

**DRIED MILK—A NEW PROCESS.**

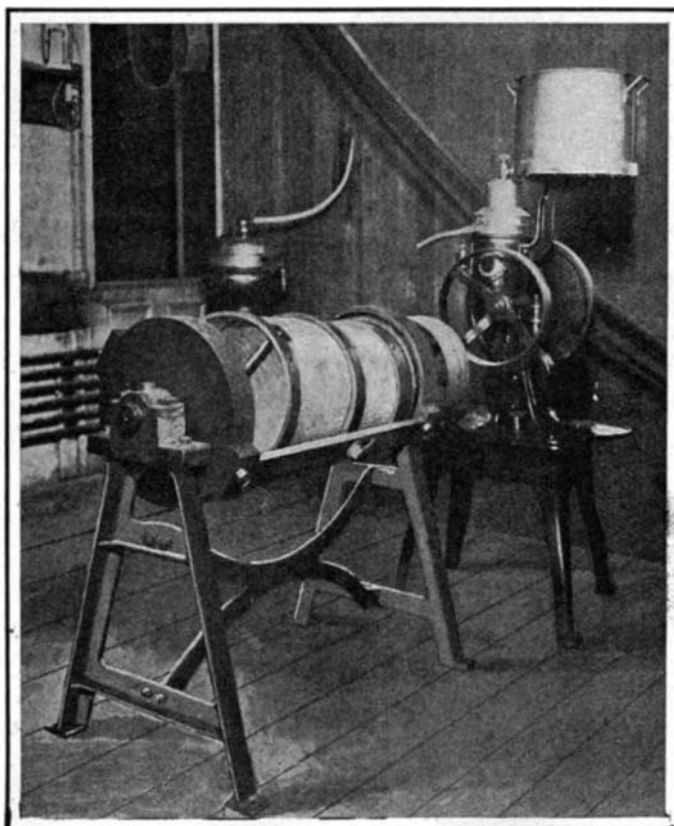
The idea of using desiccated milk for commercial purposes is by no means a novel one. In fact, for years the general public has been familiar with a partially desiccated or dried product in the form of condensed milk. The latter is nothing more nor less than milk in which the water has been partly evaporated, and which could be completely dried out by carrying the process of manufacture further. Completely dried milk, desiccated milk, milk powder, milk flour, or whatever the term is under which it may be known, is nothing other than ordinary milk from which the water has been completely eliminated by evaporation, leaving merely the solids, salts, fat, and sugar, which the liquid carried in suspension. Within recent years a number of processes for drying milk have been evolved both here and abroad, and these have been successfully exploited in various countries. Among these processes is the so-called Just method, in which the milk is thrown upon steam-heated metal rollers in the form of a very fine spray, and is thereby almost instantly converted into a thin crust which is subsequently removed from the metal by means of fixed blades and is then powdered. The objectionable feature of this and other methods employing high temperatures is said by experts to be that the chemical constituents are changed by the heat, and that even if finely ground the resulting powder is never entirely soluble.

An interesting method for the production of milk flour has recently been developed and covered by patents, which makes no use of high temperatures and in which numerous advantages are claimed for the resulting product. The accompanying photographs illustrate the apparatus which is used in this process. It is said that the cost of manufacture will be extremely low, for the plant can be located in the immediate neighborhood of some large dairy, and thus make use of the skim milk from the latter. This skim milk is often practically a waste after the cream has been used for the making of butter, and as such is either discarded or sold to farmers as hog food. Consequently it is possible to obtain it at small cost, and as the expense of manufacture is nominal, the product can be supplied to the public at low rates. Unskimmed milk can, of course, also be desiccated, but as the cream or fat becomes rancid within a few days, the product in that case is not capable of storage or shipment unless packed in hermetically-sealed receptacles. If the process is to be utilized for the manufacture of condensed milk, the evaporation is stopped when the liquid has obtained the required density. This condensed milk, however, differs from the usual article in that it retains all the properties of the raw milk, unchanged, and need have no added sweetening or preservative chemicals to make it available for daily consumption.

The milk, from which the cream has been previously separated, is run through a centrifugal clarifier, which removes all floating impurities and foreign substances; the liquid is then allowed to cool below the temperature resulting from the action of the clarifier, and is then placed in open receptacles, from which it is drawn into the desiccator. The latter consists essentially of a large, closed copper vessel, provided with glass peep-holes through which the progress of the operation may be watched, vacuum gages, and thermometers. A large pipe rises from the top of the copper vessel and leads to a cylindrical condenser, in which is arranged a coil or worm of small piping. Between the condenser and the desiccator the large connecting pipe is provided with a trap, to prevent the accidental return of any of the evaporated and subsequently condensed liquid to the

vessel. A strong vacuum pump communicates with the desiccator through the condenser and the connecting pipe.

When the milk is ready for drying the vacuum pump is started, and this creates a partial vacuum within the copper vessel. The end of a rubber tube in communication with the latter is now introduced into the receptacle containing the milk, and the liquid is then rapidly drawn into the desiccator by means of the vacuum within the same. The pump continually draws off the vapors during the entire operation, which



The Cylinder in Which the Milk is Ground to Flour.

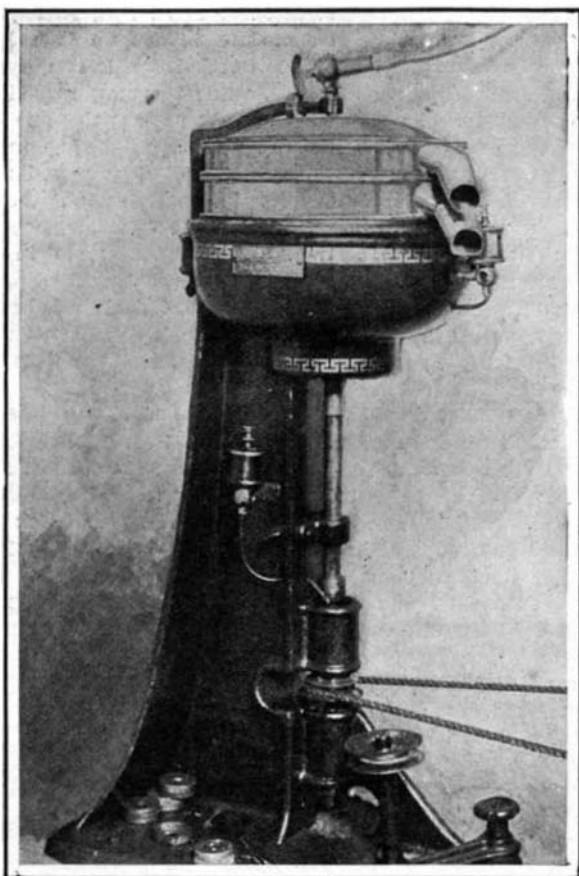
lasts from three to four hours, and it maintains the partial vacuum in the desiccator during this period. The action is thus analogous to boiling off the water, though the temperature of the milk is maintained at a point under 105 deg. F. To the eye the operation is indistinguishable from a direct boiling of the milk by means of the application of heat; but it is claimed that by this absence of heat the chemical properties of the milk are not altered in the least, notwithstanding that the process removes impurities and destroys all the harmful bacteria. The vapor is changed to liquid form in the condenser, where it is cooled by a flow of cold water through the worm located within it. From the condenser the liquid, which has been shown to be chemically-pure distilled water, flows into a tank provided with a gage glass, by means of which the amount evaporated can be accurately estimated, and thus the progress of the operation may be checked by the amount of the condensed water. When the

milk has been sufficiently dried, the moist white, flaky solid is removed from the desiccator through a suitable opening in the bottom. It is then placed on flat pans, and completely dried by means of a blast of cool, dry air.

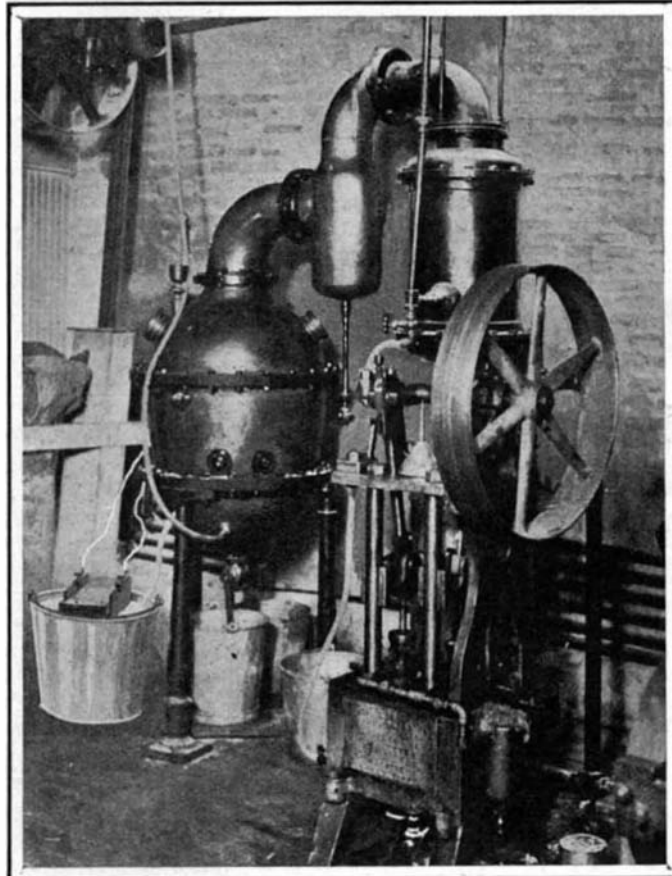
An interesting and unusual feature of the process takes place while the milk is being drawn into the desiccator. Pairs of separated carbon electrodes are introduced into the receptacles containing the milk, and a low-voltage electric current is passed through the liquid. The exact action of the current is not understood, but it is believed that it breaks up the lactose or milk sugar into two separate sugars, which have a combined sweetness greater, or at any rate more apparent to the taste, than the sweetness of the lactose itself. In consequence, the dried milk, if used for cooking or baking, requires the addition of less sugar than normal milk. It will be noted that the dried milk obtained by this process is almost pure white and odorless, while that resulting from certain of the heat-employing methods is yellow and has a distinct smell of cheese, due to the cooking and coagulating of the albumen of the milk during the operation.

The crusty mass of the dried milk is ground or powdered by being placed in a revolving metal cylinder, which contains a number of porcelain balls. These are tumbled about by the rotation of the cylinder, and soon reduce the milk solids to a fine flour. This is very nearly soluble in water, and it is possible to reconstitute the desiccated liquid milk by the addition of the requisite quantity of water to the flour. The reconstituted milk, while it has all the exact properties of real milk, has a flat taste and is, of course, not as palatable as the original article. The great value of solid milk lies in its use in baking and cooking, or for certain commercial purposes. Thus in the manufacture of milk chocolate, which is so popular at the present time, the maker is limited in the quantity of milk which can be added to the ground chocolate, because the resulting mass must not be too thin or the chocolate will not harden properly. No such difficulty is present if milk flour is used. As it will keep indefinitely, it should prove invaluable to tourists, campers, explorers, and for military and naval purposes, not only as a powder but in tablet form as well. Its use will materially simplify the transportation of milk, as its weight is less than one-tenth the weight of the proportionate liquid milk. It will be very difficult to adulterate, for primarily no water can be added without the possibility of detection, and in the second place, no chemicals need be added to preserve unchanged its qualities as a raw milk indefinitely.

The extent to which British shipowners dispose of old vessels to foreigners is shown in statistical tables published in Lloyd's Register of Shipping. The tonnage cleared off in this way last year was 512,701 tons, comprising steamships of 422,395 tons, and sailing vessels amounting to 90,306 tons. By these sales, which are the largest since 1900, Germany acquired 101,903 tons, Italy 78,671 tons, Japan 66,328 tons, and Norway 59,702 tons. It must be a very considerable advantage to have a market like this for "second-hand" vessels. Tables which are included in the registrar-general's returns indicate that about 18 per cent of the tonnage removed from the Register because of foreign transfer was built before 1880, nearly 43 per cent before 1885, 62 per cent before 1890, 78 per cent before 1895, and over 90.6 per cent before 1900. In addition to the second-hand tonnage transferred to foreigners, 52,464 tons were transferred to British colonies during 1905, compared with 37,464 tons in 1904, 62,907 tons in 1903, and 32,603 tons in 1902.



The Clarifier for Removing Impurities.



The Evaporator with Vacuum Pump.