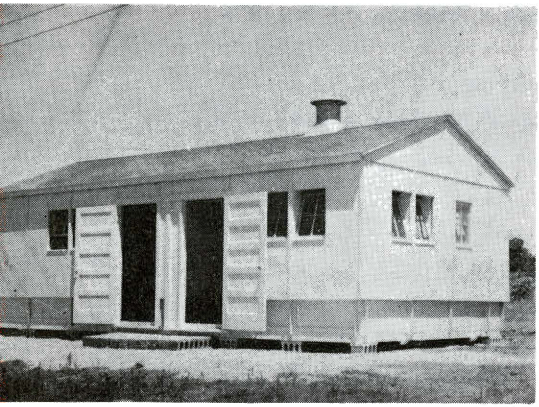

a portable milking barn

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A *Portable* Milking Barn

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Tenant farmers who wish to undertake Grade A milk production sometimes cannot do so if the farms they operate are not equipped with milking barns which meet requirements laid down by milk inspectors and other sanitation officials. Hence, even though a tenant farmer may have access to a market, the milk he produces cannot be sold as Grade A milk. Usually, the price differential between Grade A and ungraded milk produced by an average size herd is sufficient to pay for a small Grade A milking barn over a period of about two or three years. However, a tenant dairy farmer is reluctant to erect a permanent milking barn for Grade A milk production if he may later find it necessary to abandon the structure and move to another farm.

Some farming areas in Oklahoma, close to large population centers, are better suited to grazing dairy herds than to cultivation. A high percentage of these farms are tenant operated; and the tenure period is short.

Because of the foregoing factors, a need has been felt in some sections of Oklahoma and other states for a small portable structure designed to meet sanitation requirements for Grade A milk production. Such a structure would not be intended to supplant the permanent types of milking barns and parlors used by established dairymen. Obviously, some of the features incorporated in permanent milking parlors (for example, the feed room and feed alley) might need to be eliminated from a portable structure in order to keep it within reasonable cost and size limitations. However, a portable Grade A barn that meets sanitation and basic functional requirements would enable tenant farmers to continue production of Grade A milk as they move from one farm to another.

*Grateful acknowledgement for important contributions to the development of the information in this publication is given to the Bristow, Oklahoma, Chamber of Commerce Agricultural Committee, Mr. Albert Kelly, Chairman; to Mr. Clayton Langley; to Mr. D. H. Judd; and to the milk inspectors of the Bristow Health Department and the Tulsa, Oklahoma, City-County Health Department.

Also, a farm owner who is making a beginning in dairying might find it more desirable or convenient to buy a ready-made milking barn from a fabricator. Later, as his dairy enterprise becomes more firmly established, he might sell the portable structure and build a permanent, fully adequate milking parlor.

"Pilot Model" Portable Barns

The possibilities for use of a portable Grade A milking barn in their community became apparent to the Bristow, Oklahoma, Chamber of Commerce in 1951. They sponsored construction of a "pilot model" portable Grade A milking barn. Members of the Oklahoma Agricultural Experiment Station planned the barn, prepared a structural design and details for it, and gave some supervision during the construction in June 1952, at Bristow.

The information in this publication developed from experience obtained during the construction and use of the barn built at Bristow, and from construction of a barn built by a commercial steel tank fabricator at Sapulpa, Oklahoma. Both barns were of the same basic design and construction, but the barn built at Sapulpa contained some improvements found to be desirable after construction of the pilot model at Bristow.

The publication of this information on portable Grade A milking barns should not be taken as an implication that other barns modeled after them will automatically receive approval by local milk inspectors and sanitation officials. Approval of farm dairy structures for compliance with sanitation requirements is a matter for decision by sanitation authorities in the city where the milk will be sold. *Before construction of portable milking barns or any other type of farm dairy structure for Grade A milk production, the plans and details should always be submitted to the proper authorities for approval.*

General Description

The portable milking barns built at Bristow and Sapulpa are shown in Figures 1 and 2, respectively. A typical floor plan and a cross section are shown in Figure 3.

The space in the barn is divided into a 12 x 14 foot milk handling room and a 14 x 15 foot milking room with space for four cows. In order to keep the barn of minimum size, no feed room was provided. Feed may be kept in a covered, portable container located in the space

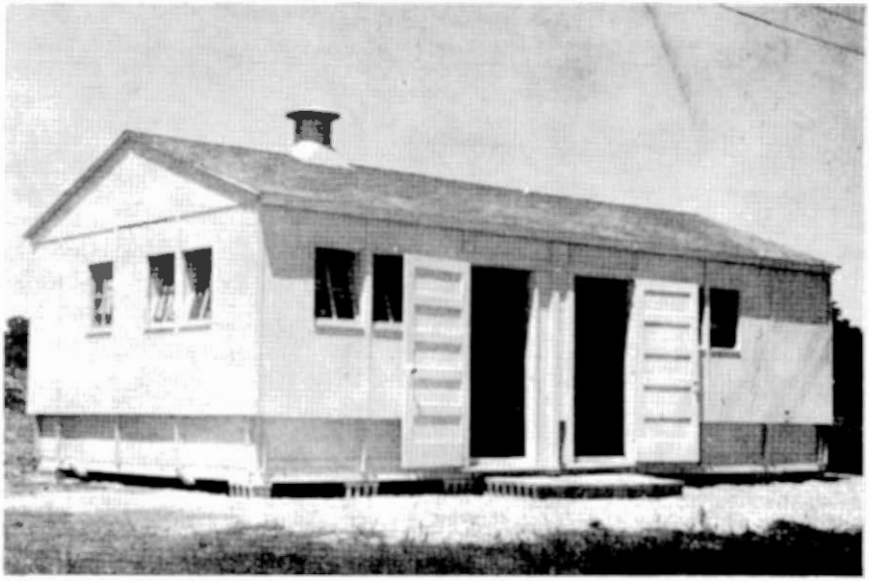


Fig. 1.—Portable Grade A milking barn at farm site near Bristow, Oklahoma. The lower part of the structure is welded steel. The upper walls are exterior type 3/8 inch fir plywood on 2 x 4 inch framing.

behind the cows. Dairy herds of more than four cows can be milked in relays of four.

The construction includes an all-welded steel "pan" for the floor and lower side wall, and a wood frame, plywood-covered superstructure. Both the steel pan construction and the plywood wall covering contribute to the rigidity of the barn and help withstand the unusual loading conditions to which portable structures are subjected.

As indicated in Figure 3, the milking room floor plating is sloped in the shape of a broad, very shallow "V" from both sides of the barn to provide lateral drainage. Longitudinal drainage can be obtained by pitching the barn lengthwise on its foundation blocks, or by building the floor with longitudinal slope as well as lateral slope. Connections to drain lines, water supply, and electricity are made at the farm site.

Compliance with Sanitation Requirements

In February 3, 1953, the Tulsa, Oklahoma, City-County Health Department issued a Grade A dairy permit to the tenant dairyman to whose farm the Bristow barn was moved after construction. According

to the departmental records as of August 18, 1953, the bacterial counts and farm inspection reports had been satisfactory since issuance of the permit.

Portability

Both the Bristow and Sapulpa barns were designed and constructed to permit transportation between sites without dismantling any part of the structure. A convenient method of moving the barn calls for use of a heavy-duty flatbed transport trailer and a pulling unit equipped with a power winch. The power winch is used to hoist one end of the barn and skid it onto the trailer.

The barn is readily portable, provided a suitable trailer is available. Weight of the Bristow barn is approximately 6½ tons. It was moved from the fabrication site to the farm site approximately five miles away in about two hours. This time included loading, hauling, and unloading onto the foundation blocks. No damage occurred other than some minor damage to a few roof shingles which resulted from a low-hanging tree limb, although some of the route over which the barn was moved

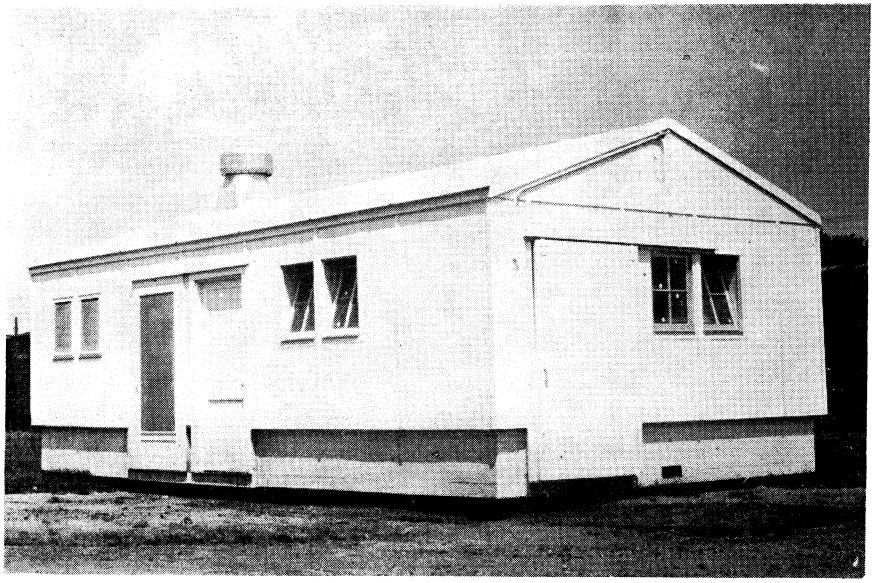


Fig. 2.—Portable Grade A milking barn at construction site in Sapulpa, Oklahoma. Cows enter through doorway at end of building. The milk handling room is at the far end of the building. The roof and the upper walls are covered with exterior type fir plywood.

was extremely rough and circuitous, and led through open fields in some instances.

CONSTRUCTION DETAILS

Materials and Cost

Major material requirements for the portable barn built at Bristow include the following approximate quantities:

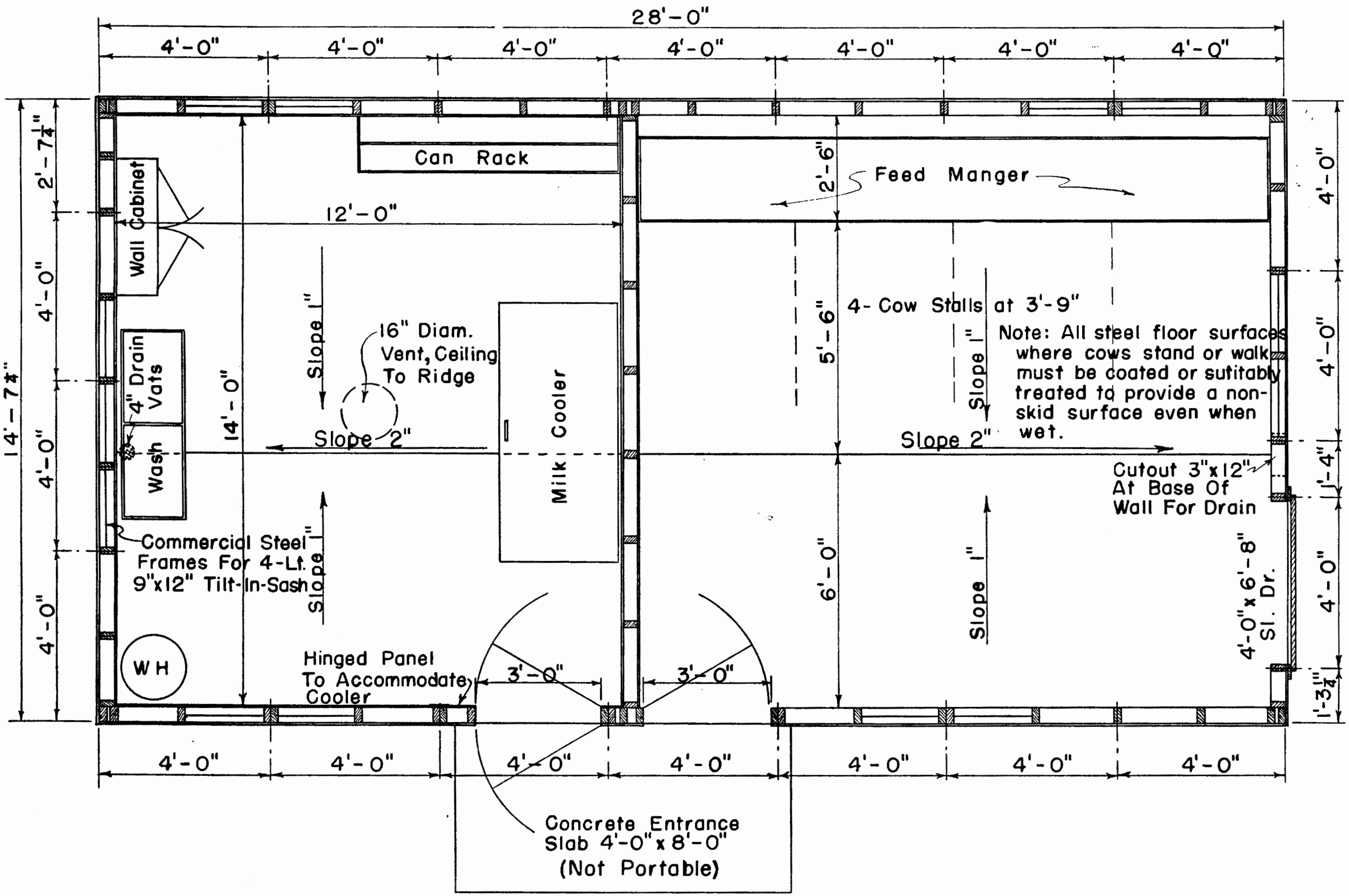
Structural steel shapes and steel plate for base construction	9600 lbs. (Including 10% for cutting and waste)
Dimension lumber for framing walls and roof	800 board feet
Fir plywood, exterior type, Grade A-C 3/8-inch thickness, for wall and roof covering	1300 square feet
Hardboard for interior lining on walls of milk handling room	500 square feet

In addition, paint, nails and bolts, windows, doors, electrical installation, and plumbing will be required.

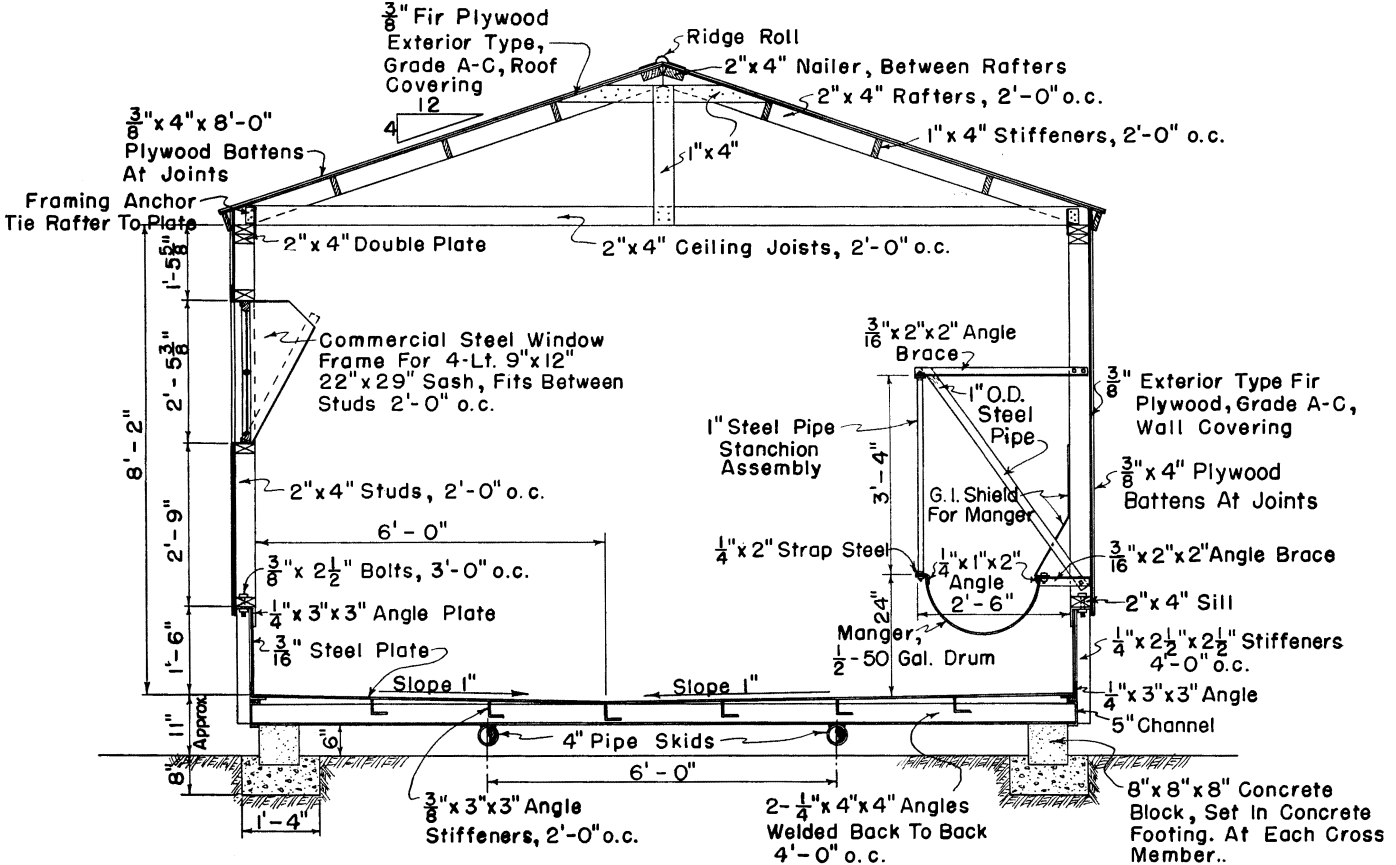
The cost of construction will vary somewhat depending upon local availability of materials, labor costs for skilled welders and carpenters, and other factors. It is estimated that a portable dairy barn of the type described herein could be manufactured commercially and sold at a reasonable profit for not more than $2,500. Equipment such as milk cooler, utensil rack, milking machine, and other installed equipment are additional cost items.

Floor Construction

Details of a typical floor and lower wall construction are illustrated in Figure 3. The floor system includes 5-inch steel channels as the main framing members along either side into which floor joists are framed. The floor joists consist of 4 x 4 inch steel angles assembled in pairs, back to back, and spaced 4 feet from end to end of the structure. The floor joists support 3 x 3 inch steel angle stiffeners spaced at two feet. The floor plating of 3/16-inch steel plate is welded to the upper leg of the floor stiffeners. In order to achieve adequate drainage, the floor plating is sloped one inch laterally. This slope is achieved by positioning the steel stiffeners at decreasing heights from the side walls to the lowest point in the floor.


28'-0"
4'-0"
4'-0"
4'-0"
4'-0"
4'-0"
4'-0"
4'-0"
Can Rack
Feed Manger
2'-6"
12'-0"
Wall Cabinet
2'-7¼"
4'-0"
4'-0"
4'-0"
14'-7¼"
4" Drain Vats
Wash
Slope 1"
16" Diam. Vent, Ceiling To Ridge
Slope 2"
14'-0"
Milk Cooler
4- Cow Stalls at 3'-9"
5'-6"
Slope 1"
Note: All steel floor surfaces where cows stand or walk must be coated or sutitably treated to provide a non-skid surface even when wet.
Slope 2"
Cutout 3"x12" At Base Of Wall For Drain
1'-4"
Commercial Steel Frames For 4-Lt. 9"x12" Tilt-In-Sash
Slope 1"
6'-0"
Slope 1"
4'-0"x6'-8" Sl. Dr.
4'-0"
4'-0"
4'-0"
1'-3¼"
WH
Hinged Panel To Accommodate Cooler
3'-0"
3'-0"
4'-0"
4'-0"
4'-0"
4'-0"
4'-0"
4'-0"
4'-0"
Concrete Entrance Slab 4'-0" x 8'-0" (Not Portable)

FLOOR PLAN



CROSS SECTION - MILKING BARN

Three-sixteenths inch steel plating is used for the lower 18 inches of the walls. Light steel angles at 4-foot intervals along the side wall were welded to the steel plate to stiffen it. (These stiffeners were omitted in the barn built at Sapulpa. A 3 x 3 inch steel angle was welded to the top of the steel plate in the wall to serve as the connection with the wooden framing.

A non-skid surface on the milking room floor plate in the Bristow barn was achieved by covering the floor with a commercially manufactured fabric coated with mineral granules. This fabric was cemented to the steel plate. The milking room floor in the Sapulpa barn was coated with a commercial preparation of bituminous mastic with a mineral granule admixture. The floor surface of the milk handling room was untreated in both the Bristow and Sapulpa barns.

The floor covering originally applied over the steel plating in the milking room of the Bristow barn was unsatisfactory in that it gradually loosened in patches. This caused some difficulty in keeping the floor clean and dry. The covering was removed in July 1953, and replaced with a commercially manufactured safety flooring material consisting of abrasive aggregate in a plastic binder which hardens after application. It appeared that it may be necessary to periodically repair or resurface the spots which receive heaviest wear from the hoofs of cattle.

Some difficulty was experienced in obtaining proper drainage of the floor in the milking room of the Bristow barn. This was largely due to the fact that salvaged steel sheets of odd sizes were used when constructing the floor. When the sheets were welded together, buckling and irregularities caused uneveness in the floor surface. However, this condition did not appear objectionable from a sanitation standpoint.

Wall Construction

The walls of the Bristow and Sapulpa barns were constructed of ⅜-inch exterior type plywood nailed to 2 x 4 inch studs 2 feet on centers. The vertical joints between the plywood panels were covered with plywood batten strips. The original design called for walls built from demountable panels of plywood on 2 x 4 inch framing to permit disassembly of the walls when necessary to move the barn between distant points or over highways with low bridge clearances. However, it appeared that the barn to be built at Bristow would remain in that general area. Hence, the wall framing was built continuous, and permanently fixed to the lower part of the structure. Walls of the milk

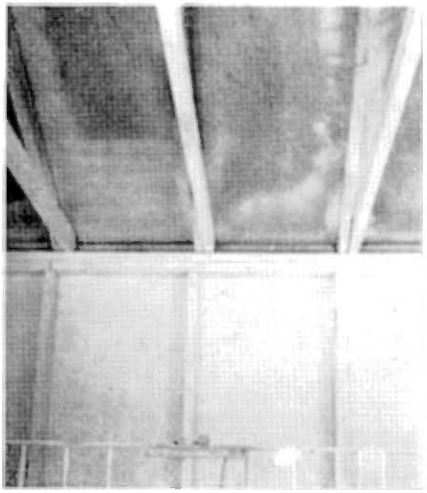


Fig. 4.—Interior of portable Grade A dairy barn with plywood-covered walls and roof. Studs and rafters are 2 feet on centers. One x 4-inch stiffeners between the rafters would be desirable.

handling room were given an interior lining of a smooth surfaced hardboard. The milking room wall interiors were unlined. Figure 4 illustrates the wall construction and appearance in the Sapulpa barn.

Roof Construction

The original design for the roof called for 4 x 8 foot plywood-covered panels which could be disassembled when the structure was to be moved. However, since it appeared that disassembly would not be necessary for the Bristow barn, the roof was framed with 2 x 4 inch rafters 2 feet on center and covered with asphalt composition shingles on a 1-inch solid wood deck. The roof for the Sapulpa barn was constructed with ⅜-inch exterior type Douglas Fir plywood on 2 x 4 inch rafters 2 feet on centers. Battens, sawn from ⅜-inch plywood, were used to cover the joints between the plywood sheets. The joints and battens were caulked with commercial caulking compound. No roof covering other than the single thickness of plywood was used on the Sapulpa barn.

Manger and Stanchion Construction

Typical manger and stanchion construction are depicted in Figure 5. The manger and stanchion assembly is hung from the wall, leaving the floor clear of supports. All fixed connections were made by welding.

Floor Drainage

The floors in the milk handling room and milking room in the Bristow barn were sloped during construction to provide lateral drainage to a point near the center of the floor. The foundation blocks were set to provide a longitudinal pitch in the building for drainage toward one end. The floor drains were connected to a longitudinal pipe drain

which conducted the drainage to the end of the building, from whence a surface pipe drain carried the liquids to the disposal point.

The Sapulpa barn was constructed with adequate slope built into the floor, so that the structure could be leveled on its foundation. Drainage from the milk handling room floor is disposed of through a grated floor opening at the end wall. Drainage from the milking room is conducted out through a rectangular wall opening at the end of the floor.

Lighting

Four, light 9 x 12 inch wood tilt-in type sashes in commercially manufactured galvanized steel frames were used for windows in both barns. Total glass area in the milk handling room was 21 square feet or 12½ percent of the floor area. Total glass area in the milking room was 18 square feet or 8½ percent of the floor area.

Ventilation

Ventilation for the milk handling room was accomplished by a 16-inch diameter flue from a screened opening in the ceiling to a hooded vent at the roof peak. No ventilation flue was installed in the milking room.

GENERAL SUGGESTIONS AND CONCLUSIONS

Construction Methods

Strength and Rigidity.—A portable dairy barn of the type and size described herein will be subjected to unusual loads during moving operations; especially when being skidded on and off the transport trailer. Therefore, it is important that the structure be designed to withstand the resulting stresses without undue distortion of any part. The construction used for the dairy barns described herein—including an all welded steel pan for the floor and lower 1½ feet of the sidewall, and plywood on 2 x 4 inch framing for the upper walls—appears to be reasonably well adapted to the strength requirements for a portable dairy barn. The welded steel portion of the lower walls, in combination with the steel floor, develops some girder action. The plywood panels serve to further brace and stiffen the structure. For a portable dairy barn, which will likely be subjected to frequent moving, it seems desirable to glue the plywood to the 2 x 4 inch studs. It is imperative that only exterior type plywood be used, because interior type plywood will not withstand the exposure conditions existing in a milking barn. All exterior type plywood is stamped with a readily visible identification mark.

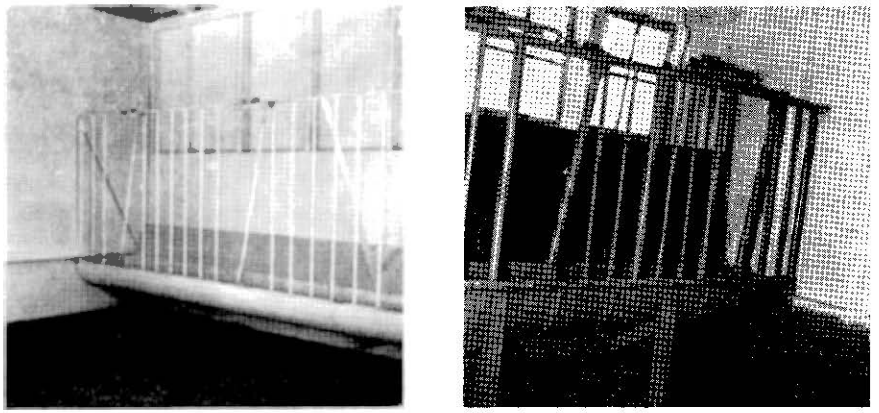


Fig. 5.—Manger and stanchion construction in the Sapulpa barn (left) and Bristow barn (right). Salvaged fuel drums were used for the manger in the Bristow barn.

Floor Construction and Covering.—Welded steel construction using steel plate for the floor deck as described in this bulletin appears satisfactory provided the steel plate can be applied with sufficient care to prevent bulging and buckling of the plates. Furthermore, the milking room floor surface must be treated to obtain a non-skid surface that will be safe for cattle even when the floor is wet. Commercial compounds which incorporate mineral granules for spreading or painting on the steel floor surface appear to have some promise as a suitable surface treatment. A commercially manufactured structural steel plate, the top surface of which has been impregnated with aluminum oxide abrasive granules to a depth of 1/16-inch, also appears to have possibilities for use in portable dairy barns. These abrasive granules impart a gritty, non-skid surface to the steel plate. The cost of this special plate is one-third to one-half greater than the cost of standard rolled steel plate in the 3/16-inch thickness.

During cold weather, a non-skid surface is also desirable for the floor in the milk handling room. Some slipping was reported in the Bristow barn when the weather was cold enough to freeze water spilled on the floor.

Drainage.—As in permanent structures, adequate floor drainage is an important requirement in a portable dairy barn. The floor should be constructed with sufficient, uniform slope to assure drainage in at least the crosswise direction. If necessary, this slope can be supplemented by setting the building on its foundation blocks with a tilt of approxi-

mately 1 inch in 10 feet in a longitudinal direction. A floor drain opening with tight connections to a 4-inch steel pipe, extended the required distance to the point of disposal, appears to be a satisfactory way to drain liquid from the milk handling room. If necessary, the floor drain can be trapped with a water seal trap. For removal of liquid wastes from the milking barn, a rectangular opening approximately 3 inches high by 8 inches wide in the base of the wall at the end of the floor is effective. The type of drainage line to use from the barn to the point of disposal will depend upon local requirements.

Foundation.—Regular 8 x 8 x 16 inch concrete blocks placed 4 feet on center under the side walls are adequate for a foundation. A cast-in-place concrete pad for a footing under each foundation block is desirable to insure uniform contact with the ground and to prevent minor, local settlement which would create drainage problems in the barn. The concrete blocks should be set in the concrete pads before they harden, and carefully adjusted so that the barn will rest on the blocks with the desired floor slope.

Fabrication Methods.—Commercial fabrication of the steel pan would, no doubt, result in superior construction and would be preferred to on-the-farm construction by inexperienced persons. Commercial fabricators have cutting and bending equipment, welding accessories, and skilled workmen with which to insure accurate, sound construction of the steel pan. Construction of the wooden superstructure is comparatively simple and can be done by relatively unskilled workmen.

Transportation

Heavy-duty, flatbed trailers such as are commonly used for moving oil field equipment appear well suited to moving a portable dairy barn without dismantling it. Maximum legal widths for loads to be moved over highways will limit highway transportation. For transportation over some highways, a special permit is required and the moving would need to be accomplished at a designated time for a 15-foot wide portable dairy barn.

Where bridge clearances or other factors such as large distances or unusual terrain would prevent moving the barn in one piece, a design that permits the walls and roof to be dismantled in 4-foot wide panels from the steel base has been prepared and is available from the Oklahoma Agricultural Experiment Station.

Financing

Many dairymen are not financially able to make a lump sum payment for a portable dairy barn. However, some might find it possible to pay for a barn out of their regular monthly milk checks if a time payment plan were available. Such time payment plans, sponsored by milk plants and material dealers, have met with some success for financing construction of permanent milking barns and milk houses.

Sanitation Precautions

Before construction or purchase of a portable dairy barn, the local milk inspection authorities should be consulted. Special local requirements or conditions may exist that would prevent the use of portable dairy barns or call for changes in design. *The description and information pertaining to portable dairy barns in this publication should not be construed as carrying general endorsement or approval by sanitation authorities.* Approval or disapproval of design or details of construction for any kind of farm dairy structure intended for Grade A milk production is a matter for decision by local sanitation authorities.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