HOUSING AND MILKING FACILITIES
FOR THE DAIRY HERD

by

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6M 1-48
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The Open Shed
The Milking Stable
The Montana Elevated Cow Stall

A trend appears to be developing on modern dairy farms toward the use of an open shed, in which the cows are housed in late fall, winter and early spring; a relatively small, well-constructed, milking stable in which the cows are fed grain, cleaned and milked, and a milk room adjoining the milking stable. This may be constructed as one unit. The open shed system of housing the dairy herd has been successfully practiced by several Montana dairymen for many years.

By this plan of housing, the cows are allowed to run loose in a large, well-constructed open shed. In the shed, or preferably out in the yard adjacent to the shed, the cows have free access to hay, water and salt. At milking time, the cows are relayed through the milking stable where they are fed grain, cleaned and milked. The milking stable generally accommodates four or more cows at a time, depending upon the size of the herd.

After the cows have been milked, they are returned to another part of the shed. Separate quarters are provided for calves, heifers, sick animals and the herd sire.

The advantages of the open shed-milking stable plan are:

First. The cost of construction is usually less than that of the standard type dairy barn. Only a few cow stalls are required and concrete floors are limited to the milking
stable and milk room. The sheds are generally made of lighter and less expensive material. In many cases old buildings may be reconstructed into satisfactory sheds, or they may be taken down and the materials used in building new sheds.

Second. Successful dairymen, who have used this system, say that their cows appear to be more comfortable than when they are confined in stalls. Tests conducted, at several experimental stations in the northern states, show that the winter milk flow is maintained as well under this system as when cows are stabled in well-constructed, standard type barns. It is generally known that well-fed cows produce more heat than is generally needed for body maintenance. Therefore, they do not need additional feed to keep them warm even in moderately cold weather. Cows seem to adapt themselves to rather cold weather without any apparent discomfort or loss in production, providing they have a deep bed of dry straw to lie on and are protected from cold drafts.

Third. Less labor is required. Another advantage of the open shed system is that the shed, aside from picking up the droppings daily, need be cleaned only once or twice a year. Bedding the shed and the feeding of roughage is also done on a larger scale, thus saving labor. By having the milk room constructed as a part of the milking stable or built adjacent to it, less time and energy is required in carrying the milk into the milk room. With the milking stable, the milker gains time by having the cows come into the stall on their own accord where they are fed, washed and milked. This also brings the milk closer to the milk room where it is strained, cooled and held.

Fourth. Cows kept in a large, well-bedded shed are generally cleaner than those confined in stalls. This aids in the production of a higher quality milk. The milking stable is easier to keep clean and contains less dust and barn odor.

Fifth. More manure will be produced and it will be better preserved due to the larger amount of bedding used.

Sixth. The number of cows may be increased without any great expense in altering the buildings.

Seventh. There are generally less udder and teat troubles due to more room for each cow and a deeper bed of straw.
to protect the udder and teats.

This system has two disadvantages that should be considered. (1) The milking stable may be uncomfortable for milking, in sub-zero weather, unless it is well insulated or some means of heating is provided. (2) Considerable more bedding is required than when cows are kept in stalls.

The Shed

Good drainage is an important consideration in locating the shed and the milking stable. If the shed must be located on low, poorly drained ground the situation may be improved by building a high foundation permitting the filling of the yard and shed with gravel. A well drained dirt floor is preferable to a concrete floor in the shed. It should be located so that the sun will shine directly
into it as much as possible. It should also be protected from cold winds. A south exposure is generally preferable; however, facing the shed either east or west is satisfactory providing there is ample protection from cold winds. The shed should also be located so as to make it easy to get the herd to and from the pasture in summer, and to provide the most convenient and sanitary arrangement.

Figure 2 shows the plan and the cross section of a satisfactory shed. It shows the floor plan of one section of the open shed. By facing the shed to the south nearly every part of the shed,

where the milking cows are housed, will be exposed to direct sunshine during the day through the large, 12-foot, open door. The large door eliminates the need for windows. The large opening also permits bringing in large loads of baled hay and straw and also makes it possible to remove the manure with mechanical manure loaders.

The five-foot door, shown in the cross section, when closed, covers the upper half of the opening and gives added protection to the cows, in severe winter weather. The cows can pass in or out of the shed under the closed door. In mild weather, the door can be opened by swinging it up to the ceiling by means of ropes and pulleys. This will allow more sunshine in the shed which will help keep the bedding dry and will supply some heat if desired. A deck, for the storage of baled hay for feed and straw for bed-
Housing, can be arranged in the shed. If a deck is constructed, some posts or other supports will be needed. These posts should be arranged so that they will not interfere too much with the removal of manure by mechanical equipment. It is well to provide facilities for storing bedding and some hay in, or adjacent to, the shed.

The arrangement of the doors, supports, and the height of shed is such that a wagon or truck can go through or be backed in for cleaning out manure and for bringing in bedding or baled hay. At least 60 square feet of space should be provided for each cow of the smaller dairy breeds and 70 square feet for each cow of the larger breeds. Adequate space, for each animal, helps in keeping the cows clean and reduces the chance of injury.

A large amount of bedding is needed. The shed must be bedded every two or three days according to the requirements. To save bedding and keep the cows clean, it is advisable to remove the droppings daily. The litter may be allowed to accumulate for an entire winter and then be hauled directly to the fields as time and opportunity offers.

Unless the shed is well made, and is deeply bedded with dry straw, this plan of housing dairy cows is not satisfactory. Unless the shed is well lighted and well bedded the cows may prefer to stay outside.

In building a substantial shed, it is advisable to make the concrete foundation 20 to 24 inches higher than the dirt floor. This prevents the wood walls from rotting as the litter accumulates.

The walls, roof and the doors should be made tight to prevent drafts through the building. Some of the better sheds are made of rough lumber nailed to the studdings and then covered with building paper and galvanized sheet steel. Drop-siding or rustic can be used on the walls. Galvanized sheet steel, shingles or composition roofing can be used on the roof. A serviceable shed can be made of rough, low-priced lumber.

The inside wall in the shed should be boarded up to a height of five feet to prevent cows from injuring themselves on the stud-
Figure 3—A convenient and practical arrangement for ventilating the milking stable.

It is advisable to construct the milking stable and the milk room, or rooms, into one well-constructed building with the open shed attached to it. This facilitates getting the cows into the milking stable and taking care of the milk. The milking stable may then be provided with hot water and heat from the milk room. The more modern milking stables consist of a few stalls, the number varying with the size of the herd. Four Montana elevated cow stalls will enable one man to milk a herd of 40 cows in about two hours. For larger herds, more stalls and an additional operator are advisable so the milking period will not be unreasonably long.

The size of the milking stable will vary with the number and

dings. A shed made 26 feet deep or more from the front to the back wall is less drafty than a narrower one.

It is recommended that the openings to the shed be 12 feet wide. If openings are less a few windows may be necessary for additional light. The shed should be divided so that the cows, that are waiting to be milked, are kept separate from those that have been milked. Most dairymen prefer feeding the hay from racks outside except in the case of very stormy weather. Figure 4 shows racks for convenient feeding of hay in the shed.

All cows should be dehorned to avoid injury to each other.
the type of stalls used. Four Montana elevated cow stalls, for large cows, can be constructed, with adequate work room, in a milking stable 17' x 18' inside measurement. For the small breeds, 16' x 17' is sufficient. The ceiling, in the milking stable, should be 7' above the stall floor.

The milking stable should be well-constructed to prevent freezing temperatures in winter. It is well to plan the milking stable so that some heat may be obtained from the milk room. A small heating unit may have to be installed for extremely cold weather. The floor should be made of concrete and slope one inch in four feet toward the drains. The concrete should be slightly roughened to prevent the cows from slipping. This can be accomplished by stroking the concrete lightly with an old broom before it sets. To facilitate cleaning and prevent rotting of the lumber, the walls should be made of concrete, hollow tile or cement blocks up to 3 feet above the floor. This will make the walls dur-

![Figure 4](image)

**Figure 4**—A convenient rack for feeding hay in the shed during bad storms, otherwise the roughage is fed from racks out in the lot. The door on the side of the shed is swung out for feeding hay. It also serves in lighting and ventilating the shed.
able and easy to clean. The inside walls may be plastered with waterproof cement and then painted a light color. All woodwork should be painted to preserve it and make it easier to clean.

The milking stable and the milk room should be well ventilated and lighted. There should be at least 4 square feet of window light for each 500 cubic feet of space.

The sliding type of doors, between the milking stable and holding pen or shed, are recommended. They should be hung on well-constructed track equipment to make them work easy and fast. The doors should be 3 feet wide so that only one cow can be admitted at a time. With the Montana elevated cow stall system, it is best to have these doors located at opposite ends of the room and as far apart as possible.

Besides the Montana elevated cow stall system, which is described in this publication, other types of stalls may be used. The conventional wood or steel stanchion with concrete manger for feeding grain and the Hagen walk-through stalls are described in Montana Extension Bulletin No. 210, "Open Shed—Milking Stable Plan of Housing the Dairy Herd."

Commercially built milking stalls are also available.

The Montana Elevated Cow Stall

In November of 1946, the Montana Agricultural Experiment Station published a preliminary report of research work done on an elevated cow stall used in connection with the open shed-milking stable system of housing dairy cows. There is much demand for additional information as to the practicability of the stall, plan of operation, details of construction and approximate cost.

From the great demand for further information about the Montana elevated cow stall, it is evident that dairy farmers are interested in a practical, home-made, low-cost milking stable system. The Montana elevated cow stall was designed to reduce labor to a minimum, to simplify the feeding of grain, to make the milking of cows easier for the operator, to aid in the production of clean milk and to provide for an easy and rapid exchange of cows through the milking stable. From observations and reports received from dairymen, who are now using these stalls, it appears that the stalls have met these requirements.

Following is a summary of four dairymen's answers to ques-

1Circular 186, "The Montana Elevated Cow Stall."
tions relative to the practical use of the stalls.

Question. Can one man properly operate two single unit milkers in a four-stall setup after the cows become trained to come into the milk stable?

Answer. All reported "yes." One dairyman added that, "it keeps the operator moving."

Question. How many cows can one man milk per hour?

Answers. One said "15 to 20 cows;" one "about 20;" one "24;" and one "up to 27 cows."

Question. Have you had any serious difficulty in getting the cows to come into the stalls?

Answers. Two replied "no;" one "not too much;" one "none at all after the first few times the cows were milked in the stall."

Question. How much grain do you feed and do cows have time enough to eat their grain while being milked?

Answers. Three replied "8, 10 and 12 pounds respectively and cows had time to eat their grain;" one replied, "14 pounds and cows usually had time to eat; however, some cows eat slower."

Question. Do you like this milking stall plan?

Answers. One replied, "I think it is the best I have ever seen;" another "I like the plan very well;" another said, "very much;" and another stated, "I will never go back to the old system."

Question. Does the Montana stall make milking easier for the operator?

Answers. Two said "Yes;" one, "Yes, not much cleaning of the stable and less walking;" another declared "Very compact, easy to heat and keep comfortable."

Question. Do you recommend this type of stall to your neighbors?

Answers. All said "Yes;" one added, "My brother is going to install one."

From the above questions and answers it is evident that the dairymen, who now use these stalls, are well pleased with them.

Observations show that a good dairyman, who knows how to handle dairy cows, has adopted the "fast milking system" and can organize his work well, can milk from 20 to 24 cows per hour. This includes bringing the cows into the milking stable from the
shed or holding pens, feeding grain, washing the udder and teats, milking, taking care of the milk and turning the cows out into the shed again. Extra time, however, is required to assemble the machines, clean the milking stable and wash the machines after milking. Training heifers to be milked, will also require a little extra time. With an elevated stall system, the operator does not need to squat to wash the udder and teats, or to attach or detach the machines.
In the planning of their milking stables and the construction of the stalls, some dairymen made improvements over those published in the preliminary Montana Agricultural Experiment Station report. Others have reported making some errors in design which has slightly affected their efficiency. In this publication, it is the intent to incorporate all the improvements observed on the farms that have the stalls in use. To better understand the operation of the Montana elevated cow stall and milking stable system, one should first study the suggested floor plan. See general plan, Figure 5.

In this plan, the cows are all driven into holding pen number 2, located in the lower left of Figure 5. They are then admitted to the milking stalls through a three-foot sliding door, operated by a rope. While in the milking stalls, the cows are locked in stanchions, fed grain, udders washed and milked. After milking, the cows are released from the stanchions and pass out into holding pen number 1, upper left Figure 5. After all the cows are milked, both holding pens in the shed may be used to house the milking herd.

Three holding pens are shown in Figure 5: A minimum of two pens are always required to keep the cows that have been milked, separate from the rest of the herd. A third pen is convenient where a large number of cows are handled. In such cases there are often individual cows that need extra attention such as the treatment of sore teats, foot ailments or, cows that are being held for breeding. With the extra holding pen, these animals can be sorted out with less effort and excitement than if they are allowed to mingle with the herd and be separated later for treatment.

The method of using these pens is largely a matter of choice. The individual dairyman will, no doubt, discover special reasons for his particular method. Some dairymen prefer using a hospital pen shown as number 3 in Figure 5 for a holding pen for the cows waiting to be milked. The advantage of this is that the operator can enter the rear of the holding pen through a door in the feed alley and thus urge the cows into the milking stable with the least effort.

It should be noted that the stable is built on two levels. The holding pens, the passage back of the stalls, where the drains are located, and the floor of the stalls, where the cows stand while being milked, are on a higher level than the trench or alley in which the milker stands while he is working.
The floor of the trench between and in front of the stalls, where the milker works, and the floor of the milk room, is 32 inches lower than the floor on which the cows stand while being milked. This makes it possible for the milker to clean the udders and operate the milking machine in a standing position and carry the milk into the nearby milk room with the least amount of physical exertion.

The milking operation can be done not more than 10 to 12 feet from the milk room door with a four-stall setup. Doors for admitting cows to the stalls from the holding pen and releasing them, from the stalls to the holding pen or shed after milking, are operated by the milker from either trench or alley by the use of ropes. This makes it unnecessary for the milker to climb to the stall level except in special cases.

Figure 6.
In order to avoid confusion, it is advisable to have the ropes, which admit the cows, attached to the same side of each trench and ropes which release the cows should be attached to the opposite side.

Instead of the customary gutters, drainage is accomplished by floor drains. Two drains are located a few feet back of the stalls and another in front of them. The floors slope gently toward the drains.

For permanent construction, the stalls should be built of $1\frac{1}{4}$" or $1\frac{1}{2}$" iron pipe welded together and spaced to permit easy cleaning of the udder and for milking. The stalls are made slightly wedge shaped and narrow enough so that the cows cannot move away from the milker while being milked. The platform, on which the cows stand, should be made of concrete with a thickness of at least 4 inches. The front part of each stall is closed in with sheet metal and the stanchion placed so...

Figure 7—Rear view of two center stalls, showing how milking machines are supported by ropes attached to the lower pipes. Note convenient position of buckets for washing udder and teats.
that it will close just back of the cow's ears. The stanchion is closed by pulling a rope attached to the movable upright. The cow is released from the stanchion by pulling a trip rope. See Figure 6, end view.

The feed box, which is 8" deep, is set 14" above the stall floor so that the cow does not need to lower her head to eat her grain. See side view Figure 6. This helps to keep the cow quiet while being milked. The concrete alley between the stalls is relatively narrow at the rear and increases in width at the front. One single unit milking machine is used between two cows. This eliminates the carrying of the machine from one cow to another. Having the floor of the stall on a higher level, from that on which the milker stands, eliminates the necessity for stooping to wash the udder, to attach or detach the milking machine, to strip after the machine is removed or to inspect the udder and teats of the cow. See Figure 9.

Figure 8—The milking machine attached. Note the short vacuum hose and notches on lower pipe permitting adjustment in position of machine.
Almost all makes of milking machines can be used with this stall. The kind that is suspended under the cow may be hung on a rope or chain supported from the two lower pipes of each stall, (see figures 7 and 8). The machine can be moved forward or backward, up or down (while in operation) by the simple adjustment of the end of the rope or chain which is hooked into notches, in an iron bar, welded to the lower pipe. Each stall is equipped with a rope or chain support which does not have to be moved from one cow to another when the machine is transferred. Only a short vacuum hose is required, and the connection can be easily made.

The conventional type of machines can be set on the stall floor or on a specially built support on the side of the stalls. If the machines are set on the stall floor, then no curb should be built where the machines are set and the floor should slope slightly away from the operator. One operator supports his machines from a long hook attached to the ceiling between the stalls. When
a cow is being milked, the machine is swung up to the side of the stall and hooked to the lower pipe.

The fact that the milk room is only a short distance from the stalls makes it possible to pipe warm water to the stalls for cleaning the udders. A small rubber hose, equipped with a fine spray nozzle and a hand trigger valve, can be used to wash the flank, udder, and teats of the cow quickly with warm water, or a bucket of warm wash water may be placed at the rear of the stalls. See Figure 7.

The grain supply may be stored on the second floor and piped to small grain bins in front of the two outside stalls or a larger bin under the feed boxes of the center stalls. Each cow can then be conveniently fed her allotted amount of grain by means of a small scoop.

The feed boxes should be made of heavy, galvanized steel and constructed so that they can easily be taken out and cleaned.

Cost of the Stalls

One important advantage of the Montana elevated cow stall system is that it can be built at home at a relatively low cost. Many farmers can now do their own welding or they can have it done locally. Frequently old pipe, for construction, can be obtained at a low cost.

The estimated costs of building the four stalls, not including the concrete, by dairymen who now have the stalls are as follows: One, $125; one, $45, but this man did all his own work; one, $175, including the concrete; the other, $100 for the pipe and welding the four stalls. In this case there was some additional expense in building the stanchion, feed boxes, putting on sheet metal or front of stalls and a few miscellaneous items.

The arrangement and dimensions of the stalls and feed boxes, shown in the views of Figures 5 and 6, have been tried and found satisfactory for Holstein cows under actual working conditions. If the stalls are to be built for smaller cows, then the dimensions need to be changed.

The sides of each stall can be made up in a welding shop but care should be exercised to make the shape of bends and dimensions as given.

A 2" x 2" angle iron extending across the building in front of the stalls and at the same height as the top of the stall has
been found to be convenient to hold the sides of each stall in place. The vacuum pipe, placed across the stalls and clamped to them, will also help to hold the sides of the stalls in place while the concrete is poured. See plan and side views Figure 6. The concrete in the floors and alleys should be of good quality, using clean aggregate in about a 1:2:4 mix. The water-cement ratio should not be more than 7 gallons of water per sack of cement used. Smooth floors are dangerous to both the cows and the milkers, especially in winter. It is advisable therefore to finish with a slightly rough surface. This can be accomplished by brushing the concrete with a stiff broom before it has set. To facilitate cleaning, all corners should be rounded as shown on the plan. See Figure 6.