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A New Milk or Water Sterilizer.

C. A. CARY, VETERINARIAN.

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A NEW MILK OR WATER STERILIZER.

BY C. A. CARY.

A cheap and practical milk sterilizer, that will destroy all the disease-producing germs which may be present in milk, has been sought as a means of preserving milk and of protecting the health of little children, and others who use milk as a chief food.

Scientists and medical authorities almost universally agree that tuberculosis (consumption) in animals and in man is caused by the same microbe; that milk from a tuberculous cow is many times infected with living tubercle baccili; that when children or grown persons consume such infected milk they may, or do in many instances, contract tuberculosis. Besides this most dreaded germ, there are occasionally other disease-producing microbes in milk, and nearly always numerous septic (decomposition) germs which hasten the process of fermentation (souring) and also interfere with the taste, digestibility and nutritive value of milk.

Milk has been sterilized by heat, by freezing and by passing electrical currents through it. The first of these three methods is the most effectual, practical and the cheapest.

The sterilization of water has been attempted by filtration, by heat, by freezing, by electricity and by the addition of drugs. The filtration method can be relied upon only when every detail is most scrupulously attended to. The value of electricity in sterilizing water has not been sufficiently tested to justify its general use; furthermore, it is not within reach of people outside of the larger cities. The employment of drugs (antiseptics, etc.,) ruin the taste of water, and in most cases would prevent its use as a food. Also, water sterilization by heat has hitherto caused the wa-

ter to taste "flat" or insipid, a result of the loss of the absorbed air, oxygen and nitrogen and possibly a little carbonic acid gas, which is usually found in well water. The sterilization of drinking water is a most valuable aid in preventing typhoid fever, cholera, yellow fever, malarial fever and indigestion. The infected water supply was the source of the cholera outbreak at Hamburg in 1892. Infected wells have been the cause of many cases of typhoid fever. It is also very probable that impure water plays an important part in the production of malarial fevers. Moreover, it is almost certain that impure water and non-sterilized milk are the primary cause of "summer complaint" in children, and infectious diarrhea and dysentery in older persons.

It matters not how scrupulously clean and careful the milkmen may be, the milk will become contaminated, more or less, by germs from the air and other sources. Consequently, were the cow perfectly healthy, and the milk to flow from the udder free from microbes, before it reaches the consumer, especially in the cities, it is sufficiently infected with bacteria to interfere with its taste, its digestive and nutritive value.

At present it is an open question as to which is the more healthful for the infant, mother's milk or properly sterilized cow's milk. Recently, in European countries extensive examinations of mother's milk have been made and in the majority of instances women's milk was found to contain microbes. This was more especially true when the mother was not perfectly healthy. Some investigators are inclined to believe that the germs entered the milk from the blood, while others are of the opinion that the microbes came from the skin over the nipple. This question, however, requires further investigation before any relatively true conclusions can be drawn.

DESCRIPTION OF STERILIZER.

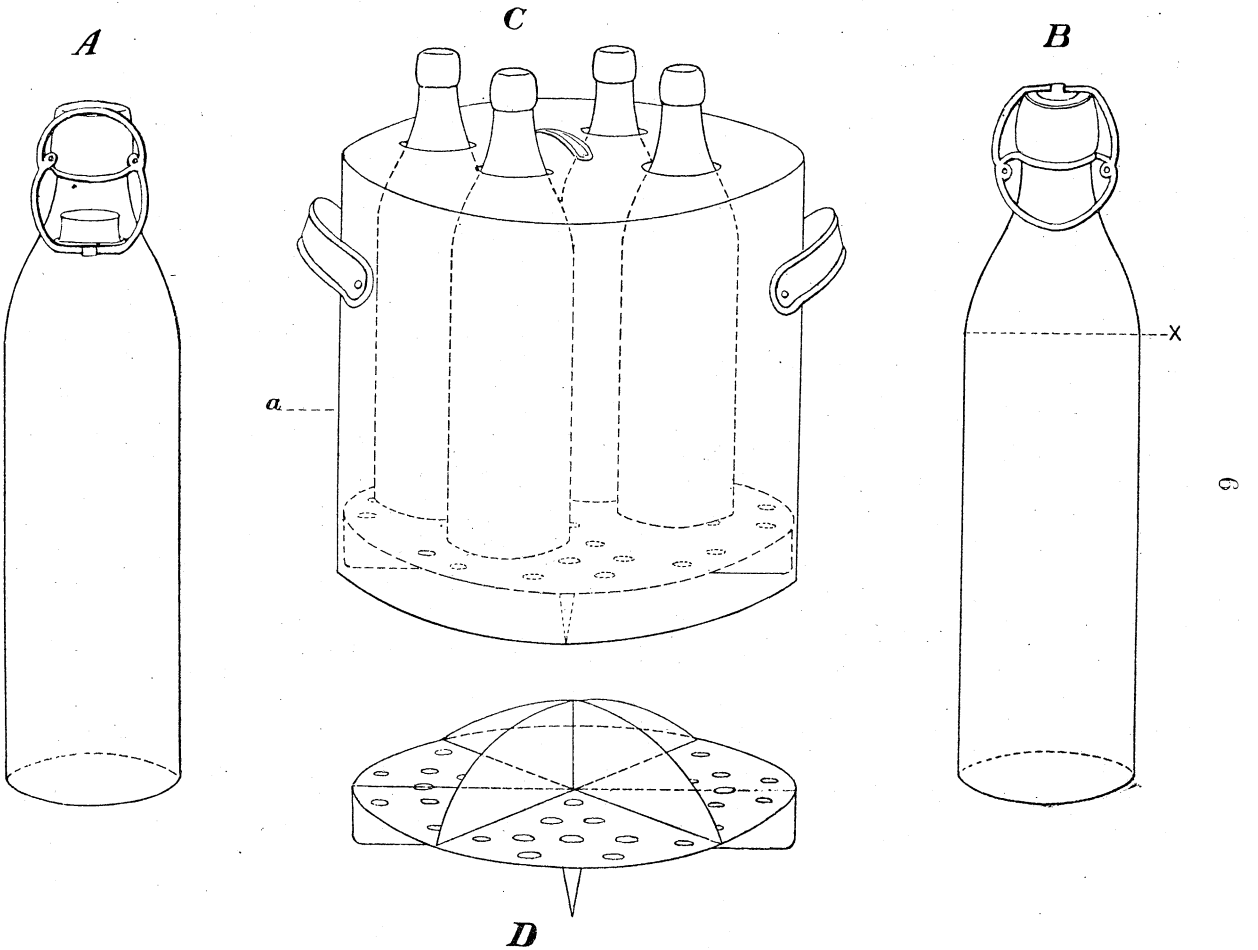
Figure C represents the sterilizing vessel, made of tin, copper or galvanized iron, with the milk or water bottles in position. This vessel, for 4 to 6 bottles, is 9 inches in diam-

eter, and 9 to 12 inches high. The lid has 4 to 6 openings (according to the number of bottles) which are 1½ to 2 inches in diameter. Resting on the flat, true bottom is a false, loose bottom that is raised 1 inch above the true bottom by two strips standing on their edges, running at right angles to each other, and firmly soldered to the inferior surface of the false bottom. This bottom (see figure D) is perforated by several openings, one-half inch in diameter. It, also, has its upper surface divided into as many parts as there are bottles, by pieces that are two to three inches high at the center with their free borders gradually curving towards the circumferance of the false bottom.

The bottles, C and D, with a capacity of ½ pint to 1 pint, are made of heavy thick glass, and are hermetically (air tight) sealed by a rubber stopper, held in position by wires. This stopper is called the "lightning stopper" and is patented. Cork stoppers may be used, but must be held in place by wires or strong cords. The cork should fit tightly and be well secured.

After thoroughly cleansing the bottles, they are filled with milk, not higher than x, figure B. They are now closed and placed in the sterilizing vessel; cold water is poured into the vessel until it rises one-fourth of an inch above the false bottom. The sterilizer is then placed on an oil, a gasoline or a cook stove, and heated until the water in the vessel boils eight to fifteen minutes. As a rule, 11 minutes boiling is sufficient. But should the water in the vessel be heated very rapidly, let it boil 15 minutes. If, however, the water comes to a boil slowly, say 30 minutes after being put upon the stove, allow it to boil 8 to 10 minutes. The vessel must then be taken from the stove, covered with dry cloths, and allowed to stand thus for 30 to 40 minutes. After cooling, the bottles may be put on ice or kept in cool water, and the milk will remain sweet for 24 hours or longer.

The temperature of the milk, under the above conditions, rises to not lower than 150 degrees or higher than 167 degrees, F. According to the best bacteriologists, nearly all growing and adult microbes are killed if heated to 140 de-


A
C
B
a
X
D

grees, F. But physiologists claim that when milk is heated 167 degrees, F., it undergoes a chemical change that impairs its digestibility and nutritive value. By heating milk higher than 167 degrees, F., its starch dissolving ferment is destroyed; a part of the albumin is coagulated, and the caseine will not readily coagulate in the presence of rennet. By prolonged heating of milk at a high temperature, the fat globules separate from the milk and this is said to interfere with the assimilation of the fat. Prolonged heating at a high temperature is said to destroy the milk sugar. But according to the bacteriologists and physiologists, heating milk to 140–167 degrees, F., will kill the adult forms of all kinds of germs, preserve the milk and render it more healthful, without impairing its value, in any way as a food. These comparatively low temperatures will not destroy the spores of many decomposition (septic) germs; consequently the milk "sours" in the course of 24 hours, or as soon as the spores develop into adult microbes. According to Fraenkel, heating cholera bacilli to 122 degrees, typhoid bacilli to 140 degrees, or tubercle bacilli to 158 degrees, F., will destroy them in a short time; this is especially true if the bacilli are in such liquids as milk or water when heated. Furthermore, it is almost absolutely certain that none of these three germs form spores.

If one should desire to keep the milk indefinitely, it must be heated as above directed for three consecutive days. To raise the temperature of the milk to 185 degrees, varying from that up to 205 degrees, F., fill the vessel, C, with cold water, one-third to one-half as high as the level of the milk in the bottles; then boil the water in the vessel 20 to 40 minutes, usually 30 minutes is sufficient to preserve the milk 2 to 4 days, Repeat the process the next day and the milk may be preserved indefinitely. I prefer this method to the preceeding for sterilizing milk in the summer.

To raise the milk or water in the bottles to 206 or 212 degrees, F., fill the sterilizing vessel with cold water as high as the level of the milk or water in the bottles, cover the vessel with a non-perforated lid, or cover the perforated lid with

cloths; then allow the water in the vessel to boil 30 to 60 minutes. This will usually keep the milk sweet as long as the bottles are kept closed. During the hot part of last summer I kept milk that had been so sterilized for 6 weeks, and the bottles stood in a window where the sun could shine on them part of the day. As a rule, on account of reasons previously stated, it is not good to sterilize milk at such a high temperature. But drinking water should always be sterilized by this method.

If milk is acid in reaction (slightly sour) before sterilization it will coagulate after sterilization, although it may be free of germs. Sometimes the milk is acid when it comes from the udder and this is said to be due to improper feeding of the cow. In order to determine if the milk is appreciably acid before sterilization, put a small strip of blue litmus paper into the milk; if it turns red the milk is acid, but if this produces no change in the blue paper the milk is neutral or alkaline. If the milk is slightly acid it may be made neutral or slightly alkaline by the addition of a sufficient quantity of a saturated solution of bicarbonate of potassium, or common baking soda, to make the red litmus paper turn blue. This may be done without injuring the milk, if practiced with care.

In sterilizing water, always heat it to 212 degrees, F., for 30 to 60 minutes. After the water in the sterilizing vessel has become partially cooled, the bottles may be placed on ice, put in cold water or transferred to a bucket that may be hung in the well.

The only practical method of using the thermometer, when sterilizing milk, is the one suggested by the Bureau of Animal Industry. It is adjusted in the lid so that the bulb is immersed in the water of the vessel. The vessel is filled with water as high as the level of the milk in the bottles. When the water reaches the desired temperature (160 to 167 degrees, F.,) the vessel is removed from the fire, covered with cloths and allowed to stand 30 to 40 minutes.

CAUTIONS.

Always scrupulously clean the bottles before using. Coarse sand or a bottle brush will remove the dry milk from the inner surface of the bottle. It is best to fill the bottles with water immediately after using the milk.

Never fill the bottles higher than indicated in figure B.

Always keep the bottles closed air tight during and after sterilizing. Never pour cold water into the sterilizer after the water in the sterilizer has commenced to boil.

Never take the bottles from the vessel when they are hot; because cold air or cold water will break them.

Never put cold bottles into boiling water.

A MILK DEALER'S STERILIZER.

This process of sterilization in closed bottles may be employed by dairymen.

A large sterilizing pan could be made after the pattern of a syrup or a sorghum evaporating pan. It may be from 6 to 10 feet long, 2 to 4 feet wide, and 12 to 15 inches deep. The bottom should be made of copper and the sides of plank. The false bottom should be constructed lattice-or slat-like, of wood strips. The bottles should have a capacity of one quart. A tight fitting lid could be constructed of wood, having but one opening, in which a thermometer may be inserted. A heating furnace, something like the one used in evaporating sorghum or cane juice, may be employed, but arranged to suit the different conditions.

After filling the bottles as previously directed, and placing them in the sterilizing pan, it may be filled with cold water as high as the level of the milk in the bottles. Now heat the water to 160 degrees, F., or higher if desired; the temperature will be indicated by the thermometer extending through the lid down into the water. When the water reaches the desired temperature the sterilizing pan, resting on rollers, may be rolled to one side, upon a platform as high as the furnace, and there left undisturbed for 30 to 40 minutes. It is important that the sterilizer remain covered

for 30 to 40 minutes after removing it from the fire ; because the milk in the bottles will not reach the same temperature as the water in the sterilizing pan, until 5 or 10 minutes after removal from the fire. When the bottles have partially cooled they may be removed to the ice chest, or to cooling pans. Crates, similar to those used by pop and beer venders, may be employed in delivering the milk.

I claim to have originated this process of sterilizing milk or water in hermetically sealed bottles.

Milk sterilized by this process may be heated to a higher temperature than in open vessels without changing its chemical composition, or interfering with its taste, digestibility or nutritive value.

This closed bottle process is not exposed to infection after sterilization.

As a water sterilizer it does not change the taste of the water ; it leaves the water just as palatable as it was before sterilization. Furthermore, the sterilizer is cheap and may be used by any cook or nurse after a little instruction.

I believe it can be successfully and effectually used by dairymen.