A large proportion of the Illinois dairymen are working at a disadvantage because their barns are not constructed or arranged in such a way that the work may be rapidly or well done. In no place is the necessity for conveniences more essential than in a dairy barn where there is always so much to be accomplished in a short time, yet how seldom we find the interior arranged so as to save steps, or the construction such as to contribute to the comfort of the cows or the production of wholesome milk. Time is a valuable asset on the dairy farm and great losses grow out of arrangements which interfere with rapidity of work. The slip-shod way of doing things in many barns is largely due, in most cases, to the awkward arrangement of the barn itself, though the skill of the man in charge is an important factor. Much of the confusion in and about the barn is rooted in the belief that a comfortable and sanitary barn is of necessity expensive. This is an unfortunate impression, for wholesome and convenient quarters can be provided at a very moderate cost.
At the present time, there is a strong demand for milk produced under better sanitary conditions. This simply means that those who are consuming milk from the farms of Illinois are demanding something better. This demand will grow and the man who will make the greatest success in the future in dairying is the one who unites himself with this new movement and adjusts his practices as soon as possible to its requirements. There are but few dairy barns that would not be greatly improved by a thorough cleaning and whitewashing. In nearly all of them a carpenter and mason could be advantageously employed if the filth and rubbish were once cleared away. It is a fact, however lamentable, that on a large proportion of the dairy farms the milk is produced in filthy barns, by filthy cows, attended by dirty milkers. The proprietors of such establishments would revolt at having their meals prepared in such places, yet they continue to place upon the market a delicate food which has been unnecessarily subjected to dangerous contamination. There is no excuse for such practices for work is accomplished more easily and at less expense where the regulations are of a high order. Dairymen must look upon the stable as a place where food is prepared and conduct it accordingly. The object here is to call attention to some of the existing conditions, and their influence upon the dairy industry of the state, and to suggest means for improving them. This circular is devoted largely to the construction of floors and the arrangement of the interior, for these are fundamental.

A stable for dairy cows should be well lighted and ventilated. It should have tight walls and ceiling and a sound floor. Dairy cows, when crowded into dark and dirty stables, cannot be expected to produce as much milk, nor milk with as wholesome properties as those provided with clean, airy quarters where the sunlight enters through numerous windows and where the foul air of the stable is replaced by pure air without subjecting the cows to injurious draughts. Tight walls and ceilings prevent excessive loss of heat in cold weather and thus contribute to the comfort of both cow and milker. When on full feed, the dairy cow is hard worked and less able to withstand extremes of weather than is other stock, for her energies are then being exerted in the direction of production rather than self-preservation. It is not only more humane but more profitable to keep her warm by making the stable comfortable, instead of compelling her to use large amounts of expensive food in maintaining her body temperature.
CUT 1.—SHOWING PROPER CONSTRUCTION OF WOODEN FLOOR TOGETHER WITH DIMENSIONS OF THE VARIOUS PARTS. THE PORTIONS WHERE THE COW STANDS AND THE WALK SHOULD SLOPE SLIGHTLY TOWARD THE GUTTER. THE SPACE BENEATH A WOODEN FLOOR SHOULD HAVE VENTILATION, BUT MUST NOT BE LEFT OPEN ELSE DIFFICULTY WILL BE MET WITH IN KEEPING THE STABLE WARM IN SEVERE WEATHER.
In the dairy barn, no one thing is of more importance than a sound, impervious floor. The benefits derived from such a floor when properly constructed are:

1. — The animals are more comfortable and hence more profitable.
2. — The manure may be saved and applied to the land without loss.
3. — Stables are cleaned with less effort.
4. — Cleaner milk is produced which commands a higher price.

One of the great leaks on the farm is the constant loss of fertility occasioned by the wasting of manure. When the liquid as well as the solid manure finds a ready escape through cracks and knot-holes, with no means of regaining it, the possible profits of the farm are greatly reduced.

**Wooden Floors**

These are usually laid in one of two ways, either close to the ground upon stringers imbedded in the earth, or upon joists allowing a circulation of air between the floor and the earth. The greatest objection to wooden floors is the fact that they often give out from decay rather than from wear. If the floor is kept either constantly saturated with moisture or entirely dry, it will last for a long time, but when it contains a certain amount of moisture, the growth of molds is encouraged which cause decay. Wooden floors are fairly satisfactory in cheap barns if laid with proper slope toward the gutters to insure being kept reasonably free from moisture, and having sufficient circulation of air beneath to keep them dry. They must be cleaned regularly and thoroughly in order to make them satisfactory during their comparatively short life. When a plank begins to show signs of decay, it should be removed and replaced by a sound one. For this reason, the planks should be of some uniform standard width, as 8, 10, or 12 inches, that repairs may be made quickly. Uneven, patched, or broken stable floors in a dairy barn should not be tolerated as they cannot be properly cleaned and soon reek with filth. Good milk can be produced in a stable with a wooden floor, if the floor is properly constructed and kept clean.

**Cement Floors**

Within the past few years the use of cement and concrete in making an impervious floor for dairy cattle has become quite general. In fact, the cement floor is looked upon by dairymen
Cut 3.—Showing the position of the different layers of a concrete floor and dimensions of its different parts. When some form of stall is used, bolts or fins for the attachment of the partition should be placed in the cement.
in the more progressive regions as essential. Its first cost is somewhat greater than that of a wooden floor, but when its durability and convenience are considered, it is by far the cheaper. The fact that it is permanent adds greatly to the importance of its introduction and use in all dairy regions where so many cows are kept and the conservation of manures is such a vital problem. In cold weather cattle on cement floors must be well bedded else there may be injury done the udder by coming in contact with the cold cement. The construction of a cement floor is simple, though the uninitiated often experience some difficulty in understanding the fundamental principles. The materials used in the construction of a cement floor are gravel, (or better, crushed rock) sand, cement, and water; the cement binding the whole together by forming an artificial stone. In many parts of Illinois gravel cannot be had and crushed rock is too expensive. The use of mine slag in making concrete has been suggested, but unfavorable reports follow its use. The construction of the floor is divided into two parts; the concrete, consisting of about 3 inches of mixed gravel and cement to form a foundation, and an upper layer of one-half inch called the facing coat made of sand and cement in the ratio of two of good, sharp sand to one of cement. The composition, mixing, and laying of each part is given in detail below.

**Construction**

The cement floor can be put in as soon as the foundation wall is completed but its construction is usually deferred until the building is inclosed. At first, six or eight inches of the surface soil should be removed and the surface reduced to an even grade and thoroughly tamped to form a firm foundation on which to place the concrete. When available, flat stones, cobble stones, brick-bats or refuse from tile yards can be used with coarse cinders to form a foundation on which to place the concrete. Whatever is done, before laying the concrete the surface on which it rests must be solid and even, for the life of the floor depends upon the success attained in preventing the formation of cracks which result when a floor with a weak foundation is subjected to constant use.

**Making the Concrete.**—For cement floors in dairy barns, the concrete should be at least three inches thick and the materials mixed in the following proportions:

- Gravel or stone: 6 parts
- Sand: 2 parts
- Portland cement: 1 part
When crushed rock is not available, a good floor can be made from gravel, sand, and cement, in which case a little more cement should be used, especially if the gravel is fine, as in this case more cement is needed to bind the mass firmly together. The right proportion of cement, sand, and gravel is placed upon a mixing board and thoroughly worked over dry so that the cement is evenly distributed through the mass. Some unit should be taken for convenience in measuring out the different quantities of cement, sand, and gravel and its size should depend upon the amount of work to be done. Either a wheelbarrow, pail, or shovel will be found to answer the purpose well. After the gravel, sand, and cement have been thoroughly mixed, a sufficient quantity of water should be added to make a stiff paste. When crushed rock is used, it should first be thoroughly drenched to wash off all dust adhering to the fragments and then well mixed with the gravel, sand, and cement. After the water has been applied the mass must be continuously stirred until placed in position.

Laying the Concrete.—Cement floors give best satisfaction when laid in blocks 4 or 5 feet square, building alternate blocks first so that there will be time for setting and thus prevent a strong union of the blocks. When the floor is not laid in this manner, cracks are sure to occur. The concrete should be made only as fast as used and must be tamped with a heavy pounder until the cement and moisture appear on the surface. In order to get a close bond between the particles they must be brought into contact by pounding, the appearance of moisture on the surface indicating that the spaces of the concrete are rea-
CUT 5.—BARN WHERE SANITARY MILK IS PRODUCED. CEILING AND SIDE WALLS ARE PAINTED WHITE AND WINDOWS ARE NUMEROUS. THE FLOOR IS OF CEMENT, KEPT CLEAN, AND THE COWS WELL BEDDED.
CUT 6.—The profits are greatly reduced when dairy cows are kept in a barn of this kind. It is cold, dark, and filthy. The cows cannot be kept comfortable, nor the stable in condition for the production of clean milk. The manure is being wasted through the action of sun, wind, and rain.

CUT 7.—A barn of moderate cost provided with numerous windows, cement floor and an application of whitewash. Such a barn is a credit to its owner and is not beyond the reach of any progressive dairymen.
sonably well filled. Narrow strips of lumber supported by stakes may be used to form the boundary of the blocks, but should be removed after the concrete begins to harden and before the adjacent block is constructed.

**Finishing Coat.**—It is important that the finishing coat be made, if possible, of sharp plastering sand and high grade cement. For stable floors the proportion should be two parts of sand to one part of cement. The materials should be carefully mixed while dry, as indicated for the concrete, and enough water added to make a plastic mortar. This should be applied before the concrete has hardened and should be floated down to a thickness of one-half inch. For dairy cows, the floor should never be made smooth. After the finishing coat has been floated to the proper thickness, it should be roughened by drawing over it a straight edge which has not been surfaced. This slightly rough surface prevents injury to the cattle by slipping and aids in keeping the bedding in place. This last coat must be cut through on the division lines of the concrete blocks and the edges neatly rounded.

**Arrangement of Interior**

Before a cement floor is laid, the general arrangement of the barn should be decided upon. The placing of the gutter, mangers, and feed alleys together with the location of the feed room, silo, and milk room, should all be finally decided upon before a stroke of work is done. In no wise, should sufficient sunlight or ventilation be overlooked. In most cases, where two rows of cows are decided upon, it will be found best to allow them to face a central feeding alley at least eight or ten feet wide. There should be a walk behind each line of cows, at least four feet wide and in long barns, one at each end and one across the middle of the stable to save steps at milking and feeding time. The thought to be borne in mind, is to secure at once the comfort of the cows, and at the same time have the stable arrangement such that it can be kept clean with the least possible labor.

In deciding upon the length of standing room for a cow, it must be borne in mind, that the space required will vary with the size of the cow and the method of fastening. When swing stanchions are used, a medium-sized cow will require a distance of fifty-six inches from the gutter to the stanchion. For small cows somewhat less should be allowed, while for large ones the distance may be slightly increased. Care should always be taken to make the distance long enough to insure the comfort of
This way of fastening cows by rigid stanchions is uncomfortable and often injurious to them. Their use should be discontinued and a more humane fastening substitute.
the cow, and yet hold her well back to the gutter. In order to provide for cows of different sizes, it is well to make the distance between gutter and stanchion slightly greater at one end of the stable than at the other, for in this way, the cows may be arranged according to size and thus be kept in a more cleanly condition.

When any of the different kinds of cow stalls are used, they may be made of uniform length, the distance from gutter to manger being about sixty inches. In these, the cows are kept back in line with the gutter by adjustable fronts which may be so placed that the occupant has just sufficient room forward and backward to be comfortable. With these patent stalls, the front projects over the manger which prevents the food being thrown out, yet they are so constructed that food may be easily put into them from the feeding alley in front. With either stalls or swing stanchions, the width of standing room should be thirty-six inches for medium-sized cows and forty inches for large ones. The gutter should be eighteen inches wide and at least eight inches deep, with the bottom sloping slightly away from the cows. The floor of the gutter should slope toward
one end to a drain leading to a manure pile or other absorbent material where the liquid manure not taken up in the stable may be saved. The bottom of the manger should be raised three inches above the level on which the cow stands, to aid her in reaching her food, and its width need not exceed eighteen inches. It should never be lower than this and there is no reason for placing it higher, as it is unnatural and inconvenient for cows to eat from high mangers.

**Fastenings**

Much importance attaches to the way cows are tied, for their production depends largely upon their comfort. The rigid, stiff stanchion should be unconditionally condemned. In its place, the modern swing stanchion or some style of cow stall should be used. Both forms of fastening have considerable

*CUT 10.—SHOWING A MANGER WHICH IS TOO HIGH AND PARTITIONS THAT ARE TOO HEAVY IN A DAIRY BARN OTHERWISE WELL ARRANGED.*
Cut II.—Any of these six styles of Patent Stanchions afford the Cows great comfort and assist in keeping them clean. The price varies from $1.00 to $1.50.
merit and are much in advance of the old methods. Each dairyman will have to decide for himself which kind he will use, but it may be well to say for his guidance, that the stalls give greater freedom to the animal and prevent injury to udders by adjacent cows; while on the other hand, swing stanchions are likewise comfortable to the cow, less expensive and do not obstruct the interior of the stable so much. If stalls with partitions are used, bolts or pins for their attachment to the floor should be set in the cement. When swing stanchions are used

CUT 12.—SHOWING HOW FRESH AIR MAY BE BROUGHT INTO A STABLE AND THE FOUL AIR REMOVED FROM NEAR THE FLOOR BY VENTILATORS. WHEN THE BARN HAS NO CUPOLA, THE FOUL AIR SHOULD BE REMOVED AS SHOWN AT B, OTHERWISE AS INDICATED AT A.
a piece of 2x4 above and below will be sufficient to hold them in place, when uprights reaching the ceiling are placed between every two cows.

**Ventilation**

In the average dairy barn, there is no provision for a change of air save that which takes place through cracks, doors, windows, and chutes. No barn for live stock should be built or re-modeled without planning for some efficient system of ventilation. The stable should be made approximately air-tight with close fitting doors and windows. The ceiling should not be more than eight feet high for when higher than this, the warm

![Cut 13—Ventilator for Removal of Foul Air, Shown at A. Ventilators Should Be Well Built and Never Obstructed. A Flue 2 Feet Is Sufficient for 20 Cows, Providing There Is a Good Circulation of Air.](image)
air generated by the animals rises so far above them that they derive little benefit from it. The most satisfactory system of ventilation is King's, in which the pure air is admitted through openings along the side walls next to the ceiling and foul air is removed by a flue extending from near the stable floor to the roof. An intake flue two feet square will supply air enough for twenty cows, providing the system is so arranged as to create a good circulation. Since the intakes are small and numerous, to avoid draughts, the sum of their areas should be somewhat greater than four square feet, to make allowance for the greater friction in the smaller openings. The outlet flue should have a capacity slightly greater than the sum of the intakes to insure sufficient circulation. In case of forty cows, the size of flues should be doubled and two outlet flues should be used. These should be of wood, not metal, and pass directly through the roof or to the cupola. With this system, the fresh air coming in at points remote from the cows is warmed before reaching them. The foul air, which is heavy, falls to the floor and passes through the roof by way of the ventilator. In planning a barn for a given number of cows, it is not so much a matter of securing a given number of cubic feet for breathing space as it is to provide sufficient circulation of pure air.

**Sunlight**

Sunlight is a great purifier and should be admitted freely to all parts of the dairy barn. No part of the stable should be too dark to read a paper easily. This necessitates the placing of numerous windows on all sides of the barn, at least one of ordinary size to every two cows. They should be so arranged that in winter as much sunlight as possible can be obtained from the south and east exposures. The windows must be well fitted into their frames else difficulty will be met with in keeping the animals comfortable during severe weather.

**Whitewash**

No stable, however cheaply constructed, is complete without an application of whitewash to the side walls, ceilings, and wood-work. Lime is cheap and the wash, which is easily prepared, can be applied with an ordinary spray pump as well as with brushes. Two applications a year should be made to keep the stable in good condition. With a nozzle throwing a fine spray, every corner and crevice can be reached. The whitewash should be prepared as follows:

Take a half bushel unslaked lime of good quality, slake it with boiling water (cold will do), cover during the process to

Cut 15.—Neat and Attractive Buildings on a Dairy Farm in Illinois. If the Barn Had Some Windows, a Cement Floor and Was Whitewashed Inside, This Would Be Almost an Ideal Equipment for a Dairy Farm.
keep in steam, and add water as the process goes on. To do this, the lime should be placed in a tight barrel and water enough added to partly cover the lime. Never cover the lime entirely with water else the slaking process will go on too slowly. Soon after the water is added, the lumps of lime which are exposed to both air and water, begin to crumble and soon the whole mass begins to steam. More water should be added and the barrel kept covered. After the slaking process is over, several pails of water should be added and the whole thoroughly stirred. This mixture should be strained through a fine sieve before placing in the barrel to which the pump is attached and if necessary, more water may be added to secure a mixture which the nozzle will deliver well. The contents of the barrel or bucket must be kept well agitated for the lime tends to settle upon the bottom. The spray must be fine and not allowed to play upon one place until the wash begins to run. When applied with brushes, a slightly heavier wash can be used as it is generally well rubbed down. Light coats frequently applied are better than heavy ones as the latter are more apt to scale off. While still wet a light coat seems to have failed in its object, but when dry the whole becomes perfectly white. One bushel of lime will make thirty gallons of whitewash. Many formulas for making whitewash are published involving the use of salt, oil, grease, glue, rice, etc., together with the boiling of the material at different stages of its preparation. These are too much involved for the ordinary man besides taking too much time. The addition of a small quantity of salt and oil is said to increase the life of the whitewash. If convenient, they should be added, but boiling is not essential where light coats are put on often as indicated above. When once understood, whitewash can be made and applied with little trouble, yielding a large return in the improved condition of the stable. Best satisfaction is obtained by keeping the mixture well agitated and making light applications.