LOOSE HOUSING

for dairy cattle

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Loose Housing for Dairy Cattle

By THAYER CLEAVER and ROBERT G. YECK, *agricultural engineers, Division of Farm Buildings and Rural Housing, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration* [1]

The loose-housing system is a flexible arrangement of buildings and open lots developed for efficient milking and management of dairy herds. In this system the cows are kept in an open building, lot, or pasture, but are not confined in stalls except while being milked. In contrast, the familiar stall barn has a stall for each cow; cows are confined in their stalls during cold weather except for short exercise periods.

Cows handled under the loose-housing system do not suffer from cold because in winter they grow thick coats of hair and have shelter from wind, rain, and snow. During the winter in cold climates manure and bedding are allowed to accumulate in a resting area to form a soft bed on which the cows like to lie. The manure pack generates some heat. If well managed, cows keep as clean or cleaner than in a stall barn and have less trouble from stiff hocks and swollen knees. In case of fire there is little danger of losing animals because they are not confined in a building.

The cows are milked in a separate room or building that usually accommodates only part of the herd at one time. Cows enter singly or in groups and are released immediately after milking. An expanding herd can be accommodated by milking more cows in a stall and, if necessary, using a larger milk cooler.

Loose housing is not a new system, but it has been greatly improved in recent years. Hay and silage can now be partly self-fed, and tractor manure loaders or power scoops eliminate hand labor in removing the manure pack and cleaning the feeding areas.

The loose-housing system has some disadvantages. Men caring for the animals are more exposed to weather than in a stall barn. If the resting and feeding areas are not definitely separated, twice as much bedding may be required to keep cows clean as in a stall barn. However, if the system is well arranged and managed, little more, and sometimes less, bedding is required than in a stall barn.

A complete loose-housing layout has (1) a farm milking plant which includes a milking room or barn, a milkhouse, and usually a concentrate feed bin; (2) roughage and concentrate feeding facilities for cows and young stock; (3) storage space for hay, silage, and bedding; (4) resting areas for adult and young stock; (5) maternity, hospital, and calf pens; and (6) an open lot (fig. 1).

In the mild climates of the South and Southwest, where cows are on pasture most of the year, building requirements are greatly simplified and only the farm milking plant may be needed.

REQUIREMENTS FOR GRADE A MILK PRODUCTION

Local and State health regulations regarding milk produced for sale within a city or other area usually include requirements affecting design, construction, and sanitation of farm dairy buildings. The buildings described and illustrated in this bulletin meet health requirements in most areas. However, any person planning farm buildings for the production of Grade A milk should make sure that they will meet requirements specified where the milk is to be sold.

[1] The authors gratefully acknowledge assistance received from representatives of State agricultural colleges and Federal agencies, as well as from manufacturers of building accessories, dairy equipment, and prefabricated buildings. This assistance included both helpful information and photographs for illustrations.

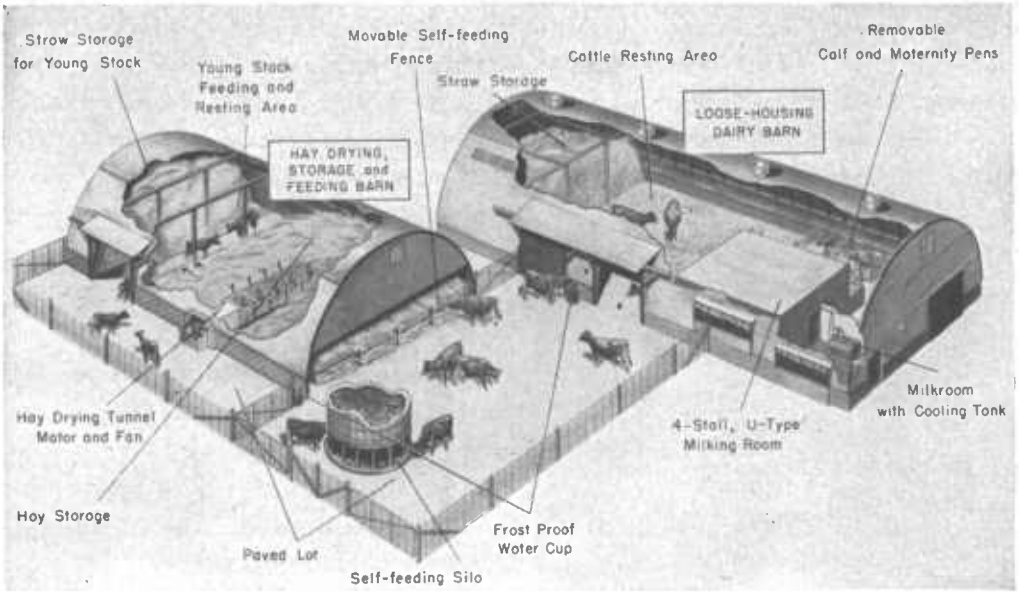

FIGURE 1.—A complete loose-housing layout for adult and young dairy cattle.

THE FARM MILKING PLANT

Milking Rooms and Barns

Where good-quality milk is to be produced, a milking room or barn has several advantages. A minimum of labor is required for milking the herd and carrying milk. Good sanitation can be maintained with little effort because the milking room is small, cows are in it only for milking, and cleaning facilities are convenient. With elevated stalls, practically all bending and stooping is eliminated.

The milking plant may be built of masonry, frame, or metal. Concrete floors are generally used. Interior walls and ceilings must be of materials that can be kept clean easily.

A farm milking plant, including milking room, attached milkhouse, and feed room, is shown in figure 2. It is convenient to have these units under one roof, though some local regulations require a separate milkhouse. With a 3-in-line arrangement of stalls (fig. 3), one man can milk 20 to 25 cows per hour. Stalls open at far side to let cows in and out.

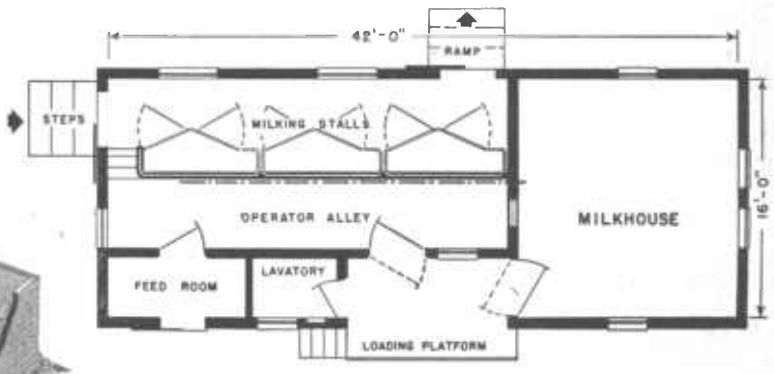

FIGURE 2.—This farm milking plant includes milking room, milkhouse, lavatory, and feed room. Loading platform may or may not be elevated. Outside toilets are optional in most areas.

A U-shaped milking room can be arranged for 3, 4, 5, or more stalls. In a 4-stall building (fig. 4), one man can milk 20 to 30 cows per hour or, with a helper, 30 to 45 per hour. The milking room is large enough for daily production of 120 gallons of milk.

A 4-stall milking room with elevated tandem walk-through stalls is shown in figure 5. Two cows enter together on each side of the milking room and leave together. Feed boxes separate the stalls (fig. 6). These are moved into the operator alley to let cows out. This type of building may cost a little less than

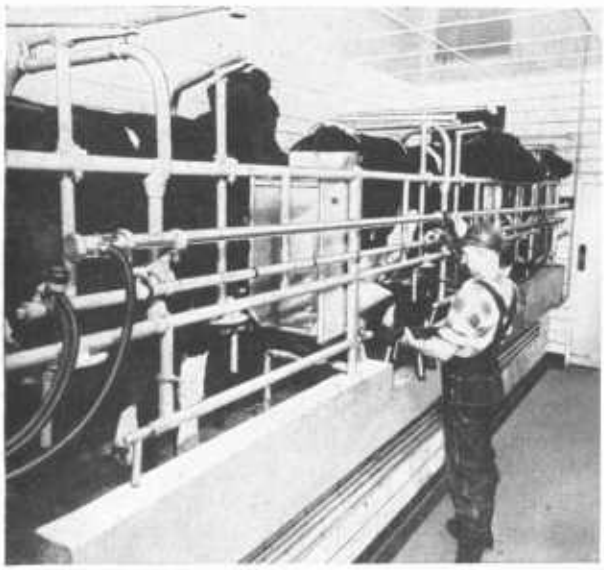

FIGURE 3.—A milking room with three-in-line, elevated, side-entering stalls.

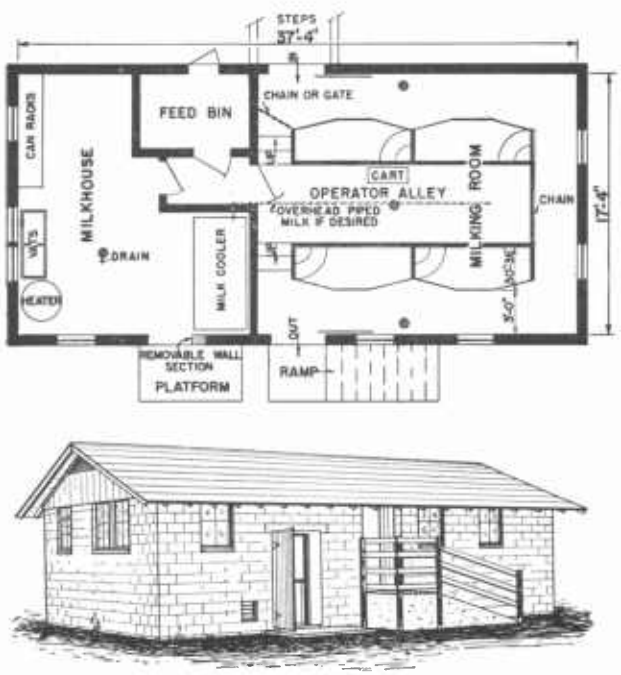

FIGURE 4.—An efficient arrangement of four elevated, side-entering stalls for piped or hand-carried milk.

FIGURE 5.—A milking room with two-in-line rows of elevated, walk-through stalls, often called chute- or lane-type stalls.

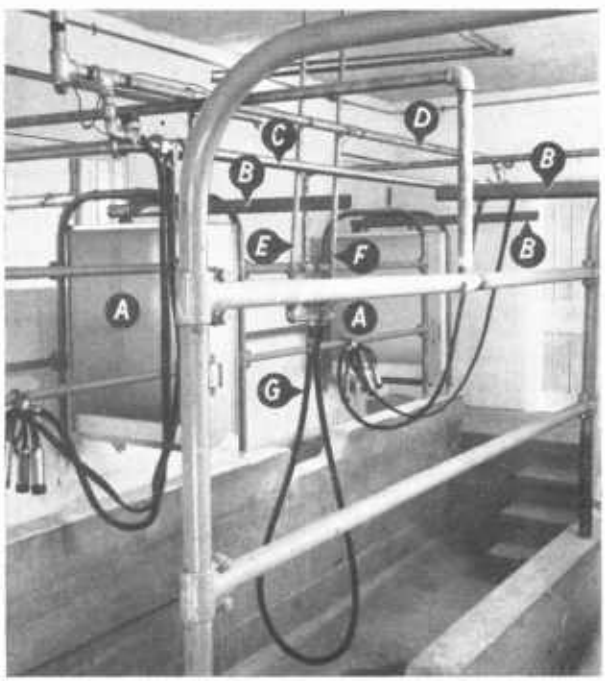

FIGURE 6.—An elevated walk-through stall arrangement. Feed boxes (*A*) are moved aside on tracks (*B*) when cows leave their stalls. Also shown are milk pipe line (*C*), vacuum line (*D*), hot and cold water lines (*E* and *F*), and water hose and spray (*G*).

those shown in figures 2 and 4. Milking rates are about the same as in U-type side-entering stalls.

A floor-level walk-through milking plant is shown in figure 7. The stall fronts swing aside to permit cows to leave after being milked. With this arrangement two men can feed and milk 25 to 40 cows per hour. Feed bins are between each pair of stalls.

Figure 8 shows a type of milking barn used in many parts of the South and West. Stalls and stanchions are similar to those in a stall barn, but often of a simpler and cheaper type. The rear gutter is shallow or is omitted, since cows are in the barn only for milking. From one-fourth to one-half as many stalls are provided as there are cows to be milked. A section of an optional interior arrangement is shown in figure 9. One man with 2 machines can milk 15 to 20 cows per hour with this system. The cost per stall is considerably less than for elevated stalls. Total cost, however, may be greater because more stalls are required to handle the same size herd.

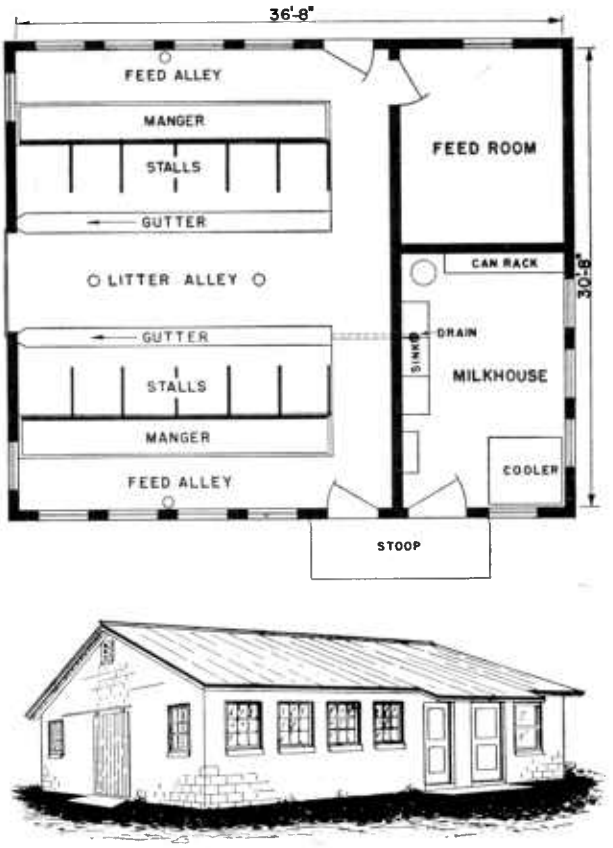

FIGURE 8.—A 12-stall milking barn for use in a loose-housing system. After the cows are milked they back out of the stalls.

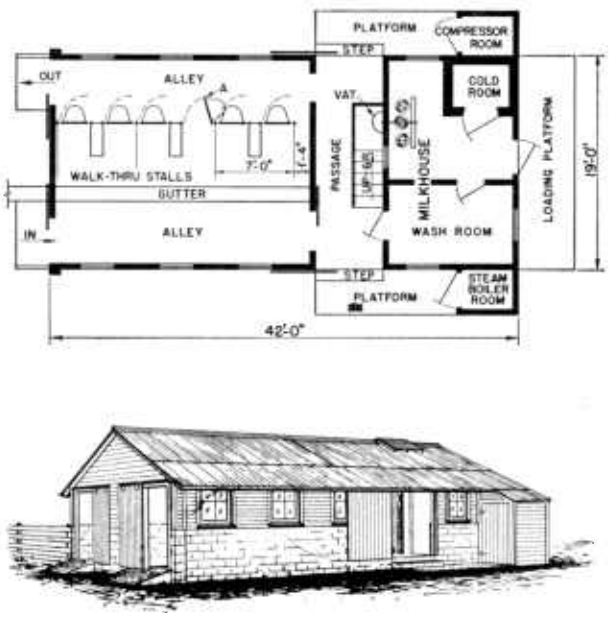

FIGURE 7.—In this floor-level walk-through milking room, the cows stand abreast. After milking, the stall front (*A*) is swung aside to permit the cow to leave.

FIGURE 9.—Interior of a milking barn without stall partitions or gutter. A heater (*A*) has been installed on the back wall.

THE MILKHOUSE

Although State and local regulations vary somewhat in detail, most of them follow the "Milk Ordinance and Code—1953 Recommendations of Public Health Service" rather closely. These require a milkhouse constructed as follows:

"The milkhouse or room shall be provided with a tight floor constructed of concrete or other impervious material, in good repair, and graded to provide proper drainage. It shall have walls and ceilings of such construction as to permit easy cleaning, and shall be well painted or finished in an approved manner. It shall be well lighted and ventilated. It shall have all openings effectively screened including outward-opening, self-closing doors, unless other effective means are provided to prevent the entrance of flies."

Suggested inside dimensions for milkhouses where Grade A milk is sold to a processor are:

Daily milk output (Gallons)	*Floor space (Feet)*
Under 20	12 x 10
20 to 50	12 x 12
50 to 100	12 x 14
Over 100	12 x 16

This space does not include pouring platform or boiler or compressor room.

The milkhouses illustrated in this bulletin will meet the requirements for Grade A milk in many localities. Where they do not, usually only minor changes are required. In some areas, for example, the milkhouse must be separated from the milking room by a vestibule or passage. Minimum equipment for the milkhouse will usually be: a milk cooler, water heater, wash vats, can rack, drying table, and storage cabinets. Figure 10 shows the interior of a well-arranged milkhouse.

Milk will be stored in the milkhouse in cans or in a bulk cold tank. Cans may be held in one of several types of coolers, the most common of which are water spray, water immersion (fig. 11), or walk-in refrigerators. All types depend on mechanical refrigeration to cool the milk properly, except possibly the water-immersion type during winter months or where ice may be used to cool the water.

Good locations for milk coolers, as illustrated in this bulletin, will simplify installations of piping for milk. They also require a minimum of travel and effort if milk is hand-carried from the milking room to the cooler, or from the cooler to the milk hauler's truck; the coolers are close to the outside door if it should be necessary to remove them and install

FIGURE 10.—Milkhouse interior showing fluorescent light (*A*), ventilator (*B*), can rack (*C*), drying table (*D*), wash vats (*E*), floor drain (*F*), corner of cooler (*G*), water heater (*H*), and space heater (*I*).

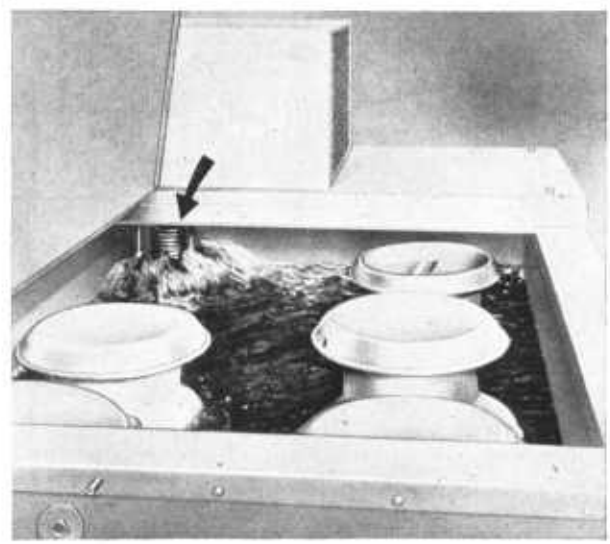

FIGURE 11.—Milk coolers of water-spray type (above) and water-immersion type (below). Immersion cooler shown has a mechanical unit (arrow) which circulates cooling water around cans.

FIGURE 12.—Refrigerated bulk milk tank into which milk is piped (*A*) from milking room. Milk is pumped to tank truck through hose or pipe connected at *B*.

others; and they are conveniently located with respect to other work areas and equipment in the milkhouse.

Refrigerated tanks for bulk milk (fig. 12) are relatively new. Milk is stored in such tanks and later transferred through a sanitary pipe or hose to the tank truck. Bulk milk cooling and storing eliminates some equipment, reduces time, travel, and labor for handling milk, and eliminates some milk losses. If good management and sanitation are practiced, milk will be of higher quality and will cost less to produce and process. However, costs of initial equipment for both producer and processor are high, and, since a tank truck cannot handle milk in cans, all producers on a route must use the bulk system or the processor must operate a second truck.

Plumbing for the Milking Plant

Hot and cold water under pressure is necessary at the wash vats in the milkhouse. Hose connections are needed for cleaning floors, filling water-immersion coolers, and preparing washes and rinses. Hose connections are needed in the milking room for washing udders and floors (fig. 6). Floor drains with water-seal traps to keep out odors are needed in the stall, operator alley, and milkhouse floors. Locate drainage outlets at least 100 feet away from buildings and lots for sanitary reasons. Drain tile should be below the frost line.

Ventilating and Heating

Minimum requirements for ventilating the milkhouse and milking room are usually determined by State and local regulations. Screened doors and windows and ceiling vents connected to roof ventilators (fig. 5), or to louvered openings in walls (fig. 8) or ridge ventilators (fig. 7), usually provide adequate ventilation. Screened wall inlets near the floor are sometimes required to help dry wet floors. An exhaust fan installed in a wall or mounted in a window frame will increase air circulation and provide more comfort for both cows and operators. Where winters are mild, parts of the walls may be omitted to give better air circulation and comfort. All wall openings and ventilating ports must be screened and fly tight.

Except in warm climates heating equipment is needed to prevent freezing of the water system and to provide a temperature of 45° to 50° F. for the operator. Between milkings the temperature in the milking room need not be more than about 40°. During the milking period the heat from the cows will help warm the room. Heat lamps or electric heating cable may protect the water system, but where the weather is severe a space heater is desirable.

Heaters are available that can be placed on the floor, mounted on a wall, or suspended from the ceiling. If electric heat is used, a 3,000-watt heater should provide enough heat for a two- or three-elevated-stall milking room if the building is tight, well constructed, and with good insulation in the ceiling. It may pay to have storm sash on the windows and use storm doors rather than pay a high heating cost with a large heater. A gas heater of 15,000 to 20,000 B. t. u. per hour capacity or an oil heater burning 1 quart of oil per hour will supply heat quickly and have reserve capacity.

Lighting the Milking Plant [2]

Good lighting is necessary for milking operations and proper cleaning and sterilizing of all milking equipment. In the milkhouse one 100-watt incandescent bulb (or equivalent fluorescent tube) above the wash vats and another above but near the cooler and can rack is usually enough. Lights should be at or near the ceiling if it is not over 8 feet high.

In the milking area it is important to have good light on flanks, udders, and teats. Sometimes lights can be installed about 5 or 6 feet above the floor in the wall opposite milking stalls to throw light on important operations. Lights hung from the ceiling

[2] For further information on lighting, see Farmers' Bulletin 1838, Electric Light for the Farmstead.

ean be eentered over the operator alley 7 to 7½ feet above the floor. At least one 100-watt bulb is needed for a two- or three-elevated-stall arrangement and two 100-watt bulbs for 4 to 6 elevated stalls.

In a milking barn (fig. 8) 100-watt bulbs are spaeed 12 to 15 feet apart above the eenter of the operator alley and 20 to 32 feet apart above the eenter of the feed alley. Lights should be 8 to 9 feet above the alley floor.

THE FEEDING AREA

Arrangements for Feeding Roughages

Feeding arrangements for the winter season or when pastures are not available may be provided outdoors or under roof, depending on the elimate.

If hay or silage is fed inside a building, the feeding area should be separated from the resting area. Arrange doors and interior posts so the feeding area ean be eleaned with traetor equipment. If possible, hay should be stored under roof beside the feeding area or in a mow above it to simplify the feeding operation. In dry elimates hay may be stored and fed with no weather proteetion (fig. 13).

Self-feeders for ehopped hay ean also be used. One type is a prefabrieated round steel building. A baled hay feeder is shown in figure 14. Feeding fenees that are moved baek as the roughage is eaten may be used inside a building or outdoors for hay and staeked or treneh silage.

Silage ean be fed in bunks in an open lot (figs. 13 and 15) in most elimates, but where winter weather is severe it may be neeessary to feed indoors beeause eattle will not eat mueh frozen silage. In either case, silage may be fed in the same manger or bunk as hay to eonserve spaee.

Silage stored in a treneh silo or staeked at one end of an open lot ean sometimes be self-fed by using a movable feeding fenee. Self-feeding arrangements for eorn silage in upright silos are also being used (fig. 1).

If eattle have aeeess to roughage at all times, 12 to 18 inehes of bunk, manger, or feeder spaee per eow is ample. If roughages are fed in bateh es so that all animals must eat at the same time, eaeh eow will need from 24 to 30 inehes of manger spaee. In either ease, eows should be dehorned. A paved strip at least 10 feet wide is needed around feed bunks and other feeding areas. A paved strip should also eonneet feeding and resting areas if the entire lot is not paved.

Tables 1 and 2 give the amounts of roughages required per 1,000-pound eow for feeding periods of different lengths. Table 3 gives the spaee per ton required to store various types of feed. Total storage space neeessary for a partieular herd ean be approximated from these tables.

FIGURE 13.—Loose-housing feed area whieh has been sueeessful in some Western States.

FIGURE 14.—Baled hay is stored in this feeder and fed from two sides. Water tank (*A*) is on the south side for proteetion from winter winds.

FIGURE 15.—Silage may be hand fed in long bunks. Hinged doors (*A*) may be swung upward after silage is distributed.

TABLE 1.—*Hay requirements per 1,000-pound cow for various feeding periods*

Type of feeding	Feeding period	Amount of hay fed	
		Per day	Total
	Days	*Pounds*	*Tons*
Hay alone	210	25	2.6
	175	25	2.2
	120	25	1.5
Hay and silage	210	[1] 15	1.6
	175	[1] 15	1.3
	120	[1] 15	.9

[1] Hay requirements will be lower if cows get all they want of top-quality silage.

TABLE 2.—*Silage requirements per 1,000-pound cow for various feeding periods*

Type of feeding	Feeding period	Amount of silage fed	
		Per day	Total
	Days	*Pounds*	*Tons*
Hay and silage	210	30	3.2
	175	30	2.6
	120	30	1.8
Silage [1]	210	60	6.3
	175	60	5.3
	120	60	3.6

[1] Assuming that some good-quality hay is fed.

TABLE 3.—*Approximate storage space required for cattle feeds*

Type of feed and form of storage	Approximate storage space required per ton	
	Maximum	Minimum
Loose hay:	*Cubic feet*	*Cubic feet*
Shallow mows	575	450
Deep mows	450	400
Baled hay:		
Loose bales	300	250
Tight bales	200	135
Chopped hay:		
Long cut (2½ inches or more)	360	250
Short cut (less than 2½ inches)	250	200
Silage:		
25 feet in depth	50	44
35 feet in depth	44	40
Mixed concentrates	45	.....

The amount of concentrates to be stored will depend on the rates at which they are fed. If concentrates are fed at the rate of 1 pound to 4 pounds of milk, a cow giving 8,000 pounds of milk per year will require 1 ton. If 1 pound of concentrate is fed for each 3 pounds of milk, 1⅓ tons will be required.

Water Supply

A milking cow requires about 15 gallons of water per day when temperatures are below about 60° F. In hot summer weather she will drink about 30 gallons. Water cups or tanks should be located near the feeding area but not in the resting area. The cup or tank can be placed outside the building but is more likely to freeze. Figures 14, 19, and 20 suggest good locations.

Cups are smaller, easier to clean, and easier to protect from freezing than tanks. One automatic cup is enough for 25 cows. The area around cup or tank should be paved for at least 10 feet. If a tank is used, it needs a float control. Water pipes should be placed below the frost line or protected by devices like electric heating cable. Outlets and faucets should be placed to avoid damage to or by vehicles and animals.

Lighting the Feeding Area

Electric lights with conveniently located switches are needed in all feeding areas and open lots. In buildings, one 100-watt bulb (or equivalent fluorescent tube) centered 6 to 9 feet above bunks and mangers is sufficient for 20 to 25 feet of length. For high hay feeders the lights should be 6 to 8 feet to one side and 9 to 12 feet above the floor, where braces or beams do not cause bad shadows. For upright silos, one 100-watt bulb for the chute and another for the silo should be placed near the top and within easy reach of the chute ladder.

For self-feeding trench silos, one 100-watt bulb with weatherproof reflector is needed at the side of the trench entrance. It should be mounted on a pole 12 to 15 feet above the trench floor. One 200-watt bulb with reflector is recommended for open lots for each 10,000 to 15,000 square feet of area. Lights should be about 15 feet above the ground and at the center of most chore operations.

THE RESTING AREA

The resting area, sometimes called bedded area, is a building or space where cows can rest or lie down on a dry bed (fig. 16). It should provide shelter from cold winds, snow, and rain. An open-front building facing south, east, or away from prevailing winter winds and kept well bedded is satisfactory in most climates. In areas having severe winter storms and low temperatures, the front may be partly closed.

During late fall, winter, and early spring in all but the mildest climates, bedding and manure are allowed to build up a deep pack that generates some heat. Few if any injuries occur to hocks, knees, udders, and teats of cows resting on a manure pack, and flies are not a menace during cold weather. Most of the fertility of the manure is conserved. The pack must be removed before the fly season. The space is then used like any other cattle shed and cleaned as necessary to control flies.

FIGURE 16.—Resting areas with deep manure packs provide shelter and warmth during the winter. The door shown in the background can be opened for removal of the manure.

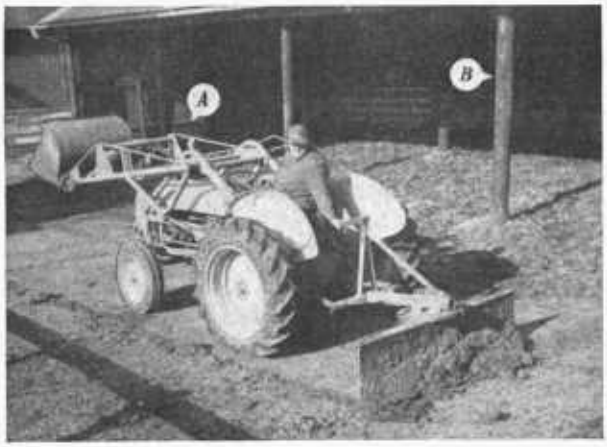

FIGURE 17.—Paved strips in front of resting areas can be easily cleaned with tractor-mounted equipment. Pole sheds should have pressure-treated retaining planks (*A*) and poles (*B*).

Earth floors may be satisfactory for resting areas, providing they are 8 to 12 inches above grade and the grade outside is sloped away from the building to provide good drainage.

With open-front buildings there should be a paved strip at least 20 feet wide along the entire open front. Most of the mud or manure on the cows' feet will drop off on this paved approach. Power equipment for removing manure can also work more effectively on this strip (fig. 17).

The space per cow required in resting areas depends on size of cow, arrangement of space, and climate. The Wisconsin Agricultural Experiment Station recommends 60 to 70 square feet for large Holsteins. In central Illinois some dairymen have had satisfactory results with only 35 square feet per cow.

The manure pack may be 2 to 4 feet deep depending on length of the housing season, how often the pack is removed, time the cows spend in the resting area, floor space allowed per cow, and amount of bedding used. Wood members in contact with manure should be pressure treated with preservative (fig. 17).

Resting areas should be nearly square rather than long and narrow, as space near the open front does not provide good shelter. Space used as a passage or walkway should not be counted as part of the resting area. At least 9½ feet of headroom at the eaves or doorway is needed if a tractor-mounted manure loader is used for cleaning. Posts or poles should be spaced at least 12 feet apart in each direction for free movement of tractors and equipment.

Bedding Requirements

The quantity of bedding required is affected by length of housing season, arrangement of buildings, space allowance per cow, climate, and management. The Wisconsin Agricultural Experiment Station reports the use of 1,522 pounds of bedding per 1,436-pound cow during a housing season of 182 days. This was an average of 8.4 pounds per cow per day. Droppings were turned over or thrown to the unused edges or thin spots of the manure pack once or twice a day. Most Northern States recommend use of 12 pounds or more of bedding per day for each animal. On the other hand, some farmers in central Illinois use less than 500 pounds for each cow per season and in some Southern States little or no bedding is used.

In a one-story building, bedding can be stored alongside the resting area, protected by a temporary fence. From 10 to 15 square feet per cow of the resting area can be used for bedding storage at the start of the season. As the bedding is used, the fence can be moved back to provide more space in the resting area. A ton of ordinary bales of straw occupies 250 to 300 cubic feet.

Summer shade and free air movement are as necessary in resting areas as protection from winter storms, particularly in the Southern States. Windows or wall panels that can be opened for light and summer ventilation are needed. If plenty of baled bedding is available, siding may be omitted from the building and bales may be stacked at the ends and back of the resting area to form walls in winter. In the spring the unused bedding can be shifted to open up the walls for more air circulation. In very mild climates shades 10 to 12 feet high and without walls are adequate. Roofs may be of aluminum, hay, or straw.

Electric light is needed in the resting area. One 100-watt bulb or equivalent mounted 10 to 14 feet above the floor will provide adequate light for about 1,000 square feet of resting area, if beams and braces do not cause bad shadows. The light should be controlled by a wall switch near the most used entrance.

YOUNG STOCK, MATERNITY, HOSPITAL, CALF, AND BULL PENS

In a well-managed dairy herd usually about 50 percent of the animals will be milking cows; 5 to 8 percent, dry cows; 25 percent, heifers 10 months to freshening; 12 percent, calves 6 weeks to 10 months old; and 5 to 8 percent, calves under 6 weeks.

Older calves, yearlings, and 2-year-olds can be handled in their own separate feeding and resting areas. Space for calves, maternity pens, and hospital pens is best provided in separate buildings but can adjoin the resting area. Recommended sizes for pens are presented in table 4.

All pens should be of panel construction, easily detachable at the corners so they can be moved when the manure pack is removed. Panels should be lifted occasionally as the manure pack builds up.

If calf pens are in the resting area, they should be near the open east or south side to let the calves get sunshine. Pens for young calves should be boarded up tight to a height of 4 to 4½ feet above the floor to lessen drafts. For individual calf pens, a false floor 2½ to 3 inches above the pen floor can be built of slats or stiff wire netting. This allows urine to drain through the bedding. A movable calf house and pen for use in warm climates is shown in figure 18.

Bulls should not be housed with other cattle but, if kept, should be in a separate shed with adjoining open lot as described in Farmers' Bulletin 1412, Care and Management of Dairy Bulls.

TABLE 4.—*Recommended dimensions for cattle pens*

Type	Length and width		Height
	Minimum	Maximum	
	Feet	*Feet*	*Feet*
Cow pens	10 x 10	12 x 12	4½
Individual pens for small calves	6 x 4	6 x 6	4
4-calf pens [1]	10 x 10	12 x 12	4½

[1] Allow 25 to 35 square feet of area and 20 to 25 inches of manger space per calf depending on size.

FIGURE 18.—This calf house and pen can be moved as needed to provide fresh pasture.

LAYOUTS FOR LOOSE HOUSING

The site for a loose-housing system should provide space for buildings, lots, driveways and turnarounds for vehicles, and for expansion. The layouts in figures 19 and 20 are for cold climates. In mild climates buildings may be separated and the feeding or resting barn may be omitted.

A complete loose-housing layout for 20 cows is shown in figure 19. If young stock are housed elsewhere, the layout is ample enough for 25 cows. The resting area allows 47 square feet per cow at the beginning of the housing season and 50 square feet before midwinter. This is exclusive of bedding storage and a maternity or hospital pen. Feeding and resting areas are separate and face south for protection from cold winds. The paved lot is sloped away from the buildings 1 foot in 50 for drainage.

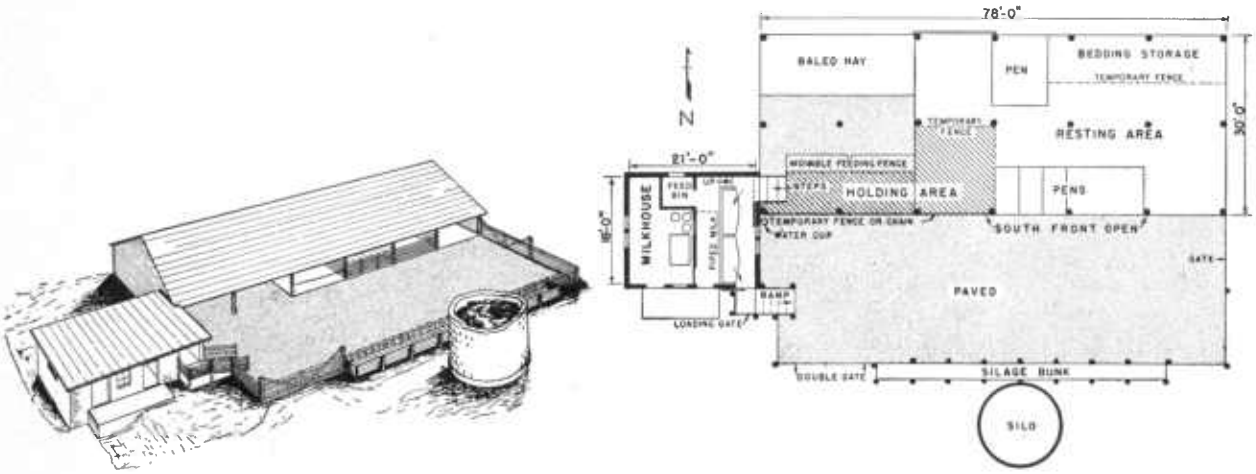

FIGURE 19.—A loose-housing layout adapted for a 20-cow herd. It is also ample for 25 cows if young stock are housed elsewhere.

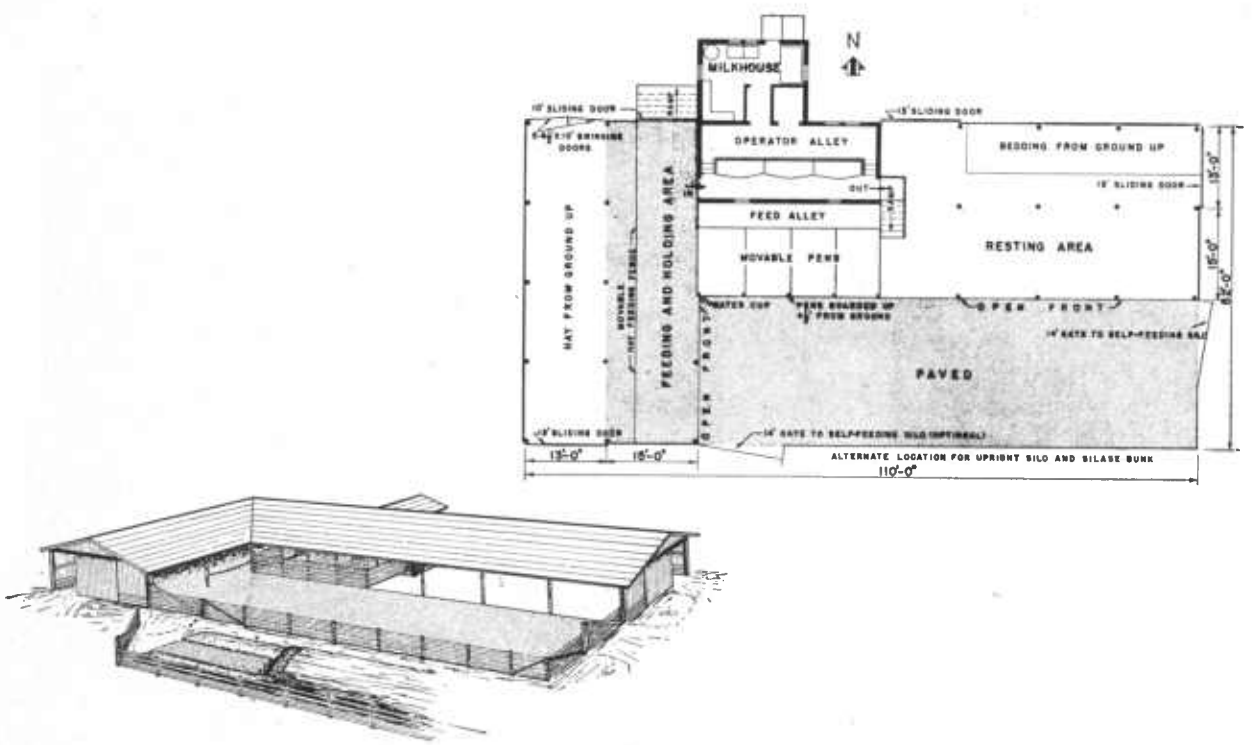

FIGURE 20.—An L-shaped loose-housing layout designed to give protection from winter winds. The feeding area slopes upward to the milking room.

In this arrangement cows enter the milking room from the hay-feeding area, which also holds unmilked cows. Cows are milked from the right side and exit into the paved lot. Entrance and exit doors and stall gates are controlled from the operator alley by a system of small cables or ropes and pulleys. Hay and bedding are stored on the ground. The movable hay-feeding fences are moved forward on the paved floor as the hay is fed. All calf pens are of tight movable panels and are located next to the open front of the resting area for winter sunshine.

An upright silo is indicated in the plan, but silage may be brought from a trench silo with a tractor-mounted scoop or self-fed directly from the silo. Self-feeding trench silos must be paved and for permanent use walls should be sloped outward and faced with concrete or masonry.

An L-shaped loose-housing arrangement for 20 to 25 cows is shown in figure 20. Because the open sheds face south and east, they provide excellent protection from winter winds. The paved hay-feeding area also serves as a holding area for unmilked cows.

Cows enter the milking room from the feeding area, are milked from the left side, and exit into the resting area. Baled bedding and hay are stored from the ground up. The resting area has about 45 square feet per cow at the beginning of the housing season, which increases to 50 square feet as bedding is used during early winter.

The entire open lot is paved. Sites are indicated for either a self-feeding trench silo or an upright silo with feed bunks.

REMODELING GENERAL-PURPOSE BARNS

Old general-purpose barns are generally unsatisfactory as dairy barns but they may be converted economically for high-quality milk production as part of a loose-housing arrangement.

Figure 21 illustrates a plan for a loose-housing layout remodeled from an old general-purpose barn. The paved dairy section can be retained as the feeding area but the gutter must be filled. Most of the interior other than the feeding area is used for pens and a resting area. If ceilings are low, a tractor-mounted blade (fig. 17) can be used to remove the manure pack by working in through large doors at both ends. This may have to be done two or three times each winter.

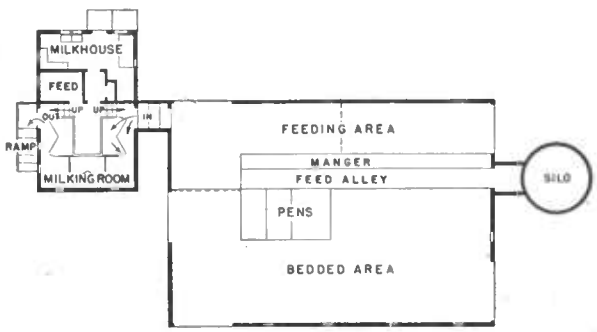

FIGURE 21.—A general-purpose barn remodeled and adapted for loose housing. The milking plant which completes the layout is new.

FIGURE 22.—Feeding arrangements in existing buildings may be satisfactory for loose housing. Electric fence separates feeding and resting areas in this barn.

To provide more headroom, an earth floor might be lowered if this would not undermine the foundation or permit flood water to enter. Sometimes the upper floor can be raised to provide at least 8 feet under joists. Unnecessary walls and partitions should be removed, leaving the posts that support the overhead haymow and roof. It may be necessary to install extra beams so that some of the supporting posts can be removed to allow working space for power equipment. The last step in conversion is to build a milking plant outside the barn. It can be attached to the feeding area by a lane or covered passage if severe weather is expected.

Existing facilities in old barns, such as the feeders in figure 22, can often be used with few or no changes. If the feeders are next to the resting area, they should be separated from it by an electric or movable fence to avoid unnecessary trampling of the bedding. A large gate or opening at one or possibly both ends of the fence will permit cows to pass freely between the two areas.

CONVERTIBLE AND EXPANSIBLE BARNS

A farmer starting into the dairy business can construct his buildings by steps. The small 5-abreast stall barn (fig. 23, A) may be used temporarily for producing Grade B milk without completing the milkhouse interior, which can be used for feed storage. After completing the milkhouse and adding feeding and resting areas, the building may be used as a floor-level milking barn for 10 or more cows to produce Grade A milk. The third step is to convert the milking barn section to an elevated 4-stall U-shaped milking room suitable for 20 to 45 cows (figs. 4 and 23, B).

The outer walls will not need alteration if dimensions are correct from the start. Conversion will consist mainly of adding inside features for the production of quality milk and shed space to accommodate the herd.

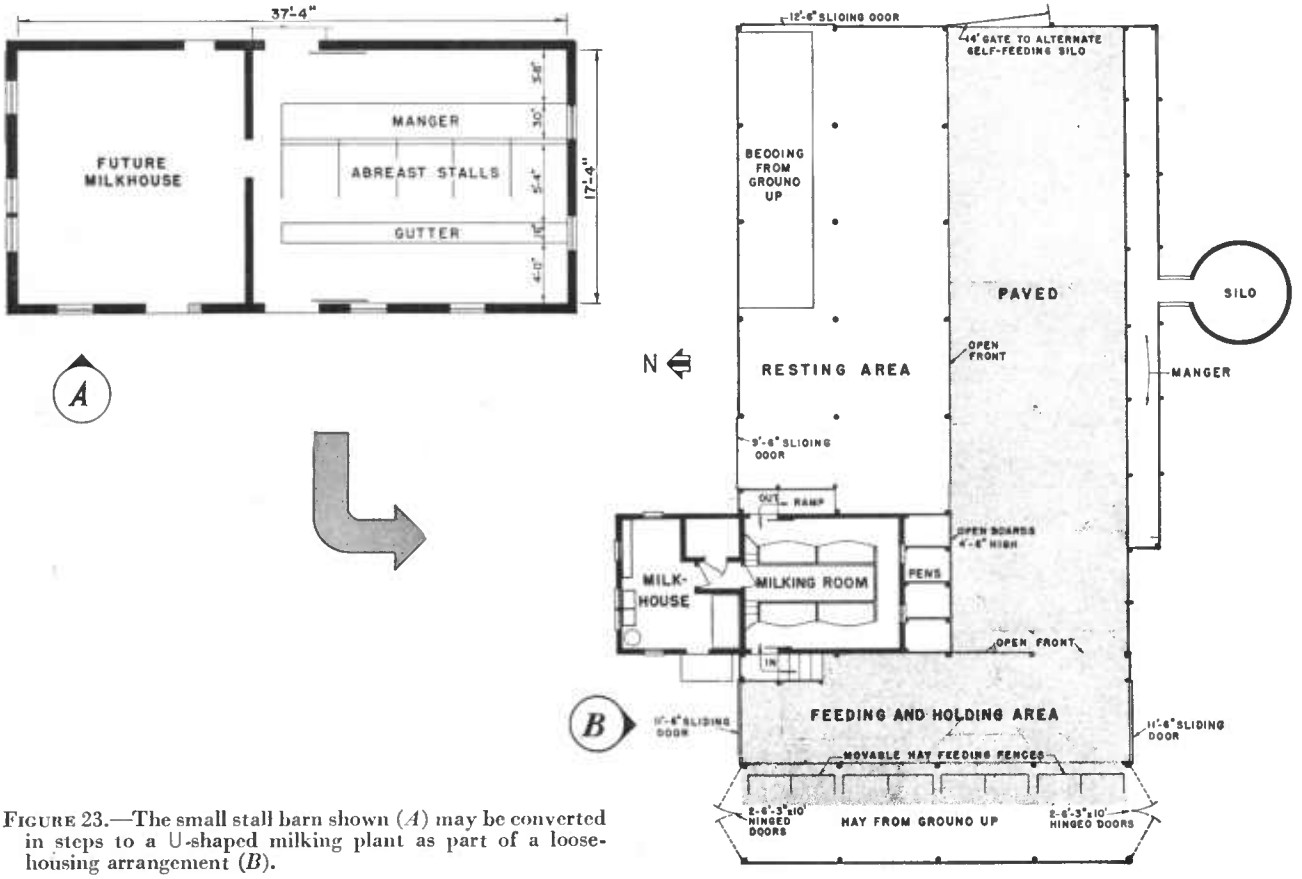

FIGURE 23.—The small stall barn shown (*A*) may be converted in steps to a U-shaped milking plant as part of a loose-housing arrangement (*B*).

BUILDING COSTS

Although construction costs for materials and labor vary considerably between areas, some examples may be useful in indicating current levels. The small milking plant shown attached to the old barn in figure 24 has two elevated side-opening stalls. It was built in central Illinois in 1952 for about $1,800. The cost includes value of labor and materials but not equipment. Farm-family labor was used to build the structure. Building materials, plumbing, and wiring cost $952. The estimated cost of essential equipment is $1,200, including two bucket-type milking machines, a 6-can milk cooler, water heater, space heater, and can racks. The building meets the Illinois requirements for producing Grade A pasteurized milk. It exceeds minimum requirements for Grade A pasteurized milk production in many other areas.

Figure 25 shows a loose-housing layout built in 1951 in the Midwest that meets local requirements for Grade A milk production. It is similar to the layout in figure 19 except for the location of the milking plant.

The small flat-roofed milking plant includes milkhouse, feed bin, and a milking room with three elevated side-entering stalls as shown in figure 2. The building cost $3,540. This included all labor, plumbing, and wiring costs but no equipment costs.

The resting-feeding shed includes feeding area, resting area, and hay and bedding storage. It will accommodate 30 cows, allowing 50 square feet of floor area per cow in the resting area. This building cost $2,760, including pavement in the feeding area and a 20-foot paved approach along the entire open side of the building. This amounts to 90 cents per square foot of floor area. There is no silo.

Farm-family labor valued at $160 was used for laying concrete inside and in front of the shed, and for some nonskilled tasks. All labor for building construction was hired.

Building costs, including family labor, totaled $6,300, or $210 per cow. Cost of new equipment, including piping for milk and space heaters, would amount to $50 to $60 per cow more.

Studies indicate that all buildings, equipment, paved lots, and upright silo for a 25-cow herd can be built with hired labor for $325 to $350 per cow. This includes pens for young stock, piped milk, new equipment for milking room and milkhouse, silage bunks, and pole-frame building for feeding and resting areas and pens and allows for purchase of all materials and equipment at retail levels.

FIGURE 24.—An inexpensive milking plant attached to an existing barn will satisfy requirements for Grade A milk production in many areas.

FIGURE 25.—This well-arranged loose-housing system includes a milking room and milkhouse located at the far right. It meets local requirements for Grade A milk production.

OPERATION AND MANAGEMENT SUGGESTIONS

Successful use of a milking room with loose housing depends largely on good management. Experience has shown the importance of these points:

1. Handle cows gently in training them for a milking room. Some cows need to be led or driven into the milking stall only once. Others may have to be led a second or third time but after this they usually enter stalls readily. Steps are generally safer for the milking room entrance and a ramp is generally safer for the exit. Steps should have a 6-inch rise and an 18- to 20-inch run. Ramps should rise about 2 feet in an 8-foot run.

2. Where bucket-type machines are used, provide one or two more stalls than the number of machines. Cows can be readied for milking in the

extra stalls, thus reducing idle time for the machines. With piped milk a milker unit may be installed at each stall.

3. If concentrates are fed in the milking room or milking bar, store feeds in a bin adjoining the milking room or in overhead bins. Various mechanical equipment may be used for feeding. One of the simplest and most economical methods is to fill a small feed cart at the bin and move it to a spot in the operator alley next to a feedbox. Feed is then put in the boxes with a hand scoop. Only a few steps are required to feed any cow. Another simple method is to have a feed bin on one side of the operator area and at the same height as the elevated stalls on the opposite side. The bin extends almost the length of the milking stalls. Feeding is done with a hand scoop.

4. Arrange for efficient feeding procedures. Most cows fed concentrates in the milking room learn to eat in about 6 minutes and 7½ minutes should be ample for the slow ones. The time available depends on how fast cows are milked, number of stalls, order of operations, and number of machines. A good procedure is to release a cow as soon as the teat cups are removed and put feed in the feed box while the next cow is entering so that she will have the maximum time to eat. Most cows will have ample time to eat their grain and operators can work efficiently with the following combinations:

(*a*) One operator, 3-in-line elevated stalls, 2 bucket-type machines.

(*b*) One operator, 3-in-line elevated stalls, 3 machines with piped milk.

(*c*) One operator, 4 elevated stalls in a U-shape or walk-through tandem, 2 bucket-type machines or 2 swinging pipeline milker units.

(*d*) For the smallest herds, 1 operator, 2 elevated stalls, and 1 bucket-type machine.

(*e*) For the larger herds, 4 to 8 elevated stalls in a U-shape or 2-row walk-through tandem with 4 stationary or 2 swinging pipeline milker units per operator.

(*f*) Two machines with 2 elevated stalls is a good combination for some operators, but the most efficient operators can handle a third and in some cases a fourth stall to good advantage.

5. When ample water is available, keep the floor clean by washing down as required. If water is scarce, manure that may be dropped in the milking room can be scooped up. The floor can be washed with a hose and stiff brush after the cows are milked. Some local areas permit the liming of floors after cleaning but washing is quicker and more sanitary.

6. Clean the paved feeding area daily or as required and do not bed it. Allow the manure pack in the resting area to build up during the winter.

7. Provide a restraining chute, squeeze gate, or stanchion for dehorning, trimming, or other veterinary work.

HOW TO OBTAIN PLANS

Blueprints of plans suitable for a particular locality may usually be obtained from the State Extension agricultural engineer at each State agricultural college. If the engineer cannot furnish the plans, he can advise where they can be obtained. County agents or farm advisers will ordinarily have a catalog illustrating the plans available and should also be able to advise as to their cost and how to order them.

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