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COLLEGE OF AGRICULTURE

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THOMAS P. COOPER, Dean and Director

CIRCULAR NO. 249

Producing Milk of Good Quality



Interior of a Well-kept Barn

Lexington, Ky.
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CIRCULAR NO. 249

Producing Milk of Good Quality

By HENRY B. MORRISON

Milk constitutes a large and important part of the food of American people, especially the children. It is exceptionally nutritious and wholesome, and has been called the most nearly perfect food. Therefore, its use should be encouraged. But milk is a medium in which bacteria grow readily and sometimes it has been the vehicle by which certain diseases were spread in a community. For this reason, steps have been taken to set up standards of purity for milk for sale and regulations have been made to govern the sanitary conditions in the dairies where it is produced. But even if the producer is not responsible to local regulations, his ambition should be to produce a pure and wholesome product. This circular is intended to show how this can be done by careful attention to certain details, using only the customary equipment of the dairy.

Good milk should be:

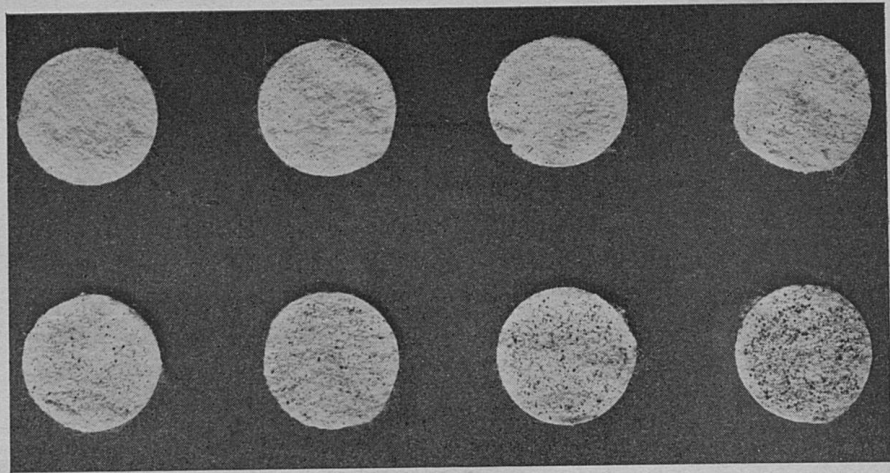
1. Sweet.
2. Free from visible dirt, unpleasant odors and tastes.
3. Free from disease germs.
4. Free from an excessive number of bacteria.

In order to assure the production of good milk the producer should:

1. Milk only clean, healthy cows.
2. Keep his cows in a clean, well-ventilated barn.
3. Have a suitable milk house for handling the milk.
4. Make sure that persons handling his cows and milk are healthy, clean, and careful in their work.
5. Use only clean, sterile utensils of proper design.
6. Cool the milk promptly and thoroly.
7. Keep the milk cold until it is delivered.

CLEAN, HEALTHY COWS

Dirty cows are the source of most of the visible dirt in milk. Dirt and filth readily accumulate on the udders and flanks of cows, especially if they are kept in poorly cleaned



Cotton disks showing varying amounts of dirt in milk. The photograph shows the dirt which accumulated on the pads during the passage of one pint of milk thru them. If the cows had been cleaned properly all the pads would closely resemble the one in the upper left corner.

barns, dirty lots, or lots that are poorly drained. All dirt and filth adhering to the udder and flanks of the cows should be removed with the aid of a brush. This should be done a sufficient time before milking to allow dust, caused by the brushing, to settle. Immediately before milking, the udder and flanks should be washed thoroly and wiped with a cloth to remove any dirt left on them.

Certain diseases of cattle may be transmitted to man, and milk from cows suffering from these diseases should not be used. All cows should be tested for tuberculosis by a competent veterinarian and reactors eliminated from the herd. Also all cows should be tested for contagious abortion and a plan adopted to eliminate this disease from the herd. Milk from cows suffering from garget or mastitis should be kept separate from rest of the milk and not used for human food. Garget may be easily detected by milking the first three or four streams

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from each teat on to a clean piece of glass or a fine screen. If any lumps or strings are found in the milk of a cow, her milk should not be used until this condition has disappeared.

CLEAN, WELL-VENTILATED BARN

All manure should be removed daily to a place where flies and odors from it will not enter the barn. Flies may carry disease germs and filth. If not kept away from the barn and milk, they may be the cause of serious contamination of the milk.

There should be proper ventilation of the barn to allow the escape of undesirable odors. In the construction of a barn at least 500 cubic feet of air space per cow should be allowed. A minimum of three square feet of window space per cow should be provided for the entrance of sunlight which has a healthful and antiseptic effect. Because of the greater ease of cleaning and draining, concrete or some equally impervious material should be used for flooring in the barn and milk room.

A SUITABLE MILK HOUSE

It is desirable to have a milk house for the handling and storing of milk and utensils, separated from the barn by a passage. The walls and ceiling of the milk house or room should be of such construction as to permit easy cleaning and should be kept painted a light color. The milk house or room should have sufficient windows, properly screened, to give adequate light and ventilation and yet keep out flies. Equipment and utensils should be placed for ease and efficiency in performing the necessary operations. See plans on pages 8 and 9.* See also Ky. Extension Circular 128, Building Plans for the Dairy Farm.

Buildings properly constructed and cared for are not only a source of pride and satisfaction to their owner but also are a most desirable advertisement of the product produced in them.

* Working drawings can be had at nominal cost, by writing to the Director, Experiment Station, Lexington, Ky.

HEALTHY, CAREFUL WORKERS

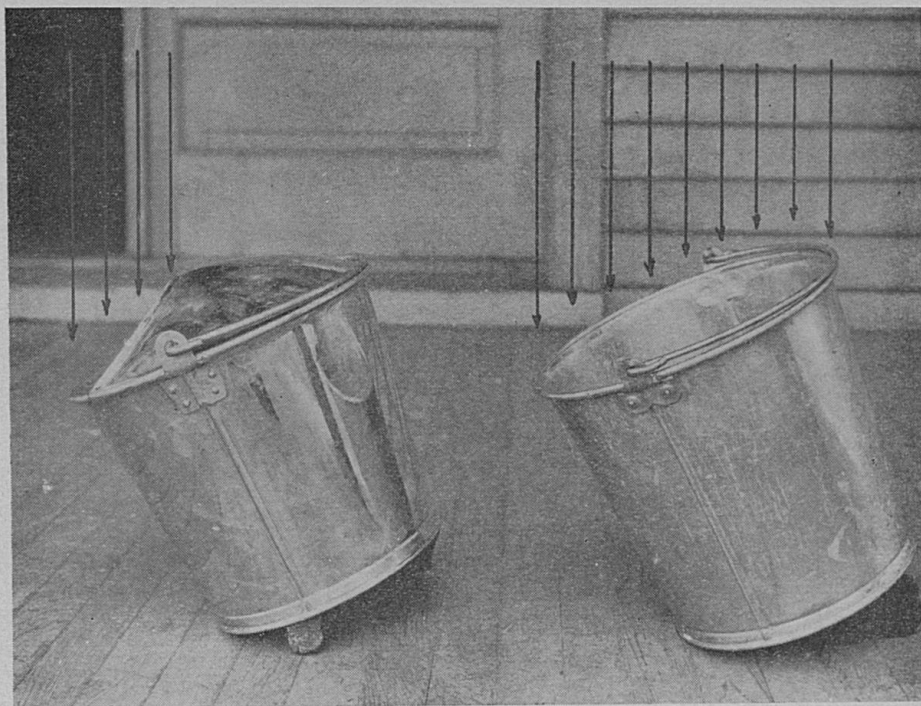
Unhealthy persons should not be allowed to milk the cows or handle the milk. Disease germs from these persons may find their way into the milk and spread disease, especially when the milk is not pasteurized. Some of the most serious diseases such as typhoid fever, diphtheria, scarlet fever and septic sore throat may be spread in this manner. In some instances these diseases have been spread by persons who still harbor the disease germs even tho they have recovered from the disease. Body discharges of milkers and other milk handlers should be submitted to a local health officer for examination at least once each year. It is essential that all persons handling milk be habitually clean. Milkers' hands should be thoroly washed and dried before milking. Milking with wet hands should never be permitted. Clothing worn by milkers should be kept clean and changed often. Light-colored clothes are to be recommended because they show the dirt more easily and will, therefore, be changed more often than dark clothes.

A PRECAUTION IN MILKING

The first few streams from each teat always contain more bacteria than those during the later portion of the milking. Sometimes they contain an excessive number. For this reason if the first two or three streams from each teat are milked into a separate vessel and discarded the bacterial content of the milk may be reduced appreciably. The milker should be alert to notice any abnormalities in the milk or condition of the cow.

CLEAN, STERILE UTENSILS OF PROPER DESIGN

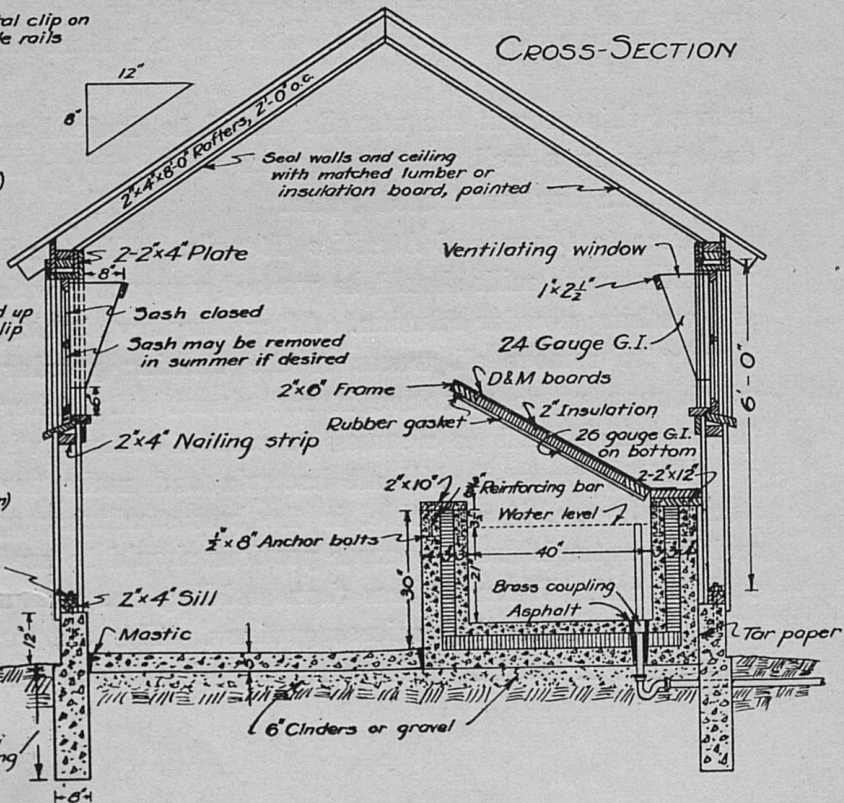
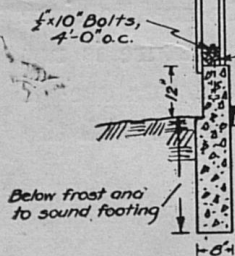
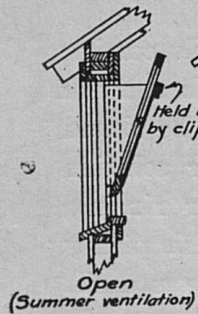
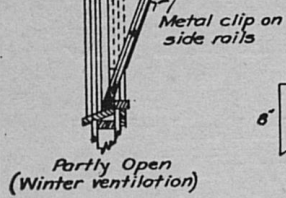
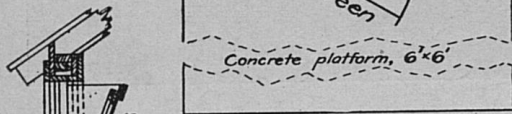
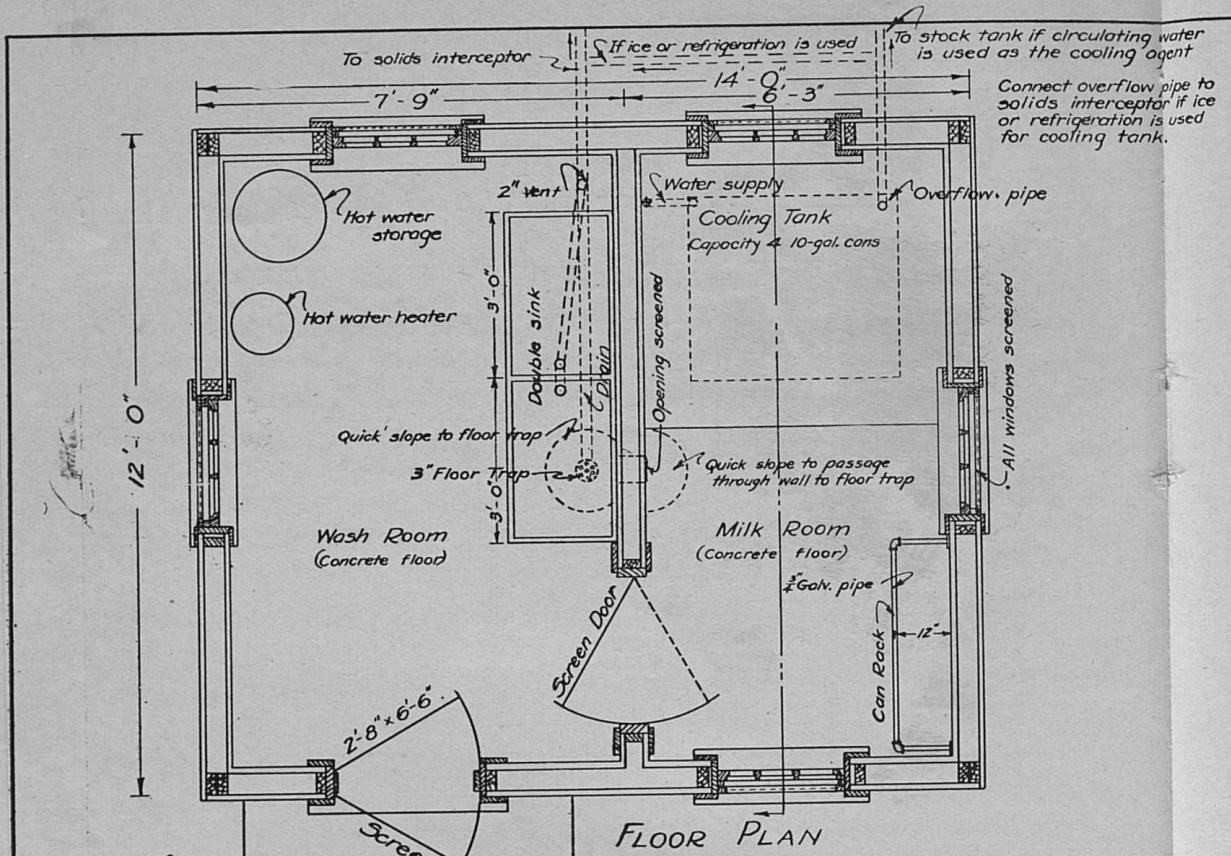
Why Clean Utensils. The bacteria that cause milk to sour are extremely small, their average diameter being about 1/25,000 of an inch or less. Such tiny organisms can grow and multiply with extremely small quantities of food. Any traces of milk solids left on the utensils may furnish food for many thousands and even millions of bacteria. For this reason all milk utensils should be washed entirely free from milk solids. Bacteria must have moisture in order to multiply; to



Open and small-top pails. A small-top pail has an opening only about one-fourth as large as that of an open-top pail; therefore, the chance of any foreign material dropping into the milk while it is in the pail is greatly lessened.

prevent this growth the utensils should be drained and placed on a rack in a well ventilated place where they will dry out and remain dry until used again.

How to Clean and Sterilize Utensils. All utensils coming in contact with milk should be washed vigorously with a brush and washing powder solution. After this they should be rinsed thoroly to remove all traces of the washing powder solution which may prove corrosive if not rinsed off. After rinsing, the utensils should be steamed or scalded thoroly with plenty of scalding water to kill all bacteria and make the utensils sterile. Steam, if available, is the best sterilizing agent. If scalding water is used, separate portions should be used to rinse each utensil. Water at less than scalding temperature is not effective in destroying microorganisms. The temperature of water used in scalding falls so rapidly, due to contact with the

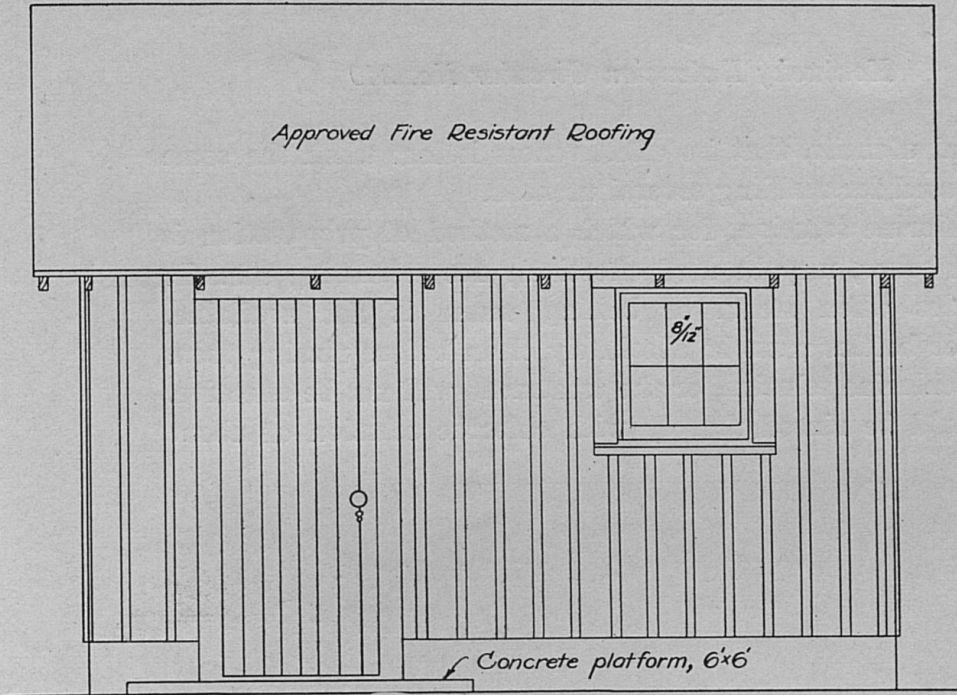


Scale $\frac{1}{2}'' = 1'-0''$

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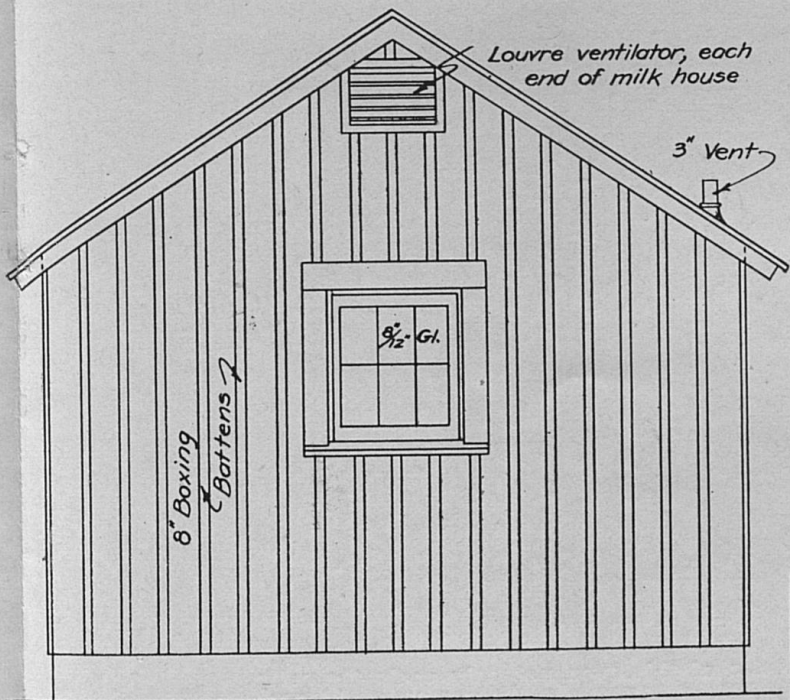
A DESIRABLE MILK RO

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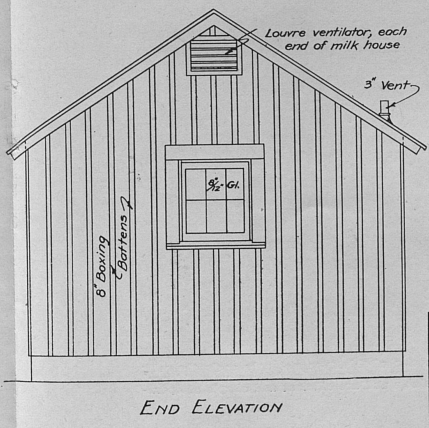
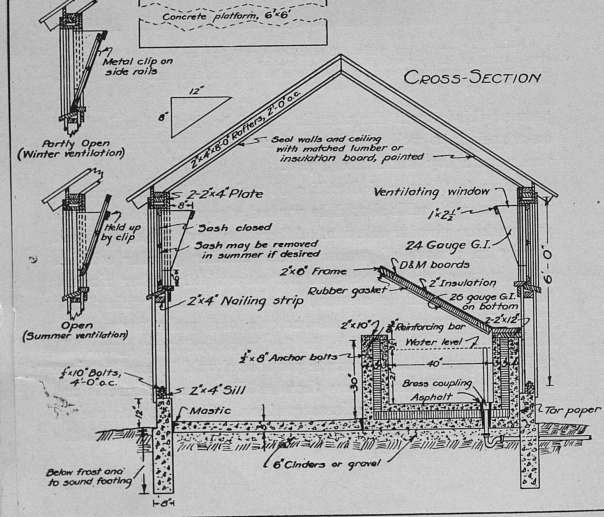
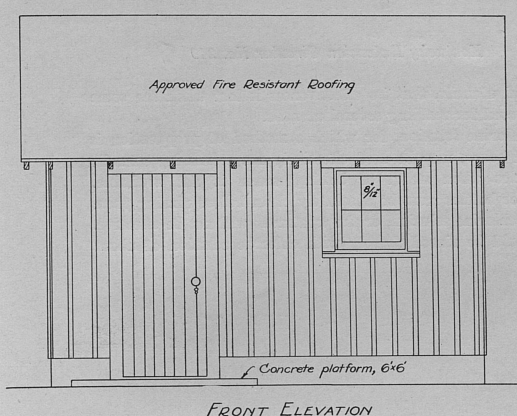
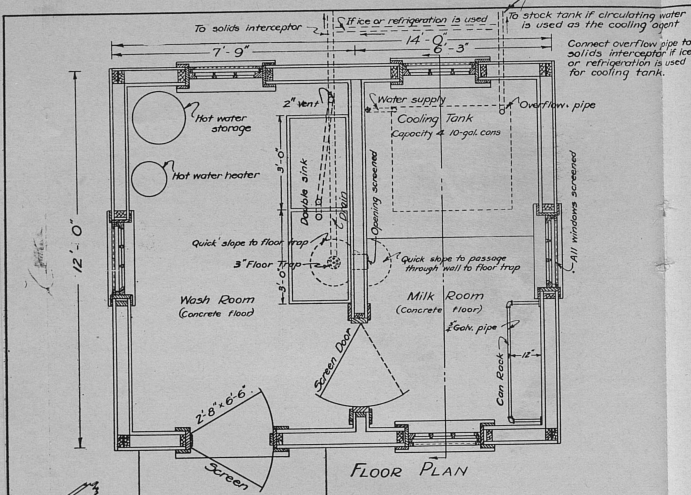
1/2" = 1'-0"



END ELEVATION

APPROVED FOR STATE BOARD OF HEALTH BY S.H.V. DUGAN

No. D-4-139-2
MILK HOUSE
EXTENSION WORK
IN
AGRICULTURAL ENGINEERING
COLLEGE OF AGRICULTURE—UNIVERSITY OF KENTUCKY
Designed and drawn by J.B. Kelley
Traced by Howard Matson—8-25-'31
Approved by J.B. Kelley, Agr. Eng. Division
Approved by Fordyce Ely, Dairy Division



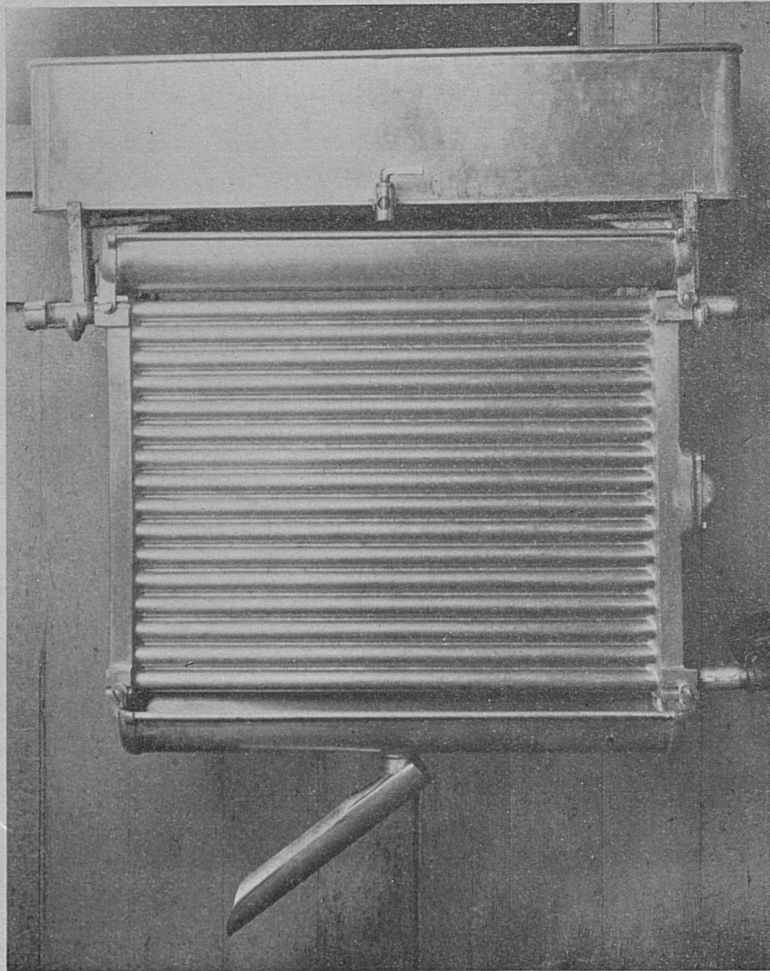
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A DESIRABLE MILK ROOM

cool metal utensils, that its effectiveness is lost when the same water is used for scalding several utensils.

A chlorine solution, for which a method of preparation is described below, may be used effectively for sterilizing utensils and bottles when steam or boiling water is not available. Utensils or bottles must be absolutely clean before rinsing them with the chlorine solution, or the treatment will not be effective. Cans should be rinsed thoroly with chlorine solution of about



A milk cooler. A surface cooler of this type not only cools the milk rapidly but also is instrumental in removing any absorbed or animal flavors from it. Conical coolers are available and are efficient and simple of operation.

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the same strength as recommended for milking machines. About two quarts of solution will be necessary for large cans, whereas small cans and pails will require only about half as much. Bottles may be treated by filling with the chlorine solution, emptying and inverting in a rack to drain. The utensils should be kept from contamination from flies or dust and, when possible, they should be placed so that direct sunlight strikes them.

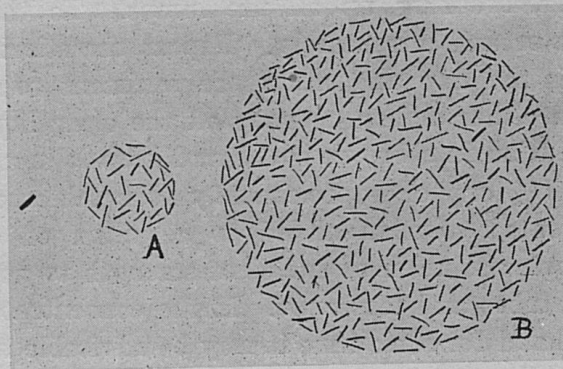
A Sterilizing Solution. A cheap and efficient chlorine sterilizer solution may be prepared as follows: Mix the contents of a 12-ounce can of chlorinated lime with one pound of washing soda, breaking up all the lumps. To this add one gallon of water and stir thoroly. Repeat the stirring once or twice during the day and allow the sediment to settle over night. Then either siphon or pour off the clear liquid. Place this clear solution in a brown bottle and keep it in a cool place. Two ounces ($\frac{1}{4}$ cup or approximately four tablespoonfuls) of this concentrated solution added to a gallon of cold water makes a chlorine solution of sufficient strength to use for milking machine tubes and teat cups. If the concentrated solution has been on hand for some time it may be advisable to use three ounces per gallon.

Care of the Milking Machine. Immediately following their use, milking machine teat cups and tubes should be rinsed successively with cold or lukewarm water, hot washing powder solution and clean hot water. This can be done very easily before the vacuum pump is turned off. Between milkings the tubes and teat cups should be kept filled with a chlorine sterilizer solution of sufficient strength to prevent any bacterial growth. At least twice each week the tubes should be entirely taken apart and given a thoro cleaning with a brush and washing powder solution.

Other Necessary Equipment. Much of the dirt that finds its way into milk drops into the milk from the cow's udder and flanks during milking. A small-top pail has an opening about one-fourth the size of that of the ordinary pail. The use of small-top pails materially reduces contamination from dirt dropping from the cow's body.

Cotton pad strainers are preferable to strainers in which cloth is used because a fresh, sterile cotton pad must be used at each milking. If cloth strainers are used, they should be washed thoroly and then boiled at least five minutes after each usage. They should be dried promptly and kept dry until used again to prevent them from becoming a serious source of contamination.

All metal utensils for handling milk should have joints filled flush with solder to eliminate cracks and crevices from which bacteria and milk residues are extremely hard to dislodge.



Increase of bacteria. The diagram represents the increase in one day from one bacterium, if kept at 70 degrees F. (A) and if kept at 98 degrees F. (B).

COOL MILK PROMPTLY AND THOROLY

Milk is an excellent food for the growth of bacteria. If the temperature of the milk is favorable, bacteria multiply very rapidly in it. The temperature necessary to prevent the majority of bacterial growth is about 50 degrees F. In a recent trial, a sample of milk with a bacterial count of 2,372 per cc was divided into three parts, one of which was held at 50 degrees F., one at 70 degrees F. and one at 98 degrees F. After 22 hours the bacterial counts were as follows:

	Time held, hours	Bacteria per c. c.
Portion held at 50° F.	22	2,744
Portion held at 70° F.	22	566,000
Portion held at 98° F.	22	432,000,000 (sour)

These figures illustrate very forcibly that milk must be cooled promptly to a temperature of 50 degrees or below in order to prevent a rapid increase of bacteria and quick souring. Milk placed out-of-doors on a cold day or in cold water without stirring does not cool quickly enough to prevent a large increase in the bacterial content. The use of an aerator or surface cooler containing cold water, ice water or some refrigerant is much to be preferred. Milk to be cooled in cans placed in a tank of water should be stirred thoroly at about five-minute intervals for at least 30 minutes, to assure proper cooling. A reliable dairy thermometer should be used to determine when the milk has reached a suitable temperature (50 degrees F. or lower). The temperature to which milk is cooled and at which it is held should never be estimated, as a difference of a few degrees may mean the difference between sweet and sour milk and possibly satisfied or dissatisfied customers.

CARE OF MILK TO BE USED AT HOME

The milk used by a large portion of the people of Kentucky is produced at home by their herds or family cows. In many instances, adequate means of cooling milk, such as ice, cold well water or cold spring water, are not available on the farm or in the home, but, even if the water available is only moderately cool, the milk should be placed in a clean metal vessel which should be set in a larger vessel containing the cool water. The milk should be stirred thoroly several times while cooling to remove the cowy or animal odor and flavor. Especially in homes where milk cannot be kept cold (50° F. degrees or lower), it should be used as quickly following milking as possible, to prevent its rapid deterioration. There are no regulations that apply to milk produced and used at home, but it is essential to the health of those concerned, that as great care be exercised in the production and handling of such milk as of milk which is to be sold. The owner of the family cow owes it to himself and those using the milk he produces to be as careful as the largest dairyman in keeping his cow and barn

scrupulously clean, his utensils clean and sterile, and to exclude animal flavors and odors from his milk.

SUMMARY

The production of good, clean, wholesome milk is not a difficult task but one which requires strict attention to details. The producer must be careful not only of the health of his cows and milkers but of the absolute cleanliness of everything with which the milk comes in contact. Also he should be careful to maintain the proper temperature of milk to be sold for human consumption. Elaborate equipment is not so essential in producing clean milk as close adherence to details. Instructions offered in this circular are for the purpose of producing milk of a desirable quality, a milk which will be in demand by the public and of which the dairyman himself will be proud.

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