The present invention relates to an apparatus for processing evaporated milk for purposes of preservation.

This application is a division of my copending application Serial No. 381,492, filed March 3, 1941, for Method and apparatus for treating evaporated milk.

One object of the present invention is to provide an improved apparatus for processing milk.

Another object is to provide an apparatus for treating evaporated milk which employs a heat exchange chamber provided with a reciprocable and a stationary canway portion wherein the cans are permitted to roll during their travel through the reciprocable canway portion but are prevented from rolling during their travel through the stationary portion of the canway.

Other and further objects and advantages of the present invention will become apparent from the following description and drawings in which:

Fig. 1 is a plan view showing somewhat diagrammatically the arrangement of the apparatus.

Fig. 2 is an end elevation of the feed end of the sterilizer.

Fig. 3 is an end elevation of the discharge end of the sterilizer and the feed end of the cooler.

Fig. 4 is a vertical longitudinal section of the sterilizer with the reel removed and the canway shown in elevation to illustrate its configuration.

Fig. 5 is a detail view of the inlet of the sterilizer with the valve removed, showing the beginning of the canway into which the cans are introduced.

Fig. 6 is an enlarged view taken from the interior of the canway showing the junction of the ends of the movable portion of the canway with the beginning of the stationary portion.

Fig. 7 is a detail section of a bearing on which the movable portion of the canway is supported for sliding movement in the shell of the sterilizer.

Fig. 8 is a vertical transverse section through the feed end of the sterilizer.

Fig. 9 is a diagram illustrating the correlation of heat and agitation control.

Referring to Fig. 1, reference character A indicates a can filling and soldering machine, B a sterilizer and C a cooler. These units are arranged so that the cans pass in procession from one to the other in the order named. The can filling and soldering machine A is of the continuous automatic type adapted to receive a continuous file or procession of cans and to fill them with evaporated milk through small openings provided in the head of each can, and then to apply solder over the openings to hermetically seal the cans. Machines of this type are well known in the art and accordingly the detailed construction thereof has not been disclosed. The sterilizer B is an enclosed pressuretight chamber adapted to be supplied with a heating medium such as steam under pressure and maintained at the sterilizing temperature. The cooler C is an enclosed pressuretight chamber adapted to be supplied with a cooling medium such as water. The cooler is also supplied with compressed air from any suitable source so as to maintain a pressure above atmospheric therein.

The filled and sealed cans, as indicated at 10, are discharged from the filling machine A and are received in rolling procession by an inclined gravity chute 20. The chute 20 delivers the cans to an elevator 21 which discharges them into the pockets 22 (Fig. 8) of a rotary pressuretight valve 23. The casing 25 of the valve is mounted over an inlet 26 in the top of the sterilizer B by means of a casting 27. As the valve rotates, the cans are introduced one after another into longitudinal can channels formed between rails 31 on a reel 32. The reel 32 is mounted on a shaft 33 which, as shown in Fig. 4, is rotatably mounted in bearings 34, 35 in heads 36, 37 respectively, which close the ends of the cylindrical shell 38. A gear 39 is keyed to the end of shaft 33 for rotating the reel.

A canway 40 (Fig. 4), formed by helically trending T rails 41, is provided for advancing the cans through the sterilizer along the can channels on the reel, the base flanges 41c and ribs 41b of adjacent convolutions of the rails cooperating to form the canway in which the cans are advanced in rolling procession by the rails 31 and the reel 32. This canway is constructed in two sections. The first section 42, which extends from the inlet 26 to an intermediate point in the sterilizer, is slidable mounted for longitudinal reciprocation, while the other section 43 is stationary, being rigidly secured to the shell 38. The movable and stationary sections 42, 43 together provide a continuous canway 40 to guide the cans through the sterilizer from the inlet 26 to the outlet 44.

The movable section of the canway comprises a plurality of helical turns which are secured together as an integral unit by means of six parallel straps 45 (Figs. 4 and 8). The lowermost straps have sliding bearing on straps 46 (Figs. 4 and 7) which are welded to the shell 38. The canway also bears against two spacer strips 47 which are welded to the shell. In this manner the movable section 42 of the canway 40 is supported in the shell 38 for sliding movement back and forth parallel to the reel shaft 33. A ring 50 (Figs. 4 and 11) is rigidly connected

APPARATUS FOR TREATING EVAPORATED MILK

Albert R. Thompson, Los Gatos, Calif., assignor to Food Machinery Corporation, San Jose, Calif., a corporation of Delaware

Original application March 3, 1941, Serial No. 381,492. Divided and this application June 26, 1944, Serial No. 542,079

1 Claim. (Cl. 99-365)
to the movable canway unit 42 by means of plates 51, 52, 53. Two pins 54 are mounted on the ring 50 and are connected by links 55 to levers 56 splined on shafts 57. The shafts 57 extend laterally outside the shell 30 in bearings 60 mounted on the shell. The outer ends of the shafts 57 have levers 58 splined thereon. The relatively ends of the levers 58 are connected by means of pivot pins 60 with links 61, the opposite ends of which are pivotally attached by means of bearings 62 (Figs. 2 and 4) with cranks 63 formed in a transversely extending shaft 64.

The shaft 64 (Fig. 4) is supported for rotation in bearing brackets 65 mounted on the exterior of the shell, and has a pulley 66 thereon which is belt-driven from a motor 67, preferably through a variable speed drive 68, so that the speed of rotation of shaft 64 can be varied somewhat if desired. It will be apparent that when the crank shaft 64 is rotated the levers 58 and 56 will oscillate, causing reciprocation of the movable section 42 (Fig. 4) of the canway 40.

In order to facilitate introduction of the cans into the reciprocating section of the canway the inlet end of the canway which is disposed beneath the sterilizer inlet 26 is formed by means of two rails 69 and 70 (Fig. 4) which are T shaped in section. For a short distance adjacent the terminus of these rails at the inlet 26 their inner base flanges are cut away at 71 and 72 (Fig. 5) to admit the can into the channels between the real rails 31. The rails 69 and 70 are also spread apart for a short distance back from their ends 73, 74, the reason for this being that the rail ends move from the full line position to the dot-dash line position and return in each reciprocatory stroke of the movable part of the canway. Hence the rail ends 73, 74 must be spaced apart a distance equal to the length of the can (shown in broken lines at 19) plus the stroke of the canway and a small amount of clearance, so that neither end will obstruct admission of the can to the real end canway.

In operation, the valve 23 (Fig. 4) is driven in timed relation with the rotating reel 32 so as to deposit the cans between the ends 73, 74 (Fig. 5) of the canway and into the channels between the rails 31 (Fig. 6) of the reel which carries the can into the canway. Hence the rail ends 73, 74 (Fig. 5) converge a short distance back from their inlet end terminus to reduce the spacing therebetween which was necessary to admit the can, so that by the time the can has been carried to the point 76 in the canway the ribs of the rails 68, 70 engage the ends of the cans and impart reciprocatory movement thereto.

The rails 69, 70 (Fig. 4) form substantially the first half turn of the helical canway, and the pitch of this initial half turn is made greater than that of the rest of the canway in order to rapidly remove the can from the plane of the inlet 26, because the next turn must begin at 77 beside the inlet. The rail 70 merges with the rail 69 at 78 and from this point on throughout the rest of the reciprocating canway section a single rib is used, both sides of the rail rib over this part of the canway being effective on the cans. The use of the single rail over this part of the canway is made possible because the pitch of the helix remains constant.

As the cans travel around the section 42 of the canway, the reciprocating section them back and forth to vigorously agitate the milk. The rate of rotation of the reel 32 is such that by the time the cans arrive at the end 79 of the reciprocating section of the canway the milk temperature has reached the maximum sterilizing temperature and the can is ready to enter the stationary section 43 of the canway.

The junction of the end 79 of the reciprocating section 42 of the canway with the beginning 80 of the stationary section is shown in detail in Figs. 4 and 6. It will be noted that the end 79 is forked to provide two guiding flanges 81, 82 which are alternately aligned with the rib 83 of the stationary canway rail 84 at each end of the stroke of the canway section 42. In the first turn of the stationary section 43 of the canway the pitch is increased to obtain sufficient clearance to permit the reciprocation of the last turn of the reciprocating section 42 of the canway. This necessitates the use of the double rail construction comprising the two angles 85, 86 which diverge at 87 and converge at 88.

The can is transferred from the reciprocating section of the canway to the stationary section in the following manner: As the can approaches the end of the reciprocating section its right hand end is guided by the moving rib 81 onto the stationary rib 83. In the first convolution the left hand end of the can is guided by the rib of the canway 85. When the can again arrives opposite the junction the left hand end of can is guided by the moving rib 81 onto the stationary rib 83.

In the next convolution the left hand end of the can is guided by the rib of the canway 86. When the left hand end of the can passes the point 88 the can enters the stationary canway proper which is formed of a single rail 89 coined in a helix of constant pitch. Upon arrival at the point 90 double rails 81, 82 are again employed to increase the pitch and shift the can over into line with the discharge outlet 44.

It will be noted by reference to Fig. 8 that the rails 31 of the reel 32 are of conventional T shaped form at the inlet end of the reel, and these rails are of this shape from the inlet end of the reel to the plane of the junction between the reciprocating and stationary sections of the canway 40 as indicated by the arrow 95 in Fig. 4. In other words, the T shaped form of the rails 31 enters the rails 68, 70 (Fig. 5) and converges a short distance back from their inlet end terminus to reduce the spacing therebetween which was necessary to admit the can, so that by the time the can has been carried to the point 76 in the canway the ribs of the rails 68, 70 engage the ends of the cans and impart reciprocatory movement thereto.

The remainder of the reel, from the plane of the junction between the two canway sections as indicated at 95 in Fig. 4, to the discharge end of the reel, is of non-agitating construction such as disclosed in U. S. Patent No. 2,211,002, issued to me August 20, 1940, the ribs of the rails 31 being provided with flanges 93 along their outer edges, as best seen in Fig. 3, so that throughout the length of the stationary canway section 43 the rails of the canway are of T shaped section. Thus the section of the reel is of the non-agitating type, so called because of the fact that the flanges 93 serve to support the cans as they are carried
around the underside of the reel and thereby maintain them out of engagement with the base flanges 40 of the canway. Consequently agitation of the cans is minimized because they are prevented from having any rolling engagement with the canway such as they do along the reciprocating canway section, and are merely carried around bodily by the reel without any rolling motion. The only agitation imparted to the cans along the stationary section of the canway therefore is the very slight amount due to the turning of the cans with the reel.

When the cans leave the sterilizer through the discharge outlet 44 they are transferred to the cooler C (Fig. 3) by means of a pressure tight transfer valve 100 which may be of the construction shown in U. S. Letters Patent No. 1,467,960, issued to me September 11, 1923. The cans are then conveyed through the cooler by means of a conventional reel and canway, not shown, but which may be similar to the reel and canway illustrated in the above patent. Upon arrival at the end of the cooler C (Fig. 1) the cans are removed therefrom through a pressure tight discharge valve 101.

The driving mechanism will now be described. A motor 102 (Fig. 1) mounted on top of the sterilizer B has a belt and pulley connection 103 with the shaft 104. Pinions 105, 106 secured to the ends of the drive shaft 104 drive the gears 38, 108, respectively, secured to the sterilizer reel shaft 33 through intermediate gears 109 (Fig. 2), 110 (Fig. 3). The gear 108 (Fig. 3) drives the gear 111 which operates the transfer valve 100. The gear 111 meshes with the gear 112 secured to the shaft 113 of the cooler reel. The rotary pocketed valve which introduces the cans into the sterilizer is driven by the gear 114 (Fig. 2) from gear 38, and the gear train 115 provides a drive for the elevator 21.

The operation of the apparatus is as follows: The cans are filled with evaporated milk and sealed in the machine A (Fig. 1). In rolling process they descend the gravity chute 26 to the elevator 1 which deposits them into the valve 23 (Fig. 6) which introduces them one after another into the can channels formed by the rails 31 on the sterilizer reel. The reel is rotating and carries the cans into the reciprocating canway section 42 which begins to vigorously shake the cans. As the reel rotates, the cans are free to roll on the canway because the can channels are open in this part of the reel. The rolling and shaking of the cans provides maximum agitation which promotes the heat exchange to raise the milk temperature as rapidly as possible. It will be understood that the interior of the sterilizer is maintained at sterilizing temperature by the introduction of steam under pressure therewith.

The rate of rotation of the reel is such that when the cans arrive at the end of the reciprocating canway 42 (Fig. 4) the milk has substantially reached sterilizing temperature. The cans then pass into the stationary portion 43 of the canway which results in discontinuation of the shaking. In addition, the flanged portion 43 which begins at this point serves to restrain the cans from rolling on the canway. Thus, when the milk temperature reaches a maximum the agitation is discontinued and held to a minimum during the ensuing holding period.

During the travel of the cans through the stationary portion of the canway the milk temperature remains at sterilizing temperature, and when the cans arrive at the outlet of the sterilizer the sterilization of the milk is completed. The cans are then transferred by the valve 100 (Fig. 3) to the cooler where they are deposited in the rotating reel of the cooler. This reel is preferably of the agitating type to provide at least moderate agitation to prevent the formation of skin as the milk cools. After being cooled the cans are discharged from the cooler through the valve 101 and the treatment is finished.

The manner in which the temperature and agitation are controlled is illustrated by the diagram in Fig. 9. The abscissas are units of time and the ordinates are units of time the progress of the cans being from left to right in the direction of the arrow 139. The ordinates are degrees of temperature and agitation. The temperature curve is in full lines and the agitation curve in broken lines. It is to be understood that these curves are not specifically to scale but drawn merely to illustrate in a general way the time of increase and decrease in temperature and agitation as the milk is treated in the apparatus of the present invention.

The temperature of the milk as it leaves the filling machine and enters the sterilizer is indicated at 131. As the cans progress through the fore part of the sterilizer they receive maximum agitation indicated by the broken line 132 and the milk temperature rises to the sterilizing temperature at 133. At this point the cans are transferred from the movable canway to the stationary canway and the agitation drops from a maximum at 134 to a minimum at 135.

The milk temperature remains at the sterilizing temperature as indicated by the line 136 during the travel of the cans through the stationary part of the sterilizer canway, during which time it receives minimum agitation as indicated by the broken line 137. During the travel of the cans through the cooler the milk temperature falls from 133 to 138. The can receives increased agitation in the cooler to aid the heat exchange and prevent the formation of skin, as indicated by the broken line 140.

Having thus described my invention, what I claim as new and desire to protect by U. S. Letters Patent is:

An apparatus for treating evaporated milk in cans comprising a heat exchange chamber having an inlet and an outlet, a helical canway in said chamber, a portion of said canway being reciprocable relative to said chamber, the remainder of said canway being stationary relative to said chamber, means for reciprocating said reciprocable portion of said canway, a rotary reel within said canway having longitudinal can channels thereon, said can channels being open in said reciprocable portion of said canway to permit the cans to roll on the canway, and means on said can channels in said stationary portion of said canway to restrain the cans from rolling on the canway.

ALBERT R. THOMPSON.