This invention relates to methods and apparatus for packing fruits and like commodities which are particularly subject to deterioration from contact with air through oxidation or bacterial action.

The principal object of the invention is to provide a method and apparatus which absolutely insures the expulsion of air from the containers such as bottles or cans and their thorough sterilization, and also prevents the re-entry of air and possible recontamination of the product during the capping or other container closing operation.

The container filling and closing machines now universally used for packaging beverages, of which there are a number of different makes, are satisfactory for most beverages but some beverages, particularly fresh fruit juices, milk and some milk products, if packed by the processes and apparatus now available, will not retain their freshness when stored at ordinary warehouse and store room temperatures and must be stored under refrigeration or sold for immediate consumption. In the operation of such machines the previously sterilized containers are filled and closed while the containers are moved through the machines by suitable conveyors but contact with the air is not prevented and commodities such as mentioned above will develop an "off taste" or even spoil as a result.

By my invention the containers are sterilized in the filling machine and contact with the air is prevented during the entire packing operation. In addition, the container after it is closed may be further treated to remove the gas and vapor overlying the contents of the container and an inert gas substituted.

In the accompanying drawings I have shown my invention as applied to a widely used type of bottling machine known as the Meyer Dunmore Filler, and in the said drawings:

Fig. 1 is a plan view of a portion of the above mentioned machine as modified to carry out my invention;

Fig. 2 is a vertical section of a portion of the machine shown in Fig. 1 on an enlarged scale;

Fig. 3 is a vertical section on a further enlarged scale showing one filling unit;

Figs. 4, 5, 6 and 7 are similar views somewhat further enlarged showing the successive steps in the filling operation;

Fig. 8 is a detail view showing the mechanism for charging the capped container with steam or inert gas.

Referring to the drawings, particularly to Figs. 1 and 2, the frame of the machine and a continuously driven conveyor by which the containers, here shown as the so-called crown cans, are fed to the machine. 3 indicates the annular reservoir for the beverage which is continuously rotated during the operation of the machine. Underlying the reservoir and rotating therewith is the table of the machine upon which the can supports 4 are mounted. A portion of the table is shown in Fig. 3 and it will be understood that the can supports are elevated to bring the cans into filling position after they are moved onto the supports by the star-wheel 5 and are lowered before the cans reach the star-wheel 6 by which they are removed from the can supports and fed to the cap applying mechanism the position of which is indicated by the dot-and-dash square 7 in Fig. 1. Mounted in the bottom wall of the annular reservoir around its outer periphery are a series of can receiving connections 8 rubber lined as shown to fit over the necks of the cans when elevated by the supports 4 and prevent the entrance of air into the cans during the sterilizing and filling operations.

The beverage in reservoir 3 is admitted to the cans through valves 9 which seat against valve seats on the upper faces of the connection 8. The valves are attached to tubular valve stems 10 supported in guide sleeves 11 extending upwardly from the connections 8, the sleeves being slotted between their ends to admit the contents of the reservoir to the valves. The valves are biased to open position by springs 12 within the guide sleeves and pressing against collars 13 attached to the tubular valve stems 10.

The reservoir 3 is maintained under super atmospheric pressure by gas from a compressor or gas cylinder, not shown, but connected to the gas inlet ports 14 when the pressure maintained in the reservoir 3 is sufficient to keep the valves 9 closed against pressure of their respective springs. The gas is inert and sterilized.

The tubular valve stems 10 are fitted at their upper ends with sleeves 15 having ports 16 in their side walls positioned to lie above the ends of the valve stems 10 when the sleeves are lifted by their springs 17 and to be closed when the sleeves are depressed by their cam operated levers 38.

Each connection 8 is provided with a pressure relief valve 20 normally biased outwardly by a spring 21 in closed position and opened by a cam, as shown, to vent the pressure in the can at the proper times in the sequence of operations. The liquid in the reservoir is maintained at a constant level by a float feed, not shown.

The structures so far shown and described are the same as in the Meyer Dunmore Filler referred to above, except that the sleeves 16 are closed at their upper ends instead of having the steam inlet ports 19 here shown.

In my new machine the bores 19 extend into knobs 23 at the upper ends of the sleeves 16 and are there connected by flexible pipes 24 to steam valves 22 carried by the top wall of the reservoir 3 which in turn are connected to a steam manifold 25 supported by pipes 26 radiating from a rotating sleeve 27 on a fixed steam pipe 28 in line with the axis of rotation of the reservoir 3. The gas under pressure for charging the reservoir enters the machine through a fixed pipe 29, axially supported in the steam pipe 28 and terminating in a stuffing box 30 to which the pipe 14 is connected.

The steam valves 22 are normally closed by the pressure of the steam and held open by a cam track 31 supported, see Fig. 1, in position to open the valves immediately after the cans are elevated and their necks positioned in the rubber sleeves of the connections 8.

The relief valves 20 which in the ordinary operation of the filling machine are opened at the conclusion of the filling operation are also opened in the operation of the present machine after the steaming operation to permit the escape of steam from the can before filling. For this purpose a track 32 (see Fig. 3) is fixedly supported on the machine frame to engage the stems of the valves 20 and hold them open in the same manner that the track 31 holds the steam valves open during the first quarter revolution of the carrier wheel. During this initial quarter turn of the carrier wheel the sleeve...
2,868,508

16 which is provided with the ports 18 for the passage of the gas overlying the liquid in the reservoir 3, is held by its crank arms 38 in its lowest position with respect to the tube 10 so as to thereby retain the ports 18 closed during the steaming operation. The crank arms 38 are held down by the rock arms 35 on the shafts 34 by gravity and engage a stationary cam track 36 around the reservoir from the point where the filling is completed to a point where the steam valves are closed as they pass beyond the track 31.

During the beginning of the first quarter turn of the conveyer wheel while the steam at a sterilizing temperature is entering the cans through the ports 19 the relief valves 20 are closed so that the pressure will build up on the cans sufficiently above atmosphere for the cans to be heated to a sterilizing temperature which is maintained for a long enough period to thoroughly sterilize the cans. As will be seen, the rubber lining of the connection 5 may be of somewhat larger internal diameter than the necks of the cans so as to allow the steam to pass over the liquid in the reservoir and thereby lower the pressure in the cans so that when the ports 18 are opened the sterilized gas in the reservoir will enter the cans and drive out the steam.

The steam valves close as their stems leave the track 31 and the rock arms 35 on the shafts of the crank arms 38 at the same time move beyond the track 39 thereby allowing the spring 17 to lift the sleeve 16 and open the ports 18 to thereby permit the entrance of gas under pressure from the space in the reservoir overlying the liquid, to the containers. As stated above, the gas in the reservoir above the liquid is preferably an inert gas such as nitrogen, and the opening of the ports 18 permits the nitrogen under pressure to sweep through the cans and drive out any oxygen that may remain through having been entrained with the steam. The position of the parts at this point in the operation is illustrated in Fig. 4. As here shown, the ports 18 are open, the steam valve 22 is closed, and immediately thereafter the exhaust valve 20 also closes. The pressure in the cans will therefore be built up to approximately the pressure existing in the reservoir.

When the pressure in the can is sufficiently built up for the spring 12 to overcome the unbalanced pressure of the upper face of the valve 9, the valve will open through the action of the spring, thereby permitting the liquid in the reservoir to flow into the cans through the open valve 20. The relative positions of the parts at this point are shown in Fig. 5.

As the pressure of the liquid is the same as the nitrogen gas in the reservoir the liquid will displace the gas, driving the gas out through the ports 18 until the level of the liquid reaches the holes 37 through which the steam and gas are admitted to the cans. The position of the parts when this level is reached is shown in Fig. 6. When the level of the liquid in the cans rises above the openings 37, thereby cutting off the flow of the nitrogen from the cans, the liquid will no longer flow into the cans, thereby filling the cans with exactly the required volume of liquid, the portion of the can above the liquid level being filled with nitrogen at the pressure prevailing in the reservoir.

Throughout the filling operation the cans are continuously moving toward the discharge star wheels 6, 41 and 42 (see Fig. 1) by means of which the filled cans are carried from the carrier to the cap closing position and finally back onto the continuously moving container from which the empty cans are removed by the star wheel 5. Shortly after the cans are filled to the desired level the crank arms 38 reach the end of the can track 39, thereby closing the ports 18. At about the same time the relief valve 20 is opened by engagement with a stationary cam track 40 to thereby relieve the pressure within the can. The pressure in the reservoir thereupon closes the valve 9, the parts being at this point in the relative positions shown in Fig. 7. After the pressure is relieved the valve 20 is closed. Just prior to reaching the star wheel 6 the vertically movable can holders 4 are lowered by the cam track 44 shown, but which is the same as in the Dunmore filling machine. Immediately thereafter the cans are engaged by the projections of the star wheel 6 which is rotated continuously at the same speed as the conveyer 2. By this arrangement the successive operations of the star wheel come behind the cans as they are being carried forward by the conveyer 2 and sweep them off their supporting stands onto the table top underlying the star wheel and thereafter advance them from the conveyer about the periphery of the star wheel into engagement with the second star wheel 41 which is rotated continuously in the reverse direction from the star wheel. In the Meyer Dunmore machine the cap applying mechanism is of the turret type concentric with the shaft 51 of the star wheel 41 with the capping heads overlying the can receiving recesses of the star wheel. The structure is unchanged in the present machine and is therefore not shown in the drawings.

In order to absolutely prevent recontamination of the contents of the can during the brief interval between the lowering of the filled can away from the filler spout and the application of the cap, the space through which the cans are moved is maintained filled with steam at a pressure sufficient to prevent the ingress of air. To this end, as shown in Figs. 1 and 3, there is attached to the underside of the reservoir a cylindrical drum 45 of sheet metal, fiberboard or other available material which forms the inner wall of a steam filled compartment through which the cans are moved as they are carried around by the wheel. The outer wall of the can passage consists of a similar sheet 46 of metal or fiberboard which is supported by a fixed track 47 carried by the machine frame and concentric with the tracks 29 and 32 which operate the steam valve 22 and relief valve 20. This outer wall 46 is continuous except for the portion of the circumference of the carrier wheel 3 where the star wheel 6 projects across the carrier to sweep the filled cans from their vertically adjustable supports. At this point in the circumference of the carrier wheel the outer wall of the can passage is formed by two sections 48, 49 supported on the machine table 1 and covered by a suitable cover coextensive with the wall sections so as to completely enclose the passage of the cans from their entrance point to the discharge openings between the star wheels 42 and 41. These openings are of a size to permit the cans to move into and out of the enclosed can passage and to insure the steam and the steam which is supplied continuously to the enclosed can passage escapes primarily through these openings. It will be understood that the steam so supplied is maintained at sufficient pressure to prevent the ingress of air into the enclosed can passage and to insure sterilization of the exposed inner face of the cap before it is applied to the container.

The cans after being capped at the capping station during the movement of the can in the course of its advance by the star wheel 41 is a fully sealed and fully sterilized package. However, to more fully insure against the contamination of the contents of the can by the entrained air 1 preferably a conventional crown cap with the imperforate metal portion, a crown cap such as disclosed in the pending application of William Geisler, Ser. No. 436,822 filed June 15, 1954 wherein the metal portion of the crown cap has a central orifice, indicated at 50 in Fig. 8, the orifice being closed by the rubber lining of the cap, which, in the process described in said co-pending application, is applied to the sheet metal out of which the caps are formed
by an extrusion molding process, thereby forming a projecting middle portion on the upper face of the rubber washer which fills the hole in the cap. With a cap of this kind the contents of the can may be further sterilized after closing. To this end I provide a series of reciprocating heads, one of which is shown at 55 in Fig. 8, which may be mounted over the path of movement of the cans as advanced by the star wheel 42 in a manner similar to the capping heads which overlie the wheel 4.

Each reciprocating head 55 has attached to it a flexible steam pipe 56 leading to the vertical bore 57 in the reciprocating head which in turn leads to the chuck of a hollow needle 58 depending from the reciprocating head 55. The needle 58 has attached to one side by welding or otherwise a short hollow needle section 59 which is opened at both ends, the lower end terminating somewhat above the open end of the needle 59. The reciprocating head 55 is lowered as the freshly capped can comes to place beneath the reciprocating head, far enough for the end of the short needle section 59 to be projected fully into the can. In this lowered position steam from the steam hose 56 is discharged into the can above the liquid level and is exhausted through the short needle section 59. During the interval that the end of the needle section 59 is below the cap sufficient steam will sweep through the can to sterilize the contents of the can against any re-contamination that might possibly occur during the filling operation and remove any oxygen that may be present in the overlying gases filling the upper portion of the can. As the needle is withdrawn through the self-sealing rubber gasket the needle section 59 is cut off for a brief period before the needle is fully withdrawn through the cap and during this brief interval sufficient steam is discharged into the can to fill all the space in the can so that when the steam is condensed as the can is discharged from the machine a vacuum of two or three pounds will be formed in the can, which vacuum has the effect of drawing in the middle part of the rubber portion of the crown cap so that the top of the rubber is no longer fully flush with the surrounding metal. By this means it is possible to tell at a glance whether or not the cans are properly crowned. If the seal afforded by the crown is not completely tight, enough air will leak into the can to restore the internal pressure to atmospheric, thereby allowing the mid portion of the rubber to rise into the hole of the cap until it is flush with the outer surface of the metal. As long, however, as the cans maintain their perfect seal against the admission of air the rubber will be depressed below the surface of the surrounding metal of the cap, thereby protecting the customer against the purchase of imperfectly closed cans.

I have shown my improvements as incorporated in a filling machine of the Dunmore type, but it will be understood that my improvements may be adapted to other types of filling machines and that the structure therein shown and described may be otherwise modified within the scope of the appended claims.

I claim:

1. In a machine of the class described, the combination of a carrier for containers, a reservoir for liquid to be packaged, a series of filling spouts attached to said reservoir and positioned to discharge into containers on said carrier, means for successively bringing said containers into fluid tight contact with said filling spouts, tubular members carried by said spouts and positioned to discharge into said containers when said containers are brought into engagement with said spouts, a source of steam under sterilizing pressure, a source of inert gas under pressure, said filling spouts having valves opening to the atmosphere, valves controlling the passage of steam, gas under pressure and the liquid to be packaged to said filling spouts, means to close said first mentioned valves at the beginning of steam flow and to open said first mentioned valves after pressure is built up, and means thereafter for delivering the liquid to be packaged and gas under pressure to said filling spouts while maintaining a superatmospheric pressure in said container to prevent ingress of air.

2. The machine of claim 1 wherein means are provided to close said first mentioned valves during the gas flow to build up a gas pressure in said containers.

3. The machine of claim 1 wherein the gas under pressure is retained in the reservoir, and the valve means for controlling the flow of gas and liquid is automatically operated upon the buildup of gas pressure in the container.

References Cited in the file of this patent

UNITED STATES PATENTS

1,270,798 Dunkley ------------------ July 2, 1918
1,842,969 Heyman ----------------- Jan. 26, 1932
2,334,327 Hermann ---------------- Nov. 16, 1943
2,361,640 McKinnis ------------- Oct. 31, 1944
2,503,147 Appelzweig ---------- Apr. 4, 1950
2,562,815 Osoeff ----------------- July 31, 1951
2,575,863 Clifcorn -------------- Nov. 20, 1951
2,630,958 Hohl ------------------ Mar. 10, 1953