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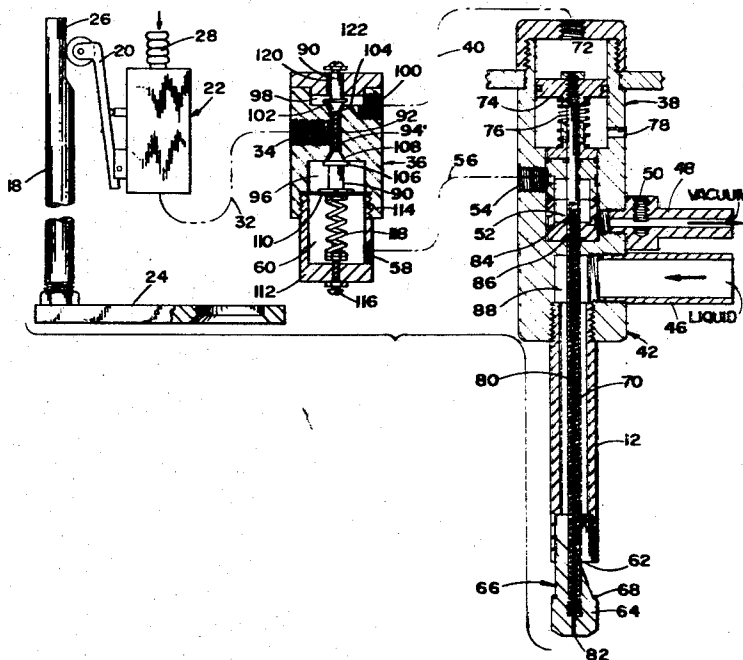
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[54] **AUTOMATIC FILLING VALVE**
5 Claims, 3 Drawing Figs.

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137/373, 141/160, 141/198, 141/275, 251/28
 [51] Int. Cl. **B65b 3/26**
 [50] Field of Search **137/373;**
141/39—41, 46, 59, 160, 198, 276, 301, 361;
251/28

[56] **References Cited**
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ABSTRACT: An automatic-filling valve unit has a nozzle disposable within the neck of a container and a flow control-valve is located on the lower end of said nozzle for quick shut-off. The valve is opened by air pressure and closed by a spring. Vacuum is drawn through the lower end of the nozzle constantly while filling of a container progresses and is interconnected to a control valve for the air pressure which operates the flow control valve, whereby when liquid rising in the container reaches the suction inlet on the nozzle, the control valve is actuated to release the air pressure instantly and permit the spring to close the flow control valve.



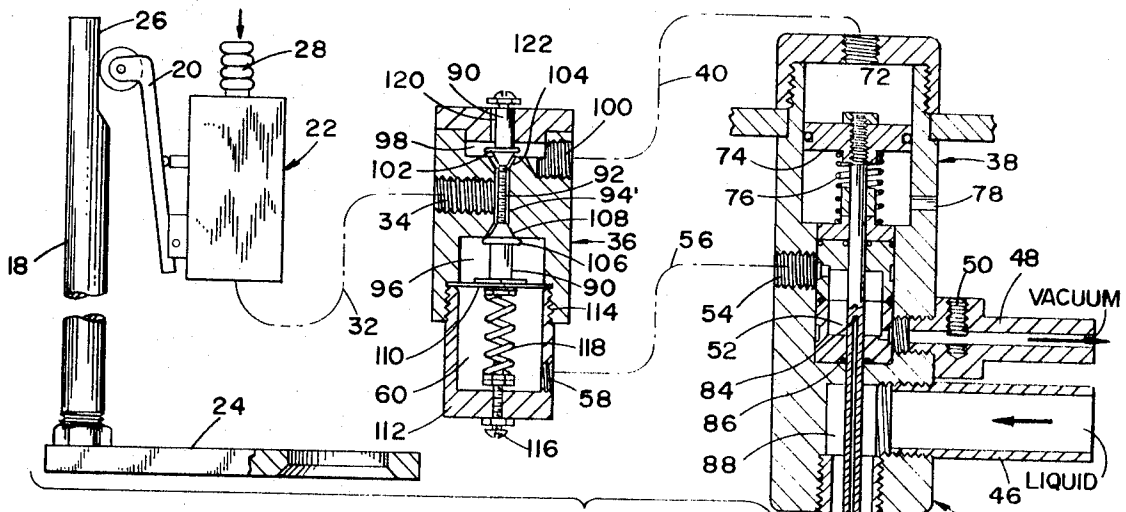


FIG. 1

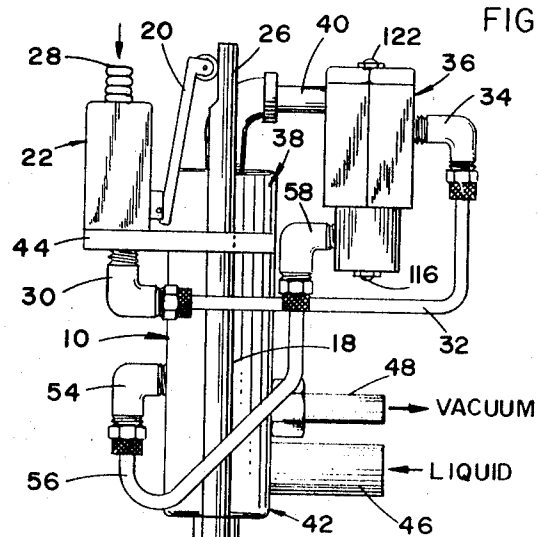


FIG. 2

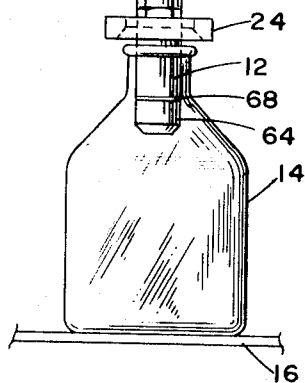


FIG. 3

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AUTOMATIC FILLING VALVE

BACKGROUND OF THE INVENTION

Numerous types of filling nozzles have been designed for discharging liquid into containers of various types such as bottles, jars, cans, etc. Many of these prior types of filling nozzles have included means which engage the upper ends of containers, such as bottles and jars, incident either to moving the container upwardly relative to the nozzle or lowering the nozzle into the container, for purposes of opening the discharge control valve. In recent years, however, many types of thin-walled containers have been developed which are extruded or blown from synthetic resin or plastics, some of which have irregular shapes incapable of readily sustaining forces applied thereto in a longitudinal direction, whereby said aforementioned filling technique which has been extensively employed in filling mechanisms cannot be resorted to.

Particularly for purposes of actuating a discharge control valve for liquid to be introduced into relatively fragile containers, but without restriction thereto, filling mechanisms have been developed which are responsive to the level of a liquid when discharged to a predetermined extent within a container and including means operable incident to a predetermined level of liquid being reached to close the discharge control valve for the liquid supply. Certain of said mechanisms have employed vacuum means associated with the discharge end of the filling nozzle so that when the rising liquid encountered the inlet to the vacuum means, mechanism of a relatively complex nature is operated to close the discharge control valve for the liquid supply. Examples of mechanism of this type are shown and described in U.S. Pats. Nos. 3,037,536, issued June 5, 1962, and 3,150,697, issued Sept. 29, 1964.

Another type of mechanism previously developed for achieving the foregoing purposes relies upon the discharge of air from the delivery end of the filling nozzle and upon the discharge end of the air conduit encountering liquid rising in a container, control mechanism is actuated to close the discharge control valve for the liquid supply. An example of this type of apparatus comprises the subject matter of U.S. Pat. No. 3,207,189, dated Sept. 21, 1965.

SUMMARY OF THE INVENTION

It is a principal object of the present invention to provide a more simplified type of automatic filling valve unit than those previously developed, such as exemplified by the aforementioned patents, such filling unit including a filling nozzle positionable within a container to dispose the discharge end at a predetermined level within the upper portion thereof and including a discharge control valve positioned at the discharge end of the nozzle to effect instantaneous closing of the valve when a predetermined level of liquid is reached within a container, said discharge control valve being actuated by spring means to close it and including fluid-operated means operable to open the discharge valve when filling is to occur, the closing of the valve being in response to vacuum-operated means having an inlet adjacent the discharge control valve and effective to discontinue the function of the fluid-operated means and permit the spring means to close said discharge control valve.

It is a further object of the invention to utilize a discharge control valve at the discharge end of the filling nozzle which has a plug-type movable valve member cooperable with the discharge end of the nozzle and actuated by a piston rod extending axially within the nozzle and connected at its other end to a piston within a cylinder unit comprising said fluid-operated means for said discharge control valve.

It is a further object of the invention to additionally include in said filling valve unit an additional control valve for the fluid-operated means which is located between a source of fluid and said fluid-operated means, also including means interconnecting said additional control valve to said vacuum passage means of said filling valve unit to effect operation of

said control valve in response to vacuum for purposes of closing said additional control valve and thereby discontinue the delivery of fluid under pressure to said fluid-operated means, whereby said aforementioned spring means may close said flow-control valve instantly.

Still another object of the invention is to employ an air valve between a source of air under pressure and said additional control valve for said fluid-operated means, said air valve being operable by appropriate tripping means which is actuated incident to disposing the discharge end of the filling nozzle within a container but without requiring positive engagement of any portion of the mechanism with said container.

Details of the foregoing objects and of the invention, as well as other objects thereof, are set forth in the following specification and illustrated in the accompanying drawing comprising a part thereof.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an exploded, somewhat diagrammatic view, principally in vertical sectional elevation of the components illustrated therein which comprise part of an automatic filling valve unit embodying the principles of the present invention.

FIG. 2 is a side elevation of the automatic filling valve unit embodying the principles of the present invention and showing the lower end of the filling nozzle in an exemplary position within a container for filling the same to a predetermined level.

FIG. 3 is an enlarged vertical sectional view of a control valve similar to that illustrated intermediately in FIG. 1 in smaller scale.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An exemplary automatic filling valve unit 10 embodying the principles of the present invention is shown in side elevation in FIG. 2. Said unit comprises a filling nozzle 12 which is inserted at least into the neck portion of an exemplary container 14, such as a bottle or jar. Such container may be supported upon a suitable exemplary support 16 of any suitable type such as a belt conveyor, table, platform, or otherwise. It is immaterial relative to the present invention whether the nozzle 12 is lowered into the container or the container 14 is elevated with respect to the nozzle. Accordingly, it is only required that relative vertical motion between the container and nozzle shall occur to dispose the same in operative relationship during a filling operation, followed by separation of the same so that the container may be moved for further operation upon the same, such as capping or otherwise closing it.

The unit 10 also includes a longitudinally extending rod 18 which is suitably movable axially relative to the unit 10 for purposes of tripping or otherwise operating the actuator 20 of an air control valve 22 which preferably comprises a conventional 3-way valve. No specific means have been illustrated for effecting relative movement between the rod 18 and valve unit 10 because any one of a number of different types of conventional means may be used. In addition to operating the actuator 20 of valve 22, the rod 18 also supports a container-centering means 24 which preferably engages the upper end of the container 14 with no more than light pressure or no actual contact at all. The opposite end of rod 18 has a cam surface 26 which engages a roller or otherwise on actuator 20 to trip said air valve for purposes to be described.

Air control valve 22 has air inlet means 28 thereon connectable to a source of air under suitable pressure. The opposite end of valve 22 has air discharge means 30 connected to one end of conduit 32, the other end of the conduit being connected to inlet port 34 of an air pressure control valve 36 which primarily controls the delivery of air under pressure to fluid-operated means 38 by means of conduit 40 which enters the outer end of fluid-operated means 38 that comprises part of a filling head 42. The 3-way valve 22 also provides for inlet means 30 communicating with atmosphere when the valve is closed. As readily can be seen from FIG. 2, the air control

valve 22 is compactly supported upon a bracket plate 44 connected to the upper end of filling head 42 and air pressure control valve 36 likewise is mounted closely to the fluid-operated means 38 on the upper end of filling head 42. To illustrate the function of these various components, however, FIG. 1 has been arranged in exploded manner and most of the components have been vertically sectioned to illustrate details thereof.

Filling head 42, adjacent the lower end thereof, has a transverse inlet port to which liquid inlet conduit 46 is connected, the opposite end thereof being connected to a source of liquid with which containers are to be filled. Directly above the inlet conduit 46, the filling head 42 is provided with another inlet port to which a valved nipple 48 is connected, the same having a threaded screw valve member 50 therein and the outer end thereof being connectable to a source of vacuum of suitable degree or range. The valve 50 provides means for regulating the amount of vacuum applied to inner chamber 52 which has a port 54 also communicating therewith for purposes of connecting one end of a vacuum conduit 56 thereto and the opposite end thereof being connected to a port communicating with inner chamber 60 in the lower portion of air pressure control valve 36.

From FIG. 1, it will be seen that the filling nozzle 12 is tubular and the discharge end 62 thereof is cylindrically counter-bored interiorly to receive the upper end of a pluglike valve member 64 which cooperates with discharge end 62 to form a discharge control valve 66. The upper end of valve member 64 preferably slopes, as illustrated in FIG. 1, and intermediately of the ends thereof, a sealing O-ring 68 is mounted for abutment against the terminal end surface of discharge end 62 of filling nozzle 12, the same being shown in closed position in FIG. 2.

The movable valve member 64 is connected to the lower end of a piston rod 70 which extends longitudinally within filling nozzle 12 and preferably is coaxial therewith. The normally upper end of the piston rod 70 extends into the cylinder 72 of fluid-operated means 38 and is connected to a piston 74 operable within cylinder 72. A compression spring 76 surrounds the upper end of piston rod 70 and extends between the lower face of piston 74 and the inner surface of the lower wall of cylinder 72. Said spring is of sufficient strength to rapidly move valve member 64 to the closed position thereof shown in FIG. 2 when pressure is relieved from the upper face of piston 74. One wall of cylinder 72 is also provided with an air relief port 78 open to atmosphere.

Piston rod 70 is provided centrally thereof with a longitudinally extending passage 80 of small diameter which is coaxial with a hole 82 of correspondingly relatively small diameter which extends axially through the valve member 64 so as to communicate with the atmosphere. The upper end of passage 80 communicates with a laterally extending port 84 which communicates with the interior of chamber 52 and, correspondingly, with conduit 56. In the preferred construction, a small O-ring 86 surrounds the piston rod 70 between chamber 52 and inlet chamber 88 so as to seal against the possibility of liquid which enters chamber 88 through inlet conduit 46 from entering the vacuum chamber 52.

The air pressure control valve 36 has a valve rod 90 extending axially therein. The intermediate portion 92 thereof is smaller in diameter than the outer end portions. Said intermediate portion is reciprocable within a bore 94 which is coaxial therewith and of slightly larger diameter to provide a passage between chamber 96 and chamber 98 within the body of control valve 36. Chamber 98 communicates with discharge port 100 to which one end of conduit 40 is connected.

The inner end of the enlarged upper portion of valve rod 90 has a movable valve member 102 surrounding the same, the same preferably comprising an O-ring of suitable size for coaction with valve seat 104. This comprises a first poppet valve. The upper end of the lower enlarged portion of valve rod 90 has a corresponding O-ring 106 thereon which coacts with

valve seat 108 and comprises a second poppet valve. The lower end of valve rod 90 is connected to a flexible diaphragm 110, the rim of which is firmly clamped between the upper end of lower member 112 of the body of control valve 36 and an opposing seat in said body. Such body has a threaded recess 114 therein to engage and retain the lower member 112 tightly connected to said body as well as clamping the rim of the diaphragm 110 firmly between the members.

Threaded into the bottom of lower member 112 is an adjusting screw 116 which is coengageable at its inner end with one end of a pressure-regulating spring 118, the upper end of said spring normally exerting limited pressure against the lower central portion of diaphragm 110, as can be clearly seen from FIGS. 1 and 3. The upper enlarged end portion of valve rod 90 operates within a bore having a relief 120 at least at one side thereof for the discharge of residual air from the upper end of cylinder 72 when the discharge control valve 66 is to be closed by spring 76 in accordance with the procedure of operation described hereinafter. The valve member 102 closes said relief 120 when the first poppet valve is open. The upper end of valve rod 90 has a movement-limiting screw 122 therein which is engageable with the upper face of the body of air pressure control valve 36 and also is adjustable relative to the valve rod 90 for purposes of controlling the degree of pressure with which valve member 102 engages seat 104 thereof.

OPERATION OF THE FILLING VALVE UNIT

When the filling nozzle 12 is placed in filling relationship with at least the upper portion of the container 14 as the result of relative longitudinal movement effected between the two in the manner described hereinabove, the valve-tripping rod 18 is also moved longitudinally relative to the filling valve unit 10 and thereby opens air control valve 22 to cause air under pressure to enter chamber 98 of air pressure control valve 36 due to the spring 118 normally maintaining first poppet valve open between valve member 102 and seat 104. Valve member 102 also substantially closes relief opening 120. Air is thus introduced under pressure against the upper face of piston 74 in cylinder 72 and thereby promptly projects discharge control valve 66 to open position. Valve member 66 is in direct communication with the filling liquid made constantly available through inlet conduit 46. Meanwhile, vacuum of a desired degree is constantly made available through valved nipple 48 which produces corresponding suction through passage 80 in piston rod 70 which results in a limited amount of air constantly being drawn inward through hole 82 in the lower end of movable valve member 64.

Liquid continues to discharge through the open control valve 66 until the upper surface of the rising liquid encounters the lower end of valve member 64, thereby shutting off the free suction of air through hole 82 in said valve member. This results in the normal vacuum being drawn through nipple 48 to be applied substantially entirely to chamber 52, vacuum conduit 56, and chamber 60 in air pressure control valve 36, with the result that the central portion of diaphragm 110 is drawn instantly downward and thereby closes the first poppet valve comprising valve member 102 and seat 104 in the upper portion of air pressure control valve 36. Such movement also opens second poppet valve comprising valve member 106 and seat 108 which causes air under pressure to be applied against diaphragm 110, in opposition to spring 118, as in FIG. 3.

Such discontinuance of pressure against the upper face of piston 74 permits spring 76 instantly to elevate piston 74 and correspondingly move the plug valve member 64 into closed relationship with the lower end of nozzle 12 and thereby immediately discontinue the flow of liquid therethrough. Such movement disposes the sealing ring 68 against the lower end of nozzle 12. Also, residual pressure in the upper end of cylinder 72 will be dissipated to atmosphere through the relief passage 120 in the upper end of air pressure control valve 36. Upward movement of valve member 64 momentarily separates it from the rising liquid in the container, thus expos-

ing the end of vacuum passage 80 but, meanwhile, the air pressure in chamber 96 against diaphragm 110 maintains discharge control valve 66 closed.

Separation of the filling nozzle 12 from the container then is effected by conventional mechanism, not shown, and not comprising part of the present invention. Rod 18 also is moved to remove centering means 24 from any interference to removal of the filled container 14 from the filling station. Such movement of rod 18 causes cam surface 26 thereon to disengage the roller on valve actuator 20 and thereby closes valve 22 which causes inlet means 30 to communicate with atmosphere, as aforesaid. This permits a release of the pressure in chamber 96 to atmosphere through conduit 32, whereby spring 118 then is capable of restoring diaphragm 110 to its initial position in which valve member 106 is seated against seat 108 and valve 102, 104 is open. This is the reset position of valve 36. An empty container then is moved into filling position and the cycle described above is repeated commencing with the actuation of rod 18 which opens valve 22 to introduce air pressure to valve 36.

During the operation of the mechanism as described above, a very slight amount of liquid may be drawn from the filled container through hole 82 and up the passage 80 and from there into the valved nipple 48. To accommodate the same, the apparatus may, if desired, be provided with a small waste container, not shown, communicating with the passage in nipple 48 or the conduit connected thereto to receive such liquid and accumulate it, such receptacle somewhat resembling a sediment bulb in a conventional gasoline line of an automotive vehicle. The amount of liquid involved in such operation is extremely slight. Also, during operation of the mechanism, the vacuum provided through valved nipple 48 and the passages communicating therewith is continuously supplied during operation of the machine and thus will continue to draw air through hole 82 and passage 80 during the time interval elapsing between when the nozzle is being removed from a filled container and introduced into an empty container and otherwise while the machine may be idle, at least until a master control valve, not shown, but effective upon the passage in nipple 48, is closed.

From the foregoing, it will be seen that the filling mechanism and the means for actuating the flow control valve for liquid being delivered to a container is relatively simple, foolproof, capable of being operated at high speed and operable to introduce liquid accurately into containers to a precise level controlled solely by the position of the lower end of the filling nozzle within such containers. Appropriate adjustable means are provided to regulate the operation and it is only necessary to provide a source of air under pressure of relatively small capacity as well as a limited amount of vacuum from a suitable source. If desired, a simple compressor may be utilized to furnish the air pressure and the inlet of the compressor can provide the necessary vacuum. Also, the provision of the flow control or shutoff valve for the filling liquid at the lower end of the nozzle provides for very effective and accurate control for shutting off of the flow of liquid instantly and, by virtue of the continual application of a small amount of suction constantly through hole 82 in the lower end of valve member 64, no dripping of any residual liquid from the lower end of valve member 64 will occur.

While the invention has been illustrated and described in its several preferred embodiments, it is to be understood that the same is not to be restricted to the precise details illustrated and described herein since the same may be carried out in other ways falling within the scope of the invention as illustrated and described.

I claim:

1. An automatic-filling valve unit connectable to a supply of

liquid and operable to effect discharge of said liquid into containers, said unit comprising in combination, a filling nozzle, means operable to dispose said nozzle within a container and position the discharge end at a predetermined level, within the upper portion of the container; a discharge control valve including a valve member movable at the discharge end of said nozzle, spring means connected to said valve member and operable to move it to closed position, fluid-operated means responsive to fluid under pressure and directly connected to said valve member and operable to move it to open position in opposition to said spring means; and a pressure control valve connected between said fluid-operated means and a source of fluid under pressure, said control valve comprising a first and second poppet valve and a diaphragm connected commonly thereto for simultaneous actuation thereof, a spring operable against one side of said diaphragm for movement thereof and said poppet valves connected thereto in one direction, passages in said pressure control valve connecting said poppet valves with said source of fluid under pressure, said first and second poppet valves respectively controlling the flow of fluid under pressure to said fluid operated means and the opposite side of said diaphragm for movement thereof in opposition to said spring; vacuum passage means connectable to a source of vacuum and terminating at one end adjacent said discharge end of said nozzle, and conduit means interconnecting said vacuum passage to said one side of said diaphragm of said pressure control valve and operable upon the rising level of liquid in said container reaching said one end of said vacuum passage means to cause vacuum in said passage to move said diaphragm of said pressure control valve in a direction to close said first poppet valve to discontinue flow of fluid pressure to said fluid-operated means and open said second poppet valve to direct fluid under pressure against said diaphragm in opposition to the pressure of said spring to insure the closing of said first poppet valve, said pressure control valve also having a conduit between said first poppet valve and said fluid-operated means of said flow control valve and a port open to atmosphere communicating with said conduit, whereby when said first poppet valve is closed as aforesaid said port can release pressure upon said discharge control valve member and thereby permit said spring means of said discharge control valve to move said discharge control valve member to closed position.

2. The filling valve unit according to claim 1 in which said fluid operated means for said discharge control valve comprises a cylinder and piston unit and further including a piston rod extending from said piston longitudinally through said filling nozzle, and said movable valve member of said discharge control valve being connected to and supported by one end of said piston rod for actuation thereby.

3. The filling valve unit according to claim 2 in which said movable valve member of said discharge control valve comprises a plug movable relative to the lower end of said nozzle to effect opening and closing of said valve.

4. The filling valve unit according to claim 2 in which said vacuum passage means extends longitudinally through said piston rod from the outer end thereof adjacent said movable valve member thereon, and said filling head having a vacuum inlet therein communicating with the vacuum passage means in said piston rod.

5. The filling valve unit according to claim 1 further including an air valve connected between a source of air under pressure and said pressure control valve, and actuating means for said air valve operable incident to disposing said filling nozzle within a container to deliver air to said pressure control valve and also to said cylinder and piston unit of said discharge control valve to open said discharge control valve for the delivery of liquid through said filling nozzle to a container.