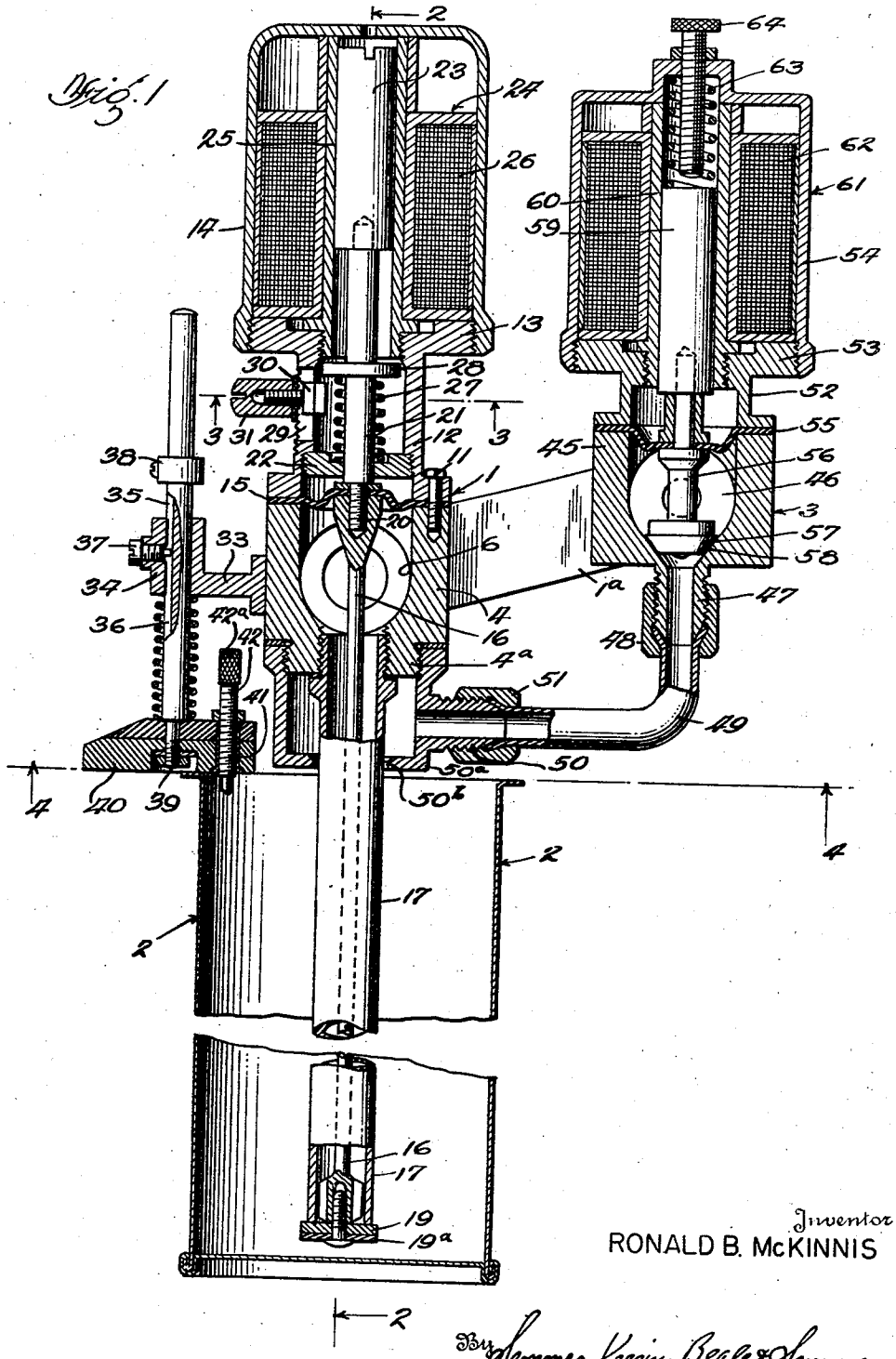
May 11, 1943. R. B. McKINNIS 2,319,075

CONTROL FOR BOTTOM FILLING OF CONTAINERS

Filed April 28, 1941 3 Sheets-Sheet 1



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CONTROL FOR BOTTOM FILLING OF CONTAINERS

Filed April 28, 1941 3 Sheets-Sheet 2

Fig. 2

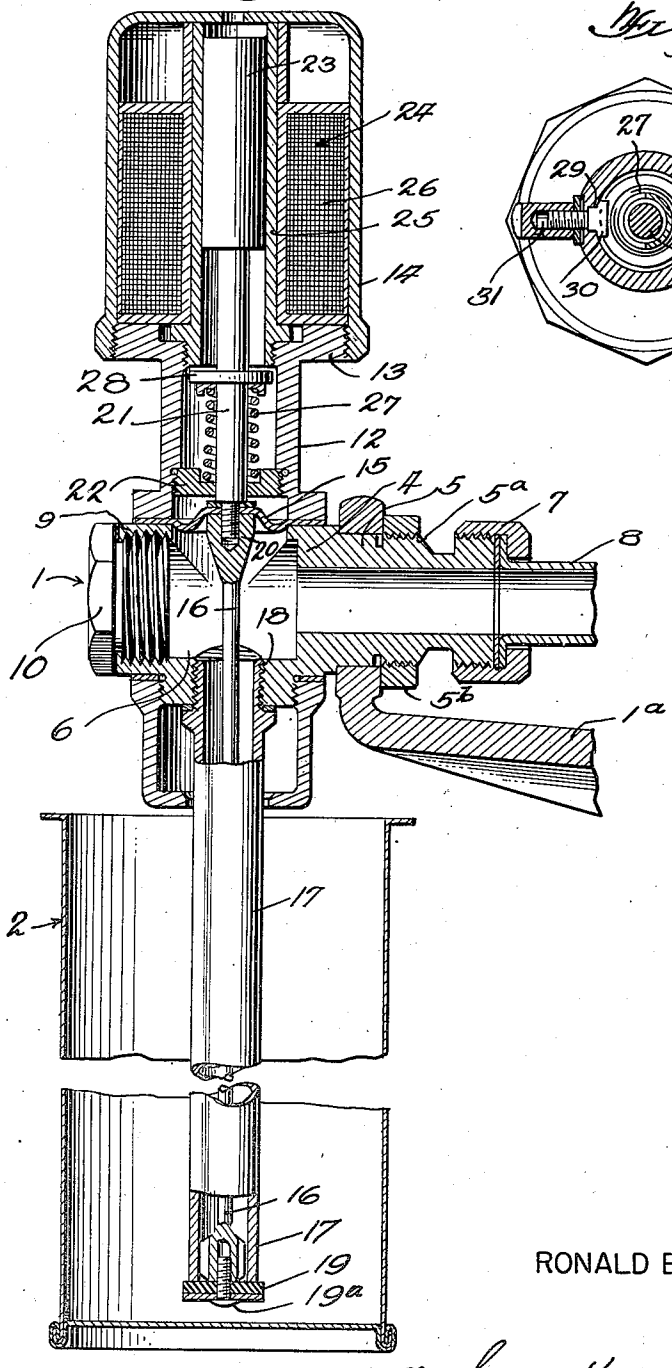


Fig. 3

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CONTROL FOR BOTTOM FILLING OF CONTAINERS

Filed April 28, 1941 3 Sheets-Sheet 3

Fig. 4

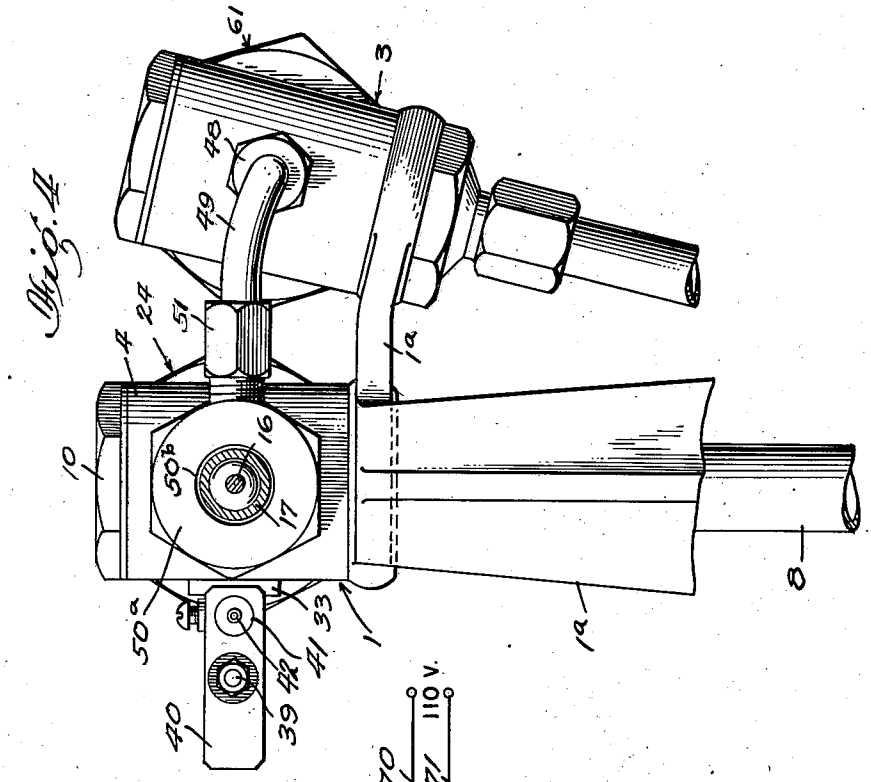
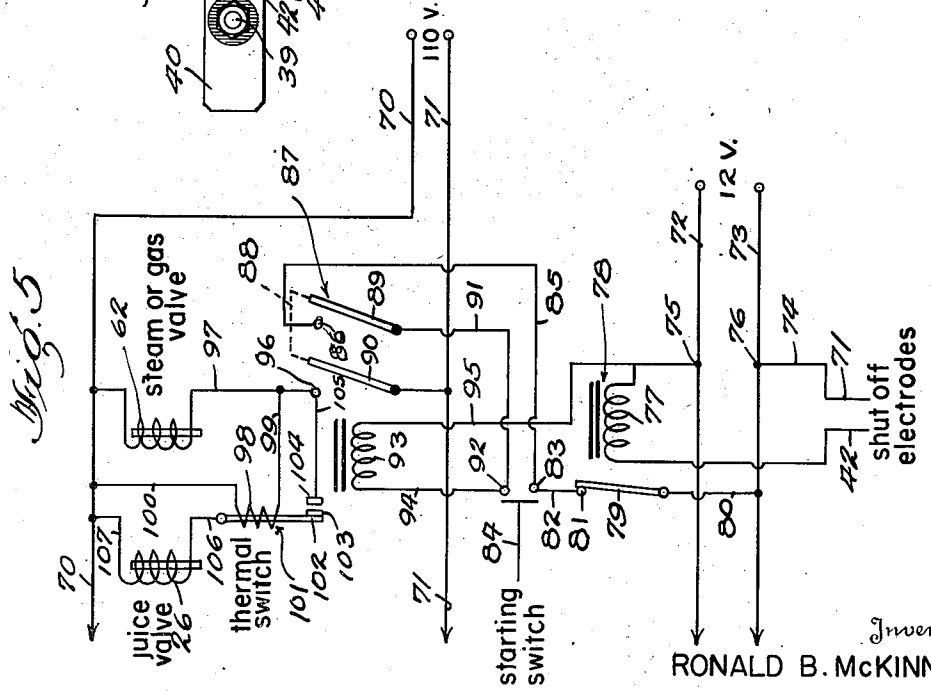


Fig. 5



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CONTROL FOR BOTTOM FILLING OF CONTAINERS

Ronald B. McKinnis, Winter Haven, Fla., assignor, by mesne assignments, to Ronald B. McKinnis, doing business as McKinnis Foods, Winter Haven, Fla.

Application April 28, 1941, Serial No. 390,815

10 Claims. (Cl. 226—127)

The present invention relates in general to apparatus for filling containers with liquid and more specifically to an apparatus for filling containers with liquids that are subject to oxidation, such as, the juices of citrus fruits wherein the liquids are maintained out of contact with the atmosphere. Of course, it is to be understood that the apparatus can be employed for filling receptacles with liquids of other types.

It is well known that it is necessary to employ extreme care in filling containers with fruit juices to prevent the oxidation of the juices. The old style mechanisms for filling the containers from the bottom have been complicated in construction and slow in operation.

An object of the present apparatus is to provide a machine whereby the juices may be filled from the bottom of the container which is simple in construction and operation.

Another object of the present invention is to provide apparatus for filling the receptacle or container from the bottom, the container remaining open during filling, but by the employment of inert gas or other suitable fluids to produce a blanketing of the surface of the liquid during the filling operation, oxidation of the juices is prevented.

Still another object of this invention is to provide apparatus for filling cans in which the filling operation is so controlled that the opened receptacle is subjected to a blast of inert gas to force out of the same the atmospheric air and after a predetermined period of time, the blast of blanketing fluid is followed by the introduction of a stream of the juice, the stream being surrounded in a tube of mobile inert gas or steam.

In addition to the objects hereinabove mentioned, I provide a mechanism which will fill the containers to the desired level whereby the top edge of the container becomes a gauge, so to speak, by which the quantity of liquid permitted to flow into the container can be determined, thereby permitting a constant head space to be afforded in all containers regardless of variations in the container sizes.

With these and other objects in view, which may be incident to my improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising my invention may be varied in construction, proportions and arrangements, without departing from the spirit and scope of the appended claims.

In order to make my invention more clearly understood, I have shown in the accompanying drawings means for carrying the same into practical effect without limiting the improvements in their useful applications to the particular constructions which, for the purpose of explanation, have been made the subject of illustration.

In the drawings:

Figure 1 is a transverse sectional view of my filling apparatus showing the liquid and blanketing valves.

Figure 2 is a sectional view taken along the line 2—2 of Figure 1, looking in the direction of the arrows.

Figure 3 is a sectional view taken along the line 3—3 of Figure 1, looking in the direction of the arrows.

Figure 4 is a sectional view taken along the line 4—4 of Figure 1, looking in the direction of the arrows.

Figure 5 is a diagrammatic representation of the control system for actuating the filling operation.

Referring to the drawings, and more particularly to Figures 1 and 2, I have shown a valve mechanism indicated generally 1 for controlling the citrus juices or other liquids that are adapted to be filled into the containers, one of which is designated by the numeral 2. A second valve mechanism designated generally 3 is provided to control the flow of a blanketing fluid such as steam or inert gas that is adapted to blanket or surround the juice during the filling operation. As best shown in Figure 2, the valve 1 is provided with a body portion 4 formed with a lateral extension 5 having an axial bore through which the juice is adapted to be fed to a central chamber 6 of the valve body. Secured to the extremity of the extension 5 by a threaded flange cap or coupling 7 is a juice conduit 8 which is in communication with a source of juice supply (not indicated). As shown in Figure 2, the extension 5 is provided with a threaded portion 5a which is received in a bracket 1a supported on the filling machine. A nut 5b is mounted on the portion 5a and cooperates with a shoulder against which the bracket abuts to grip the bracket 1a.

A threaded opening 9 diametrically opposed to the inner end of the extension 5 is provided in the valve body 4 to enable the interior of the valve to be cleaned, etc., and a threaded plug 10 normally closes this opening.

Secured to the upper face of the valve body 4 by screws or the like 11 is a hollow sleeve 12. A peripherally threaded flange 13 is carried by

the upper end of the sleeve 12 as an integral part thereof. A cover member or solenoid housing 14 is adapted to be threaded onto the flange 13. Interposed between the upper face of the valve body and the hollow sleeve 12 is a neoprene diaphragm 15. Attached to the diaphragm 15 is a valve stem 16 which extends through a tube 17 secured at its upper end in a threaded aperture 18 formed in the lower portion of the valve body. As clearly shown in Figure 1, the tube 17 extends to a point adjacent to the bottom of the container 2 and the lower end of the stem 16 carries a disc valve 19 of any suitable construction which closes the lower open end of the tube. Valve disc 14 is secured by screw 19a to the lower end of stem 16.

Attached to the upper end of the stem 16, as shown at 20, is a solenoid connecting rod 21 which extends through a peripherally threaded guide 22 threadedly mounted in the sleeve 12 which is internally threaded for this purpose as shown. The upper end of the rod 21 is secured to an armature 23 of a solenoid device indicated generally by reference character 24. The armature slides in a barrel 25 which is carried by the upper end of sleeve 12 within the casing 14. The solenoid 24 is of course provided with a conventional solenoid winding 26 which is adapted upon being energized to lower the armature 23, and consequently lower the solenoid connecting rod 21 and the stem 16 to open the valve 19. A helical coil spring 27 surrounds the rod 21 and one end thereof bears against a collar 28 fixed on rod 21 and the other end bears against the rod guide 22. It will be appreciated that the spring 27 normally holds the stem 16 in the position shown in Figure 1, or in other words, maintains the valve 19 in its closed position.

Sleeve 12 is provided with an elongated slot 29 wherein is mounted for vertical movement a stop 30 formed with an adjusting and setting head 31. Obviously, by varying the position of the stop 30 in the slot 29 the amount of movement of the collar 28 can be regulated, thus limiting the amount of the opening of the valve 19. In connection with the neoprene diaphragm it might be mentioned that this member will prevent any liquid in the valve body 4 from coming into contact with the solenoid and its various operating parts.

Attached to the valve body 4 is a bracket 33 which carries a hub 34. A vertical rod 35 is mounted in the hub 34 for vertical movement and is formed with an axially extending groove or slot 36. A screw 37 has a reduced end engaging in the slot 36, and thus prevents the rod 35 from turning in the hub 34. An adjustable collar 38 is also provided on the rod 35 for limiting its downward movement. Secured to the lower end of the rod 35, as shown at 39, is an insulating block 40. An internally threaded metal sleeve 41 is fitted into an aperture formed in the block 40 and an electrode 42 provided with a knurled head 42a is fitted into the sleeve. The body of the electrode is provided with screw threads which enable the tip of the electrode to adjustably extend below the lower surface of the insulating block 40 to a desired distance.

It can be seen from Figure 1 that when the block 40 is in its lowermost position, it rests on the rim of the container 2 and that the tip of the electrode projects into the interior of the container to the exact level to which it is desired to fill the container.

The tube 17 surrounding the valve stem 16 functions as the other electrode cooperating with electrode 42 to complete an electrical circuit through the juice. The complete electrical circuit controlling the operation of the valves will later be more fully described.

The valve 3 which controls the flow of the steam or inert gas for blanketing the juice in the container is provided with a body portion 45 having a central aperture or chamber 46. A threaded nipple 47 providing communication with chamber 46 is integrally formed on the lower portion of the body 45 and is attached to a conduit or pipe 49 by a threaded coupling 48. The opposite end of the conduit 49 is connected by a coupling 51 to a threaded nipple 50 communicating with the interior of a chamber or nozzle 50a threadedly mounted on a boss 4a on the lower end of body 4.

Suitably fixed to the upper surface of the body 45 is a hollow sleeve 52 which is formed at its upper end with an annular flange 53 having a peripherally threaded surface onto which is screwed a solenoid housing 54. Between the sleeve 52 and the valve body 45 is disposed a neoprene diaphragm 55 through which extends a valve stem 56. The valve stem has at its lower end a conical valve body 57 which is adapted to engage a seat 58 formed in the lower part of chamber 46.

The upper end of the valve stem 56 is suitably secured to an armature 59 which slides in a barrel 60 of a solenoid construction indicated generally by reference character 61. The solenoid 61, of course, is housed within the member 54 and is provided with a conventional winding 62. The armature 59 is maintained normally in the position shown in Figure 1 (its down position) by means of a helical spring 63 which is disposed between the upper end of the armature and the top of the housing 54. An adjusting screw 64 extends through the housing 54 and through the helical spring to provide the upper limit of movement of the armature 59, the position of which can be varied.

In general, first I subject the apparatus to a purging step wherein steam or inert gas, such as carbon dioxide, nitrogen or a mixture thereof, is discharged in a blanket through the conduit 49 into the chamber or nozzle 50a and through the aperture formed in the bottom thereof into the container 2 by which the container is purged of atmospheric air. After this purging step, the juice is discharged through the conduit 8 into the valve chamber through the tube 17 past the valve 19 and into the bottom of the container.

In Figure 5 of the drawings, there are shown two electrical conductors 70 and 71 which are connected for instance to 110 volt mains and two conductors 72 and 73 which are supplied by a current of reduced voltage, for instance of approximately twelve volts. The electrodes consisting of the tube 17 and the vertically adjustable electrode 42 are included in a circuit 74 which is adapted to be closed or completed when the surface of the juice or liquid in the can 2 rises to the desired level. Circuit 74 is connected at 75 to conductor 72 and at 76 to conductor 73 of the low voltage supply line so as to impress a potential of approximately twelve volts thereon.

Circuit 74 includes a coil 77 of a shut-off relay 78, which comprises an armature 79 adapted normally to be in the position shown in Figure 5; i. e., in a closed position. One end of armature

79 which serves as a switch arm is connected by conductor 80 to wire 73, and the other end is adapted to engage a contact 81 which is connected by wire 82 to a contact 83 of starting switch 84. Contact 83 is also connected by conductor 85 to a contact 86 of a valve relay 87.

The valve relay 87 is normally opened as indicated in Figure 5 and comprises a double arm switch 88 consisting of a maintain arm 89 and an energizing circuit arm 90. A conductor 91 connects the maintain arm 89 to the other contact 92 of the starting switch 84.

An energizing coil 93 of the valve relay 87 has one of its ends connected by wire 94 to the contact 92 and the other end of said coil 93 is connected by a wire 95 to the wire 72 at the point 76. Coil 93 serves as the energizing means for moving an armature for actuating the double arm switch 88.

As illustrated in Figure 5, the relay 87 is provided with a contact 96 adapted to be engaged by the switch arm 90 when the latter is in its closed position. In this connection it will be noted that the switch arm 90 is connected to the main line conductor 71. Said contact 96 of the relay 87 is connected by conductor 97 to one end of the winding 62 of the solenoid 3, the other end of said winding being connected to one of the main line conductors 70.

A thermal switch winding 98 is connected at one end by a conductor 99 to said conductor 97 and at its other end by a wire 100 to said main line conductor 70. The thermal switch 101 is provided with a movable thermal element 102 which upon being heated by the winding 98 is adapted to move its contact 103 into engagement with a contact 104 which is connected to the aforesaid contact 96 by means of a lead 105. The other end of the switch arm 102 of the thermal switch is connected by a conductor 106 to the winding 26 of the solenoid 14, and the other end of said solenoid winding is connected by a wire 107 to said main line conductor 70.

In operation, the receptacle or can 2 is placed underneath the valve assembly, in a position as indicated in Figure 1 of the drawings with the electrode 42 extending downwardly into the can to a level to which it is desired to fill the can with liquid. The starting switch 84 is then actuated which closes the circuit between contacts 83 and 92. This causes the current to flow from conductor 72 of the low potential main through conductor 95, coil 93, conductor 94, switch 84, conductor 82, switch arm 79 and wire 80 to the conductor 73 of said low potential main. This flow of current energizes the coil 93 causing the double arm switch 88 to shift to bring the arms 89 and 90 into engagement with the contacts 86 and 96 respectively. The closing of switch arm 89 completes a circuit from contact 83 of the starting switch through wire 85, contact 86, switch arm 89 and conductor 91 to contact 92. Upon the completion of this circuit, the starting switch 84 may be released, and the coil 93 will remain energized to maintain the switch arms 89 and 90 in engagement with their contacts.

Upon engagement of the switch arm 90 with the contact 96, a circuit is completed from main line conductor 70 through the winding 62 of the the steam or gas valve control solenoid and through conductor 97 to contact 96 and from the latter through arm 90 to the other conductor 71 of the main line. Upon completion of this circuit and energizing the winding 62, the steam or inert gas valve 57 is opened against the action of the spring 63, and steam or inert gas is discharged through pipe 49 into the chamber 50*a* and downwardly through the opening 50*b* in the lower face of said chamber into the container or can 2 positioned beneath the same.

While the steam or inert gas is flowing into the container or can, the winding 98 of the thermal switch 101 becomes heated by completion of the circuit from conductor 70, through wire 100, winding 98 and wires 99 and 97 to contact 96 and thence through arm 90 to main line conductor 71. The heating effect of winding 98 causes the thermal arm 102 to become heated and to warp, thereby bringing its contact 103 into engagement with contact 104. This completes a circuit from main line conductor 70 through wire 107, solenoid coil 26, wire 106, arm 102, contacts 103, 104, wire 105, contact 96 and thence through arm 90 to main line conductor 71. Thus, after a predetermined time sufficient to enable the container 2 to be filled and purged with steam or inert gas, a circuit is completed through the winding 26 of the solenoid of valve 1. Upon energizing the winding controlling the valve 1, said valve is displaced downwardly causing the rod 16 to move the valve body 19 away from the lower end of the tube 17 to permit the flow of juice or other liquid into the can in the bottom thereof.

As the juice or other liquid enters the can 2 at the bottom thereof, it forces the blanket of steam or inert gas upwardly and out through the open upper end of said can as the level of the liquid deposited in the bottom of the can rises.

The inert gas or steam lies in the form of a blanket on top of the rising liquid in the container and prevents access of air or oxygen to the juice. There will be a considerable quantity of steam or inert gas which will find its way into bubbles beneath the surface of the juice, but since this material is entirely non-oxidizing, no deleterious effects will be obtained. In fact, the foam on the surface of the juice as it rises in the container also tends to blanket the main body of the juice in the container against oxidation effects of the atmosphere.

As the surface of the juice rises, it eventually reaches the contact point of the electrode 42, and when this level is reached, a circuit is completed between the tube 17 and the electrode 42. Referring to Figure 5 of the drawings, it will be noted that when a connection is made by the liquid between the electrodes 17 and 42, a circuit is completed from point 75 on the low potential conductor 72 through the winding 77 of the shut-off relay 78 and thence through conductor 108 to electrode 42, through the liquid to electrode 17 and thence through conductor 74 to point 76 on the low potential conductor 73. Completion of this circuit energizes the winding 77 causing the armature 79 to be displaced to remove the same from engagement with contact 81. This breaks the circuit extending from low potential conductor 73 through the winding 93 of the relay 87, permitting the double arm switch 88 to be moved by a suitable spring (not shown) away from the contacts 86 and 96, thus breaking the circuit between the conductors 70 and 71 of the main line through the solenoid windings 26 and 62 and permitting the valves 19 and 57 to be moved onto their seats by the springs 27 and 63 respectively, thereby shutting off the flow of both the juice and the steam or other inert blanketing gas.

It will be noted that the insulating block 40 carrying the electrode 42 rides on the upper rim of the container 2 during filling of the latter with the liquid. This ensures that the liquid will be filled to a constant level with respect to the upper rim of the can, which level can be varied by adjusting the position of electrode 42 in the threaded sleeve or bushing 41.

It will be realized that the apparatus of the present invention enables a container to be thoroughly purged of oxidizing atmosphere by the introduction of a non-oxidized liquid into the can, filling them from the bottom upward. The apparatus disclosed herein is much simpler and more effective than heretofore employed and considerably reduces the expense of the filling operation.

I desire that my invention be limited only by the showing of the prior art and the scope of the appended claims.

I claim:

1. An apparatus for filling open top containers with an oxidizable liquid comprising a nozzle positioned above a container to be filled for discharging a stream of inert gas down through the open top of the container to form a blanket in the container, a tube extending down through said nozzle and through the open top of the container to a point adjacent the bottom thereof for introducing said liquid into the bottom of the container beneath the blanket of inert gas, valves controlling the flow of inert gas through the nozzle and liquid through the tube, means for opening the liquid control valve after opening of the inert gas control valve, an electrode extending down into said container, and means including an electric circuit completed by the liquid engaging said tube and electrode for closing said valves.

2. An apparatus for filling open top containers with an oxidizable liquid comprising a nozzle positioned above a container to be filled for discharging a stream of inert gas down through the open top of the container to form a blanket in the container, a tube extending down through said nozzle and through the open top of the container to a point adjacent the bottom thereof for introducing said liquid into the bottom of the container beneath the blanket of inert gas, valves controlling the flow of inert gas through the nozzle and liquid through the tube, resilient means urging said valves to a closed position, electromagnetic means for opening said valves, an electrode extending down into said container, and means including an electric circuit completed by the liquid engaging said tube and electrode for closing said valves.

3. An apparatus for filling open top containers with an oxidizable liquid comprising a nozzle positioned above a container to be filled for discharging a stream of inert gas down through the open top of the container to form a blanket in the container, a tube extending down through said nozzle and through the open top of the container to a point adjacent the bottom thereof for introducing said liquid into the bottom of the container beneath the blanket of inert gas, valves controlling the flow of inert gas through the nozzle and liquid through the tube, resilient means urging said valves to a closed position, electromagnetic means for opening the inert gas valve and electromagnetic means including a time delay contactor for opening the liquid valve at a time interval after the opening of the inert gas valve, an electrode extending down into said container, and means including an electric circuit completed by the liquid engaging said tube and electrode for closing said valves.

4. An apparatus for filling open top containers with an oxidizable liquid comprising a nozzle positioned above a container to be filled for discharging a stream of inert gas down through the open top of the container to form a blanket in the container, a tube extending down through said nozzle and through the open top of the container to a point adjacent the bottom thereof for introducing said liquid into the bottom of the container beneath the blanket of inert gas, valves controlling the flow of inert gas through the nozzle and liquid through the tube, resilient means urging said valves to a closed position, a solenoid for opening the inert gas valve, a solenoid for opening the liquid valve, a starting switch for energizing the solenoid for the inert gas valve, a thermal switch for energizing the solenoid for the liquid valve after the starting switch has been closed a predetermined time, an electrode extending down into said container, and means including an electric circuit completed by the liquid engaging said tube and electrode for closing said valves.

5. An apparatus for filling open top containers with an oxidizable liquid comprising a nozzle positioned above a container to be filled for discharging a stream of inert gas down through the open top of the container to form a blanket in the container, a tube extending down through said nozzle and through the open top of the container to a point adjacent the bottom thereof for introducing said liquid into the bottom of the container beneath the blanket of inert gas, valves controlling the flow of inert gas through the nozzle and liquid through the tube, resilient means urging said valves to a closed position, a solenoid for opening the inert gas valve, a solenoid for opening the liquid valve, a starting switch for energizing the solenoid for the inert gas valve, timing means for energizing the solenoid for the liquid valve a predetermined interval of time after the closing of the starting switch, an electrode extending down into said container, and means including an electric circuit completed by the liquid engaging said tube and electrode for closing said valves.

6. An apparatus for filling open top containers with an oxidizable liquid comprising a nozzle positioned above a container to be filled for discharging a stream of inert gas down through the open top of the container to form a blanket in the container, a tube extending down through said nozzle and through the open top of the container to a point adjacent the bottom thereof for introducing said liquid into the bottom of the container beneath the blanket of inert gas, valves controlling the flow of inert gas through the nozzle and liquid through the tube, resilient means urging said valves to a closed position, a solenoid for opening the inert gas valve, a solenoid for opening the liquid valve, a starting switch for energizing the solenoid for the inert gas valve, a timing means for energizing the solenoid for the liquid valve a predetermined interval of time after the closing of the starting switch, a shut-off electrode adapted to have the circuit closed between it and the tube by the surface of the liquid in the container, and means operated by the closing of the circuit through the shut-off electrodes to de-energize both solenoids.

7. An apparatus for filling open top containers

with an oxidizable liquid comprising a nozzle positioned above a container to be filled for discharging a stream of inert gas down through the open top of the container to form a blanket in the container, a tube extending down through said nozzle and through the open top of the container to a point adjacent the bottom thereof for introducing said liquid into the bottom of the container beneath the blanket of inert gas, valves controlling the flow of inert gas through the nozzle and liquid through the tube, resilient means urging said valves to a closed position, a solenoid for opening the inert gas valve, a solenoid for opening the liquid valve, a starting switch for energizing the solenoid for the inert gas valve, a thermal switch for energizing the solenoid for the liquid valve after the starting switch has been closed a predetermined time, a shut-off electrode adapted to have the circuit closed between it and the tube by the surface of the liquid in the container, and means operated by the closing of the circuit through the shut-off electrodes to de-energize both solenoids.

8. An apparatus for filling open top containers with an oxidizable liquid comprising a nozzle positioned above a container to be filled for discharging a stream of inert gas down through the open top of the container to form a blanket in the container, a tube extending down through said nozzle and through the open top of the container to a point adjacent the bottom thereof for introducing said liquid into the bottom of the container beneath the blanket of inert gas, valves controlling the flow of inert gas through the nozzle and liquid through the tube, resilient means urging said valves to a closed position, a solenoid for opening the inert gas valve, a solenoid for opening the liquid valve, a starting switch for energizing the solenoid for the inert gas valve, a timing means for energizing the solenoid for the liquid valve a predetermined interval of time after the closing of the starting switch, a shut-off electrode adapted to have the circuit closed between it and the tube by the surface of the liquid in the container, and a shut-off relay normally closed which is opened by the closing of the circuit through the shut-off electrodes to de-energize both solenoids.

9. An apparatus for filling open top containers with an oxidizable liquid comprising a nozzle positioned above a container to be filled for discharging a stream of inert gas down through the open top of the container to form a blanket in the container, a tube extending down through said nozzle and through the open top of the container to a point adjacent the bottom thereof for introducing said liquid into the bottom of the container beneath the blanket of inert gas, valves controlling the flow of inert gas through the nozzle and liquid through the tube, resilient means urging said valves to a closed position, a solenoid for opening the inert gas valve, a solenoid for opening the liquid valve, a starting switch for energizing the solenoid for the inert gas valve, a thermal switch for energizing the solenoid for the liquid valve after the starting switch has been closed a predetermined time, a shut-off electrode adapted to have the circuit closed between it and the tube by the surface of the liquid in the container, and a shut-off relay normally closed which is opened by the closing of the circuit through the shut-off electrodes to de-energize both solenoids.

10. An apparatus for filling open top containers with an oxidizable liquid comprising a nozzle positioned above a container to be filled for discharging a stream of inert gas down through the open top of the container to form a blanket in the container, a tube extending down through the nozzle and through the open top of the container to a point adjacent the bottom thereof for introducing the liquid into the bottom of the container beneath the blanket of inert gas, valves to control the flow of inert gas through the nozzle and liquid through the tube, resilient means normally maintaining said valves closed, means to open the liquid valve after opening of the inert gas valve, an electrode extending down into the container, and further means including an electric circuit completed by the liquid engaging the tube and electrode to close the valves.

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