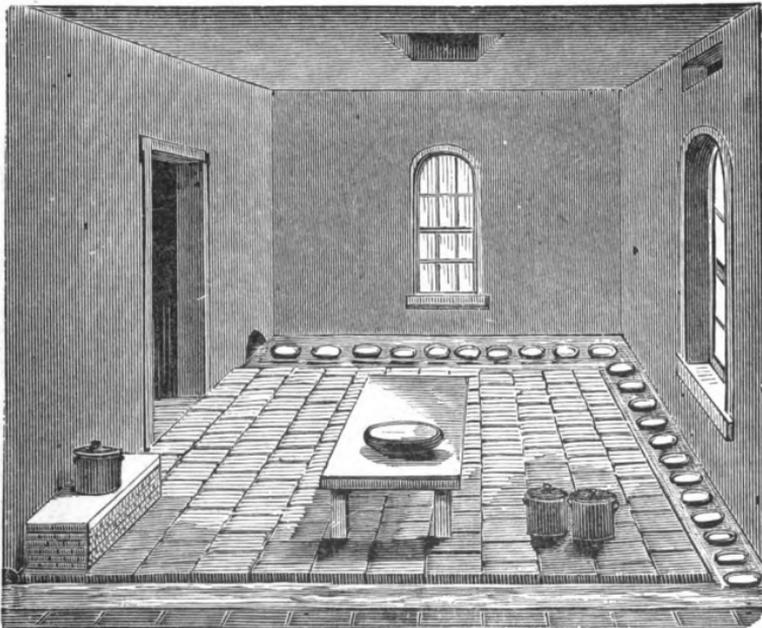


Fig. 278—INTERIOR OF SPRING HOUSE, WITH LOW TROUGH

purity of the air is to be secured by removing all stagnant water or filth from around the spring. All decaying roots and muck that may have collected should be removed, and the ground around the house either paved roughly with stone or sodded. The openings which admit and discharge the water should be large enough to allow a free current of air to pass in or out. These

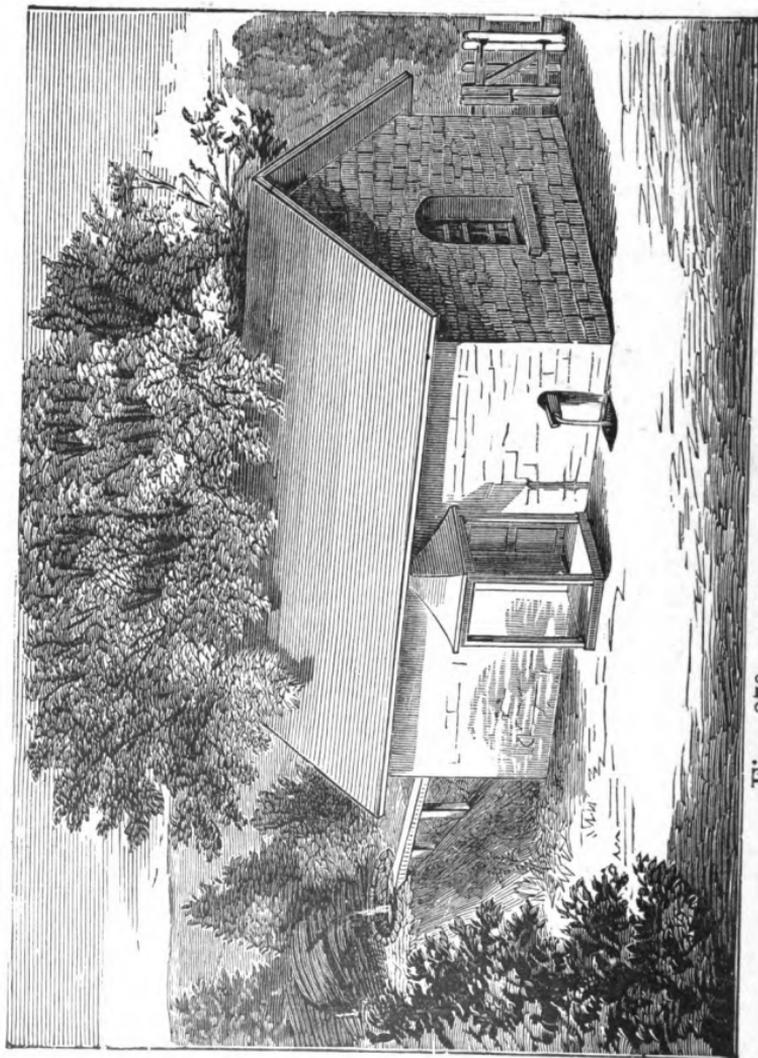


Fig. 279—EXTERIOR OF SPRING HOUSE

openings are to be covered with wire gauze, to prevent insects or vermin from entering the house. The house should be smoothly plastered, and frequently white-washed with lime, and a large ventilator should be made in the ceiling. There should be no wood used in the walls or floors, or water channels. An even temperature can best be secured by building of stone or brick, with walls twelve inches thick, double windows and a ceiled roof. In such a house there will be no danger of freezing in the winter time. The drainage will be secured by choosing the site so that there is ample fall for the waste water. The character of the whole building is shown in Figure 279. The size will depend altogether upon the number of cows in the dairy. For a dairy of twenty cows there should be at least 100 square feet of water surface in the troughs. The troughs should be made about eighteen inches in width, which admits a pan that would hold eight to ten quarts at three inches in depth. A house, twenty-four feet long by twelve wide, would give sixty feet of trough, eighteen inches wide, or ninety square feet. The furniture of the house should consist of a stone or cement bench, and an oak table in the center, upon which the cream jars and butter bowls may be kept.

#### A DOME-SHAPED, CONCRETE SPRING HOUSE

Figure 280 presents a plan for a spring milk house. The inside diameter is ten feet; height, eight feet. The walls are eighteen inches thick at the base, one foot at the top, and are made of concrete; that is, cement-mortar, one-third cement, two-thirds sand, in which as many stone chips from a quarry are placed as can be completely embedded in the mortar. This should be handled when freshly mixed, and as liquid as possible, and yet set solid. A complete dome is built of hemlock boards and the concrete laid upon that, the outside being rough.

so that vines will cling to and cover it. The door is very strong and tight, horizontally and diagonally boarded, of matched pine, fastened throughout with clinch nails. Ventilating doors, opening outward, are shown in the front, and this opening is protected on the inside with wire cloth. The building is lighted by a circular plate of rough glass, such as is used in floors under sky-lights, fully half an inch thick, and two feet in diameter.

Figure 281 is the ground plan. In this, *B* is the door, entering at which one comes upon the cement floor, *F*,

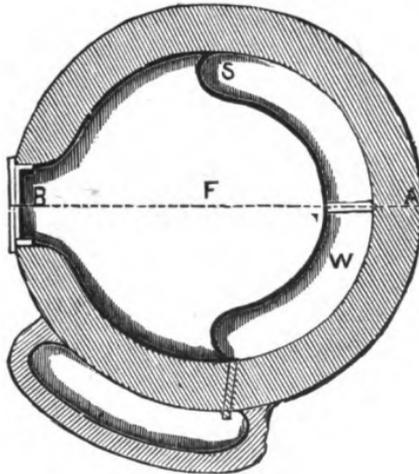


Fig. 280—FRONT VIEW OF SPRING HOUSE

that is half surrounded by the pool against the wall opposite the door. The pool is designated by *W* in the plan, Figure 281. The spring rises through its pebbly bed at *S*; there is a partition at *A*, over which the water flows, and this consequently separates the pool into fresh water, and that less directly from the fountain head, with probably a difference of one degree in the temperature. The pool has a raised rim six inches wide, and three or four inches high, to prevent water splashing out upon the floor, at about the level of which the water is intended to stand. The milk is placed in "coolers" in

the coldest part of the pool. Jars and stone pots of butter may be set in the pool nearer the outlet.

Figure 282 is a section on the line *A, B*, which is through the doorway. This shows the depth of the pool, the foundations (also laid in cement, so as to exclude surface water entirely), the window in the top, the form of the entrance, etc. The outflow of water takes place at the part of the pool farthest from the spring. A channel surrounds the floor, for conducting away any water



**Fig. 281—THE GROUND PLAN OF SPRING HOUSE**

that may be spilled upon it. The ventilation through the door, being, as it is, very near to the highest part of the dome, which is seven feet high inside, is abundant. The light may be too great on sunny days, in which case a screen on the outside will keep out both light and heat. Light is, however, no disadvantage in a dairy, if unaccompanied by heat and flies. As to warmth, in case it should seem best to use such a spring house in winter to work the butter in, it would be necessary to heat it. This is easily done by using a charcoal stove, from which

no odors come. The pipe should lead directly up and out through a two and one-half-inch hole. Sufficient warmth to make the room comfortable does not perceptibly affect the temperature of the pool, unless very long continued. Should the size of the spring house here given be too large and expensive, it may be reduced to

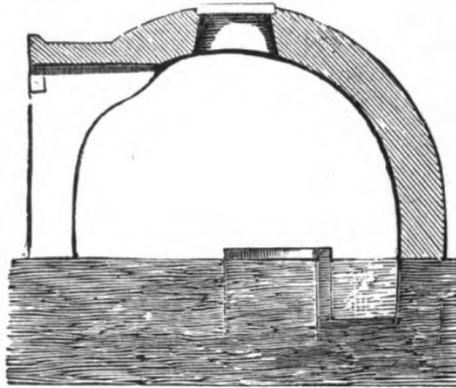


Fig. 282—SECTIONAL VIEW OF SPRING HOUSE

eight feet inside diameter and six feet high, or six in diameter, and of proportionate height, the pool being in this case a good deal contracted in size, and the floor lowered to secure head room.

## CHAPTER XIV

### *GRANARIES, ETC.*

As a rule it will be found most profitable to thresh grain as soon as it has been harvested. There is a saving of time and labor in drawing the sheaves from the field directly to the threshing machine, and mowing away the straw in the barn at once. The threshing may be done in the field, and the straw stacked there, especially now that steam-threshers are coming into more frequent use. When this plan becomes general, the granary will become as conspicuous a farm building as the barn. For storing the crops, it will be substituted to a great extent for the barn, and instead of the barn being a storehouse, it will only be a place for lodging and feeding the stock.

#### A GRANARY WITH ITS GRAIN BINS

When grain is threshed directly from the field, and is stored in bulk, it goes through a process of sweating, and if not turned or ventilated is liable to heat and spoil. It is a work of considerable labor to turn the grain, or move it from one bin to another. A granary, with ventilating bins, as here illustrated and described, saves this labor. The granary is shown in Figure 283. That it may not be accessible to rats and mice, it is made two stories in height, the lower one being used as an open shed for storing wagons and implements, or as a workshop. Access to the granary is gained by an open stairway, which, if thought proper, may be hinged at the top, and slung up when not in use. The engraving represents a building twenty-four feet long, twenty feet wide, and

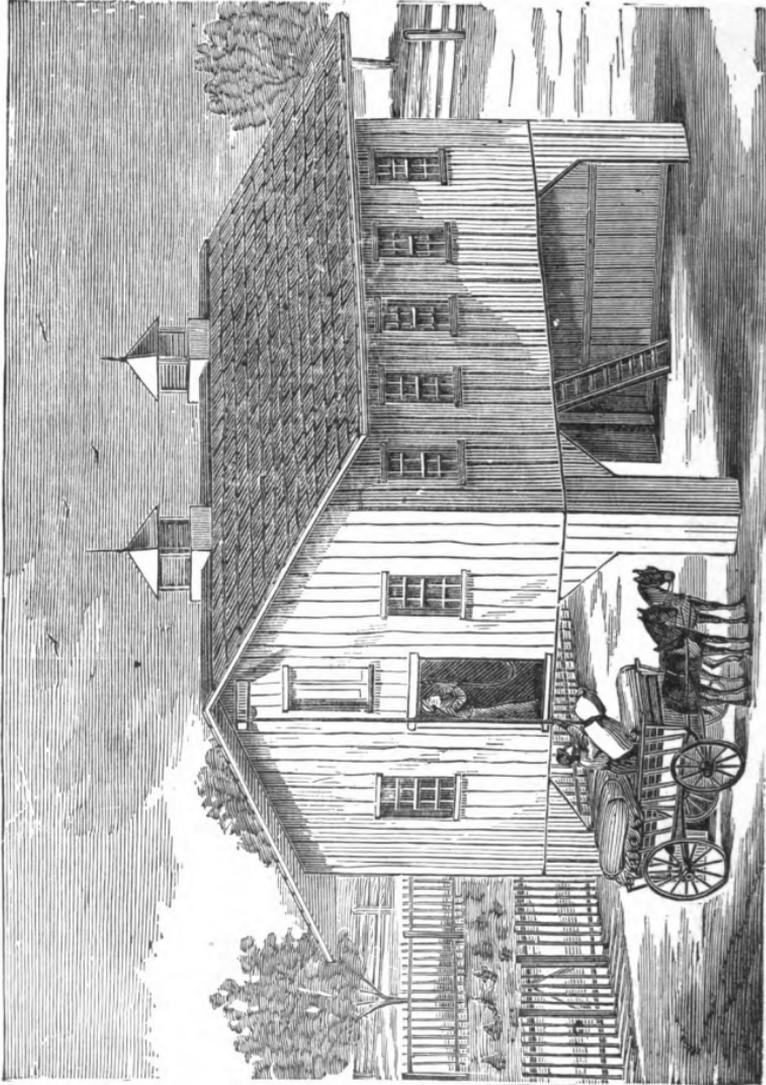


FIG. 283—PERSPECTIVE VIEW OF A GRANARY

twenty-one feet high. The shed is nine feet high, the granary eight feet, and the loft for the storage of corn is four feet to the eaves, and if the roof is one-third pitch, it is eleven feet high at the center. The frame is of heavy timber, to support the weight. The posts may be mortised into sills, bedded in concrete or lime mortar, to preserve them below the level of the ground, or the sills may be on stone underpinning. The posts should be twelve inches square, the studs four by twelve, and the frame well braced with girths. The floors should be of one and one-quarter-inch plank, and be supported by beams of ten by three timber, placed sixteen inches apart. There is a wheel-hoist in the loft, by which bags of grain are elevated from the wagons with a rope, at the end of which is a loop or sling, made by a piece of wood, with a hole at each end, through which the rope



Fig. 284  
—SLING

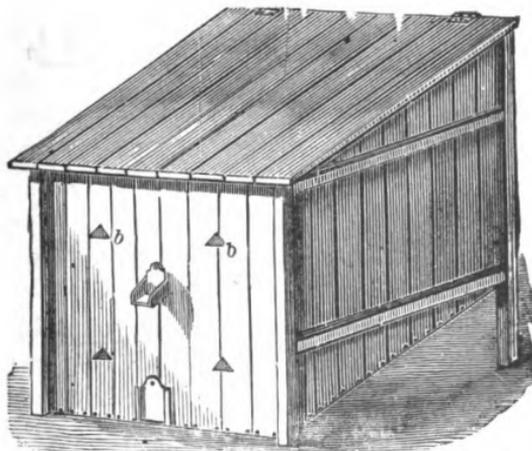


Fig. 285—EXTERIOR OF A GRAIN BIN

passes, as seen in Figure 284. The bins are made with a substantial frame of two by four timber, mortised

together, and boarded with matched inch boards inside of the frame. The bottom is made sloping, and is raised above the floor, so that the latter can be washed or swept when needed. The form of the bins is shown in Figure 285. There is a slide at the bottom, by raising which the grain may be let out on the floor, and shoveled into bags, or through the spout seen at *a*, in Figure 286, into

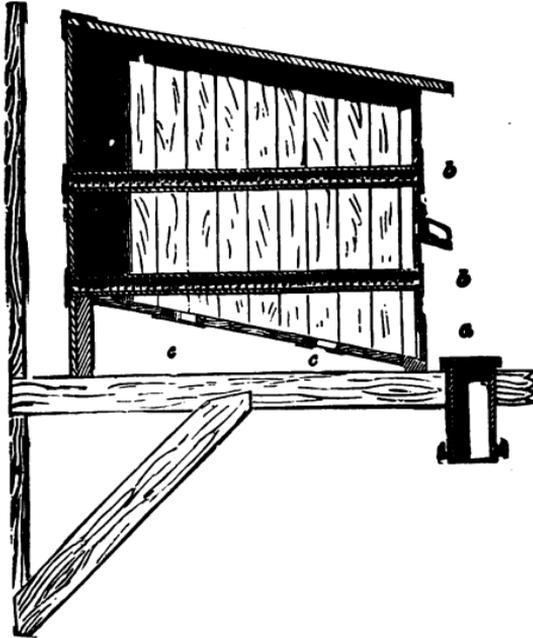


Fig. 286—SECTION OF A GRAIN BIN

bags on a wagon in the shed below. A spout in the front also enables a portion of the grain to be run into bags without shoveling, and if thought advisable, a spout may be carried through the floor from each of the slide doors, with very little expense. The spouts are provided with hooks at the bottom, upon which cloth guides, seen at *a, a*, Figure 288, are hung, to direct the grain into the bags. A space is left sufficient to allow a boy to go

behind the bins and sweep the floor and walls, and there is a space of at least four feet in the middle of the granary between the rows of bins. The bins may be made of any desired size, and separate from each other, or in one continuous bin, divided by movable partitions. Every care should be taken to have no cracks or crevices in the bins, floors or building, in which weevils can hide, and the windows should be covered with fine wire gauze. The ventilators in the roof should also be covered to prevent the entrance of the grain moth.

To provide against injury from heating, the ventilators shown at Figure 287, and at *b, b*, Figures 285 and 286, are constructed. These are strips of half-inch wood, nailed together, so as to form angular troughs about six



Fig. 287—VENTILATOR

inches wide. The sides are bored full of small holes, that will not permit the grain to pass through them, and the ends are covered with fine wire gauze. They are fitted into the bins, running from front to back, with the open side downward. When the grain is poured into the bins, vacant spaces are left beneath these ventilators, and if it heats, the moist warm air escapes through them. Small pieces of wire gauze are also fastened over holes, in the bottom of the bins, as shown at *c, c*, Figure 286, through which cool air enters the bin, as the heated air escapes above. In this way the grain is cooled and aerated. Even buckwheat, which, when newly threshed, heats so rapidly as to be troublesome in damp, warm weather, may be kept in perfect order, in such a bin as this, without trouble.

A section through the center of the building, given in Figure 288, shows the position of the bins and the passages. A granary twenty-four feet long, with bins six feet wide and five feet deep, will hold about 1200 bushels of grain on the first floor, but a large amount in addition can be stored upon the second floor in heaps or bins. If more room is needed for the grain, a great many filled bags can be piled upon the bins, so that in case of necessity 2500 bushels can be stored in a granary of this size.

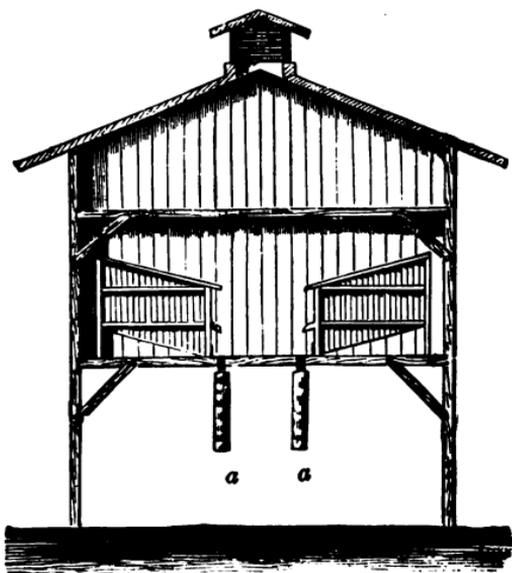


Fig. 288—SECTION THROUGH THE GRANARY

#### ANOTHER GRANARY WITH PLAN OF GRAIN BINS

Without proper bins for grain, much that is hard earned in the field is easily wasted in the barn. The floor of a granary should be of double hemlock boards one inch in thickness, dressed and tongued and grooved. Sometimes it may be desirable to lay a floor of plank,

and cover this with a layer of hydraulic lime cement three-quarters of an inch in thickness. Either of these floors will be rat-proof.

There should be a window in every granary, with fine wire gauze shades, to exclude weevils and grain moths. Figure 289 is a plan of a granary; Figure 290 shows the mode of constructing the bins. The posts, *B, B*,

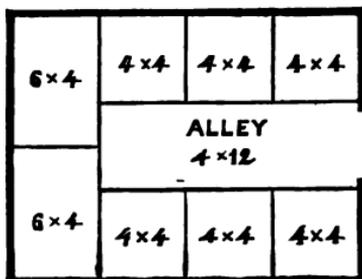


Fig. 289—PLAN OF GRANARY

have grooves, into which the boards are slipped as the bins are filled; they can be removed when not needed. The boards should be numbered, that they may always be properly placed. Portable steps, *E*, are very convenient when the bins are deep.

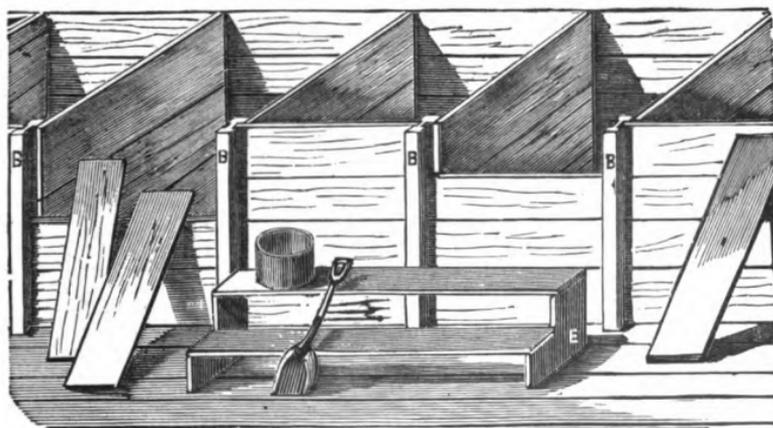


Fig. 290—ARRANGEMENT OF BINS IN GRANARY

PLAN OF CORN CRIB AND GRANARY

The following Figure 291, is a plan of a combined corn crib and granary, which is thirty-two feet long, twenty

feet wide and ten feet high from the stone foundation to the eaves of the roof. It has a driveway through the middle, ten feet wide, and double doors at each end, by

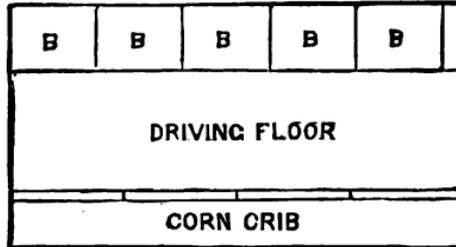


Fig. 291—PLAN OF CRIB AND GRANARY

which ample ventilation may be secured in fine weather. The bins, *B, B*, six feet square, and five in number, are upon one side; the corn crib is on the other. A stair-

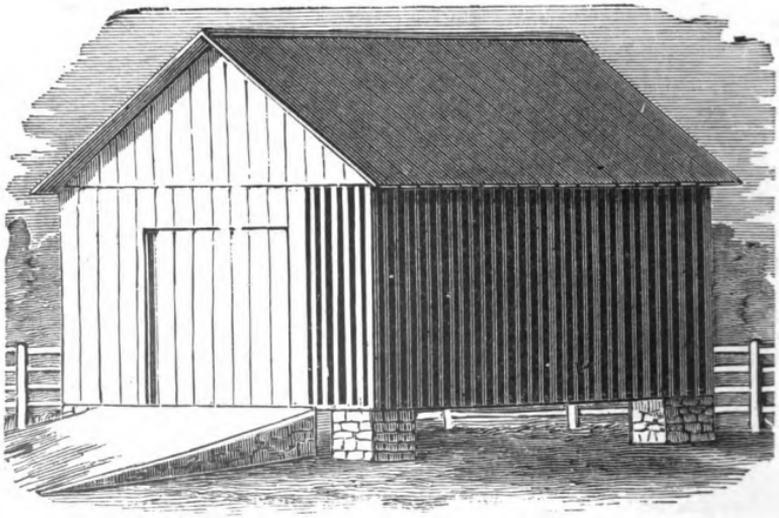


Fig. 292—VIEW OF CORN CRIB AND GRANARY

way, three feet wide, leads to the floor above, where damp grain may be spread beneath the roof to dry. The corn crib is so arranged that the corn may be shoveled

out at the bottom, by nailing cross-boards to the scantling, projecting twelve inches; a board ten inches wide is nailed to these to make a long spout or trough. An exterior view of the building is given in Figure 292.

#### A MEASURING GRAIN BIN

A grain bin, with an attachment for measuring, is given, Figure 293. There can be no waste, as the bag or sack may be hooked upon the lower end of the spout, and when filled can be easily removed. The spout requires the bin to be sufficiently elevated for the bag, when attached to the spout, to just clear the floor or a box placed for it to rest upon.

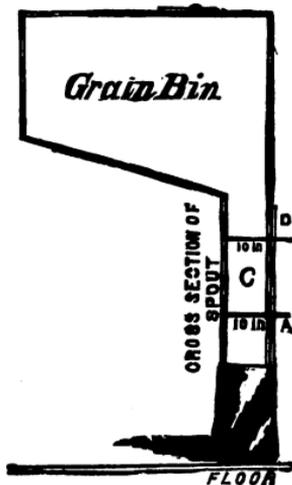


Fig. 293—A

#### MEASURING GRAIN BIN

In drawing from the bin, the slide marked *A* is closed, and the slide, *D*, is opened long enough for space, *C*, to fill, when *D* is closed, and *A* opened, and the grain passes into the bag. The size of the measuring chamber in the spout is ten by ten inches square, and twenty-one and one-half inches high. This holds just one Winchester bushel; but if a half-bushel chamber is preferred, then the proper size would be ten by ten inches square, and ten and three-quarter inches high. Of course, these measurements are for the inside of the chamber. By inserting a pane of glass in the face of the bin, or in the spout at *D*, one could always tell the quantity of grain in the bin. In constructing a bin like this, the bottom should have a rise of five inches to the foot. For example, a bin six feet from front to back, for wheat or corn, should have a rise of thirty inches in the bottom to secure a flow; oats require more.

## SLIDING SPOUT FOR A BARN OR GRANARY

A spout through which bags of grain or feed may be sent from one floor to another, in barns or granaries, is represented in Figure 294. This sliding spout will be found very useful for other purposes than the one

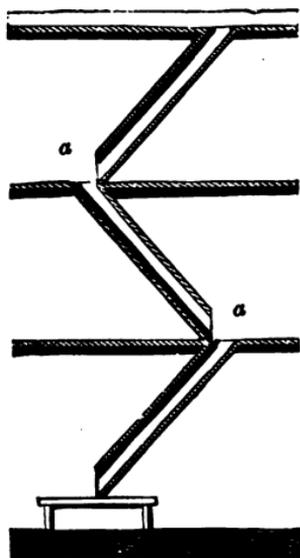


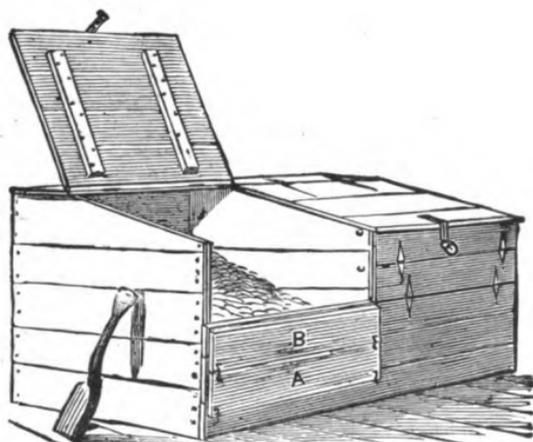
Fig. 294—SLIDING SPOUT

mentioned, and may be readily made to serve as a ventilating trunk as well. It consists of a wooden spout about two feet square, made as shown in the engraving, and passing at each turn from one floor to another. A bag of grain or feed dropped in at the top will slide from floor to floor until it reaches the table at the bottom. The openings, *a, a*, are closed by doors which may be shut down across the spout, when it is required to deliver the bags upon any intermediate floor. This spout is necessarily used in connection with a hoisting apparatus or an elevator, by which the grain or feed is raised to an upper floor. In high barns provided with a hoist and a sliding spout of this kind, it will generally be found convenient to store the grain upon the top floor, where it will be well ventilated, and may be made free from vermin.

## CONVENIENT GRAIN BIN

The strain of body and rush of blood to the head that are very often experienced, in getting grain or meal from a deep bin when the supply runs low, are avoided

by the bin shown in Figure 295. Bins are made in which the two top boards in front are hinged, being fastened up by hooks at the ends, and let down as desired. The front edge of the bin is about four feet high.



**Fig. 295—GRAIN BIN**

## CHAPTER XV

### *SMOKE HOUSES*

A good smoke house should be found upon every farm, large or small, and there are many other families besides those of farmers which would be vastly benefited by one. The object is to be able to expose meats to the action of creosote and the empyreumatic vapors resulting from the imperfect combustion of wood, etc. The peculiar taste of smoked meat is given by the creosote, which is also the preservative principle, but sundry flavors, agreeable to those who like them, are also imparted by other substances in the smoke. All that is necessary for a smoke house is a room, from size of a barrel to that of a barn, which can be filled with smoke and shut up tight, with conveniences for suspending the articles to be cured. In common smoke houses the fire is made on a stone slab in the middle of the floor. In others, a pit is dug, say a foot deep, in the ground, and here the fire is placed; sometimes a stone slab covers the fire at the height of a common table.

#### A CONVENIENT SMOKE HOUSE

The accompanying plan, Figure 296, is of a good smoke house; it diffuses the rising smoke, and prevents the direct heat of the fire affecting the meats hanging immediately above. A section of the smoke house is shown, and though somewhat expensive, is warmly praised. It is eight feet square, and built of brick. If of wood it should be plastered on the inside. It has a chimney, *C*, with an eight-inch flue and a fireplace, *B*, which is out-

side below the level of the floor. From this a flue, *F*, is carried under the chimney into the middle of the floor, where it opens under a stone table, *E*. In kindling the

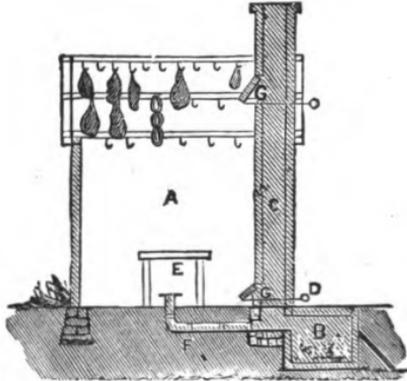


Fig. 296—INTERIOR OF SMOKE HOUSE

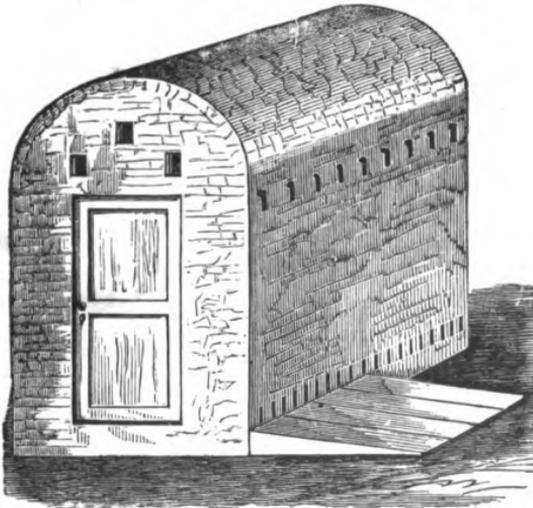


Fig. 297—AN IMPROVED SMOKE HOUSE

fire a valve is drawn directing the draft up the chimney. The green chips or cobs are thrown on, and the valve is then placed so as to turn the smoke into the house. Both

in the upper and lower parts of the chimney there are also openings, *G, G*, closed by valves regulated from the outside. The door has to be made to shut very closely, and all parts of the building must be as tight as possible. The advantage of such a house as this is, that the smoke is cooled considerably before it is admitted. No ashes rise with the smoke. Meats may be kept in it the year round, without being very much smoked, inasmuch as

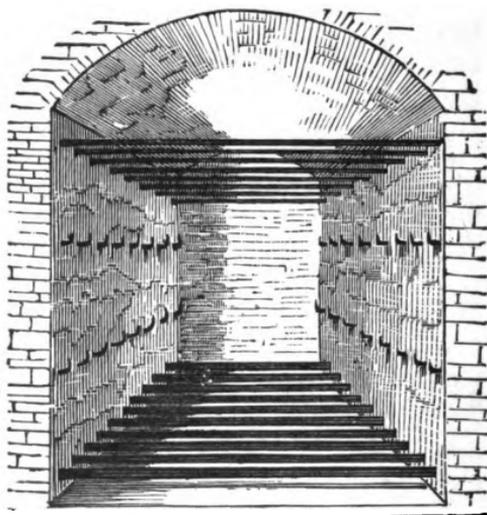


Fig. 298—INTERIOR OF SMOKE HOUSE

the smoking need be only occasionally renewed, so as to keep the flies away. The table placed in the center will be found a great convenience in any smoke house.

#### IMPROVED SMOKE HOUSES

Figure 297 is an engraving of a brick smoke house, built over an ash pit or cellar, six feet deep, the entrance to which cellar is through the door shown at the side. The roof is arched, and there is no wood about the structure, except the doors. The floor of the house is made of

narrow iron bars, three inches wide, and a quarter of an inch thick, set on edge about two inches apart, so as to form a grating. The ends of these bars are seen set in the bricks at the lower part of the house. They are made for laying side pieces of bacon upon them during the smoking. The hams are hung upon round iron bars,



Fig. 299

stretched across the upper part of the house; the ends of these bars are bent down, thus forming stays or braces to the building, as seen in the engraving. A few spaces are left in the front of the house, over the door, for ventilation. The interior of the house is shown in Figure 298. The hams are hung upon wire hooks, Figure 299, which slide upon the rods. This house required in building 2000 bricks, and two masons' labor for one and a half days. Figure 300 represents a section of a smoke house of wood, which is very cleanly in use, there being no fire, and consequently no ashes, upon the floor. The floor is made of cement, or of hard wood laid in cement or mortar. Either of these floors will exclude rats, and may be washed when necessary. The fire ovens, made of brick, are built on each side of the house, or two of them may be erected at the rear end. They are constructed upon the outside, but spaces are left between the bricks on the inside, through which the smoke escapes. The outer part of the oven is open at the front, but may be closed by an iron door, or a piece of flat stone or slab of cement. When the fire is kindled in the ovens, the doors are closed and fastened, and the smoke has no means of escape except through the inside spaces. From being so confined, the fire cannot burn up briskly, but slowly smolders, making a cool and pungent smoke. In any smoke house, the less brisk the fire is kept, the more effective is the smoke, as the slow combustion of the wood permits the escape of most of the wood acids,

which give their flavor and their antiseptic properties to the meat. When the fire is brisk, these are consumed and destroyed, and the meat is injured by the excess of heat. These outside ovens may be fitted to any kind of a smoke house, by simply cutting the necessary openings at the bottom of the walls, and protecting the woodwork by strips of sheet iron around the bricks.

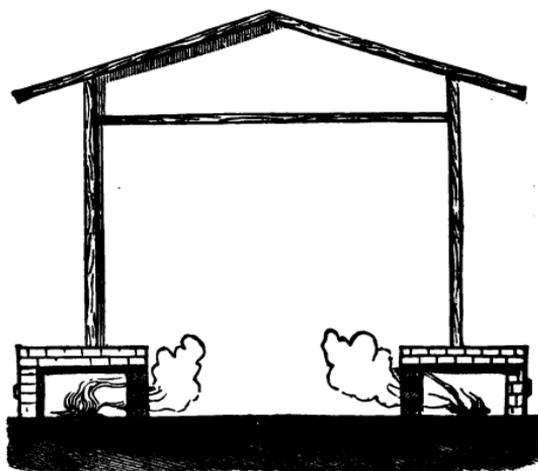


Fig. 300—WOODEN SMOKE HOUSE WITH OVENS

#### CHEAP SMOKE HOUSES

Figure 301 presents a sectional view of a brick smoke house, which may be made of any size. One seven by nine feet will be large enough for private use, but the plan admits of application for the largest sized building. At the bottom of the structure is a brick arch, with bricks left out here and there to afford passage for the smoke. Above the arch are two series of iron rods, supplied with hooks with grooved wheels, by which the ring, with its burden, may be pushed back, or drawn forward, as desired. The wheel-hook is shown in Figure 301 and

can be procured at any hardware store. In Figure 302 the house is seen in perspective, with the open archway for the fire, and the door provided with steps. Above the lower bar and below the upper one, is a series of ventilating holes through which the smoke may escape. These are made by leaving out bricks, and they can be

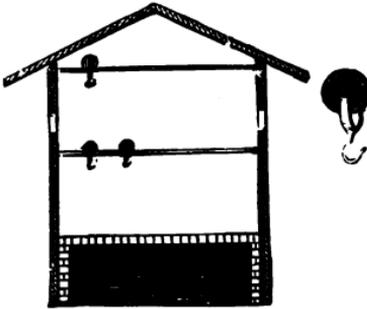


Fig. 301—SECTIONAL VIEW



Fig. 302—ELEVATION

closed by inserting bricks in the vacancies. In Figure 303 is the arch which confines the fire and ashes, and prevents any meat that may fall from being soiled or burned. A few open spaces will be sufficient to permit the smoke to pass through. This arch is constructed over a wooden



Fig. 303—THE ARCH

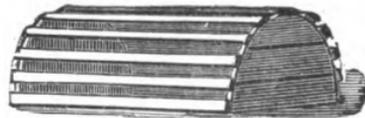


Fig. 304—FRAME FOR ARCH

frame, Figure 304, made of a few pieces of board, cut into an oval arch-shape, to which strips of wood are nailed. When the brick work is dry the center is knocked down and removed. For safety and economy a loose door may be made to shut up the arch when the fire is kindled.

Figure 305 shows a smoke house common in Maryland

*Colonial  
of modern*

and Pennsylvania. It is built upon a brick wall, and over a brick arch, through which a number of holes or spaces are left in the brick work for the smoke to pass through. Beneath the arch is the ash pit, and a door opens into this, as shown in the engraving. The door to the meat room cannot be reached without a ladder.

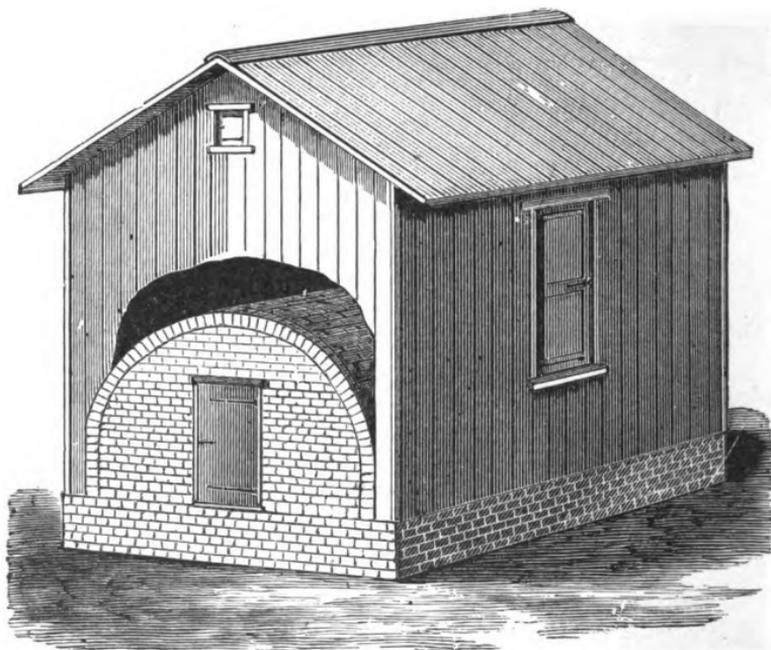


Fig. 305—A PENNSYLVANIA SMOKE HOUSE

#### SMOKING MEATS IN A SMALL WAY

It sometimes happens that one needs to smoke some hams or other meat, and no smoke house is at hand. In such a case a large cask or barrel, as shown in Figure 306, may prove a very good substitute. To make this effective, a small pit should be dug, and a flat stone or a brick placed across it, upon which the edge of the cask

will rest. Half of the pit is beneath the barrel and half of it outside. The head and bottom may be removed, or a hole can be cut in the bottom a little larger than the portion of the pit beneath the cask. The head is removed, while the hams are hung upon cross sticks. These rest upon two cross-bars, made to pass through holes bored in the sides of the cask, near the top. The head is then laid upon the cask and covered with sacks to confine the smoke. Some coals are put into the pit outside of the

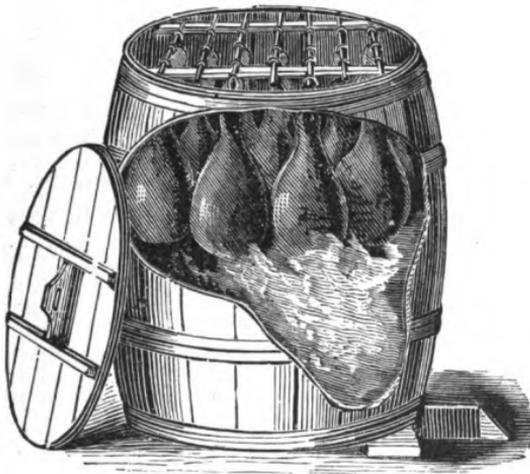


Fig. 306—SUBSTITUTE FOR A SMOKE HOUSE

cask, and the fire is fed with damp corn cobs, hardwood chips or fine brush. The pit is covered with a flat stone, by which the fire may be regulated, and it is removed when necessary to add more fuel.

#### A SMOKE HOUSE CONVENIENCE

A method of hanging the meat in a smoke house without the necessity for reaching up, or using a ladder, is shown in Figure 307. The smoke house may be of any shape,

but it should be provided with cleats fixed to the sides, upon which the hanging-bars rest. A pulley is

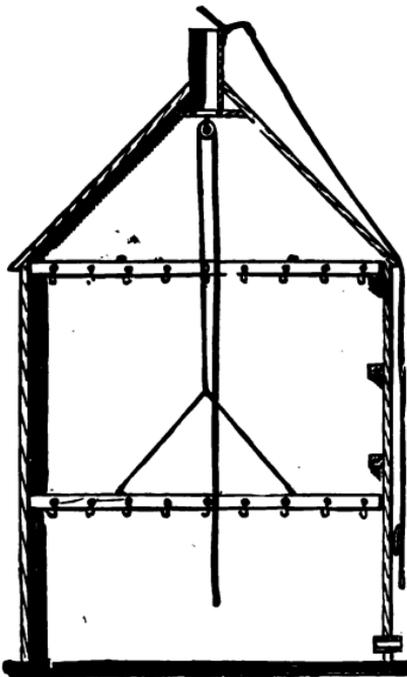


Fig. 307—A SMOKE HOUSE CON-  
VENIENCE

fitted inside to the top of the building, and a hoisting rope is passed over it. The hanging-bar is fastened to the rope by two spreading ties, so that it will not easily tip when it is loaded. The hams or bacon are hung upon hooks fixed in the bar, and the whole is hoisted to the cleats, when the bar is swung around so that the ends rest upon the cleats. The rope is then released from the bar by means of a small rod, and another bar may be loaded and raised in the same way.

#### AN OVEN AND SMOKE HOUSE COMBINED

The bricks chosen for an oven should be hard, well burned and molded, and with straight edges. This is especially necessary for the hearth. It is best to have the oven detached from the house, and yet so near to the kitchen door that it may be easily reached. The foundation of the oven is made by building two nine-inch walls of the proper length, or about six feet, and six feet apart, to a height of two feet above the ground. Upon the walls are laid cross pieces of four-inch oak plank, or flat

timbers, made somewhat like railroad ties. These lie on the wall for the length of half a brick, so that a course of half bricks or whole bricks placed lengthwise may be built to enclose them. At the front an iron bar may be built into the wall, and the front course of bricks laid upon it. The spaces between the timbers are filled with mortar, and a layer of mortar at least an inch thick is

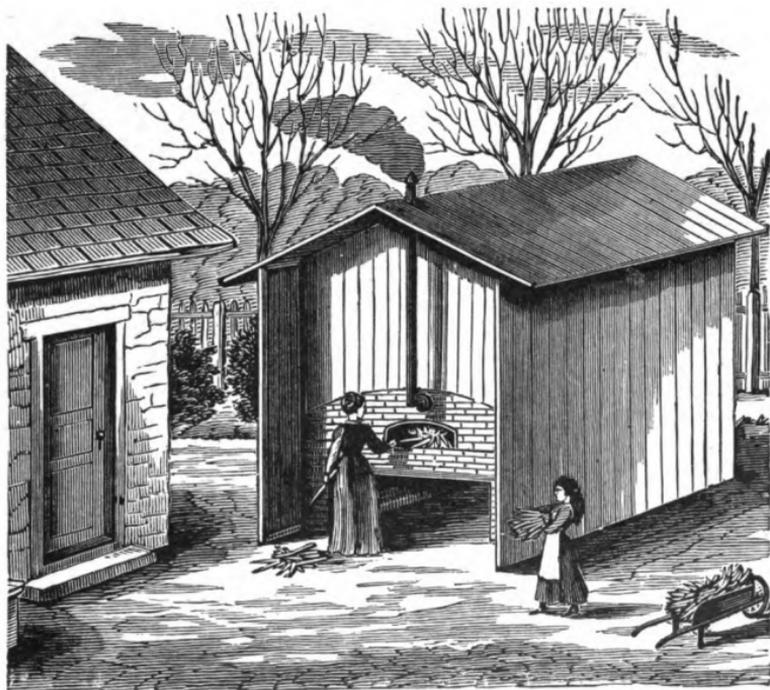


Fig. 308—FRONT VIEW OF COMBINED OVEN AND SMOKE HOUSE

placed upon them. Dry sand is thrown upon the mortar, and the whole bed is beaten with a mallet until it is made hard and compact. Dry sifted coal, or wood ashes, or sand, is then laid upon this bed to a depth of six inches and smoothed down. Upon this non-conducting floor the oven hearth is placed. The best, smoothest and hard-

est bricks are chosen for this. The bricks are laid very evenly and closely together, with mortar, in which a good proportion of wood ashes is mingled. When the floor is secured the walls are built in the same manner with bricks placed endwise from the inside to the outside. When the walls are about a foot high the frames for the center are fixed in their proper places. These are cut out of

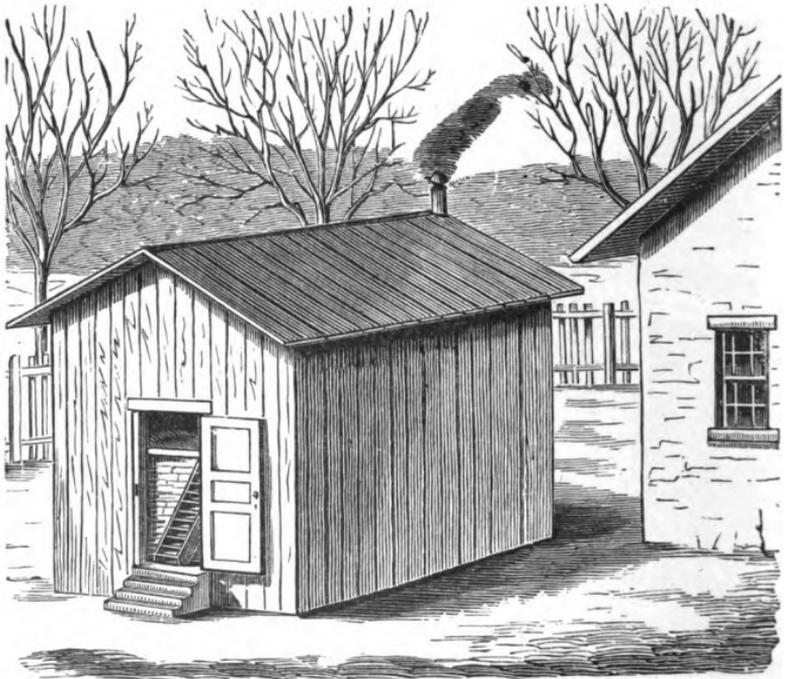


Fig. 309—REAR VIEW OF COMBINED OVEN AND SMOKE HOUSE

common inch boards of the shape to fit the arched roof. The rise of the arch is about eight inches, giving a total height in the middle of the oven of twenty inches, and twelve inches at the sides. The boards should be cut in two through the middle and lightly tacked together, so that they can be readily knocked apart and removed from

the door when the arch is dry. The wall around the oven and the arched roof should be well bound together, and brick work placed around the outside of the top of the arch, so as to make the connection between the walls and arch firm and solid. The inside of the oven will then consist of a solid nine-inch wall of brick laid with the ends toward the middle of the oven, or nearly so. This will serve to retain the heat a long time, and will make a very serviceable oven. The outside wall should be carried

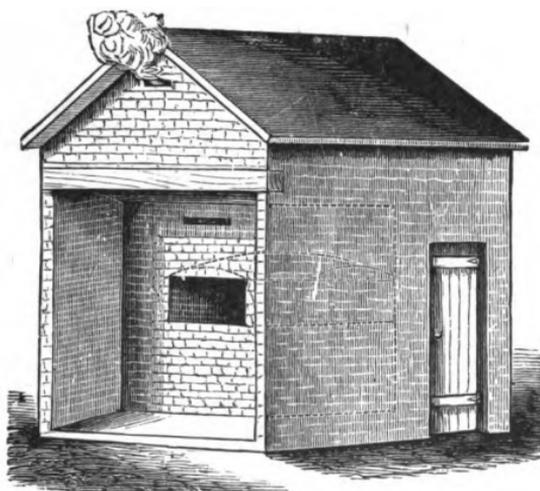


Fig. 310—COMBINED SMOKE HOUSE AND OVEN

a few inches above the line of the top of the oven, and fine dry sand thrown in the space to level it off. A plank floor may then be placed across the top, which can serve for the floor of part of the smoke house above. Figure 308 shows the front of the oven when complete. The rear of the combined oven and smoke house is shown in Figure 309.

Figure 310 represents another plan for a bake oven and smoke house combined in one building. The oven occu-

pies the front and that part of the interior which is represented by the dotted lines. The smoke house occupies the rear and extends over the open. The advantages of this kind of building are the perfect dryness secured, which is of great importance in preserving the meat, and the economy in building the two together, as the smoke that escapes from the oven may be turned into the smoke house.



## CHAPTER XVI

### *DOG KENNELS*

The dog is frequently left to find shelter as best he can on the lee side of the house or barn, or under the barn. He may have sufficient sagacity to know when he is well or ill treated, and he may very reasonably lose his self-respect and take to evil courses, such as prowling abroad, marauding and killing sheep, when not taught better, and

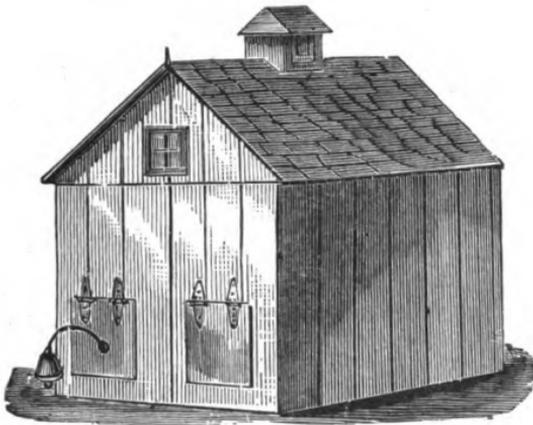


Fig. 311—A DOG KENNEL

provided with decent quarters at home. The conduct and attitude of a roughly used, half-starved cur is entirely different from that of a well-fed and decently kept dog, and everyone who keeps a dog should certainly take pains to treat him well and thoroughly train him. A shelter of some kind should be provided, which the animal will recognize as his home, and the more comfortable this is made the more contented he will be, not to

speak of the freedom from disease and vermin to be enjoyed. The disrepute into which these animals have fallen in the estimation of sheep and poultry keepers and gardeners is greatly owing to the liberty given them by owners to prowl about and commit depredations.

#### FARM DOG KENNELS

The kennel shown in Figure 311 is seven feet long by three feet six inches wide, and has two doors, one opening inward and one outward. The latter door is provided

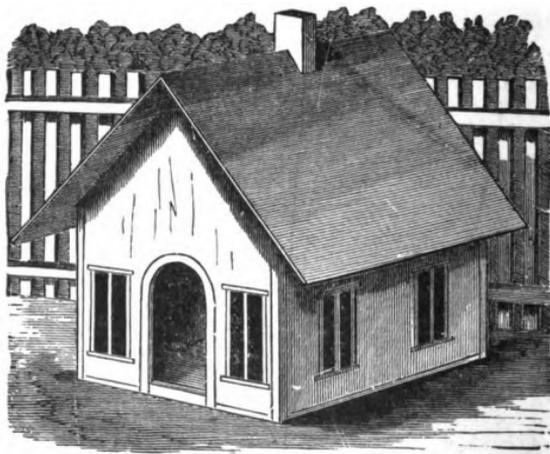


Fig. 312—A NEAT DOG KENNEL

with a bell, by which the owner can tell when the dog goes out at night. In summer one door may be used for ventilation, but in the winter both should be let down.

The manner of making a very neat kennel is shown in Figure 312. The bottom is two feet six inches by four feet, and from this to the top of the roof it is three feet nine inches. The door has an arched top and should be of any size from eight by twelve inches up to twelve by twenty-two inches, to suit the size of the occupant. It

is painted light brown, with the corners, base and window planks painted darker. Brackets may be placed beneath the cornice molding. A cheap and equally service-

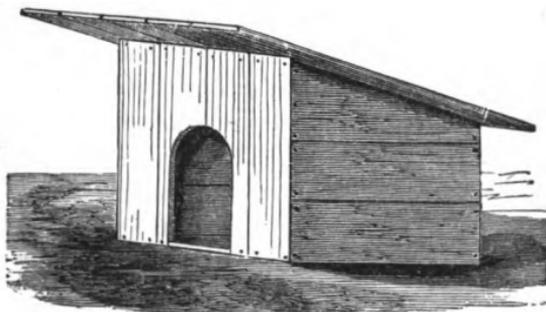


Fig. 313—A CHEAP KENNEL

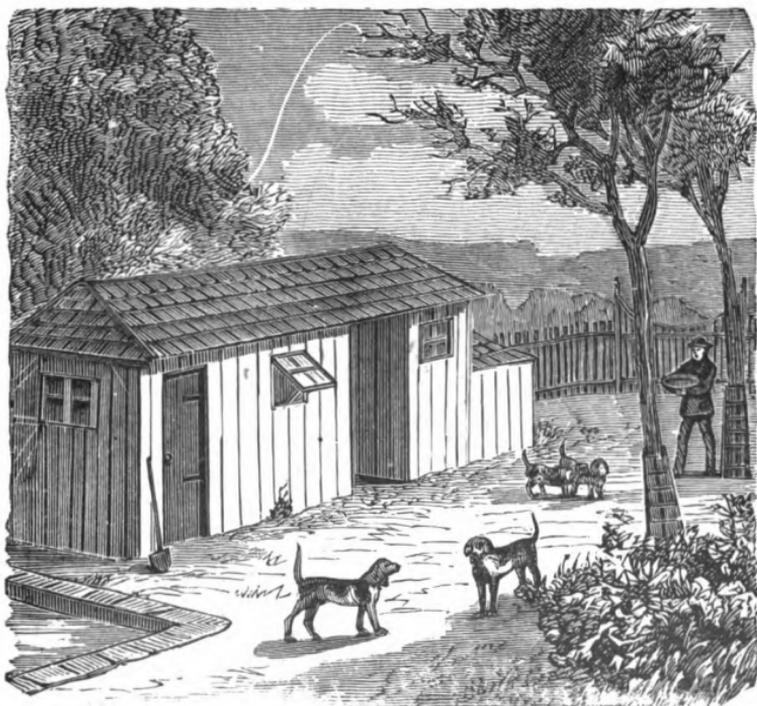


Fig. 314—KENNEL WITH YARD FOR DOGS

able kennel is shown in Figure 313. It has a floor the same size as the preceding, is three feet four inches high in front, and the roof has a fall of eight inches. A yet cheaper one is made by taking a square box, three by four feet, and cutting a door in one end. During winter, if the kennel be in an exposed situation, tack a piece of heavy carpeting over the door on the inside, so that it will cover the entire doorway. Where several dogs are kept, a roomy kennel and yard should be provided, in which to confine them. A dog yard with kennel is shown in Figure 314. It is roomy, so as to admit of exercise, well shaded, and furnished with water, and a sleeping house. A water tank is indispensable, and generally there should be a place for bathing.



## CHAPTER XVII

### BIRD HOUSES

It is a mistake to have bird houses too showy and too much exposed. Most birds naturally choose a retired place for their nests, and slip into them quietly, that no enemy may discover where they live. All that is required in a bird house is a hiding place, with an opening just

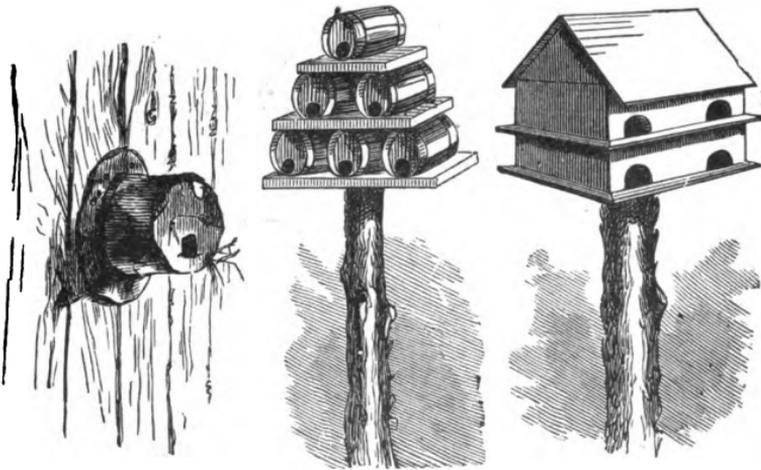


Fig. 315—HAT HOUSE    Fig. 316—KEG HOUSE    Fig. 317—LARGE HOUSE

large enough for the bird, and a water-tight roof. There are so very many ways in which these may be provided any boy can contrive to make all the bird houses that may be needed. An old hat, with a hole for a door, tacked by the rim against a shed, as in Figure 315, will be occupied by birds sooner than a showy bird house.

Figure 316 shows how six kegs may be placed together to rest upon a pole; the kegs are fastened to the boards by screws inserted from beneath. Figure 317 shows how a two-story house may be made separate from two shallow boxes, each divided into four tenements. Each box has a bottom board, projecting two inches all around, to answer as a landing place. The roof should be tight and the whole so strongly nailed that it will not warp. It should be well painted.

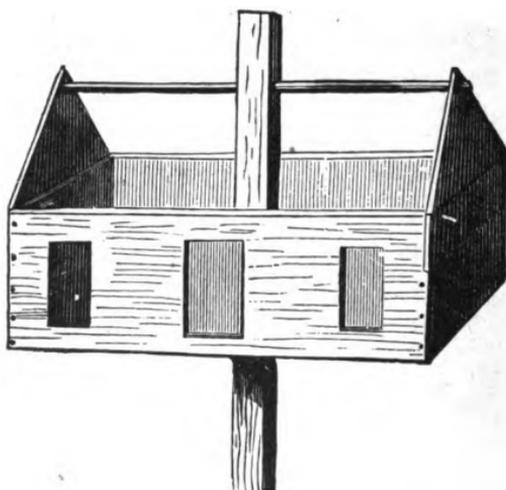


Fig. 318—FRAMEWORK OF BIRD HOUSE

The foundation of the house shown in Figure 318 is any convenient sized box, such as may be had at the stores. A piece is nailed to each end, cut to the slope it is desired to have the roof. As the roof is to be thatched, it had better be pretty steep; it will not only shed the rain the more readily, but the house will look better. The upper end of the pole which is to support the house is made square; it passes through a hole in the bottom of the box and extends far enough above the ridge of the roof to form the chimney. A ridge pole is

then passed through the upright pole and the end pieces, as shown in the figure. Places for the windows are to be cut out, but the door may be only a dummy, and painted black. Small branches of any straight, easy-splitting wood are to be cut of the proper lengths and split lengthwise. These, with the bark on, are fastened by small nails all over the exterior of the house, as shown in Figure 319, which gives this form of bird house complete.



**Fig. 319—BIRD HOUSE COMPLETE**

#### PIGEON HOUSES

Pigeons are valued both as ornamental birds and as furnishing an exceedingly delicate article of food. If kept for use, or if reared purely for fancy, pigeons must be housed over the stable or some outbuilding, to secure them from cats, rats, weasels, etc. This gives the owner access at all times to the birds and their nests. The room is subdivided by latticework partitions into as many apartments as are desirable. When, however,

persons do not desire to make a business of raising pigeons, and wish to keep only one, or possibly two, ornamental varieties, it is very well to make the houses as well as the birds contribute to the ornamentation of the

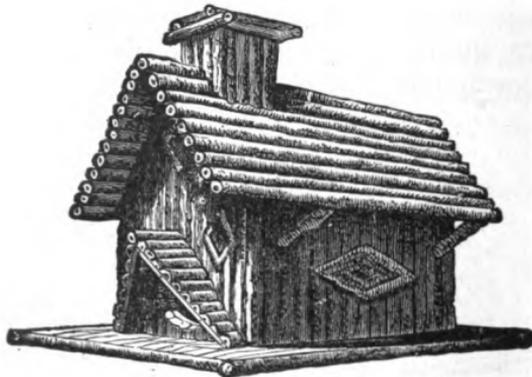


Fig. 320—RUSTIC PIGEON HOUSE

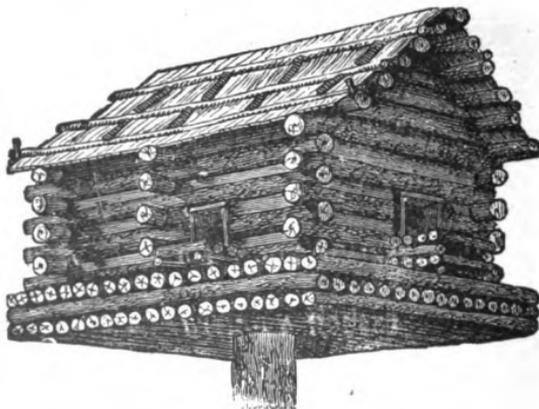


Fig. 321—LOG CABIN PIGEON HOUSE

place. Herewith are given some engravings of simple "pole houses," and one which may appropriately be set, as exhibited, upon a roof. For convenience of examinations pigeon houses should have the roof keyed on so as to be lifted off. The roofs should have wide, projecting

eaves and gable ends, to keep out the rain. The houses should be fastened very securely by iron straps, shaped like the letter L inverted, screwed to the bottom of the structures and to the side of the post. The post should be very smooth for several feet below the top, and painted, to prevent vermin getting to the pigeons.

Figure 320 represents a simple house, twenty by twenty inches, for a single pair of pigeons. It has two brooding rooms, and a vestibule or outside room con-

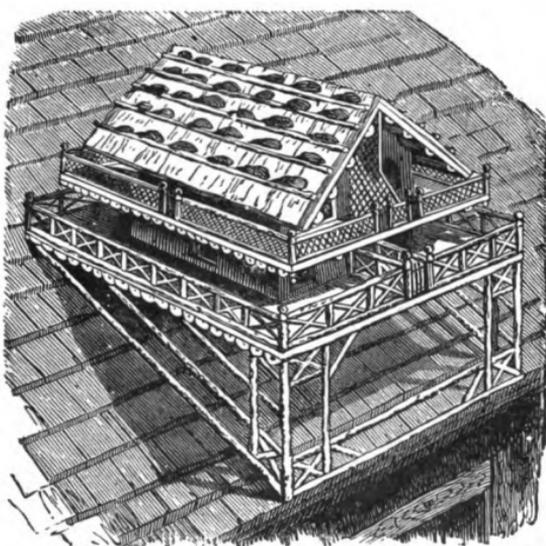


Fig. 322—SWISS PIGEON COTTAGE

necting them. This house, as also the log cabin, Figure 321, is constructed of round and half round sticks of as nearly a uniform size as possible, which, after drying with the bark on, are tacked upon a box made or adapted to the purpose. Figure 322 is a Swiss pigeon cottage; it is a good deal larger than the pole house, and will accommodate as many pairs of birds as there are distinct apartments. No vestibules are provided, but each tenement is big enough for two nests, if needed. The Swiss

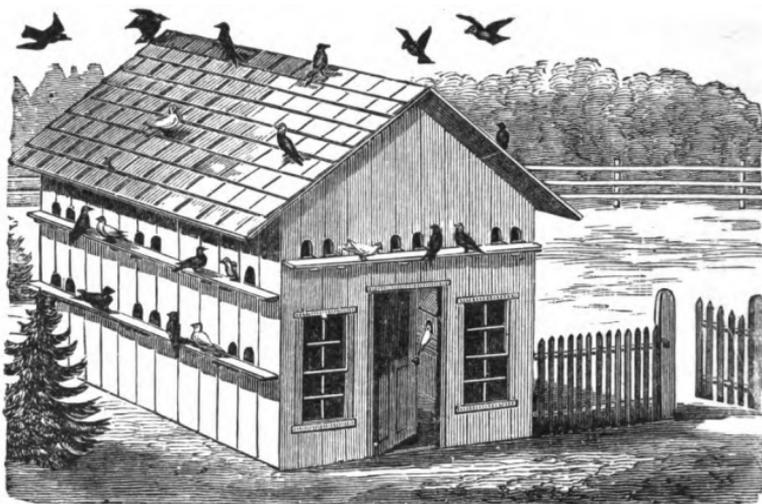


Fig. 323—A NEAT PIGEON HOUSE

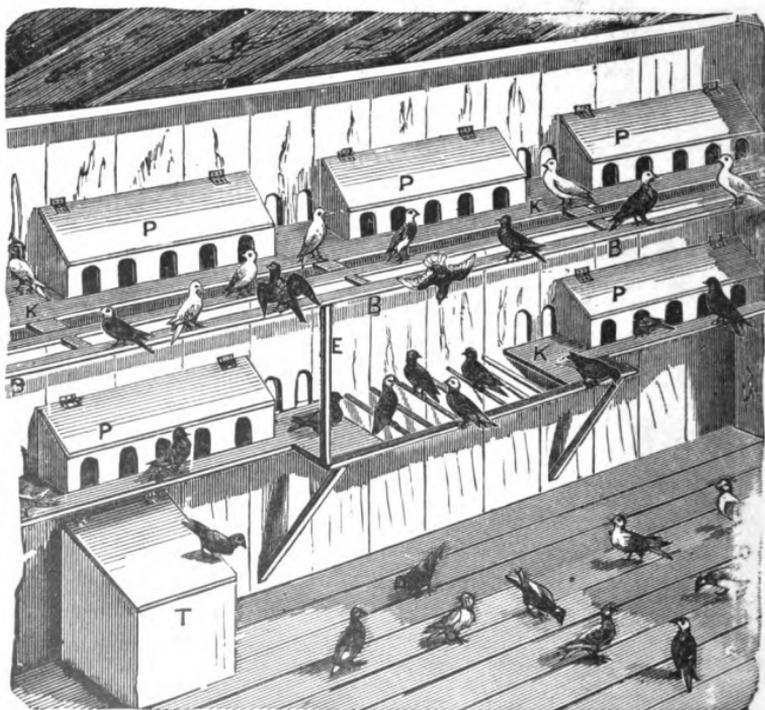


Fig. 324—INTERIOR OF A LARGE PIGEON HOUSE

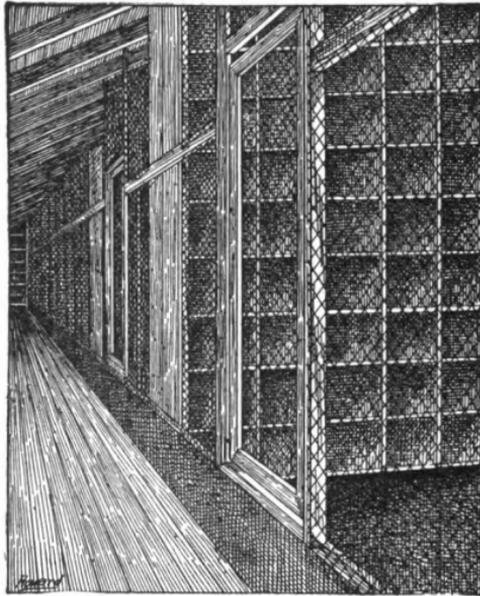
cottage is very elaborate and will require a skillful hand and patience to make it. Each story of the house should be made separate, the lower one at least eight inches high and the lower piazza eight inches wide. The stones upon the roof should be wired to the cross-strips.

Those who go into pigeon raising as a matter of profit should make suitable arrangements for the birds, and not only provide them with a desirable house, but see to their feeding, and, what is quite important, insure protection from cats, rats and all other enemies. A house of this kind is shown in the accompanying engravings. The outside, Figure 323, is ten by sixteen feet, eight feet high at the eaves, with a tight, shingled roof. Figure 324 shows one side of the interior, where there are platforms, *K, K*, upon which the birds enter, and which holds three nesting and hatching boxes, *P, P*. A building of this kind should be placed where it can be shaded by trees in the heat of the day, and in a quiet place, where the nesting birds will not be disturbed by noises. Besides abundant feed, the birds should be constantly supplied with water, and have a mixture of salt, sulphur and gravel placed where they can always get at it.

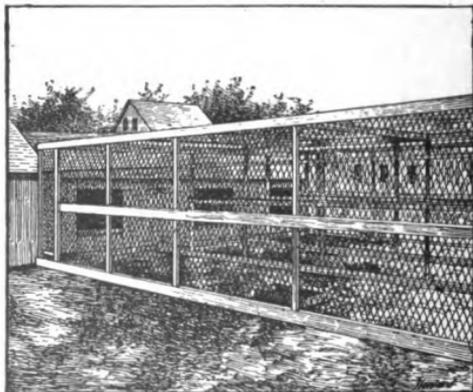
#### A HOUSE FOR SQUAB RAISING

Squab raising offers some inducements in the way of profit for those who like pigeons and have an hour or two of spare time every day. The most important thing in starting right is the site, which must be in a spot well drained, facing east or south, sheltered from prevailing winds and not exposed to extremes of heat, cold or wind. A shallow stream of pure running water for drinking and bathing is desirable. The house is as important as the site.

It should be built in sections for no more than 250 pairs, and not more than fifty pairs in each section, and

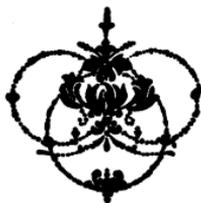


**Fig. 325—INTERIOR VIEW OF PIGEON HOUSE**



**Fig. 326—PIGEON HOUSE AND COVERED FLY.**

designed so as to be well ventilated, easily kept clean, secure from attacks of mice, rats and other animals, and not subject to drafts of air. The houses of Mr. William E. Rice, a successful New Jersey squab raiser, are forty feet long, twelve feet wide, nine feet to peak of roof. Nest boxes are made twelve inches wide, nine inches high and twelve inches long, as shown in interior view, Figure 325. An alleyway at the rear allows of access to each pen without disturbing all the occupants. A covered yard or fly thirty-two feet long and eight feet high is attached to the house, as shown in Figure 326.



## CHAPTER XVIII

### *SILOS*

The past two decades have seen the rapid adoption of silos as a part of American farm buildings. They are used for the preservation of forage in a green state, and are commonly employed for keeping corn fodder, although other crops are often put in them. The silo is essentially a building having practically air-tight bottom and sides, with a roof to protect the contents. It may be built of wood, stone, brick or a combination of these materials. The process of preserving green crops in silos is to exclude the air so as to prevent decomposition. A partial fermentation takes place, due to the air which is in the spaces between the particles of silage, but when the oxygen is used up this fermentation ceases entirely, or proceeds very slowly. The common practice is to cut corn fodder at about the stage when the kernels begin to glaze or harden. Stalks are then run through a cutter and cut fine, into lengths varying from one-half to one inch. This material is at once put into the silo and packed solidly around the edges. Other crops, such as cowpeas, are sometimes mixed with the corn in order to increase the feeding value of the silage. After the silo is filled the silage may be covered with any material at hand, such as straw, poor hay, swale grass cut green, or even earth or sawdust. Some do not cover at all, in which case a foot or more of the green fodder spoils and is thrown out before feeding.

The first silos were pits in the ground, but they were very expensive to build, and much labor was entailed in taking

out the material. Square silos above ground came next into vogue, and were largely used, but the difficulty was encountered of building them strong enough so that the sides did not bulge and let in the air after the silage settled, in which case considerable of the material would be spoiled at the edges. Of late years the round silo has come into great favor, owing to the cheapness of construction and its superior form and strength. Difficulty is always encountered in a square silo in getting the corners solidly filled. The silo may be built in the barn, or as a separate structure outside. Both methods have their advocates, but which to adopt must be considered by every builder in accordance with his conditions.

Inside the silo must be perfectly smooth and free from obstructions in order to allow the silage to settle evenly. It should be painted every two or three years, but never with a paint containing white lead, as this will peel off when the silage is removed and prove injurious, if not fatal, to cattle. Gas tar put on top is often employed for painting the inside and will answer the purpose very well.

Each two inches of corn silage will weigh from five pounds per square foot at the top to ten pounds at the bottom, or an average of seven and one-half pounds. On this basis the proper surface area is five square feet per cow per day. This must be borne in mind in building the silo, to make it in diameter proportionate to the number of cattle kept. If the feeding area is larger than six or six and one-half feet per head, the silage will spoil faster than it can be fed out. The following table, compiled by Prof. F. H. King of Wisconsin, gives the capacity of round silos of different diameters and different depths for well matured corn silage in tons. In this table the horizontal lines give the number of tons held by a silo having the depth given at the top of the column, the first number of each line being the diameter of the silo:

## CAPACITY OF ROUND SILOS

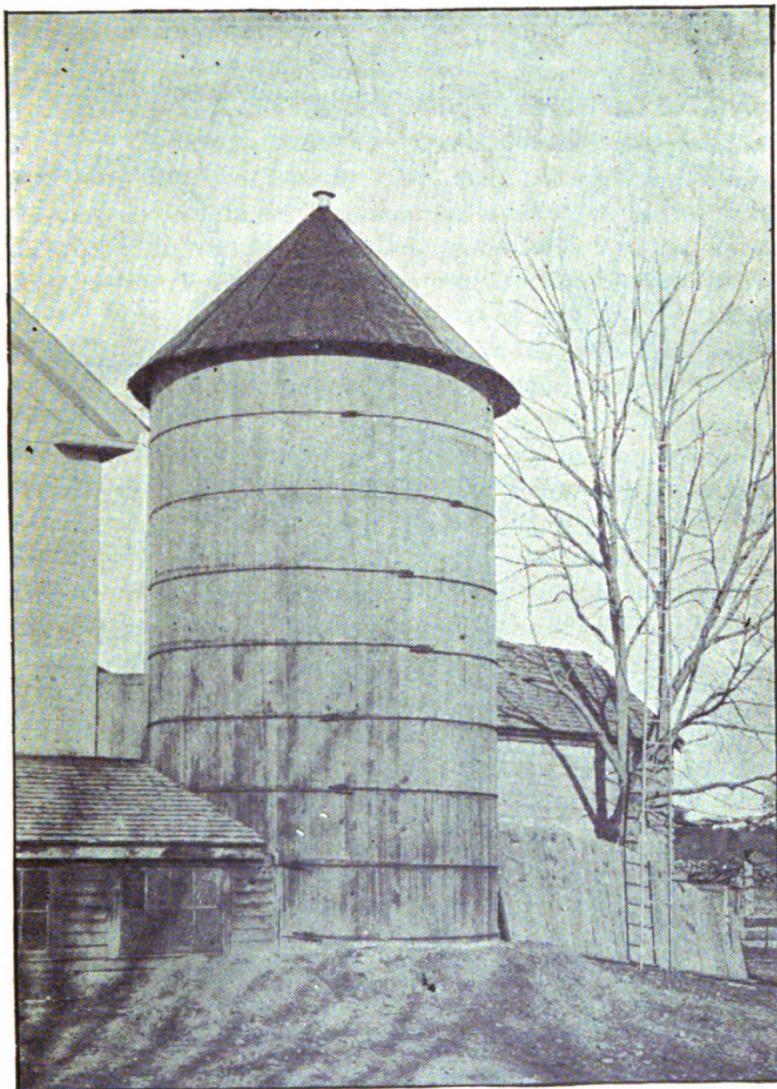
	15	16	17	18	19	20	21	22	23	24	25	26
20	58.84	66.95	75.58	84.74	94.41	104.6	115.3	126.6	138.3	150.6	163.4	176.8
21	62.90	71.56	80.79	90.57	100.9	111.8	123.3	135.3	147.9	161.0	174.7	189.0
22	67.35	76.52	86.38	96.84	107.9	119.6	131.8	144.7	158.1	172.2	186.8	202.1
23	71.73	81.61	92.14	103.3	115.1	127.5	140.6	154.3	168.7	183.6	199.3	215.5
24	76.12	86.61	97.78	109.6	122.1	135.3	149.2	163.7	179.0	194.9	211.5	228.7
25	80.62	89.64	103.6	116.1	129.3	143.3	158.0	173.4	189.5	206.4	223.9	242.2
26	85.45	97.23	109.8	123.0	137.1	151.9	167.5	183.8	200.9	218.8	237.4	256.7
27	90.17	102.6	115.8	129.8	144.7	160.3	176.7	194.0	212.0	230.8	250.5	270.9
28	94.99	108.1	122.0	136.8	152.4	168.9	186.2	204.3	223.3	243.2	263.9	285.4
29	99.92	113.7	128.3	143.9	160.3	177.6	195.8	214.9	234.9	255.8	277.6	300.2
30	105.0	119.4	134.8	151.1	168.4	186.6	205.7	225.8	246.8	268.7	291.6	315.3
31	109.8	124.9	141.1	158.2	176.2	195.2	215.3	236.3	258.2	281.8	306.1	330.0
32	115.1	135.9	147.8	165.7	184.6	204.6	225.5	247.5	270.5	294.6	319.6	345.7

## THE STAVE SILO

Silos have come to be an article of commerce, the same as mowing machines and wagons. Such silos are built of staves in the same manner as water tanks. These staves, which are usually two inches thick and six inches wide, are of various kinds of material, such as cypress, white pine, California redwood, cedar and hemlock, and the cost varies largely with the grade of material used. It is important that the staves be of sound stuff, free from knots and sappy places, and of a uniform grade throughout. If there are any poor sections in the silo they will give out in a few years, and the expense of putting in a new stave is considerable; sometimes it is necessary to rebuild the entire silo. The stave silo of E. W. Moody of North Andover, Mass., shown in Figure 327, is hooped with five-eighths-inch rods which run through two lugs, and have a long screw threaded on each end in order to take up slack. Roofs of stave silos are put on in various ways to meet the fancy of the owner. These silos are commonly set on a stone or brick foundation outside the barn.

## CONSTRUCTING A ROUND SILO

A round wooden silo is, as a rule, the most satisfactory. In Bulletin 59 of the Wisconsin Experiment Station,



**Fig. 327—A MODERN ROUND SILO**

F. H. King, professor of agricultural physics, described in detail the construction of silos, from which the accompanying illustration and the following description is substantially an abstract: There should be a good, substantial masonry foundation for all forms of wood silos, and the

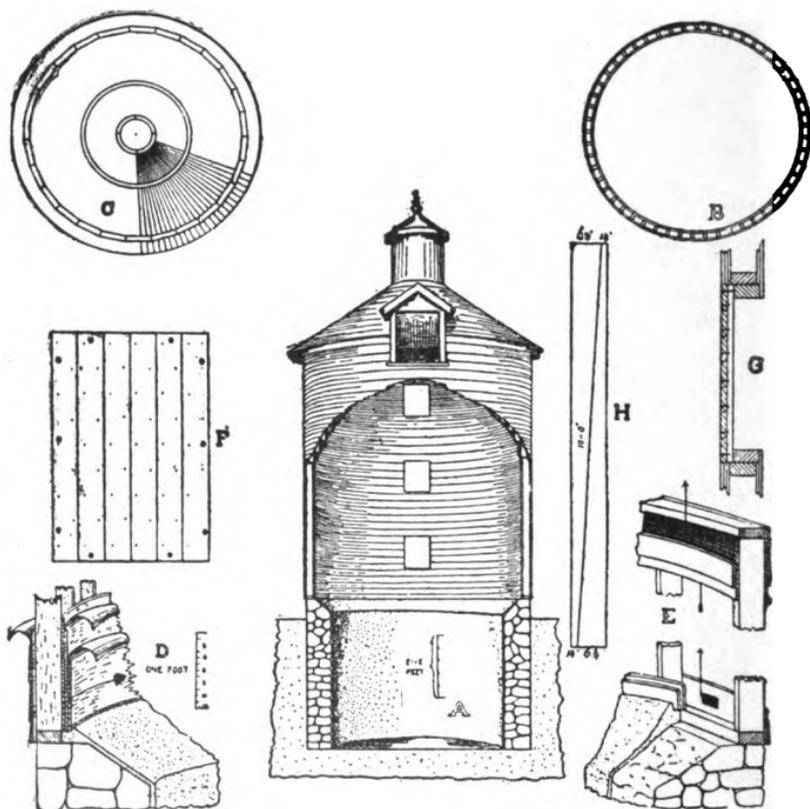


Fig. 328—CONSTRUCTION OF SILO IN DETAIL

woodwork should everywhere be at least twelve inches above the earth, to prevent decay from dampness. There are few conditions where it will not be desirable to have the bottom of the silo three feet or more below the feeding floor of the stable, and this will require not less than four

to six feet of stone, brick or concrete wall. For a silo thirty feet deep the foundation wall of stone should be one and one-half to two feet thick.

Upon the outer edge of this wall is laid the sill, made of two by fours, cut in two-foot lengths, with the ends beveled so that they may be toe-nailed together and bedded in cement mortar. The studding need not be larger than two by four inches unless the diameter is to exceed thirty feet, but they should be set as closely together as one foot from center to center, in the manner shown at *B* in Figure 328. This number of studs is not required for strength, but they are needed in order to bring the three layers of lining very close together so as to press the paper closely and prevent air from entering where the paper laps. Where studding longer than twenty feet are needed, short lengths may be lapped one foot and simply spiked together before they are set in place on the wall. This will be cheaper than to pay the higher price for long lengths. All studding should be given the exact length desired before putting them in place.

To stay the studding a post should be set in the ground in the center of the silo long enough to reach about five feet above the sill, and to this stays may be nailed to hold in place the alternate studs until the lower five feet of outside sheeting has been put on. The studs should be set first at the angles formed in the sill and carefully stayed and plumbed on the side toward the center. When a number of these have been set they should be tied together by bending a strip of half-inch sheeting around the outside as high up as a man can reach, taking care to plumb each stud on the side before nailing. When the alternate studs have been set in this way the remainder may be placed and toe-nailed to the sill and stayed to the rib, first plumbing them sideways and toward the center. On the side of the silo where the doors are to be placed the studding should be set double the distance apart to

give the desired width. A stud should be set between the two door studs, as though no door were to be there, and the doors cut out at the places desired afterward. The construction of the door is shown at *F* and *G*, Figure 328.

The character of the siding and sheeting will vary considerably according to conditions and size of silo. Where the diameter of the silo is less than eighteen feet inside and not much attention need be paid to frost, a single layer of beveled siding, rabbeted on the inside of the thick edge deep enough to receive the thin edge of the board below, will be all that is absolutely necessary on the outside for strength and protection against weather. This statement is made on the supposition that the inside lining is made of three layers of fencing split in two, the four layers constituting the hoops. If the silo is larger than eighteen feet inside diameter, there should be a layer of half-inch sheeting outside, under the siding. If basswood is used for siding, care should be taken to paint it at once, otherwise it will warp badly if it gets wet before painting. In applying the sheeting, begin at the bottom, carrying the work upward until staging is needed, following this at once with the siding. Two eightpenny nails should be used in each board in every stud, and to prevent the walls from getting "out of round," the succeeding courses of boards should begin on the next stud, thus making the ends of the boards break joints.

When the stagings are put up, new stays should be tacked to the studs above, taking care to plumb each one from side to side. The siding itself will bring them into place and keep them plumb the other way if care is taken to start new courses as described above. When the last staging is up, the plate should be formed by spiking two by fours cut in two-foot lengths, in the same manner as the sill, and as represented at *C* in cut, down upon the tops of studs, using two courses, making the second break joints with the first.

The lining of the silo should be three layers of half-inch boards. This is obtained by having good fencing, with only very small knots, and these thoroughly sound and not black, split in two at a mill, with two layers of paper between the three layers of boards; see *D* in illustration. The precaution to be observed with this type of lining is that the boards may not press the two layers together close enough so but that some air may arise between the two sheets where they overlap and thus gain access to the silage. It would be a good plan to tack down closely with small carpet tacks the edges of the paper where they overlap, and if this is done a lap of two inches will be sufficient. The first layer of lining should be put on with eightpenny nails, two in each board and stud, and the second and third layers with tenpenny nails, the fundamental object being to draw the two layers of boards as closely together as possible. It is very important that a good paper be used, one that is both water and acid proof. A paper that is not acid and water proof will disintegrate at the joints in a very short time and thus leave the lining very defective.

If the silo is no larger than fifteen feet inside diameter, no rafters need be used in putting on the roof, which may be only a single circle like that shown at *C*. This is made of two-inch stuff cut in sections in the form of a circle, and two layers spiked together, breaking joints. The roof boards are put on by nailing them to the inner circle and to the plate as shown at *C*, the boards having been sawed diagonally, as represented at *H*, making the wide and narrow ends the same relative widths as the circumferences of the outer edge of the roof and of the inner circle.

If the silo has an inside diameter exceeding fifteen feet it will be necessary to use two or three hoops according to diameter. When the diameter is greater than twenty-five feet it will usually be best to use the rafters and headers cut in for circles four feet apart to nail the roof

boards to, which are cut as represented at *H*. The conical roof may be covered with ordinary shingles, splitting those wider than eight inches. By laying the butts of the shingles one-eighth to one-fourth inch apart it is not necessary to taper any of the shingles except a few courses near the peak of the roof. In laying the shingles to a true circle and with the right exposure to the weather a good method is to use a strip of wood as a radius which works on a center set at the peak of the roof and provided with a nail or pencil to mark on the shingles where the butts of the next course are to come. Every silo which has a roof should be provided with ample ventilation to keep the underside of the roof dry, and, in the case of wood silos, to prevent the walls and lining from rotting.

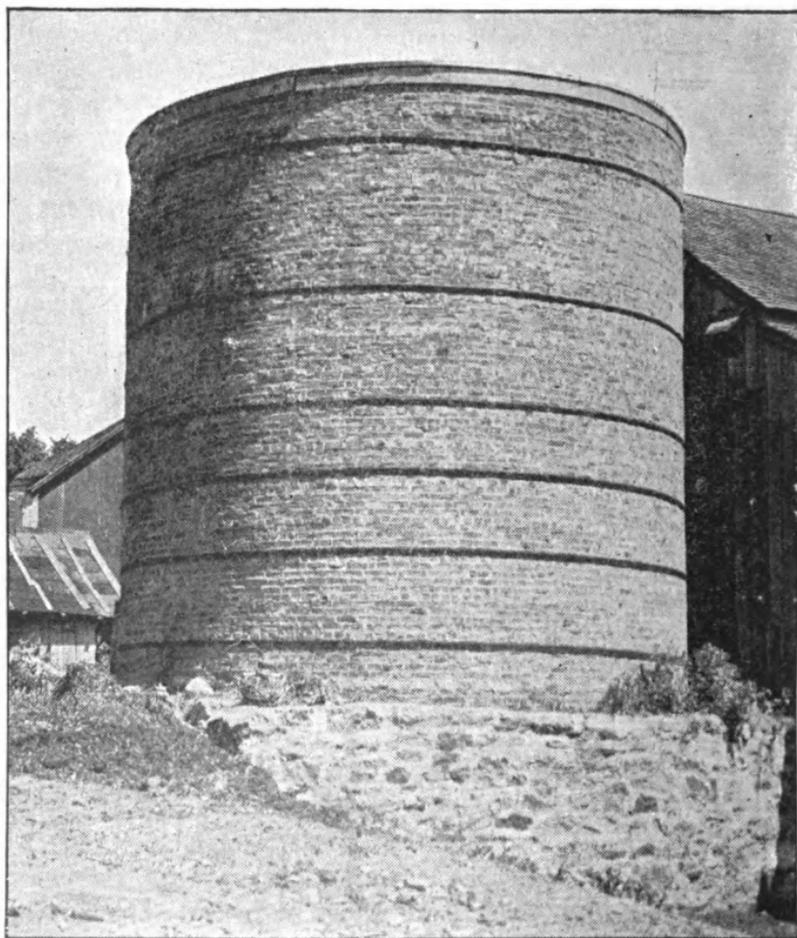
One of the most serious mistakes in the early construction of wood silos was the making of the walls with dead air spaces, which, on account of the dampness from the silage, led to rapid dry rot of the lining. In the wood silo it is important to provide ample ventilation for the spaces between the studs, as well as for the roof and the inside of the silo, and a good method of doing this is shown at *E*, where the lower portion represents the sill and the upper the plate of the silo. Between each pair of studs at the bottom, and on the outside of the silo, a one and one-fourth-inch auger hole is bored to admit air, and covered with wire netting to keep out mice and rats. At the top of silo on the inside the lining is left off for a space of two inches below the plate, and this space is covered with wire netting to prevent silage from falling into the studding spaces. This arrangement permits dry air from outside to enter at the bottom between each pair of studs, and to pass up and into the silo, thus keeping the lining and studding dry and at the same time drying the underside of the roof and the inside of the lining as fast as exposed. There should be a ventilator on the roof. It may take the form of a cupola to serve for an orna-

ment as well, or it may be a simple galvanized iron pipe twelve to twenty-four inches in diameter, rising a foot or two through the peak of the roof.

After the silo has been completed the ground forming the bottom should be thoroughly tamped, so as to be solid, then covered with two or three inches of good cement made of one part of cement to three or four of sand and gravel. The amount of silage which will spoil on a hard clay floor will not be large, but enough to pay a good interest on the money invested in the cement floor. If the bottom of the silo is in dry sand or gravel the cement bottom is imperative to shut out the soil air. A silo constructed after the manner described will prove to be a durable building and will give satisfactory results.

#### A SUBSTANTIAL AND DURABLE SILO

A round brick silo was put up by Daniel Brothers of Middlesex County, Ct. It is shown in Figure 329, and is thirty feet high, twenty feet in diameter and built eleven feet in the ground. It has a capacity of 200 tons and cost complete \$300. The wall was built eight inches thick of swelled brick which cost \$3 per 1000 and \$2 for cartage. It took 21,000 brick to put up the silo. Six hoops of three-sixteenths-inch flat iron two inches wide, with one lug each, were used around the silo. The windows for throwing out the silage are two by two and one-half feet and placed four feet apart. A frame of three by six-inch chestnut was set in the wall, and inside this was nailed one by two-inch cleats, against which were placed tight boards as the silo was filled. The silo is filled through the roof. The roof, which is flat, is covered with tight boards and then with tarred paper. On the paper was put a coat of hot coal tar, then another layer of paper, some more hot tar, and a third layer of paper and again hot tar.



**Fig. 329—DANIEL BROTHERS' BRICK SILO**

The expense for cement and lime was \$48, mason work, foundation and roof \$120, hoops \$20, material for roof \$15. Silo was plastered inside with a coat of three-fourths Portland cement and one-fourth sand. After filling, the silage was covered with sawdust and not a pound of it spoiled. Several other brick silos have been put in the immediate vicinity and all are giving satisfaction. Where brick can be had at moderate prices it would seem that this kind of silo would in the end prove much cheaper than a wooden one.

#### THE SILO IN BEEF FEEDING

The silo has come to be a feature in the feeding of cattle in the middle west, particularly in Illinois and states east. Some of these silos are of immense size, holding many hundred tons of silage, and they are seldom roofed. On the farm of Humphrey Jones in Fayette County, Ohio, is a concrete silo of 1500 tons capacity, besides two other silos of large capacity, which are shown in Figure 330. The concrete silo is thirty-six feet inside diameter, forty-seven feet high, with an unfinished wood top of six feet. It is built of solid concrete from gravel and cement, and the walls are one foot thick. Mr. Jones says these walls are thicker than is necessary, and if he were to build another it would be with walls only four inches thick.

In the midst of these cement walls are imbedded strands of 00 wire, which are as thick as a lead pencil, and have enormous strength. These strands go clear around the silo and the ends are looped about each other and are imbedded in the cement about eight inches apart vertically. With a thin wall the wires should be put as close as six inches at the lower part of the silo, where the pressure is greatest. The outside hoops were put on this silo temporarily, because it was filled before it was finished,

and the cement had not time to harden properly. He estimates that he can build silos in this manner for less than one dollar per ton capacity.

The tubes on the outside of the silos are chutes for throwing down the silage. Inside these chutes are doors opening into the silo, through which the material is

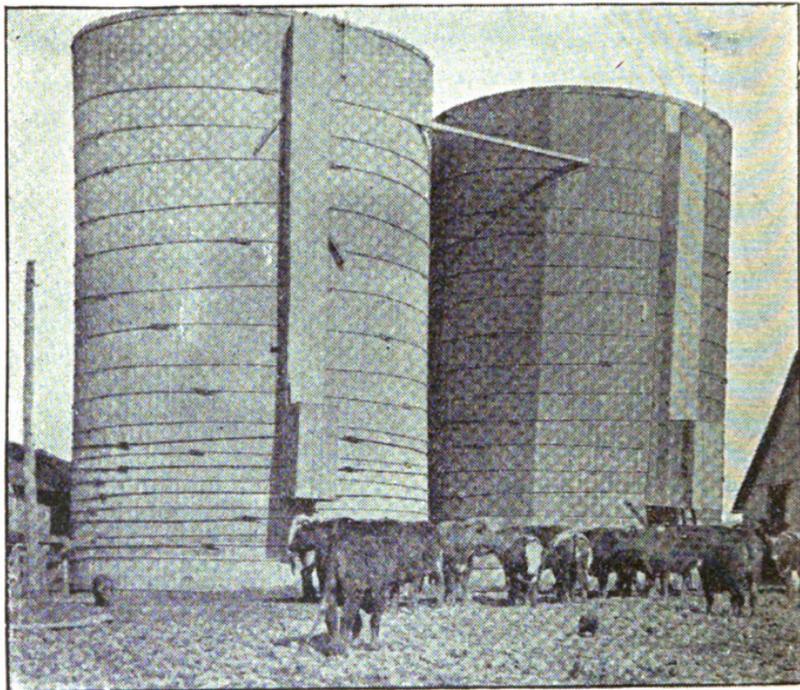


Fig. 330—HUMPHREY JONES' SILOS AND BEEF CATTLE

thrown. The bottom of the chute should be high enough from the ground so that a wagon can be driven under it and the silage dropped directly into this without extra handling. The bottom of the silo is raised slightly above the surrounding ground, in order to provide suitable drain-

age. The silo is covered with six inches of sawdust, which almost wholly prevents spoiling. The wooden top holds the silage until it has time to settle.

#### BUILDING A CHEAP SILO

Edward Van Alstyne of Columbia County, N. Y., has three silos which he built himself. One has been filled thirteen times, and another for nine winters. Anyone can build one of this sort who can handle a level and saw,

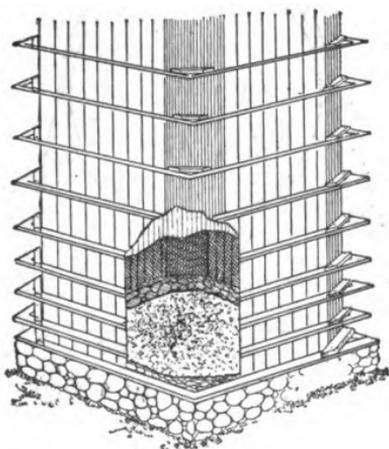


Fig. 331—SQUARE SILO

or use a hammer and nails, and a good thing about them is that they can be set anywhere and made to conform to the size of the barn, if you want to put them inside. Figure 331 shows clearly how the silo is built. The foundation is below frost made of stones laid in cement mortar. On this are placed sills of two by six or two by eight. Matched pine siding is stood up and braced with two by eight or two by ten-inch scantling placed as shown. The corners are put in on a bevel to avoid the square corner, and also to allow of braces to strengthen the silo.

A second thickness of siding should be put on to break joints. Do not use paper between the boards, as it will rot out.

#### FASTENING A SILO TO THE BARN

Where round silos are built outside of the barn in an exposed situation it is sometimes necessary to stay them, in order to prevent their being blown down, when empty,

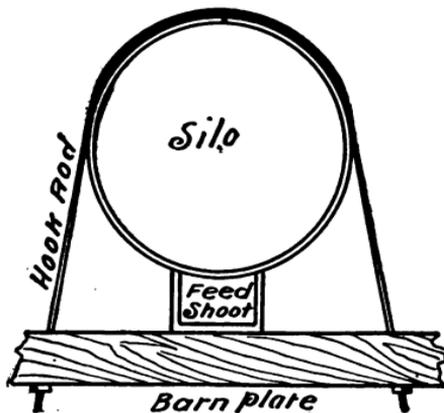


Fig. 332—TYING A SILO

by high winds. A heavy rod or five-eighths-inch wire rope can be placed around the silo and fastened to the plate of the barn as shown in Figure 332.

#### A CHEAP HOMEMADE SILO

By building it octagonal, or eight-sided in shape, and ceiling perpendicularly with two thicknesses of inch hemlock boards, with felt paper between, a perfect silo may be made at small cost. Alonzo Devenpeck of New York built one of this shape and it has given perfect satisfaction. He says: "Every silo that has been built in this vicinity since, and I know of twelve, has been built after

the same plan, and others will be built the coming year. They can be built any size wanted. With 2500 feet good hemlock boards, 900 two by sevens, three feet long, and \$6 worth of felt and nails, three men can build a silo in three days. The expense for roof and bottom would be the same as for any other shape or style.

"I got out the lumber for mine, and, paying the saw bill, cement, nails, paper, mason work and all complete,

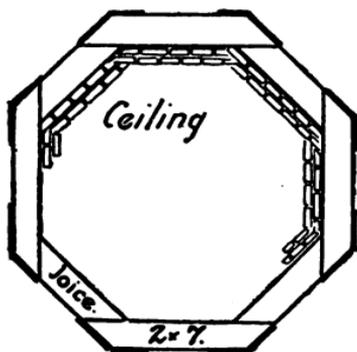


Fig. 333—OCTAGONAL SILO

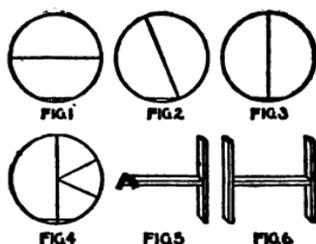


Fig. 334—DIVIDING A SILO

it cost me \$29.70. The size is twelve feet inside and twenty-four feet high. It will hold silage enough to feed twelve head of cattle twice a day for six months. When the foundation is completed, place the sills on and nail the corners together. Then set the boards up at the corners and plumb them with a level or plumb staff, let one man hold the joist on the outside where they belong, place two feet apart and nail them from the inside. Spike the joist at the corners as you go for the first twelve feet, then put the upper section up the same way. The joist may be sawed the same length with a crosscut saw by bunching them together." By the ground plan in Figure 333 it will be seen that the joist and boards at the corners all have to be the same slant, which is a square miter or an angle of forty-five degrees.

## DIVIDING A ROUND SILO

It is sometimes desirable to put a partition in a silo in order to diminish the feeding surface. In Figure 334 Figs. 1, 2 and 3 show the three plans. By putting the partition as in Figs. 1 and 2, the silage from one half must be thrown across the other, which means much extra work in emptying a silo. The partition should be placed as in Fig. 3, and good doors made to fit the opening in each side. Use acid and water proof paper, or, what is better, felt, to make the joints air-tight.

It would be impossible to make a partition air-tight when the boards are cut and the partition put in as the silo is filled. Too much care cannot be taken in putting in such a partition. The ends will have to have much work where joined to the walls or air will get through when one side is empty. The work should be done in a good and substantial manner, as there is great pressure. Both sides should be filled simultaneously and well compacted at all times. It would break down the best made partition if one side was put in at a time. After it is well settled if one side is taken out the pressure is not so great.

When taking out the first side have a large number of braces ready the proper length, and as fast as the silage is used put in the braces. Fig. 4 shows the braces in position from the sides of the silo to the partition. These braces should have some pieces at the ends running the opposite direction to the material against which the brace is to support. That is, if the silo is stave and the partition horizontal to the brace, the end pieces should be as in Fig. 5. If the timber of the outside of the silo is horizontal, the brace should be as in Fig. 6. When one side of the silo is empty there is no danger of the wall giving way if these precautions are taken. Next year, when filling, the braces as well as the end pieces should be taken out and laid away for another year. By this method the

man with a small herd can build a moderate sized silo and have silage through the dry time as well as winter at a very small outlay of money.

## SILO FOR BREWERS' GRAINS

E. B. Brady, Westchester County, N. Y., has a silo which is used for storing brewers' grains. Figure 335 shows shape and mode of constructing the Westchester

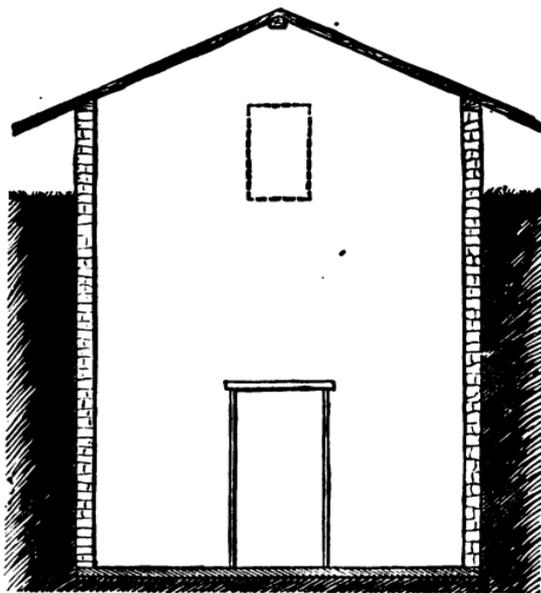


Fig. 335—VIEW OF SILO

county silo, and Figure 336 the manner in which it is used. The silo, shown in Figure 335, consists of a sort of basement cellar, with the door opening into the cow stable, and the rear sunk for the most part beneath the ground. A road passes the end of it, where there is a door, shown by dotted lines, for the purpose of unloading the grains. The walls are of stone, and the floor is of cement. The silo is covered with an ordinary shingle

roof. The grains are packed in solidly, until they reach the level of the door at the top, when they are covered with boards, and some straw is thrown over the boards. The lower door is opened when the grain is required, and it is dug out as bright as when put in, but somewhat soured. As the mass is cut away, nothing is done to the surface, which is left exposed to the air; the surface is made fresh every day by the removal of what was left exposed the day before.

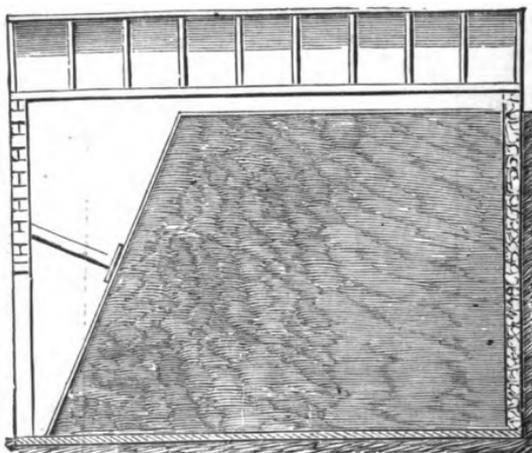


Fig. 336—SILO, MANNER OF COVERING

#### BEST HOOPS FOR SILO

For hoops five-eighths-inch wire rope is very satisfactory. It can be bought for the same price as the five-eighths-inch rods, but the tensile strength of the iron rope is very much greater than the tensile strength of the iron rod and it has this advantage, that it gives and takes the expansion and contraction of heat and cold better, and only needs one buckle or coupling, and it is very much more easy to put around. The round silo is best in one respect, and that is because it has no corners.

## CHAPTER XIX

### ROOT CELLARS AND ROOT HOUSES

The leading features of a good root cellar are: cheapness, nearness to the place where the roots are consumed, dryness, ventilation, and, above all, it should be frost-proof. If a hillside is handy, it can aid much in securing all of these important points. First make an excavation in the hillside, in size according to the desired capacity of the cellar. Erect in this excavation a stout

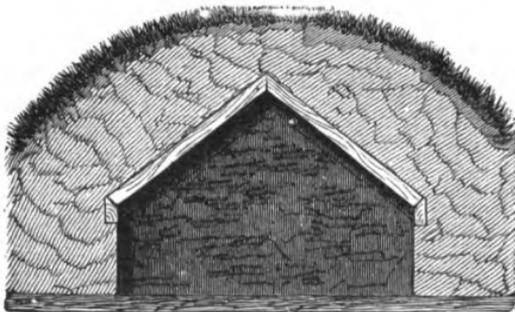


Fig. 337—CROSS-SECTION OF A ROOT CELLAR

frame of timber and planks, or of logs, which latter are often cheaper. Over this frame construct a strong roof. Throw the earth which has been excavated over the structure until the whole is covered, top and all, to a depth of two feet or more. A door should be provided upon the exposed side or end. This door may be large enough to enter without stooping. Or it may be simply a manhole, which is better than a regular door, so far as protection from frost is concerned, but not so convenient for putting in and taking out roots. Sometimes, when

the bank is a stiff clay, such houses are built without constructing any side walls, the roof resting directly on the clay. A cross-section of such a root cellar is shown in Figure 337. In such cases, the facing, or front, of the cellar may be built up with planks, logs or stones, as circumstances determine. In Figure 338 a facing of stone is shown. This is a large cellar provided with a wide door; it has also a window on each side. Two tight fences, of stakes and planks, two feet apart, with earth filled in between, or of logs, or stout rails used in the same manner, make a cheaper front, and is a better protection against cold than stone. If there is no hillside

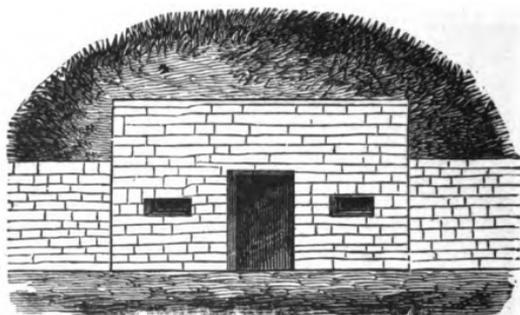


Fig. 338—STONE FACING OF HILLSIDE CELLAR

convenient, a knoll or other dry place should be selected, and the soil removed over a space a trifle larger than the ground plan of the house, and to the depth of two feet or more, provided there is no danger that the bottom will be wet. In the construction of the house, select poles or logs of two sizes, the larger ones being shortest; these are for the inside pen, as it is subjected to greater strain. The ends of the logs are cut flat, so that they will fit down closely together, and make a pen that is nearly tight. At least two logs in each layer of the inner pen should be cut long enough to pass through and fit into the outer pen, to serve to fasten the two walls together—

the space between the two being two feet on each side. Figure 339 shows the excavation, and beginning of the root house walls, with the method of "locking" them together. The doorway is built up by having short logs,

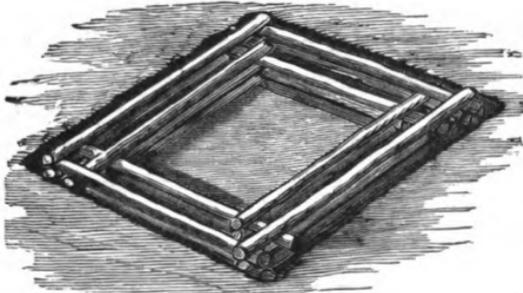


Fig. 339—EXCAVATION AND BASE OF ROOT HOUSE

which pass from one layer of poles to the other, and serve as supports to the ends of the wall poles. This is shown in Figure 340, where the house is represented as completed. The space between the two walls is filled

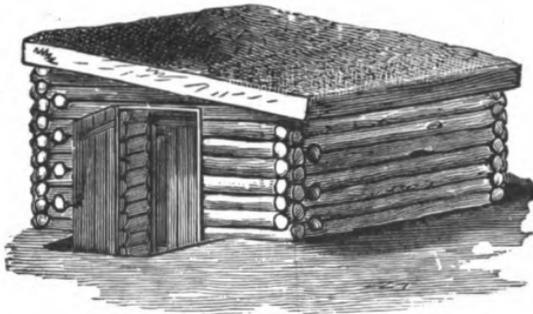


Fig. 340—ROOT HOUSE COMPLETED

with earth, sods being used to fill in between the logs to block the earth. It is best to begin putting in the earth before the walls are completed, as otherwise it will require an undue amount of hard lifting. When the walls are

built up five to six feet on one side, and about two feet higher on the other, to give the necessary slope, the roof is put on. The latter should be of poles placed close together, well secured to the logs, and covered with sod, eighteen inches of earth, and sodded again on the top. Two doors should be provided, one on the inner, and the other on the outer wall, both to fit closely. A filling of straw can be placed between the doors, if it is found necessary to do so in order to keep out the frost. Figure 340 shows the root house as thus constructed, and is a structure that will last for many years, paying for its moderate cost many times over.

#### WELL-ARRANGED ONION STORAGE HOUSE

The storage house of J. G. Rowley of Michigan, shown in Figure 341, is located on the south side of a hill and faces south and east. It is forty feet long by twenty-four feet wide, and has a stone basement. The stone walls on either side are seven and one-half feet high and two feet thick; wall at west is twelve feet high, the one at the east end eight feet. There are two stories above the basement. The floors are formed of boards three and one-half inches wide by one and one-quarter inches thick, with a half-inch space between boards. The roof is made of matched lumber, well put together, covered with several thicknesses of building paper and shingled. The interior of the building is lathed and plastered and the onions will stand zero weather without freezing.

On the ground floor there is an alley into which a wagon may be backed for convenience in loading. The building is provided with a return steam heater, so that it may be warmed in coldest weather. There is also a forcing window on the south side, next to the east end. The cost of storage house, steam heater and 1000 crates for onions was \$1000.

When well cured Mr. Rowley stores his onions with tops on, and they keep just as well as hay that is well cured. They are not topped until sold. For convenience in putting in the crop, there is a track on the west end of building running from the ground to top floor. The onions are carried up in a small car and dumped into the bins below.

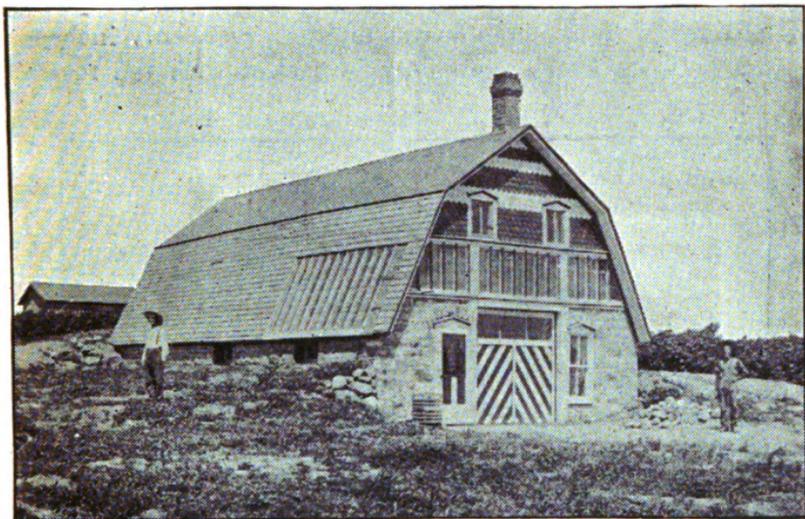


Fig. 341—STORAGE HOUSE FOR ONIONS

#### STORAGE HOUSE AND PITTS FOR CELERY

Several methods of storing celery are described and illustrated in Farmers' Bulletin 148, on celery culture, issued by the United States Department of Agriculture, from which Figures 342 and 343 are taken. Where only a small quantity of celery is to be stored for winter, a cheap method is to bank it up with earth and cover where grown. Place enough earth around the base of the plants to hold them in good form, and allow them to remain without further banking as long as there is any danger

of a hard frost. When necessary, the earth should be thrown up to the very tops of the plants, almost covering them, and as the weather becomes cooler, cover the ridge with coarse manure, straw or corn fodder held in place by means of stakes or boards.

Trenching is employed by large growers. The celery is partly banked with earth and allowed to remain where grown until in danger from heavy frosts. Set two parallel lines of twelve-inch boards eighteen or twenty inches apart between which the celery is packed with the roots

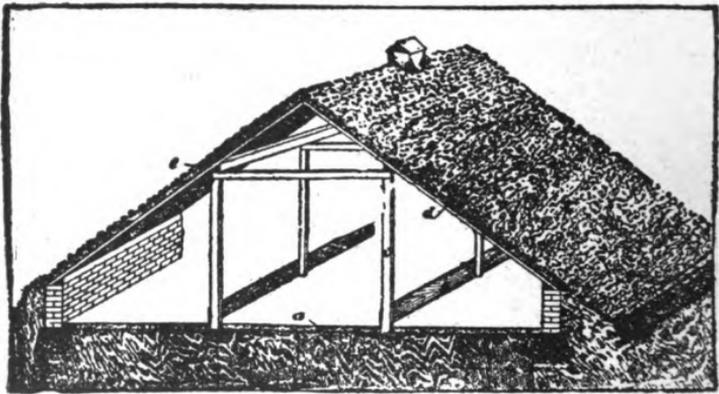


Fig. 342—CELERY STORAGE HOUSE

imbedded in soil. When the space between the boards is filled the soil is thrown up on the outside to the tops of the boards, which are then lifted out and the soil allowed to come in contact with the celery. Trenches are usually made from fifty to sixty feet long, or small enough to permit the removal of the whole trench at one time. As colder weather approaches, the celery is either removed and marketed or covered with boards, straw or corn fodder on top for protection.

Another method of trenching is to excavate a pit about twenty-four inches deep, three feet wide and of any de-

sired length, as shown in Figure 343. Loosen the soil in the bottom and set the roots in this. Pack the trench full of plants, placing the roots close together with considerable soil attaching to them. As the celery is placed in the trench it should be well watered and then allowed to remain open long enough for the tops to become dry. Place a twelve-inch board on edge, along each side of the trench, and bank up with earth on the outside. Cover the trench with a roof of boards, sash, straw, poles or cornstalks, and as the weather becomes cooler increase the covering to keep out frost. Celery stored in this manner will keep until late in winter. This method is recommended for farmers and small gardeners.



Fig. 343—CELERY TRENCH

Large growers who wish to store celery for late keeping employ a storage house similar to the one illustrated in Figure 342. A cross-section shows a house twenty-four feet wide, its side walls two feet high and eleven feet to the ridge. The roof should be of heavy planks with

one end resting on top of the wall and the other on a ridge pole supported by a line of posts through the center. The cracks between the roof planks may be battened with old celery blanching boards, and the whole covered to a depth of four inches with earth and sodded over or double roofed to keep out frost. The ends of the house should be built double with a dead-air space between, and there should be a large door in each end. The floor of the house should have a covering of three or four inches of sand or fine earth in which to pack the roots of the celery. It is desirable to have the storehouse subdivided lengthwise into beds six to eight feet wide by

means of six-inch boards raised three or four inches from the ground and fastened to stakes. These partitions increase the circulation of air through the celery and tend to keep the plants up in good condition.

#### CONVENIENT DOORS TO A CELLAR

Where there is no barn cellar, the roots to be fed the stock are usually stored in the house cellar and carried out daily, entailing a great amount of work. Where the barn has some space beneath it, a dry location and a tight foundation, a pit can be dug under some convenient

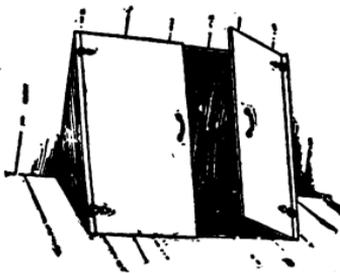


Fig. 344—HATCHWAY

point in the feeding floor and a light wall of brick or stones laid up about the sides, extending up to the barn floor. Through this floor an opening is cut and "bulk-head" doors arranged over it, as shown in Figure 344. Bank up the brick or stone wall about the pit with earth on the outside, heaping up this banking nearly to the barn floor, and there should be no trouble from freezing.

#### A CAVE FOR STORING APPLES

For storing fruit on the farm, nothing can equal a good cave. J. F. Record, a leading western orchardist, built a cave seven years ago and has found it an excellent place in which to store apples. The cave was dug into a north hill slope and the dirt removed with a spade and wheelbarrow. It is sixteen feet wide by fifty feet deep and will hold two carloads of apples. The clay walls need nothing to hold them in place.

The roof is made of bridge plank, held in place by posts along the sides. The plank are covered with dirt

and sodded over to turn the rain. Two twelve-inch tiles at the top provide ventilation. Rats have not bothered much. A few got in, but were caught with a wire trap. A fruit house, Figure 345, sixteen by twenty feet, is built in front of the cave. Double doors open on the north, so that two wagons can be backed in for unloading. There is an orchard and timber on the south, so that hot south winds have no chance to enter this cave. Apples are stored in barrels, which are kept off the ground by setting them on timbers laid down for this purpose.

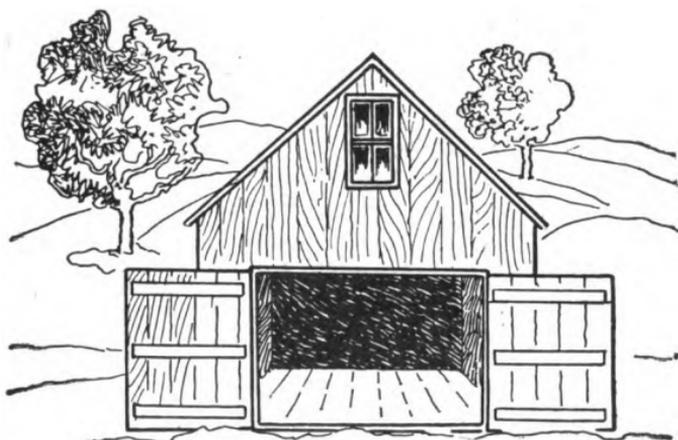


Fig. 345—ENTRANCE TO APPLE CAVE

#### A FIELD ROOT CELLAR

A field root cellar may be cheaply built, from the following directions: Dig in dry ground a trench five feet deep, eight feet wide, and ten feet longer than it is intended to make the cellar. Along each side, one and one-half feet below the surface, cut out a groove such as is shown at *g, g*, in Figure 346, so as to form an oblique support for a board eight inches wide lying against its lower side. Procure for rafters either light chestnut

posts, or two by five spruce joists; saw them to a length of five feet, and set up a pair (spiked together at the top) every three feet of the length of the building. Nail cheap boards or slabs on top of these rafters, so as to completely cover it. Openings an inch wide between the

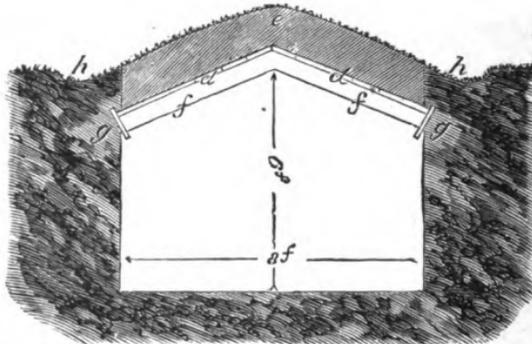


Fig. 346—CROSS-SECTION OF A FIELD ROOT CELLAR

boards will do no harm. Cover this roof twelve or eighteen inches thick with earth, and sod it neatly, drawing the sod on each side to a gutter, *h, h*, which will lead away the water of rains. The ends may be closed with

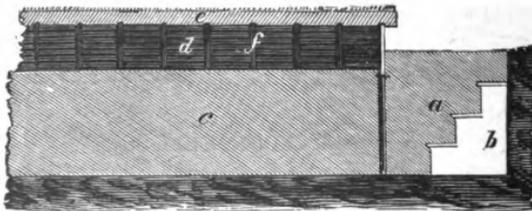


Fig. 347—LENGTHWISE SECTION OF ROOT CELLAR

double boarding filled in with sawdust, leaves, seaweed or other litter, and provided with doors wide enough to admit a bushel basket. The gable over the tops of the doors should be left open for ventilation, or, what is better, supplied with movable shutters. Figure 347

shows the longitudinal section of such a cellar about thirty feet long, with an area five feet long at each end, having steps, *b*, *a*, for the approach. The earthen wall of the cellar is shown at *c*, *d* the board roof, *e* the earth covering, and *f* the rafters. In light soils it will be necessary to place a stone, brick, or post and board wall against the side of the cellar, and similar protection should always be given to the area at the ends. Such a cellar will last for twenty years, and is thoroughly frost proof. If made thirty feet long it will hold, being filled only to the eaves, about 700 bushels. It may, of course, be made wider and higher, and have root bins on each side with a passageway between them.

#### PITS FOR STORING ROOTS

When properly put away in pits, roots of all kinds keep better than when stored in cellars. The chief difficulties in the way of keeping roots in pits are, the danger that frost will penetrate the covering, and the risk of heating for want of ventilation. By the use of board coverings shown in Figure 348, these difficulties may, with care, be wholly removed. The covering boards are made of a length to cover one side of the pit, and of such a width as to be handy and portable. Six feet square will be found a convenient size. The cheapest kind of boards will answer the purpose. These are cut into the required lengths and nailed to cross pieces or cleats at least four or six inches wide, placed edgewise, as shown in Figure 348. When the roots are heaped in the usual manner, and covered with straw placed up and down on the heaps, the boards are laid on the straw so that they nearly meet on the top, as shown in Figure 349. Space is left, through which the ends of the straw project. The straw is turned down over the edges of the boards when the earth is thrown on them. The boards

are placed upon the straw, with the cleats down, and so that they lie horizontally. There is then an air space of four to six inches besides the thickness of straw as a protection to the roots. In addition there may be as thick a covering of earth thrown upon the boards as may be required. In many places no earth will be needed, but it will always be useful in keeping the roots at an even temperature, and so low that they will not sprout or heat. If a covering of earth is put on, the projecting straw should be turned down on the opposite side to

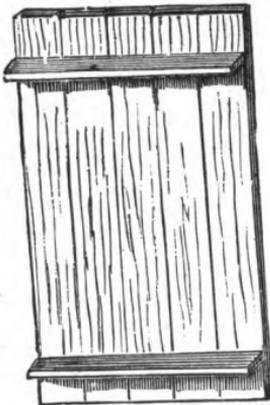


Fig. 348—SHUTTER  
FOR PIT

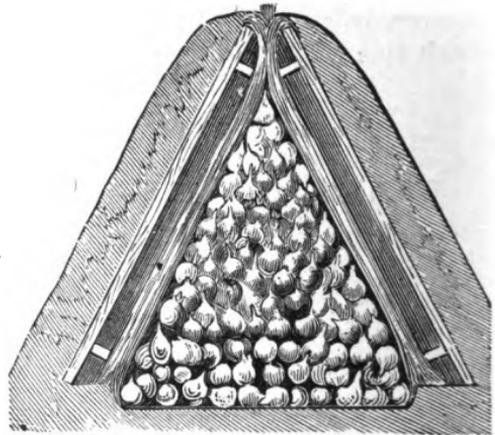


Fig. 349—SECTION OF FIN-  
ISHED PIT

that on which it is laid, and the ends covered with earth. The extreme top of the heap need not be covered at all unless severe cold is expected, when a few places should be left uncovered for ventilation. Figure 350 shows a root pit for use in the open prairies, where shelter is scarce, and the means of building are not abundant. An excavation is made in the ground six or seven feet deep and as wide as may be suitable to the length of the poles with which it is to be covered. The length will be according to the necessities of the builder. It is

covered with rough poles, over which some coarse hay is thrown. The sod, which should be cut from the surface in strips with the plow and an ax, is then laid closely on top, and earth is heaped over the sod. A manhole at one corner, or, if it is a long cellar, in the middle, is constructed with small poles and about two feet high. A ladder or row of steps is made from this to the bottom. The manhole when not used is filled with straw or hay, which is thrown upon a loose door or boards resting upon

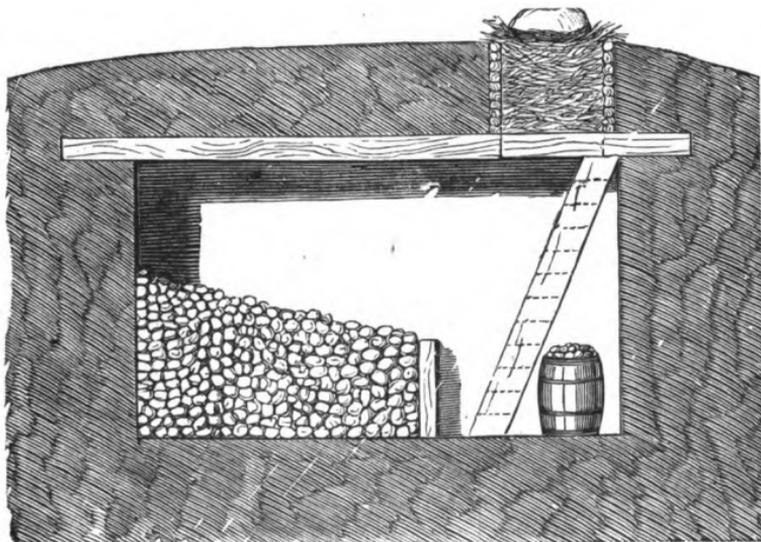


Fig. 350—PRAIRIE ROOT CELLAR

the logs, and a stone or log is laid upon the straw to keep it from being blown away. Openings may be made along the side opposite to the entrance, through which the roots or potatoes may be shoveled or dumped. These openings may be closed with sods and earth during the winter.

#### A CAVE FOR ROOTS

An oblong cellar is dug twenty-four feet in length, about twelve feet wide and three feet deep. This is

planked around with ordinary slabs and roofed over with the same material. The sides and roof are covered with the earth thrown out of the cellar, and is then sodded over, appearing as shown in the annexed engraving, Figure 351. The door is double, and steps are provided to descend to it. For such a cave it is not necessary to dig into a hillside; the north end, however, should be protected by extra covering. Caves of this kind are often the only kind that the pioneer can provide, and they will frequently be found useful on old farms. It is far better to have a cave like this for roots than to store them

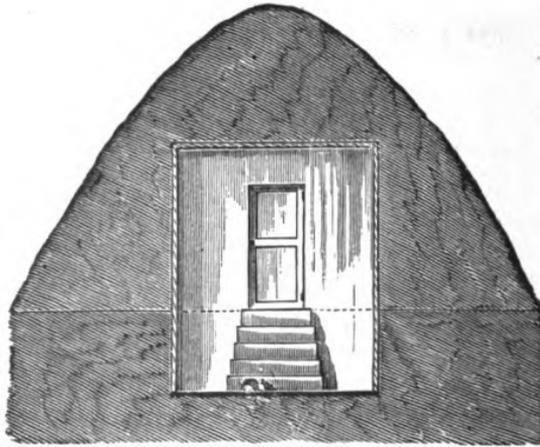


Fig. 351—CAVE FOR ROOTS

in the cellar of the house. Unless on loose, sandy, or very dry land, special care should be taken to have all water conducted away, either by good, deep drains, or by grading the surface around to carry rain water to a distance, or by both of these methods, if necessary.

#### PRESERVING ROOTS IN HEAPS

The pits for roots may be made in the field where the crop is harvested, or in a yard or field near the barn. A

slightly elevated spot should be chosen which will be dry at all seasons. On this the roots should be heaped in a pile about six feet wide at the bottom and four feet high, sloping to a point at the top, as shown in Figure 352.

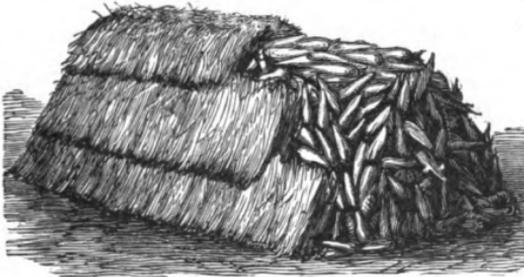


Fig. 352—BUILDING A ROOT HEAP

The heap may be made of any length, or the roots may be placed in several heaps.

The roots should not be put up until they have dried somewhat, or be covered with earth until there is imminent danger of frost. There is then much less risk of



Fig. 353—COVERING HEAP WITH EARTH

heating and decay than when they are covered before becoming dry. The straw covering should be a foot thick. A foot of straw and three inches of earth are better than a foot of earth and three inches of straw. The straw

should be laid on straight and evenly so as to shed rain. It ought to be gathered closely at the top for the same reason. The covering of earth, free from stones, should be about six inches thick, laid on compactly and well beaten down, as shown in Figure 353. At spaces of about six feet apart there should be wisps of straight straw placed upright and projecting through the earth covering. These are for ventilators, and serve to carry off the moisture and heat from the roots during the sweating or fermentation which they are sure to undergo to some extent. One of these pits may be opened at any time during the winter in moderate weather, and when a stock of roots sufficient to last a week has been taken out it may be closed again, care being had that it is done as quickly as possible.



## CHAPTER XX

### *BUILDINGS OF VARIOUS KINDS*

#### COLD STORAGE HOUSE FOR APPLES

The cold storage house shown in Figure 354 was built in 1889 by J. H. Dunn of Linn County, Mo., and has been in successful operation every year since. It was built more particularly for eggs, but has been used for apples, and with splendid success. The temperature is quite uniform, ranging from thirty-six to thirty-eight degrees Fahrenheit. Capacity of storage room, about 500 barrels; capacity of ice chamber, 175 wagon loads; cost of building, \$2000. The building is twenty-four by fifty feet, twenty feet high. It is placed on a solid rock foundation. The walls are constructed of two by ten-inch studding, on which is first nailed building paper and over this shiplap, on outside of building. On inside of studding is nailed building paper and over this rough sheathing boards. The ten-inch space between is filled with sawdust. A two by two-inch piece is then nailed on the inside sheathing opposite each of the two by ten studding, and on these two is nailed rough sheathing lumber. The two-inch space thus made is left for an air space. On the last inside sheathing mentioned is nailed a two by four-inch piece, so as to form a four-inch space for charcoal. The charcoal is used to absorb excessive moisture and impure odors and would not be necessary in a house for apples alone, as sawdust would answer as well instead.

Through the center of the building lengthwise, are placed four posts or pillars twelve by twelve inches, eight

feet in height, ten feet apart, on which rests a plate twelve by twelve inches. On this plate the joists are placed twelve inches apart from center to center. The joists are three by twelve inches, eleven feet eight inches long, the ends lacking four inches of coming together on plate in center of building. The outer ends of joists rest on a two by ten-inch piece let into the two by ten-inch studding and are nailed securely to the studding. The top corners of joists over center plate are hewed off to admit the trough with a fall of six inches to the center. The under sides of joists are ceiled and sawdust is filled in to top of joists. On top of joists is nailed a two-inch floor for bracing the building. On this floor is placed another set of joists of the same length and thickness as the first set, but nine inches wide at outside end and three inches wide at inside end. On these sloping joists is nailed another two-inch floor diagonally to further strengthen and brace the building.

A covering of galvanized iron is placed on the diagonal floor, which, as will be seen, has a fall of six inches to the center to carry off water. The edges of this covering are turned up six inches against the wall all around, to prevent leakage down the walls, but the two edges that come together in the center are turned down over the ends of the sloping joists. From this the leakage drips into the galvanized iron trough below and is carried to the center of building, where it empties into a pipe which conveys it from the building. On the galvanized covering is placed another set of sloping joists of exactly the same dimensions as the other set already described, but these have the wide end inside and the narrow end outside. This brings up the line to a level again. On these top joists are nailed two by four-inch pieces twelve inches apart from center to center, on which directly rests the ice.

A much cheaper house may be constructed on the same general plan for the keeping of apples alone. In the first place a better and in some sections a cheaper storage room could be constructed under ground; say an excavation eight feet deep and walled up with rock, brick or

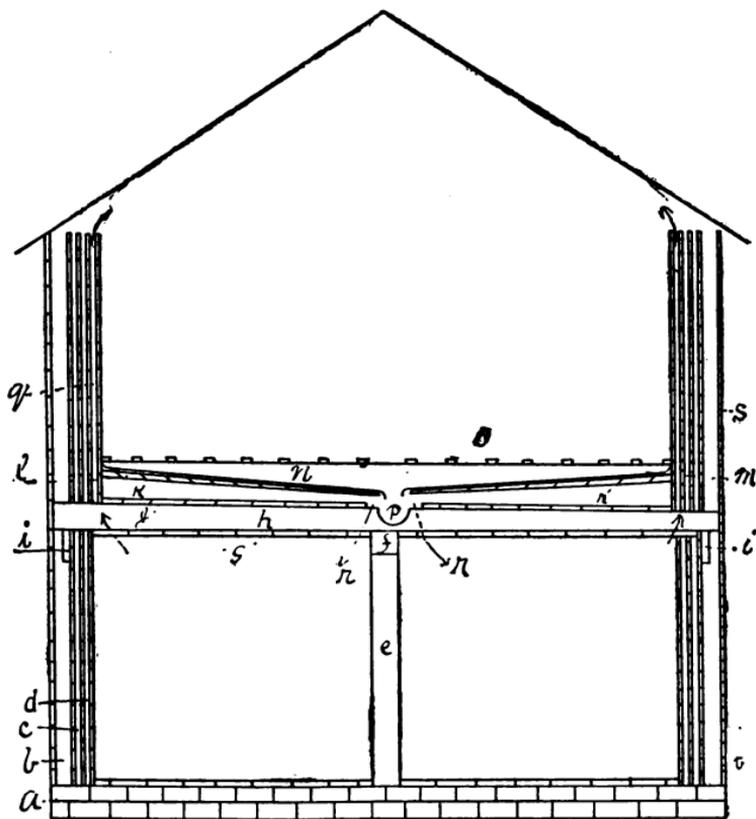


Fig. 354—PLAN OF CONSTRUCTION

any other material at hand. Upon this the structure might be built essentially as described, except that the heavy posts and plates might be replaced with lighter ones. The extra bracing to support the heavy weight of

ice might be dispensed with unless it was desired to store a large quantity of ice, which, by the way, is not necessary to the successful operation of the house in the keeping of apples.

It has been demonstrated that one and one-half or two feet of ice will reduce the temperature the same as when the house is filled full. A cheap house may be built on the bank of a stream or pond, where it is not desirable to build the storage house in such a situation, and the ice can be very economically harvested. It should be remembered that ice used in keeping winter apples must be kept through the entire summer before it can be used, hence it will be seen that there would be more expense and waste of ice in a cold storage house than in a well constructed ice house.

The storage house could then be iced from time to time as needed. When the weather is cold icing is unnecessary if the house is filled with cold air and kept closed when the weather outside is changeable or warm. Great care, however, must be used to maintain a low, even temperature. At any rate the waste of ice in cold weather is slight, as compared with warm weather, and fortunately we do not usually have long spells of warm weather after winter apples are stored.

The ice is placed in the ice chamber the same as in any ice house. The cold air, descending into the spaces between the joists, finds its way into storage or cooling room by an opening between the trough and the galvanized covering above. This opening varies in width from four to eight inches, caused by the fall of the trough to the center. In Figure 354, *a*, foundation; *b*, ten-inch space for sawdust; *c*, two-inch air space; *d*, four-inch space for charcoal; *e*, center post twelve by twelve inches; *f*, plate on center post twelve by twelve inches; *g*, ceiling; *h*, joist three by twelve inches and twelve feet long; *i*, end of two by ten-inch on which the joist

rests; *j*, two-inch floor; *k*, sloping joist three by nine inches and three by three inches at ends; *l*, diagonal floor; *m*, galvanized floor; *n*, sloping rafters inverted; *o*, two by fours, on which ice rests; *p*, waste water trough; *q*, four-inch space for conveying warm air from storage room; *r*, space for descending cold air; *s*, sheathing lumber; *t*, floor.

## A MASSACHUSETTS APPLE HOUSE

A house that will hold several hundred barrels of apples has been built by John W. Clark of North Hadley, Mass.,

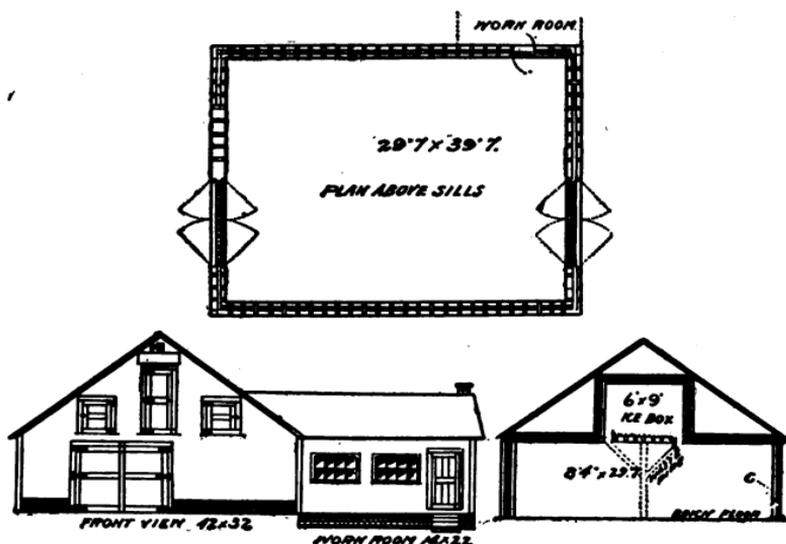


Fig. 355—MR. CLARK'S APPLE HOUSE

who has very large, extensive apple orchards. The accompanying plan, Figure 355, shows in detail the construction of the house. Two air spaces well insulated with building paper are provided at *a* and *c*, space *b* between studs being filled with charcoal or sawdust. The ice box, six by nine feet in size, extends the full length of

the building, and is filled as occasion requires from a large ice house in which about 1500 tons are stored each winter. The bottom of this ice box is well supported on posts, which do not show in the engraving. It has a sloping floor covered with galvanized iron, and the waste water is led off through pipes. Attached to the building is a work room, in which the picking and sorting are done. There are double doors into the cold storage room.

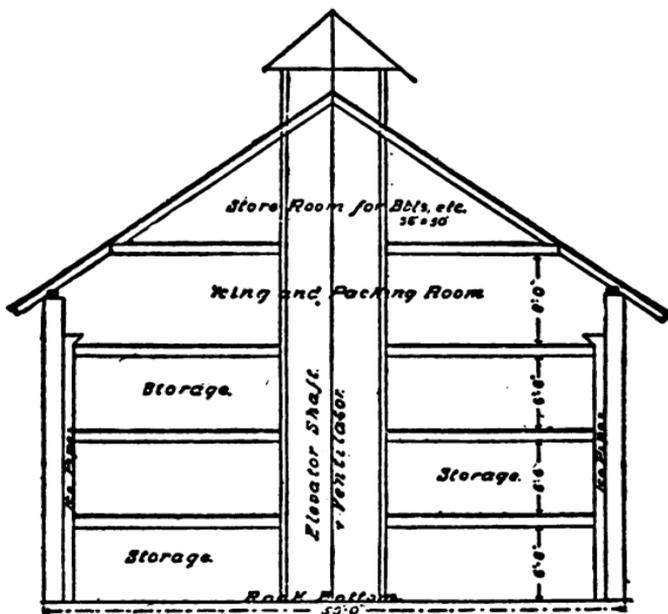


Fig. 356—SECTIONAL VIEW OF STORAGE HOUSE

#### A NOVEL APPLE STORAGE HOUSE

A somewhat novel type of apple storage house is projected by Arthur H. Hill, a large apple grower of Grand Isle County, Vt., to suit rather unusual conditions. He has an old stone quarry on the bank of Lake Champlain. The stone has been cut out in such a manner as to leave a perpendicular wall a little over

twenty feet high facing the lake. He proposes to build the storage house against the face of this rock wall, thus saving the construction of the west wall of his storage house. The other three walls will be built of stone taken from the quarry on the spot.

The site has two other natural and unusual advantages. The position on the very shore of the lake makes it very easy to secure a supply of ice, and the plan is to use ice in cooling the fruit rooms. In the second place, the apples are often shipped by boat, and a dock can easily be provided within a few feet of the building, so that barrels can be loaded directly out of the house and into the boat.

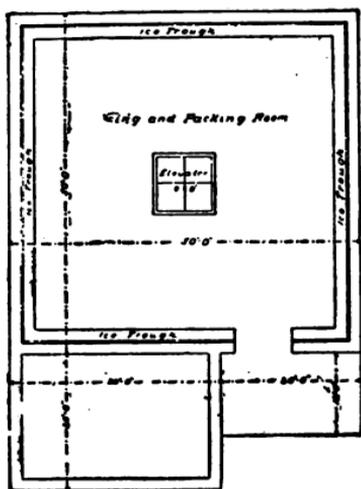


Fig. 357—FLOOR PLAN OF STORAGE HOUSE

The proposed plan, shown in Figures 356 and 357, calls for a building fifty feet square and twenty-four feet high to the eaves, with four stories and a garret. Each story of the storage space proper is made low, only six and one-half feet between floor and ceiling. This will accommodate two tiers of barrels on end, and, in case of crowd-

ing, another tier on the side. This makes less work in handling than when barrels are piled three tiers high, and there is consequently less rough handling of the fruit.

In the center is a shaft eight by eight feet in size, which serves the triple purpose of elevator, ventilator and support for the floors. This will be open on all four sides, but with doors arranged so as to control ventila-

tion when necessary. The upper floor, the one opening on the bank, will be used as a packing room. The fruit will be received here, and may be discharged either from here or from the lower story. This room will be used also for icing the pipes in cooling the rooms below.

Pipes of galvanized iron eight inches in diameter will extend from the icing trough on the upper floor to the waste trough on the lower floor. These can be filled with the crushed ice and salt mixture when desired. If only a part of the storage space is in demand, the lower room will be cooled by filling the tubes as high as the ceiling of that room. The necessary ice house will be built against the storage house, probably on the edge of the bluff above, and on a level with the floor of the icing room.

A lining of rough sheathing will be used between the stone wall and the cooling pipes, and another lining or curtain of lighter material will be placed inside the range of pipes. Other details of construction have not yet been determined, but will be sufficiently obvious so that any practical builder can follow the general outlines of this plan and make the necessary adaptations under any circumstances which make a similar construction seem desirable.

#### AN APPLE EVAPORATOR

The evaporated apple industry centers in a few towns in Wayne County, N. Y., bordering the southern shore of Lake Ontario. Here almost every farm has a large apple orchard, and from a very early time the drying of this fruit has been a special industry. Out of these years of experience has grown the present kiln or dry house and the labor-saving machinery. The farm dry house as now constructed usually consists of two rooms, each sixteen feet square. Whenever the land permits it is built upon a hillside, which admits of a deep basement under

one end of the building, while the floor of the other end is level with the ground, as shown in Figure 358. In the outside or receiving room, *b*, the apples are pared, bleached and sliced, while the inner room, *a*, is used exclusively for drying.

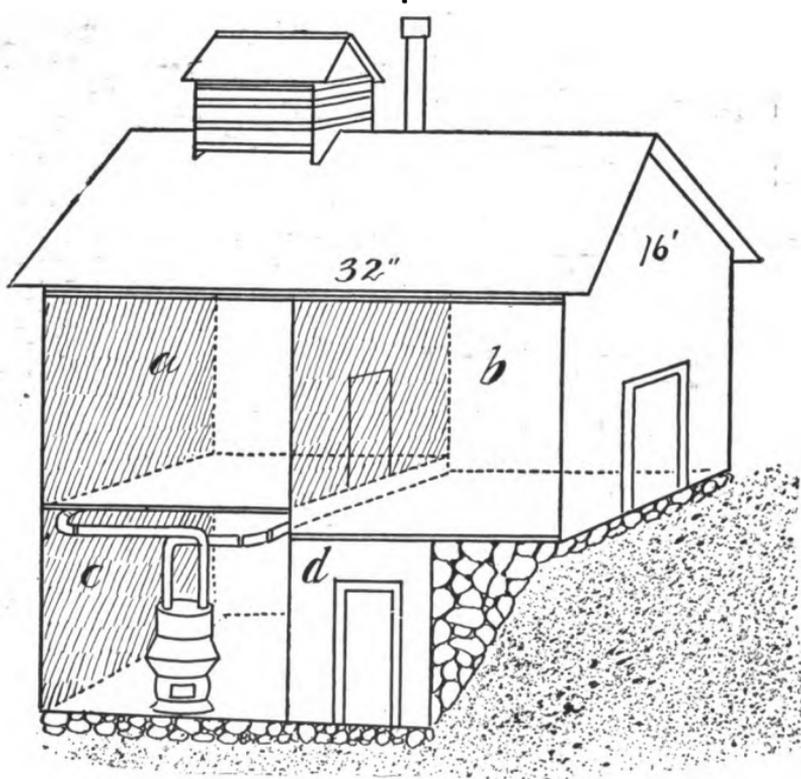


Fig. 358—SHOWING ARRANGEMENT OF EVAPORATOR

The peculiarity of this drying room is in the floor, which is made of wooden strips about one inch wide and thick, and beveled on both sides, set wide side up and about one-half inch apart on top. This makes a slatted floor, the spaces of which are wider apart on the under side than on top. The heat passes through this form of

floor better than one made of square-edged strips. In the roof is a ventilator, through which the heated air and vapor pass off.

The basement, *c*, below the drying floor, is generally twelve feet high and sometimes more. In the center is placed a large furnace, in which a coal fire is kept day and night. To assist in distributing the heat evenly, the gases pass through pipes that circle around the room about two feet from the floor above, Figure 361, finally uniting and entering a chimney at the side of the building.

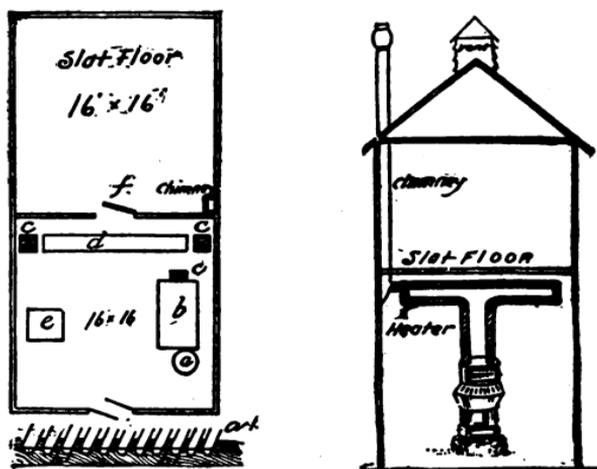


Fig. 359—FLOOR PLAN AND END VIEW

In some of the modern houses the chimney is carried through the center of the floor and through the ventilator in the roof, thus causing a more rapid circulation of air. The basement, and sometimes the drying room above, is often ceiled with lath and plaster as a protection against fire. The entire basement is practically a hot air furnace, cool air being admitted through holes in the foundation wall, and when heated passing through the slatted floor above. The object is to create a rapid circulation of hot, dry air.

Apples are stored in sheds or convenient piles outside and brought into the operating room as needed. Here they are pared and cored by a large machine, *a*, Fig. 359. The pared fruit falls upon a table, *b*, at which operatives sit, who examine each apple and cut off fragments of the skin, decayed spots, etc., finally throwing the perfect fruit into bushel crates, *c c*. This is then placed in the bleaching box, *d*, for half an hour, where it is subjected to the fumes of burning sulphur, after which the apples are sliced with a machine, *e*. The sliced apples fall into bushel crates, which when full are emptied on the floor of the drying room. The floor can be covered to a depth of four to six inches of fresh fruit. After drying for several hours the fruit is shoveled over, and when the proper degree of evaporation is reached it is shoveled into barrels or bags and sold.

In Wayne county it is estimated that a dry house with a sixteen-foot kiln can be built and equipped for \$300 to \$350. The cost of equipment is, furnace \$20, pipes \$20, parer \$13, slicer \$20, bleaching box and crates \$15, total \$88. Some consider a better furnace, costing \$40, more economical. Commercial drying houses, *i. e.*, those purchasing green fruit for drying, are on the same general plan as the farm evaporators, but larger.

#### A MODERN MAPLE SUGAR HOUSE

The sugar house of A. J. Harmon of Ohio, shown in Figures 360 and 361, is sixteen by thirty-six feet, twelve feet high, with syrup and packing room in front, twelve by sixteen feet, with room for sap pails directly above. These rooms are ceiled with a tight partition between evaporator rooms, except doors, and therefore exclude all steam from the tins stored in them. The house is built on a side hill, so that sap can be drawn from gathering wagon or sled to store tank, there to evaporator

without any pumping or handling. The camp consists of 1000 sugar maples, a large proportion being thrifty second growth, set in orchard style about forty years ago.



Fig. 360—AN OHIO MAPLE SUGAR HOUSE

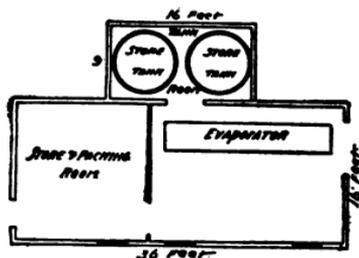


Fig. 361—FLOOR PLAN OF SUGAR HOUSE

#### A MODERN BACON HOG FACTORY

Small bacon factories are spread all over Europe, notably in Sweden and Denmark, for in remote districts where farmers carry on large dairy business and feed skim milk in large quantities to pigs it is often impossible to dispose of live pigs to advantage. These factories have the advantage of being small and cost comparatively little to build. The illustration given in Figure 362, from the

journal of the Royal Agricultural Society of England, is capable of handling about fifty pigs per week, and cheapness of construction is what is aimed at in many of these factories. The cellar and engine room is substantially built, but the rest of the building is put up as cheaply as possible.

Preferably, a site should be selected where there is plenty of space and an abundance of water. The pigs

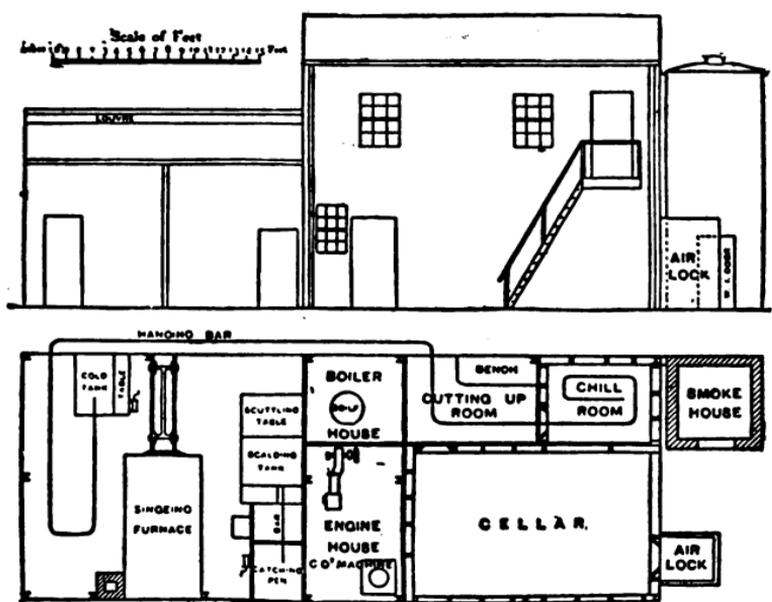


Fig. 362—GROUND PLAN AND ELEVATION OF BACON FACTORY

are slaughtered, dressed and pushed along the bars into the hanging house, whence they are passed into the chill room and then into the cutting up room. From this latter place the various sections are distributed to their various departments. The factory is equipped with the necessary machinery for lard making and sausage making, etc., and the offal is converted into fertilizer.

After being killed and hung a few moments to bleed, the pigs are pushed through on to the dumping table and into the scalding vat, eight by five by two and one-half feet, which is fitted with a cradle and lever attachment to lift the carcasses to the scuttling table. The water is kept at 140 degrees for fine-skinned pigs and 150 for those that are coarse. Above the scuttling table is arranged a series of cold water sprinklers, which are allowed to play upon the warm carcasses while the scraping is proceeding. The carcasses are then singed upon the singeing stack, which is the most important of the appliances of the slaughtering department. It consists of a vertical stack built strongly of fire brick bound together and arranged on the top of four columns by means of a platform. The flue in the center is circular and just large enough to hold pigs.

From the top is hung a heavy chain, which is lowered down by means of a windlass. A gob hook is inserted in the lower jaw and the pigs are pushed down an oblique board from the scuttling table and are then suspended by a hook. They are pushed forward until they come under the flue of the singer, when the hook is caught up by the singeing chain. The windlass is set in motion and the carcass is raised through the fire. It is then dropped into a bath of cold water and the hooks withdrawn. The toenails are removed and the gambrel stick is inserted in the hind legs. The pigs are then hung up, scraped and disemboweled. The pigs go from here to the hanging room, where they are partially cooled before being put into the chill room, which is kept at a temperature of about forty degrees. After hanging until thoroughly cooled through they are taken down and cut up.

#### A CONNECTICUT VALLEY TOBACCO BARN

In the accompanying illustrations is shown in detail the construction of a tobacco curing barn, the plans of

which were made by Mr. C. M. Hubbard of Sunderland, Mass., a successful grower of cigar leaf in the Connecticut valley. The lumber was bought on the stump at \$5 per M, hauled one and one-half miles to a mill and sawed out. The cost of two barns, each twenty-four by 105 feet, was \$500, not including his own time and that of the hired man and team. While the sheds were made twenty-four feet wide, Mr. Hubbard says that if he were to build again he would make them twenty-seven or thirty. Each bent contains eight poles and seven rows of lath are hung across the bent; lath are three and one-half feet long.

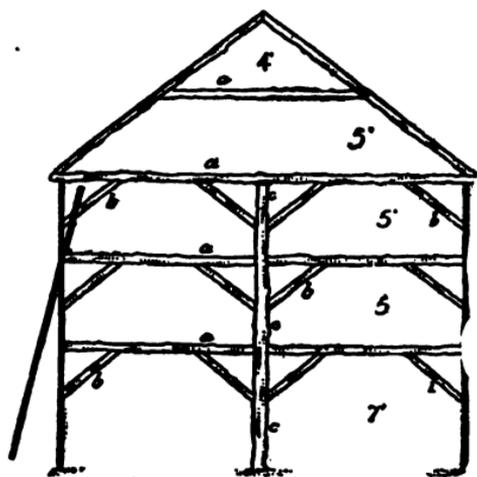


Fig. 363—END VIEW

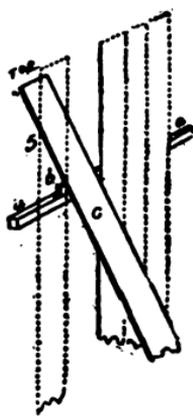


Fig. 364—VENTILATOR

The barn is twenty-four by 105 feet, seventeen feet to eaves, contains seven bents (although only six are shown in Figure 365), and four tiers. The space between the ground and second tier, Figure 363, is seven feet, and between second, third and fourth tiers five feet, while the upper hanging pole is four feet from the ridge. No poles are used in the peak and there are no purlin plates. The rafters are placed three feet apart and collar boards are nailed to the rafters five feet above the plate and the



board. When the barn is to be ventilated the hook is raised, board, *c*, swung out on hinge, *b*, shown in Figure 366, and the hook slipped into eye, *b*, on the under

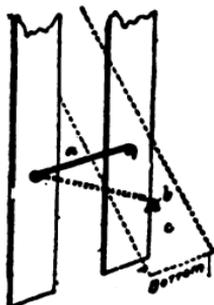


Fig. 366—VENTILATOR HOOK

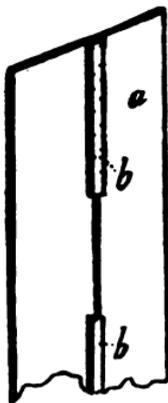


Fig. 367—SIDEBOARDS

side of board, *c*. The hooks, *a*, are about eighteen inches long, which allow the bottom of the board being tipped out about two feet. The top will be swung in about nine inches. The hinge is placed on the beam five feet

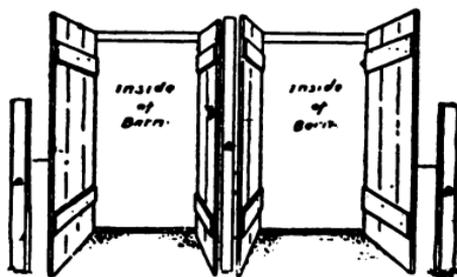


Fig. 368—ARRANGEMENT OF DOUBLE DOORS

below eaves. By this method of swinging the door more air can be obtained in the shed than if the boards are hung at the top; there is also no expense for hinges.

The wire for hooks, *a*, cost thirty-five cents, and Mr. Hubbard bent them in a few minutes. The staples for fastening hooks cost ten cents. As there are thirty-five doors on a side, seventy hooks were used to each barn.

The sideboards are placed in position as shown by Figure 367. One board, *a*, is nailed in place and the three-inch wide lining strip, *b*, is slipped under. Another board is nailed so as to cover the uncovered part of lining board. A lining strip is slipped under the edge of the second board and nailed, and so on.

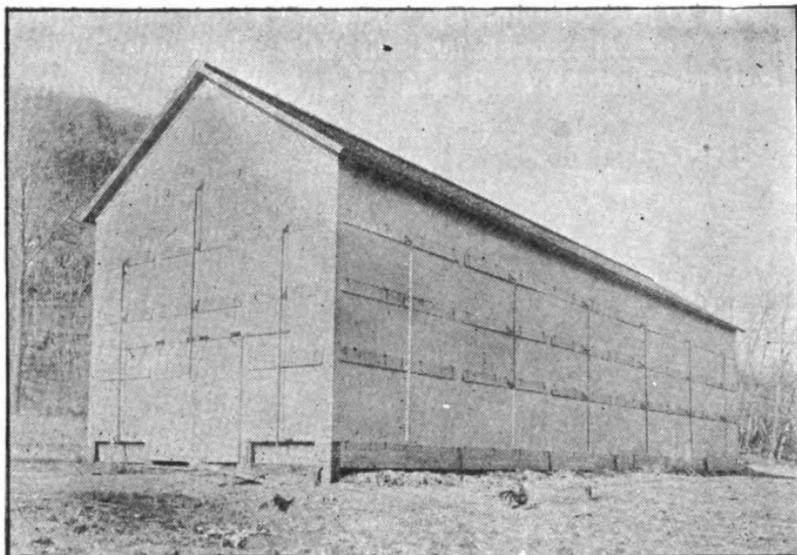
As shown by Figure 368, the double doors at each end are fastened securely to posts, *a*, ten feet long, three feet of which are set in the ground. An eye is driven in each post so that the wire hook attached to the door can be slipped into them; this holds the doors securely in place, prevents them blowing about or against tobacco when being drawn out. All four doors swing out. Each door is five by ten feet.

#### A WELL BUILT TOBACCO CURING BARN

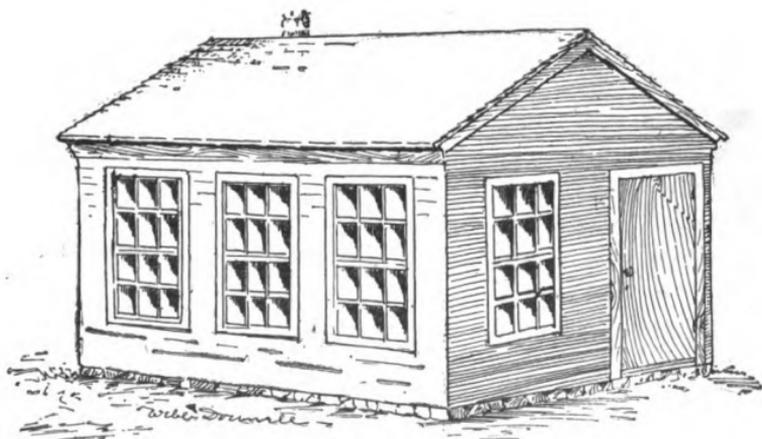
The curing barn portrayed in Figure 369 was built for Mr. W. J. Clark of New Milford, Ct., at a cost of nearly \$900. It is twenty-eight by ninety-six feet, with twenty-foot posts. It will contain tobacco from about three and one-half acres. There is a driveway through it lengthwise by removing one tier of slip poles. This building has a very strong frame and foundation and is covered with splendid materials. It is well arranged for ventilation on sides, ends and ridge. Of course anyone can use cheaper material and with nearly like results in curing.

#### A FARMER'S GREENHOUSE

To build an all-over glass house for growing early plants is both expensive and difficult, while the building is fit for nothing else should the growing of early plants



**Fig. 369—A CONNECTICUT TOBACCO SHED**



**Fig. 370—USEFUL FOR MANY PURPOSES**

be given up. A small house that has a great deal of sunlight in it, that is inexpensive and easy to build, and can be used for other purposes, should occasion warrant, is shown in Figure 370. The three windows face the south, with a window in both east and west ends.

The house can be made of any dimensions desired and can be heated by a small stove. There is a walk along the back side, with a wide bench before the windows. The stove can occupy the farther end of the walk, with a slight partition of galvanized iron to keep the strong heat from the plants that are near. A shed-roofed house can be built, but it would have to be high enough in the rear to afford a walk, so there would be but little if any saving in expense, and a decided loss in attractiveness.

#### A HOUSE APIARY

A bee house in use by F. G. Herman of Englewood, N. J., was built of common inch matched boards planed on one side. The frame was made of two by four-inch wall strips. The roof was covered with paper and is perfectly watertight. The building, Figure 371, is nine by fourteen feet, with a window in each end and one opposite the door, which faces northward. The building rests on large stones, has a good floor, is neatly painted, was built by a mechanic, and cost \$53. It is located on a berry farm, two and one-half miles from his home apiary. It contains twenty colonies of bees in two tiers of hives. The broad side of the house which is in view faces eastward and the end southward. There are no hives facing the other two sides.

The hives used are known as the Long Ideal and are made to order. They hold twenty Langstroth frames crosswise and are expressly used for extracted honey. The total cost of the hives, fixtures and house was \$125, not counting the bees. The top row of hives rests on a frame just high enough so one can raise the covers and look

into them comfortably, as the interior view in Figure 372 shows; the other row rests on the floor. The hives are only one story, so there is no use for queen excluders and no tiering up to be done. There are no bees at large in the house excepting a few which leave the combs while handling them, and these quickly make their escape by way of

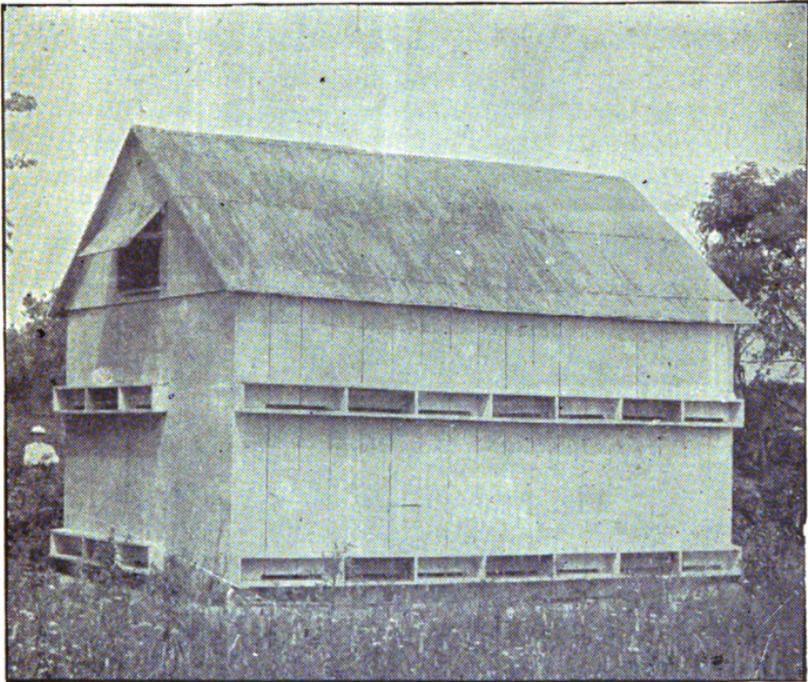


Fig. 371—A HOUSE APIARY

the windows, which are left open all summer for ventilation. The netting on the windows is so arranged that the bees can leave the room, but cannot enter it. The awning over the windows is to prevent the rain from coming in while the windows are left open.

The nine entrances match the corresponding slots in the side of the house, and when the bees enter the slot or entrance they go direct into their respective hives. Each alternate entrance is painted a darker color for the purpose of helping the bees to mark their hive. The berry plantation is worked by a practical nurseryman and berry grower, who is desirous of having bees on the farm. He

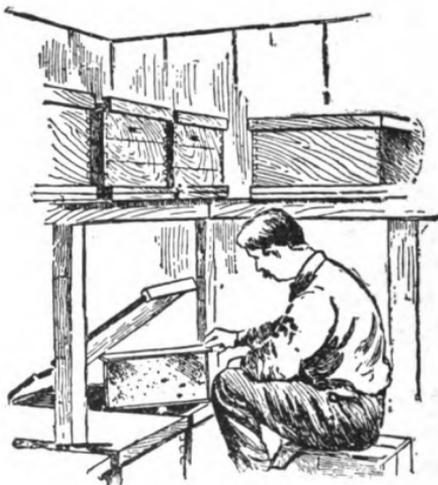


Fig. 372—INTERIOR OF APIARY

said the yield of berries was unusually large the year following the establishment of the apiary, and thinks the bees were responsible for the extra yield. The bees got some very nice honey from the raspberry and blackberry blossoms.

#### FRUIT AND FARM COLD STORAGE HOUSE

Temporary structures for storing ice can be made very cheaply, but we strongly recommend that a cold storage house be built with the view of permanence and continuous use. Such a house is illustrated in detail in Figures 373 and 374, which are taken of a house built by the Kansas State Experiment Station. The building is designed

to be located on a hillside of such a slope that the first floor will be on the level of the surface at one end and the second floor a few feet above the surface at the other. The building is eighteen by thirty-eight feet, interior measurement, two stories in height, and divided into four rooms, two on each floor. On the second floor is the ice storage room, eighteen by twenty-one feet, in which the future supply of ice is stored, and the ice chamber, fifteen by sixteen feet, in which is held the ice that cools the refrigerating room directly below. A door in the ice chamber communicates with the outside. This is for the unloading of ice and is the only outside entrance into the second story. The refrigerating room is sixteen by eighteen feet, and is the compartment in which the temperature is to be reduced, and in which perishable products are to be stored. Leading into this room is the cooling room, eighteen by twenty-one feet, which is to be used as a general purpose storage cellar. A small entrance room protects the doorway into the cooling room. This is the only entrance into the ground floor.

The building rests upon a twenty-inch stone foundation. Between the foundation walls is bedded twelve inches of broken stone. Over this pass the two by ten-inch sills, sixteen inches on centers. The floor joists are bedded in dry sand or dry, well-packed cinders. The floor is double, with two layers of building paper between the two thicknesses. Three rows of ten by ten-inch posts, carrying eight by ten-inch caps, support the ten by twelve-inch beams, upon which are laid the six by eight-inch joists for the second floor. Two-inch flooring is laid over these. The flooring is laid tight in the storage room and provided with a slope toward the center. A gutter catches the drainage and carries it into the gutter from the ice chamber (not shown in the drawing). To prevent leakage the floor of the storage room must have a sheet iron covering. The floor of the ice chamber is laid with two by

four-inch lumber, with one-inch spaces between. This provides for air circulation and water drainage. A sloping catch floor, shown in Figure 373, leads the water into the gutter which carries it down and out through the cooling room. The upright studding, outside of the walls, two by

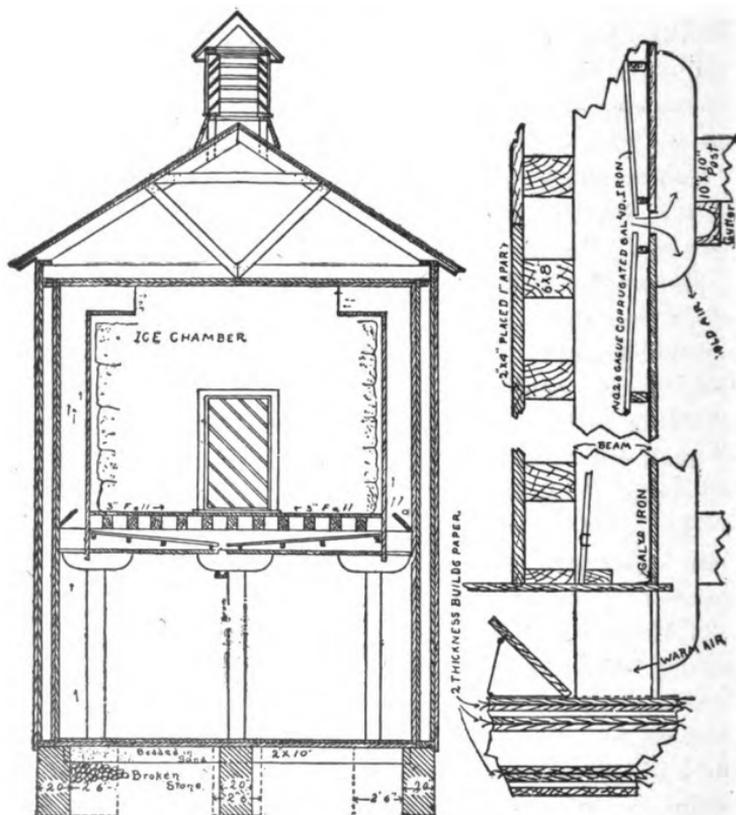


Fig. 373—CROSS-SECTION OF THE STORAGE HOUSE

six inches, are twenty inches apart. On the inside is an inch of rough boarding, two layers of building paper, a second inch board, then an inch air space, then two other thicknesses of inch boarding with double thicknesses of building paper between. On the outside of the studding

is a double thickness of inch boarding with two layers of building paper between. Beyond that, building paper, an inch space and the weather boarding. The space between the studs should be packed a foot from the foundation with mineral wool or sawdust. The inch dead air spaces and the double layers of building paper should be continuous around the room. If there is a break that admits air the dead air space loses all its qualities of insulation and becomes an air conductor. The ceiling over the ice chamber and storage should have a double thickness of boards and paper the same as the walls. The spaces between the joists should be filled tightly with dry sawdust, or, better yet, mineral wool.

Much of the efficiency of the building for cold storage depends upon the insulation of walls, ceiling and floor. These parts should be constructed so that they will be almost non-conductors of heat. Hence, the use of mineral wool, sawdust, building paper and "dead" air spaces. These are all poor heat conductors. Air conveys heat rapidly by circulation, but where confined, so that the process must go on by conduction, it is very slow. On this account still or "dead" air becomes one of our most useful insulating materials in cold storage construction.

The lumber for the insulation should be free from offensive odors. Pine is objectionable on this account. The outside lumber that comes in contact with the soil should be hard and durable. A coat of crude petroleum and a layer of tarred paper before the soil is banked will make it almost indestructible. The lower story may be made of stone, but the insulation will have to be provided besides, as a stone wall will allow the passage of heat very freely. The whole building, roof and all, should be painted white in order to retard the absorption of heat from the sun.

For windows in the storage room three sashes should be used, thus giving two air spaces. The sashes should be

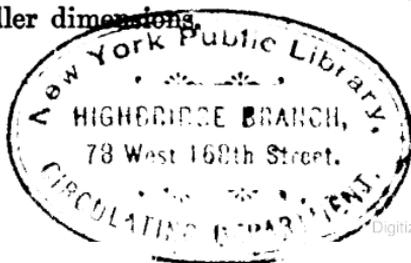


current of air is controlled by means of valves in the lower part of the passage. The circulation depends upon the fact that cold air is heavier than warm air and tends to fall, crowding the warm air out of place. The ice in the chamber being in blocks without packing material between, allows the air to pass through. In contact with the ice it becomes cooled and settles down through the cold air duct into the refrigerating room and forces the warm air upward through the passages on the sides of the room and over the ice, where it is cooled. After cooling it falls, and thus the circulation is kept up.

A system of ventilation, though not shown in the figures, will be necessary in the building. Ventilation pipes leading from the ice chamber through the roofs are all that will be necessary. These should be arranged so that they may be opened or closed at will.

The meltage water from the ice chamber and storage room will serve a very useful purpose if conducted through a tank in the cooling room. This provides an excellent place for cooling and keeping milk. This is indicated in Figure 374.

If the storage room and ice chamber are filled with good ice during the winter the quantity will be sufficient to last throughout the season. The ice in the storage room may be packed in chaff or sawdust, but that in the ice chamber should be without packing. When the ice in the chamber is exhausted it should be replenished from the storage room. After the building is supplied with ice in the winter the outside door should be packed with sawdust and not again opened. An inside ladder provides sufficient passageway into the ice chamber. Such a structure is large enough for the requirements of an ordinary fruit farm, but the plan will work successfully with either larger or smaller dimensions.





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