

June 17, 1958

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VALVE FOR LIQUID FILLING APPARATUS

Filed Oct. 15, 1956

3 Sheets-Sheet 1

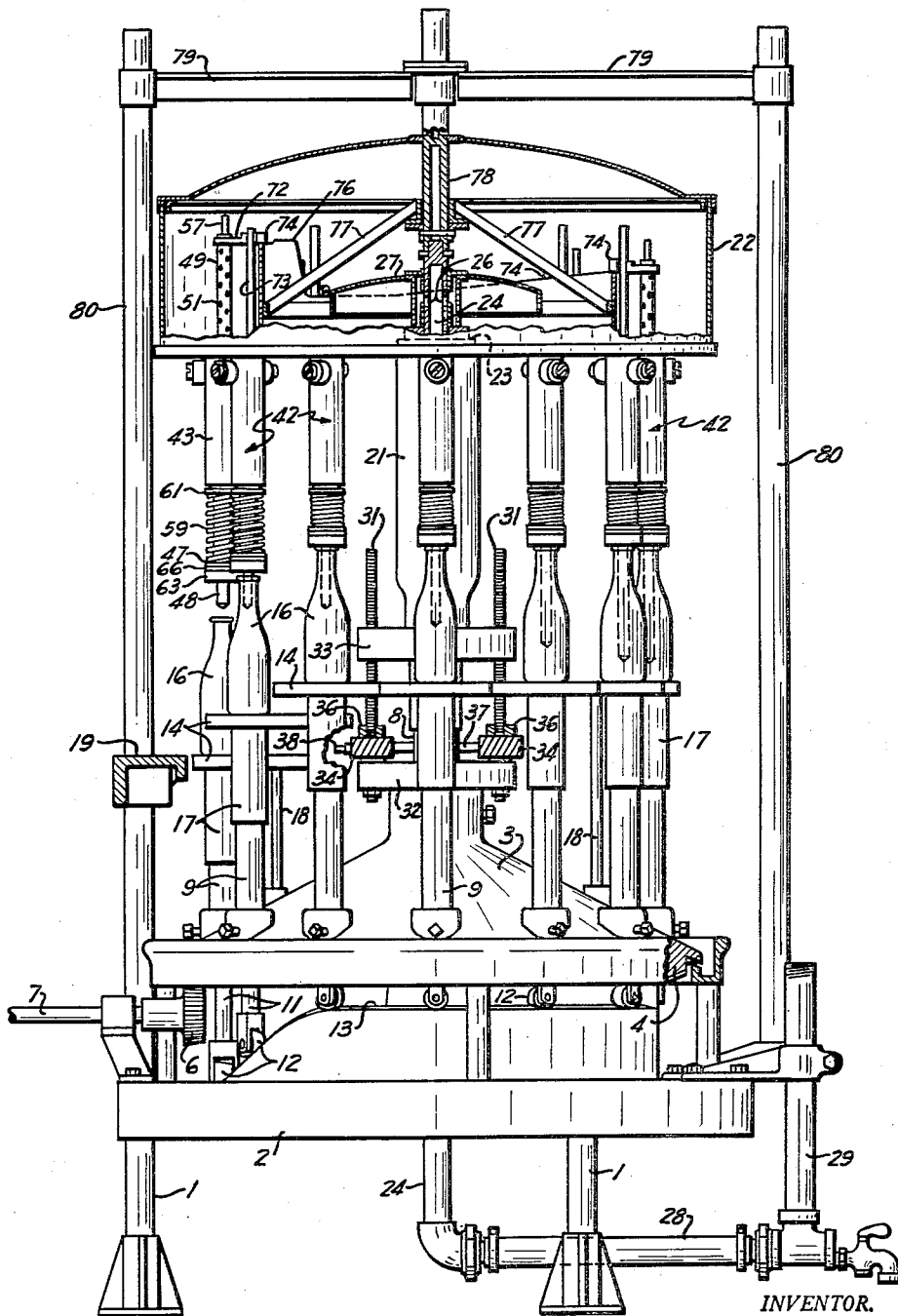


Fig. 1

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3 Sheets-Sheet 2

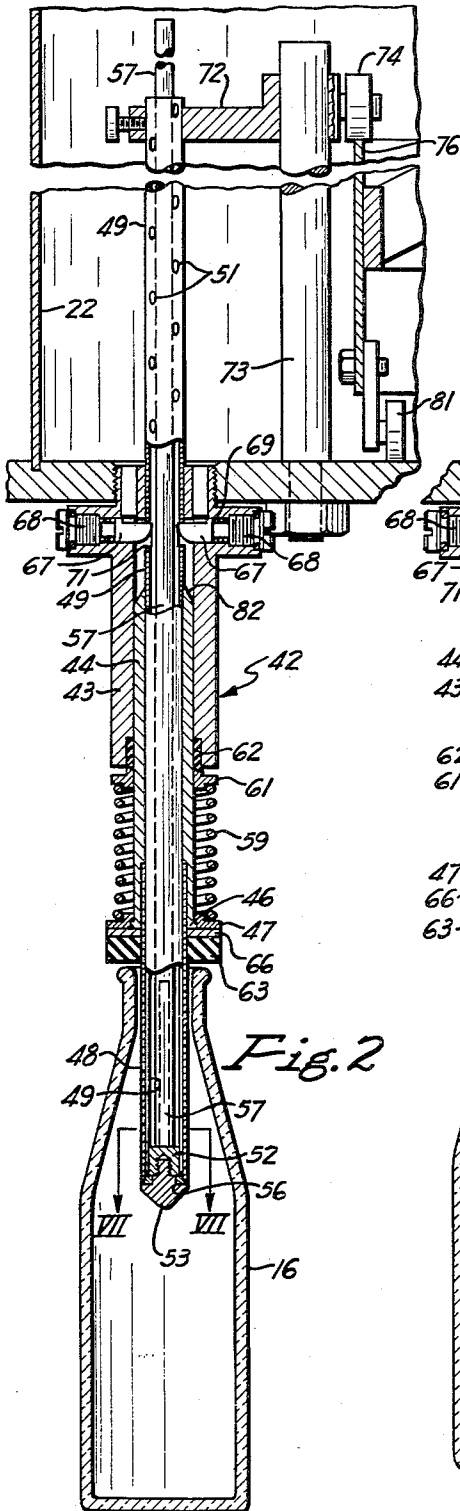


Fig. 2

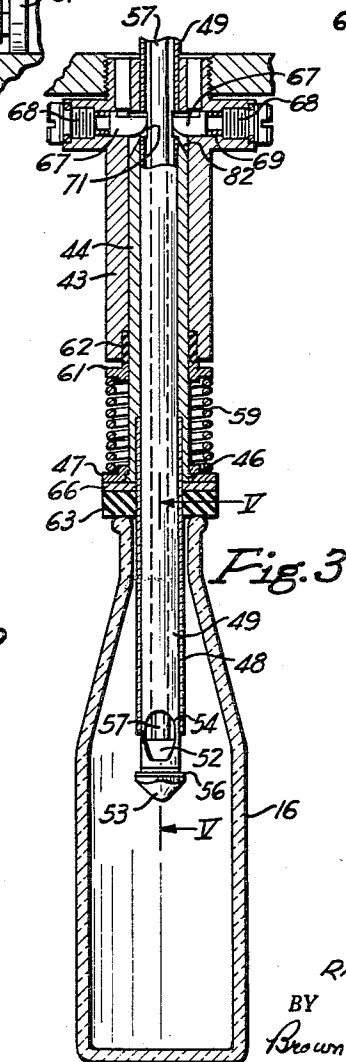


Fig. 3

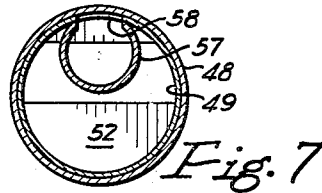


Fig. 7

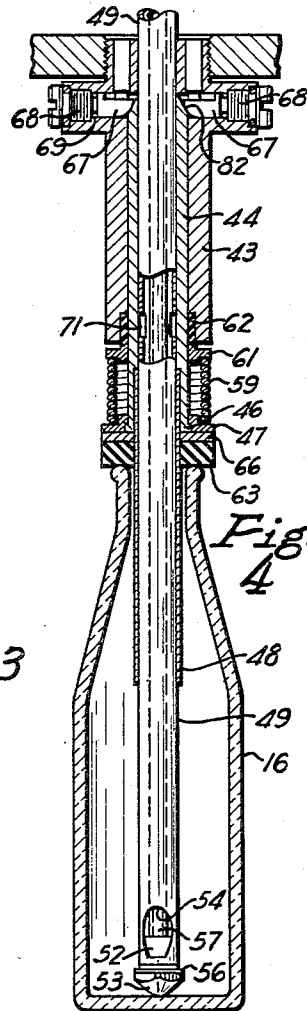


Fig. 4

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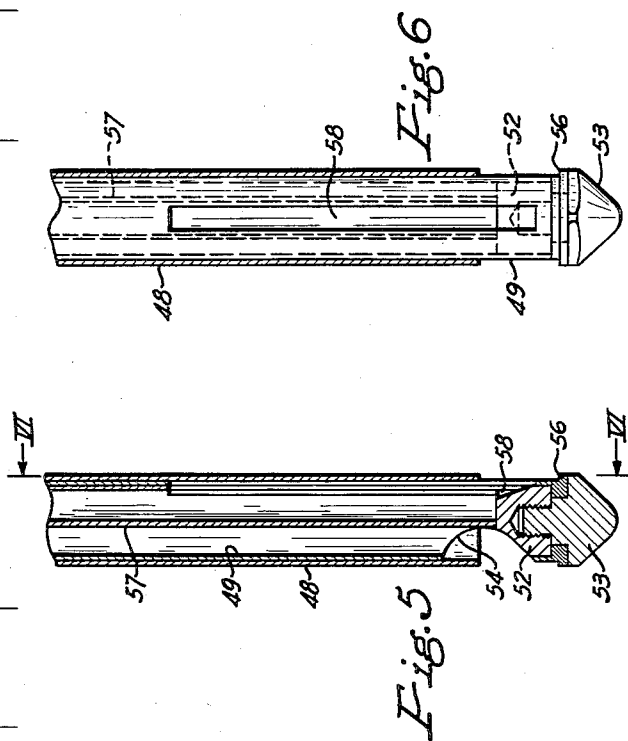
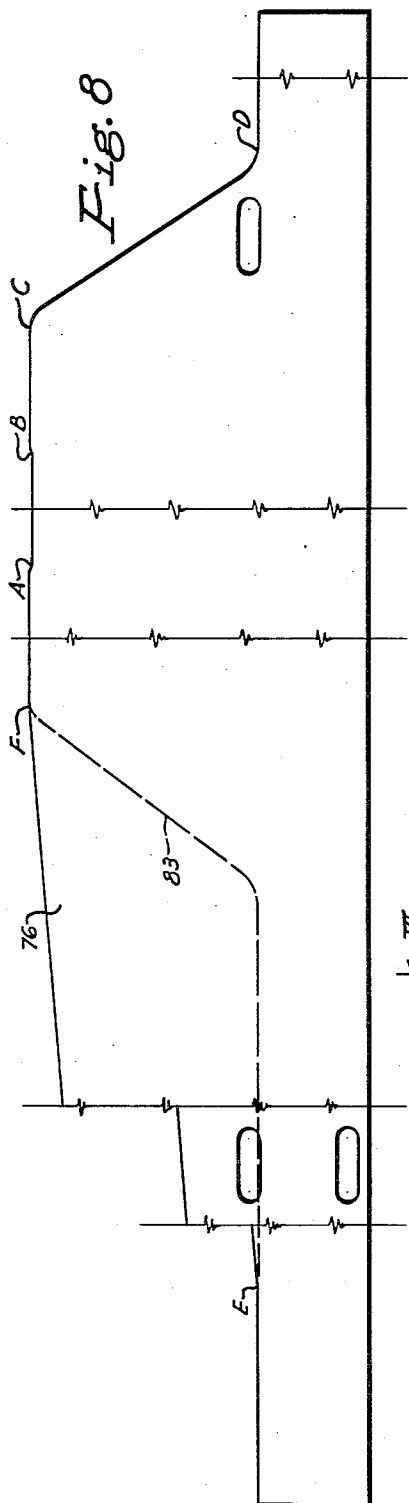
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3 Sheets-Sheet 3



1

2,839,094

VALVE FOR LIQUID FILLING APPARATUS

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20 Claims. (Cl. 141—84)

This invention relates to apparatus for filling containers with a liquid and, more particularly, to a multi-purpose valve for use in such machines, to provide means either for top filling, bottom filling, or for under surface filling of the containers.

In a well-known type of container filling machine, a continuously rotating tank is provided with downwardly extending valves which are normally closed. Empty containers are continuously carried through the machine, during which they are lifted so as to receive the valves and open them. Each valve is provided near its lower end with an outlet for liquid from the tank and with a vent port for venting air from the container being filled. These openings normally are closed by a sleeve and are opened when the sleeve is raised by a container pushing upward against a sealing washer that is mounted on the sleeve. In the usual filling operation, known as top filling, the valve projects within the container a predetermined distance so that the liquid in the container will reach the lower end of the valve sleeve when the container has been filled to the proper level and thereby cut off escape of air from the container to prevent further filling. With certain liquids, however, the agitation that is incident to top filling is undesirable and resort is had to what is known as bottom filling, in which the filling valve extends to the bottom of the container. With bottom filling valves, the liquid does not splash onto the bottom of the container or on the surface of liquid already in the container and thereby avoids much of the agitation that is inevitable with top filling.

For certain liquids, however, even bottom filling produces greater agitation than is desired. Agitation can be further reduced by using a modified form of bottom filling, herein referred to as under surface filling, in which the filling operation begins as in bottom filling with the liquid outlet at the bottom of the container and, as filling progresses, the liquid outlet is continuously raised so as to remain a predetermined distance below the rising level of liquid in the container until the filling operation is completed. Such a method of filling not only reduces agitation of the liquid mass to a minimum, but also permits the filling valve to return to its top position at the same time, or shortly before, the container is filled.

It is accordingly among the objects of this invention to provide apparatus for filling containers, in which the filling valves may be used, at the discretion of the operator, either for top filling, bottom filling, or under surface filling, in which the last mentioned filling operation begins at or adjacent to the bottom of the container and as filling progresses the liquid outlet of the filling valve rises at substantially the same rate as the liquid level in the container to decrease agitation of the filling liquid, and in which the change from any one to another of these three filling operations can be easily made.

Other objects and advantages of the present invention will be apparent from the following description of its

2

preferred embodiment, as illustrated in the accompanying drawings, in which:

Fig. 1 is a side elevation, partly in section, of the filling apparatus;

Fig. 2 is an enlarged vertical section through one of the filling valves in its closed position;

Fig. 3 is a similar section through an open valve in top filling position;

Fig. 4 is a similar section through an open valve at the beginning of the bottom or under surface filling operation;

Fig. 5 is an enlarged vertical section of the lower end of the filling valve on the line V—V of Fig. 3, showing the air vent and liquid outlet;

Fig. 6 is an enlarged side elevation of the filling valve of Fig. 5;

Fig. 7 is an enlarged horizontal section taken on the line VII—VII of Fig. 2; and

Fig. 8 is a plane development of the cam track controlling the elevation of the valve in under-surface filling operations.

Referring to Fig. 1 of the drawings, legs 1 support a base 2, on which is supported and rotatably mounted a conical hood or carrier 3, the outer edge of which is provided with an integral ring gear 4 meshing with a pinion 6 on a horizontal drive shaft 7. The carrier is rotated continuously and drives a hollow center shaft 8. This carrier is provided just inside the ring gear with a plurality of circumferentially spaced vertical openings, in each of which a sleeve 9 is rigidly mounted. Slidably mounted in each sleeve is a push rod 11, which is supported by a tapered roller 12, traveling on a circular cam track 13 mounted on the base. The lowest part of the track is at the front of the machine (at the left of Fig. 1), the rest of the track being high. Each push rod supports a rest 14 for a container, such as a bottle 16, that is to be filled with a liquid. Fastened to the bottom of the rest 14 is another sleeve 17 that telescopes over the lower sleeve 9. The container rest is prevented from turning relative to carrier 3 by means of a slide rod 18 extending from the inner end of the rest down through an opening in the carrier. The two front legs of the machine project above the base and support a narrow table 19 at the same level as the container rests at that point. As the carrier moves the rests around the center shaft 8, containers are slid from the table onto the rests at the front of the machine by well-known means (not shown), and then the cam track 13 raises the rests to a higher level at which the rests remain during the filling operation and are lowered to the level of table 19 at the end of the cycle.

Splined on the center shaft 8 above carrier 3 is a tubular flange 21, which supports a tank 22 for the liquid used in filling the containers. The bottom of the tank is horizontal and is provided with a central opening and a packing gland 23, through which extends a liquid supply pipe 24. The upper part of the pipe in the tank is provided with outlet openings 26, which are adapted to be closed by a float valve 27 when the liquid in the tank rises to a predetermined level. The float valve is slidably mounted on the pipe 24. The supply pipe 24 extends downward through the tubular flange 21 and the hollow center shaft 8, and has its lower end connected by pipes 28 and 29 to a suitable source of liquid (not shown) with which the tank is kept filled.

The tank flange 21 is supported at the desired height on the center shaft 8 by two vertical screws 31. The lower ends of these screws are rotatably supported in a collar 32, mounted on top of carrier 3; and the upper ends of the screws are threadably received in a second collar 33, mounted on the tank flange. Helical pinions 34 are rig-

3

idly mounted on each screw directly above the lower collar. Each of those pinions meshes with a corresponding helical pinion 36 on a stub shaft 37, which is rotatably supported by bearings (not shown) on the lower collar. The projecting end 38 of the stub shaft is squared to receive a crank (not shown) for rotating the screws to move the tank up or down relative to carrier 3.

The bottom of the tank is provided with a plurality of circumferentially spaced outlet openings, each of which is in axial alignment with one of the carrier push rods 11 below it. Extending down from each of these tank openings is a filling valve, generally indicated by the numeral 42, one above each container rest. An enlarged section of one of these filling valves is shown in Fig. 2. These valves fill the containers supported beneath them on these rests when the containers are raised by cam track 13 to open the valves. Each valve includes a nozzle 43 that is screwed into a tank outlet. The nozzle slidably receives the upper end of a sleeve 44, which has its lower end projecting beyond the nozzle and terminating in a flange 46 that supports a collar 47. The sleeve 44 is provided with an extension 48, projecting below the collar 47 and secured in a counterbore in the lower end of the sleeve. Slidably received within the sleeve and its extension is a filling tube 49, the upper end of which extends into the tank 22 and is provided with a plurality of openings 51, through which liquid in the tank can enter the inside of the tube. The lower end of the filling tube is closed by a plug member 52, to which is secured a removable tip 53. Just above the plug 52 is located a liquid outlet 54 (see Fig. 5) in the side of the tube. This liquid outlet is normally closed by the sleeve extension 48, the lower end of which seats in sealing engagement against a valve washer 56 supported by the tip 53. A vent tube 57, of considerably smaller diameter than the filling tube 49, is secured to the inner wall of the filling tube opposite the liquid outlet (i. e., secured to the back of the tube wall in Fig. 2, which corresponds to the right side of the wall in Fig. 5 and to the front of the wall in Fig. 6). The upper end of the vent tube extends above the filling tube into the air space over the liquid in the tank. The lower end of the vent tube is provided with a vent port 58, which registers with an opening in the side wall of the filling tube. (See Figs. 5 and 7.)

Normally sleeve 44 and its extension 48 are held in their extended position by a coil spring 59, which is compressed between the collar 47 at the end of the sleeve and a second collar 61 mounted on the end of the nozzle. This latter collar bears against a packing washer 62 mounted on the sleeve 44 inside a recess in the lower end of the nozzle and is compressed therein by the expanding force of the coil spring 59. The spring force against the lower collar 47 also causes the lower end of the sleeve extension 48 normally to press down against the valve seat 56 to close the liquid outlet 54 and the vent port 58. Encircling the sleeve extension 48 below the collar 47 is a sealing washer 63 of compressible material which is adapted to be engaged by the top of the container 16 when the container is raised on its rest 14 by the action of the cam track 13 as carrier 3 revolves. This sealing washer can be spaced from the collar any desired distance by means of removable spacers 66 slidably mounted on the sleeve extension. In Fig. 2, a container is shown positioned below one of the filling valves with the sleeve extension and the filling tube extending into the container and with the top of the container just out of contact with the sealing washer. In this position, the valve outlet and the vent port are closed and no liquid flows from the tank into the container. As carrier 3 continues to revolve, the container is raised by the rest to its maximum height by the cam track 13. This causes the top of the container to press against the sealing washer 63 and push the sleeve upwardly and thereby uncover or open the liquid outlet and the air vent port at the lower end of the filling tube, as shown in Fig. 3. It is to be noted in Fig. 3 that the

4

upper end of the sleeve 44 does not engage locking plungers 67 (whose function is presently to be described). In the position shown by Fig. 3, the filling valve performs the conventional top filling operation and liquid will flow from the tank 22 through openings 51 in the top of the filling tube and down through that tube and the liquid outlet into the container. The filling operation continues while carrier 3 revolves until the liquid level inside the container rises above the upper exposed end of the air vent port 58 to cut off the escape of air from the container. This stops the flow of liquid from the liquid outlet 54. At this point, the rest 14 is lowered by the cam track 13; and, as carrier 3 completes one revolution, the container is disengaged from the filling valve and is removed from the filling apparatus by conventional means not shown.

The use of this apparatus for under-surface filling will now be described. Each filling tube 49 extending up into the tank 22 is supported against downward vertical movement by locking plungers 67, slidably received within laterally extending cylindrical pockets 68 at the top of the nozzle 43, the inner ends of these plungers being urged by coil springs 69 into locking engagement with slots 71 in the sides of the filling tube. Each filling tube is also supported in the tank 22 by a supporting arm 72 secured to the top of the filling tube and extending laterally towards the center of the tank, with its inner end slidably received on a vertical guide post 73. On the end of each arm is mounted a roller 74 that rides on a circular cam track 76. This track is rigidly supported within the tank by braces 77 secured to a stationary tube 78 mounted on the upper end of supply pipe 24, the upper end of the tube being supported by cross members 79 mounted on supports 80. The cam track 76 may be additionally supported by rollers 81, rotatably mounted on the lower edge of the track and resting on the bottom of the tank (see Fig. 2).

A plane development of the cam track 76 is shown in Fig. 8. The upper contoured edge of the track includes a depressed horizontal portion A—B, a slightly raised horizontal portion B—C, a sharply descending incline C—D, a low horizontal portion D—E, a gradually rising inclined portion E—F, and a horizontal portion F—A corresponding in height to the portion B—C. As the carrier 3 revolves, cam track 76 remains stationary inside the tank, while the rollers 74 roll along its contoured upper edge from left to right in Fig. 8 (i. e., in a clockwise direction, looking down from above the apparatus). Initially, when a rest 14 is in its lowest position at the beginning of the filling cycle (see Fig. 1), the roller 74 directly over that rest engages the cam track at about the midpoint of the region A—B, and the filling tube 49 is supported both by the locking plungers 67 and the roller 74 in the position shown in Fig. 2.

In order that the filling valve may operate for under-surface filling, it is necessary that the sleeve 44 be raised sufficiently by the container to unlock the plungers 67 from the filling tube. This can be accomplished either by inserting additional spacers 66 between the collar 47 and the sealing washer 63 for each filling valve, or by slightly lowering the tank 22 by turning the stub shaft 37 to lower all of the filling valves at one time. In either case, the sealing washer 63 will be lowered slightly below the point shown in Fig. 2; and when the container pushes upward against the sealing washer, it will ultimately raise the sleeve 44 to the height shown in Fig. 4 and force the taper 82 at the upper end of the sleeve against the beveled lower edges of locking plungers 67. In the meantime before the sleeve engages the locking plungers, the roller 74 will have traveled to point B on cam track 76 and will have slightly raised the filling tube, so as to lift the top edges of its slots 71 above the top of the plungers to facilitate the withdrawal of the plungers (see Fig. 3). The filling tube will be held in this elevated position until after the tapered end of sleeve 44 has forced the plungers

into their pockets 68 where they no longer engage the slots in the filling tube. The filling tube is now supported vertically by its roller 74 on the track 76. Shortly after the plungers have been forced into their released positions, the roller will have reached the point C on the track, where the track begins its steep decline to the point D. As the roller goes down that declivity, the filling tube slides down within the sleeve 44 and sleeve extension 48 until the roller reaches the point D on the track when the top of the filling tube will be at or adjacent to the bottom of the container, as shown in Fig. 4, with the liquid outlet and the air vent port fully open. Filling of the container will accordingly proceed as a bottom filling operation, with the filling tube in the bottom filling position, until the roller 74 reaches point E on track 76, by which time the liquid level in the container will have risen above the outlet 54. As the roller goes past the point E and progresses up the gradual inclined slope of the track towards point F, the filling tube will be raised vertically within the sleeve, so that the liquid outlet remains just below the rising surface of the liquid in the container. When the roller has reached the point F on the cam track, the filling tube will again be at its maximum height, with its slots 71 opposed to the locking plungers and the upper edges of those slots slightly above the tops of the plungers, the container being finally filled with the tube in that position. As the container drops down with its rest 14 near the end of the filling cycle (due to the action of the cam track 13) sleeve 44 is lowered, and the locking plungers reenter the slots in the filling tube. At the end of the filling cycle, the roller will have passed point A on the track 76 and the filling tube is again supported in the position shown in Fig. 2 by the roller and the locking plungers.

It will be understood that the contour of the cam track in the tank 22 may be made to conform to various rates of filling, depending on the viscosity of the liquid that is to be put into the containers and upon other variables. It will also be understood that the contour of the cam track can be changed from that illustrated in Fig. 8, so that the containers are filled from the bottom. For example, by changing the slope of the incline E—F to correspond to that of C—D (see the broken line 83 on Fig. 8), the filling tube will remain at the bottom of the container during substantially the entire filling cycle.

It is accordingly among the advantages of this invention that the filling valve herein described can be used not only for normal top filling, but also for bottom filling or under-surface filling, the latter being especially desirable in filling containers with certain liquids where it is necessary to reduce turbulence and agitation to a minimum. Where the vertical position of the filling tube during the filling cycle is determined by the engagement of its attached roller with a prefigured cam track in the tank, the vertical movement of the tube can be closely and smoothly controlled, with the tube being returned to its normal raised position at the end of the filling cycle. Of course, when the valve is used in its top filling position, as shown in Fig. 3, the filling tube is held in its raised position by the plungers alone during most of the revolution of the carrier, i. e., when the plungers are in their locking positions, the roller will not engage the cam track except between points F and C, the tube being supported by the plungers alone during the rest of the cycle. A further advantage is that in changing the valves from their top filling position to their bottom or under-surface filling positions, the locking plungers may be released simply by lowering the tank 22 through the adjusting screws provided for that purpose. Moreover, in none of the filling positions will the filling valve be opened unless there is a container on the rest directly below the valve that will raise the sealing washer to open the liquid outlet.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent

its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. In a container filling apparatus having means for raising and lowering a container to be filled and having a liquid containing tank above the container, a filling valve comprising a nozzle secured to the bottom of the tank and extending vertically downward therefrom above the container, a sleeve slidably received within the nozzle, a filling tube slidably received within the sleeve and having its upper end communication with the interior of the tank and having a discharge opening at its lower end, locking means supported by the nozzle for securing the filling tube against downward movement relative to the nozzle, releasing means on the sleeve responsive to the upward movement of the container for releasing the locking means, and lowering means operative after the locking means have been released for lowering the filling tube into the container.

2. In a container filling apparatus having means for raising and lowering a container to be filled and a liquid containing tank above the container, a filling valve comprising a vertically movable filling tube having its upper end in communication with the tank and having a discharge opening in its lower end, locking means for securing the filling tube against downward movement relative to the tank, releasing means responsive to upward movement of the container for releasing the locking means, and lowering means operative after the locking means have been released for lowering the filling tube into the container.

3. In a container filling apparatus having means for raising and lowering a container to be filled and a liquid containing tank above the container, a filling valve comprising a nozzle secured to the bottom of the tank and extending vertically downward therefrom above the container, a vertically movable filling tube inside the nozzle with the upper end of the tube in communication with the interior of the tank and with the lower end of the tube provided with a discharge opening, locking means for securing the filling tube against downward movement relative to the nozzle, releasing means responsive to upward movement of the container for releasing the locking means, and lowering means operative after the locking means have been released to lower the filling tube into the container.

4. Apparatus in accordance with claim 3, in which the locking means includes a movable retaining member supported by the nozzle and engaging the filling tube.

5. Apparatus in accordance with claim 3, in which the locking means includes a movable retaining member supported by the nozzle and engaging the side of the filling tube; and in which the releasing means includes a sleeve slidably received within the nozzle and surrounding the filling tube, a sealing washer on the sleeve adapted to contact the top of the container when the container is raised into filling position, and means on the upper end of the sleeve for disengaging the retaining member from the filling tube when the sleeve is raised a predetermined distance by the container.

6. In a container filling apparatus having means for raising and lowering a container to be filled and a liquid containing tank above the container, a filling valve comprising a nozzle secured to the bottom of the tank and extending vertically downward therefrom above the container, a sleeve slidably received within the nozzle, a filling tube slidably received within the sleeve and having its upper end in communication with the interior of the tank and having a discharge opening at its lower end, a spring-loaded latch supported by the nozzle and normally engaging the side of the filling tube to lock the latter against downward movement relative to the nozzle, a sealing washer mounted on the sleeve for contact with

the top of the container, means on the upper end of the sleeve for disengaging the latch in response to upward movement of a predetermined amount of the sealing washer and cam means operative after the latch has been disengaged for lowering the filling tube inside the container and for subsequently raising the tube to its initial position.

7. Apparatus in accordance with claim 6, in which the cam means includes a cam track, a roller secured to the filling tube and engaging the track to support the tube thereon, and means for effecting relative movement between the roller and cam track.

8. Apparatus in accordance with claim 7, in which the track is located inside the tank and means for rotating the tank relative to the track.

9. In a container filling apparatus having means for raising and lowering a container to be filled and a liquid containing tank above the container, a filling valve comprising a nozzle secured to the bottom of the tank and extending vertically downward therefrom above the container, a sleeve slidably received within the nozzle, a filling tube slidably received within the sleeve and having its upper end in communication with the interior of the tank and having a discharge opening at its lower end, a spring-loaded latch supported by the nozzle and normally engaging the side of the filling tube to lock the latter against downward movement relative to the nozzle, a sealing washer mounted on the sleeve for contact with the top of the container, means on the upper end of the sleeve for disengaging the latch in response to a predetermined upward movement of the sealing washer, and cam means operative after the filling tube has been unlatched for initially lowering the tube inside the container and for subsequently raising the tube, the latching means being adapted to relatch the tube in response to downward movement of the sealing washer after the tube has been raised to its locked position.

10. Apparatus according to claim 9, in which the cam means includes a cam track, a roller mounted on the cam track and fixed to the filling tube, and means for effecting relative rotation between the track and roller.

11. In a container filling apparatus having a vertically movable container rest for raising and lowering a container to be filled, a filling valve comprising a vertically extending sleeve adapted to contact the top of the container and to be moved upwardly by the container, a filling tube slidably received within the sleeve and having a discharge opening at its lower end, locking means for securing the filling tube against downward movement, releasing means responsive to upward movement of the sleeve for releasing the locking means, and lowering means operative after the locking means have been released for lowering the filling tube inside the container.

12. Apparatus in accordance with claim 11, in which the locking means includes a releasable latch engaging the side of the filling tube and the releasing means includes a taper on the upper end of the sleeve adapted to withdraw the latch from its engagement with the filling tube when the sleeve is raised a predetermined distance.

13. Apparatus in accordance with claim 11, in which the lowering means includes a cam track, a roller attached to the upper end of the filling tube and resting on the cam track when the unlocked means have been released, and means for effecting relative movement between the roller and cam track.

14. In a container filling apparatus having means for raising and lowering a container to be filled, a filling valve comprising a vertically movable sleeve adapted to engage the top of the container and to be moved upwardly thereby, a filling tube slidably received within the sleeve and having a discharge opening at its lower end, locking means for securing the filling tube against downward movement, releasing means responsive to a predetermined upward movement of the container for

releasing the locking means, and cam means operatively connected to the filling tube for lowering the filling tube within the container after the locking means have been released so that the discharge opening is adjacent the bottom of the container and as the container is being filled for lifting the filling tube at a rate that will keep the discharge opening below the surface of liquid in the container until the container is filled, the locking means being adapted to relock the filling tube in its initial position in response to downward movement of the container after the filling tube has been raised by the cam means to its initial position.

15. Apparatus in accordance with claim 14, in which the cam means includes a circular cam track, a roller adapted to rest on the contoured surface of the track and rotatably mounted on the filling tube, and means for effecting relative rotation between the roller and cam track.

16. Apparatus in accordance with claim 15, in which the cam track is so contoured that the filling tube is slightly lifted above its normal locked position by the roller and supported solely thereby just before the locking means are released from the tube and just before they are reengaged with the tube.

17. In a container filling apparatus having means for raising and lowering a container to be filled and a liquid containing tank above the container, a filling valve comprising a vertically movable filling tube having its upper end in communication with the tank and having a discharge opening in its lower end, valve means normally closing the discharge opening, means responsive to upward movement of the container to a predetermined elevation for opening the valve means for top filling of the container, locking means for securing the filling tube against downward movement, releasing means responsive to an additional upward movement of the container above said predetermined elevation for releasing the locking means, and lowering means operative after the locking means have been released and after the container has reached its highest point for lowering the filling tube into the container for bottom and under-surface filling of the container.

18. In a container filling apparatus having means for raising and lowering a container to be filled and a liquid containing tank above the container, a filling valve comprising a nozzle secured to the bottom of the tank and extending vertically downward therefrom above the container, a sleeve slidably received within the nozzle, a filling tube slidably received within the sleeve and having its upper end in communication with the interior of the tank and having a discharge opening at its lower end, locking means for normally securing the filling tube against downward movement relative to the nozzle, valve means for normally closing the discharge opening in the filling tube, the valve means being opened in response to upward movement of the container to a predetermined elevation for top filling of the container, releasing means on the sleeve responsive to further upward movement of the container for releasing the locking means, and lowering means operative after the locking means have been released for lowering the filling tube into the container for bottom and under-surface filling of the container.

19. Apparatus in accordance with claim 18, in which the locking means includes a movable retaining member supported by the nozzle and engaging the filling tube.

20. Apparatus in accordance with claim 18, in which the locking means includes a movable retaining member supported by the nozzle and engaging the side of the filling tube; and in which the releasing means includes a sealing washer on the sleeve adapted to contact the top of the container when the container is raised into filling position, and means on the upper end of the sleeve for disengaging the retaining member from the filling

2,839,094

9

tube when the sleeve is raised a predetermined distance by the container.

References Cited in the file of this patent

UNITED STATES PATENTS

2,534,997 Smith _____ Dec. 19, 1950
2,638,259 Garrett _____ May 12, 1953

5

2,643,806
2,701,676
2,706,589

627,564

10

Milne _____ June 30, 1953
Day et al. _____ Feb. 8, 1955
Bingham _____ Apr. 19, 1955

FOREIGN PATENTS

France _____ June 11, 1927