# United States Patent [19]

**Bret et al.**

[11] **3,858,771**

[45] **Jan. 7, 1975**


[54] **LIQUID DELIVERY VALVE CONSTRUCTION**


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[22] Filed: **Apr. 24, 1972**

[21] Appl. No.: **246,678**

**Related U.S. Application Data**

[63] Continuation of Ser. No. 852,698, Aug. 25, 1969, abandoned.

[30] **Foreign Application Priority Data**

Apr. 4, 1969 France ..... 69.10448

[52] **U.S. Cl.** ..... **222/402.2**

[51] **Int. Cl.** ..... **B65d 83/14**

[58] **Field of Search** ..... 222/402.1, 402.13, 402.2, 222/402.25, 464; 239/601



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[57] **ABSTRACT**

A special valve construction is provided for delivering or discharging measured amounts of liquid wherein the valve requires only two operating channels and positions as contrasted with three in prior devices. A slidable valve fits in a body receivable in a pressurized bottle containing liquid to be dispensed. Discontinuous axial bore are formed in the slide valve each connecting with a transverse channel longitudinally spaced from each other and a lateral channel above the upper transverse channel connects to outlets for discharge. Axial movement of the slide valve in the body is mechanically limited and suitable packing rings are disposed where the slide valve and body meet. An elastic diaphragm fits over a convex support forming part of a bell-shaped member having a chamber which determines the amount of liquid discharged. Downward pressure on the bell-shaped member operates the valve and release of pressure closes the valve.


**9 Claims, 6 Drawing Figures**

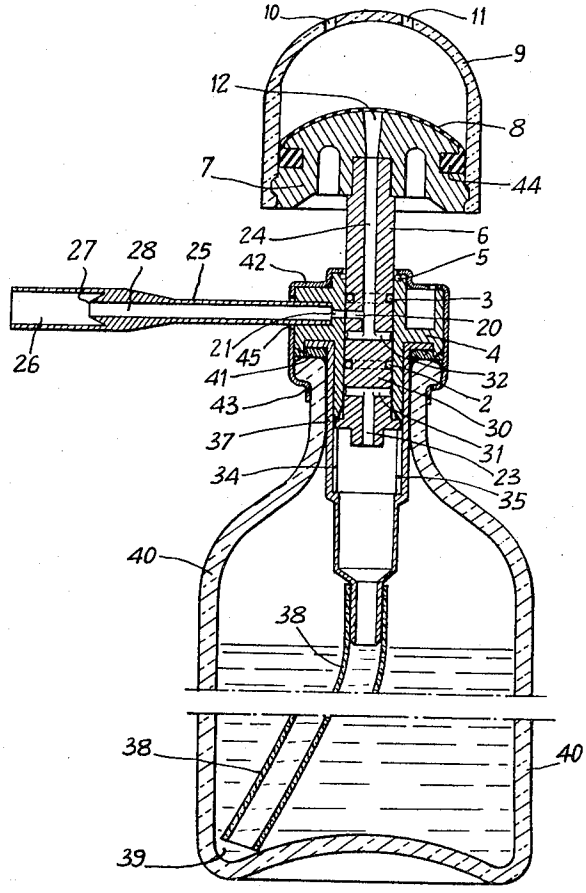

Fig. 1

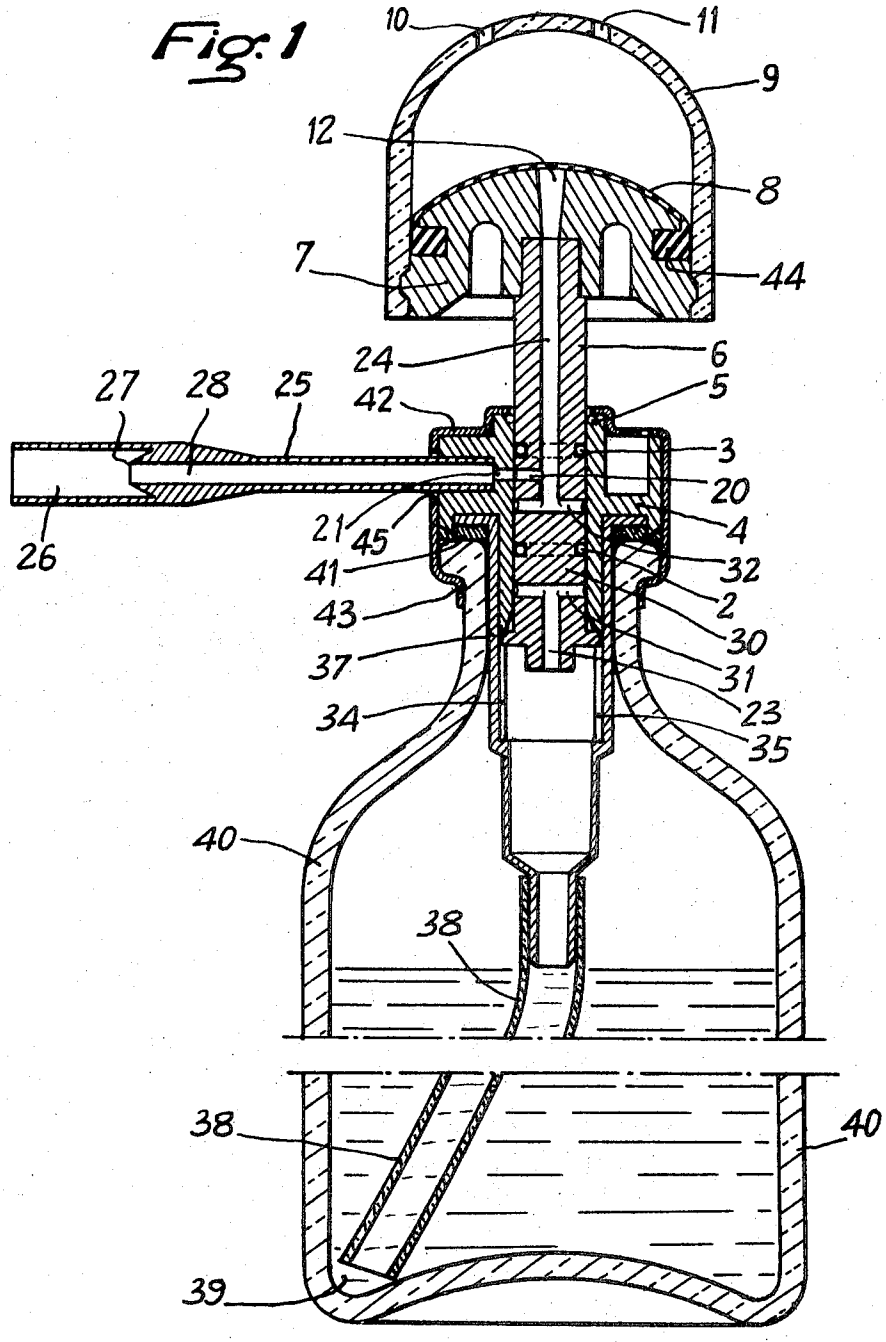


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Fig: 2

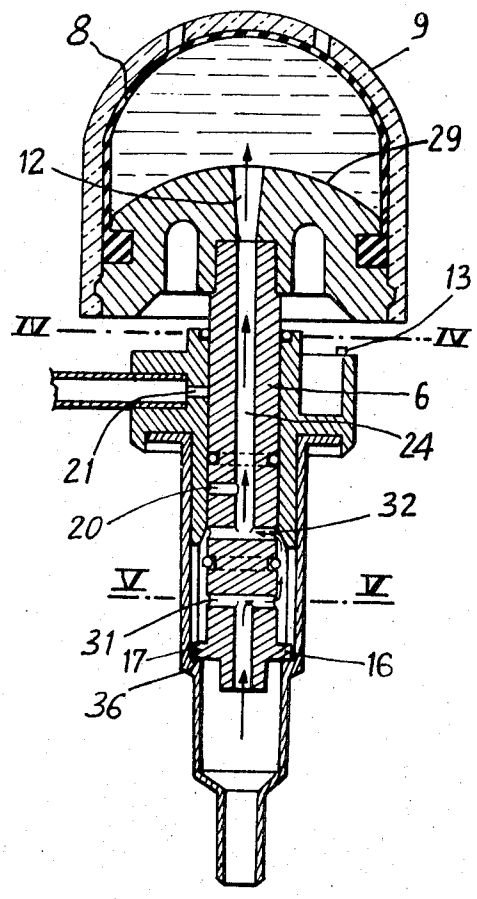


Fig: 3

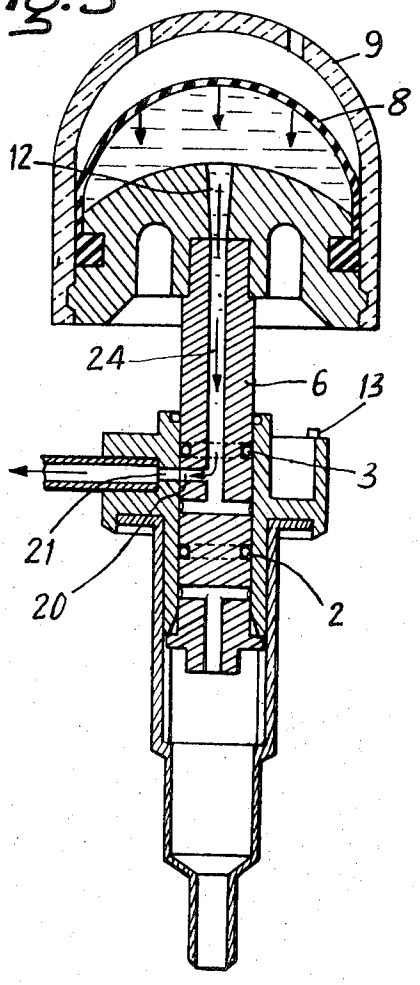


Fig: 4

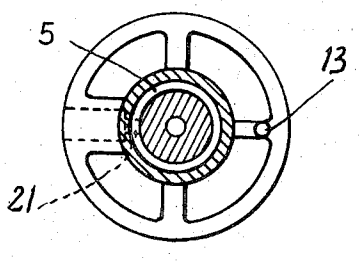


Fig: 5

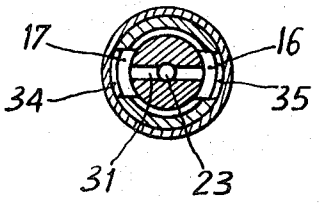


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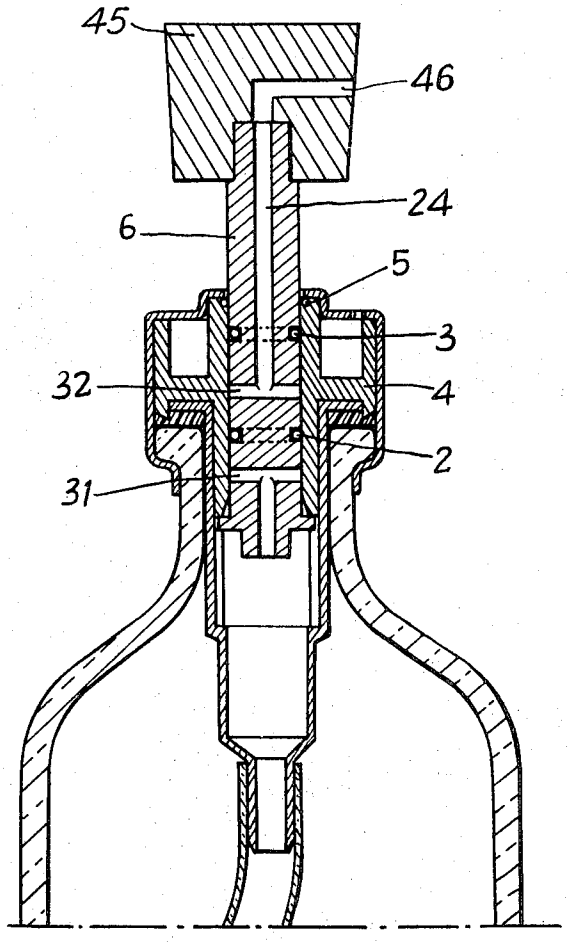
Fig: 6

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# LIQUID DELIVERY VALVE CONSTRUCTION

This is a continuation of application Ser. No. 852,698 filed Aug. 25, 1969 now abandoned.

The present invention relates to an arrangement comprising an improved automatically closing valve adapted to deliver liquids carried under pressure in a container, and also various applications of such an arrangement chiefly for embodiment in liquid distributing containers and containers permitting the ejection of atomized liquid without any proportioning.

The improved automatically closing valve system of the invention includes within a body provided with an inner cylindrical bore a distributing slide valve adapted to occupy two positions: a lower position and an upper position, said slide valve being urged outwardly by the pressure on the liquid and adapted to be depressed against said pressure upon application of a thrust on its outer end, said slide valve being provided at its lower end with means limiting its shifting within the body inside which it slides while a transverse channel which communicates permanently with an injection channel opening into the upper section of said slide valve is located between two fluid-tight packings preferably in the shape of a toroid whereby said transverse channel communicates with the inside of the container when the slide valve is in its lower position while it is disconnected from the inside of said container when the slide valve is in its upper position.

Said valve system, according to a preferred embodiment, includes as means for producing a thrust depressing the slide valve a bell-shaped member adapted to measure out the amount of liquid to be delivered. Such a bell-shaped member has already been disclosed in a prior French Pat. No. 1,458,099 filed on Jan. 8, 1965. However, in the present case, the association of the above-mentioned valve with the measuring bell-shaped member ensures in succession the liquid measuring operation and the filling of a container with liquid under pressure in accordance with the positions occupied by the slide valve, of which the lower position provides for the filling of the measuring bell-shaped member out of the container and for the filling of said container with liquid under pressure while the other, higher position corresponds to the ejection of the measured amount of liquid. The distributing slide valve extending vertically within the body of the distributor includes, in combination, in its upper section on the one hand an axial channel leading to the underside of the diaphragm of the bell-shaped member and a further, transverse channel starting from said axial channel and adapted to register with the opening in the body of the distributor through which the liquid is ejected when the slide valve is in its upper position, while on the other hand the lower section of the distributing body includes channels providing for the access of the liquid under pressure into the upper axial channel when the slide valve is in its lower position.

Furthermore, said improved arrangement is characterized by the fact that the diaphragm is stretched over a support having a convex surface so that, when unexpanded, the diaphragm engages said surface through its actual tensioning.

According to a modified embodiment, the distributor includes, at the upper end of the distributing slide valve, a pusher knob in which is provided an atomizing channel forming an extension of the upper axial channel of said slide valve.



The apparatus includes furthermore a number of other features and advantages hereinafter described by way of example and illustrated in the accompanying drawings in which:

FIG. 1 is a vertical sectional view of a liquid distributing apparatus equipped with the valve according to the invention, said apparatus being shown in its inoperative position before use,

FIGS. 2 and 3 are similar vertical sectional views of said distributing apparatus illustrated respectively in its position for which the dispensing measuring chamber is being filled and in the position corresponding to the ejection of the meassured amount of liquid,

FIG. 4 is a transverse sectional view on line IV—IV of FIG. 2,

FIG. 5 is a transverse sectional view on line V—V of FIG. 3, and

FIG. 6 is a vertical sectional view of an atomizing system equipped with such an automatically operating valve.

In the embodiment illustrated in FIGS. 1 to 5, the measuring system includes a valve body 4 inside which a distributing slide valve 6 may move vertically without any possibility of rotation, said slide valve being urged upwardly by the pressure on the fluid contained in the container or bottle 40. The system constituted by the body 4 and slide valve 6 forms an automatically operating valve. To the upper end of the slide valve 6 there is fitted, through the agency of the support 7 having a convex surface engaging the diaphragm 8, a measuring bell-shaped member 9. The slide valve 6 is provided in its lower section with an axial channel 23 and in its upper section with an axial channel 24, the two channels being separated from each other by a solid section 30. On either side of said section 30 there are provided transverse channels 31 and 32 communicating respectively with the axial channels 23 and 24. At a given distance above the channel 32 there is provided a lateral bore 20 parallel to bore 32 and adapted when the slide valve is in its extreme upper position to connect the channel 24 of the slide valve with the port 21 in the body of the distributor through which the measured amount of liquid is expelled. The distributing slide valve carries fluid-tight packing rings 2 and 3 inserted, respectively, in an annular groove formed between the channels 31 and 32 and in an annular groove located slightly above the lateral bore 20. Preferably said fluid-tight packings are constituted by rubber rings which are toroidal and particularly effective.

The support 7 for the diaphragm 8 is provided with an axial bore 12 formed in alignment with the axial channel 24 so as to ensure a connection between last-mentioned channel and the lower surface of the diaphragm 8 housed within the measuring bell-shaped member 9.

The lower section of the slide valve 6 includes two lateral projections 16 and 17 (FIG. 2) which prevent it from rotating by guiding it within the corresponding slots or ports 34 and 35 formed in the lower cylindrical extension of the valve body 4. Said lateral projections 16 and 17 abutting against the upper ends of the slots 34 and 35 or against the shoulder 36 of the sheath 37 define the two positions of the slide valve which correspond to the two essential stages of the operation of the apparatus, as hereinafter described.

The body 4 of the distributor includes an upper ring-shaped portion 42 extending downwardly as a cylindri-

cal part enclosing the slide valve. Said body **4** includes in its upper section a scraper ring **5** adapted to prevent any leak of liquid when the slide valve rises.

The cylindrical section of the body of the measuring apparatus is urged with a force fit within the sheath **37** which carries a tubular extension **38** which is incurved or deformed so that its end may engage the bottom of the container or bottle **40** at a point such as **39** of its inner periphery registering angularly with the liquid ejector **25.** Reference notches may be provided on the sheath **37** and on the body **4** so as to ensure coincidence of their angular setting. Through such an arrangement it is possible with a container of any conventional shape to deliver completely the liquid contained therein by merely giving a slope to the container towards the side carrying the ejector.

The body of the distributor is secured to the container **40** preferably with the interposition of the fluid-tight packing **41** as provided by a collar **42** the lower edge **43** of which is crimped underneath the neck of the container. For an easier assembly it is possible to provide a stud **13** (FIG. 2) engaging a corresponding opening (not illustrated) in the collar or flange **42** and this ensures registration between the opening **45** provided in the collar **42** for the passage of the ejector **25** and the ejecting lateral bore **20** in the distributor body.

The measuring bell-shaped member **9** secured to the diaphragm support **7** is provided with ports such as **10** and **11** for the exhaust of the air contained above the diaphragm or for the entrance of the air within the member **9.** The diaphragm is made of an elastic material such as rubber and it has along its periphery a securing annulus **44** housed in a corresponding groove formed in said support **7,** said annulus being locked inside said groove by the positioning of the bell-shaped member. The arrangement constituted by the support **7,** the diaphragm **8** and the bell-shaped member **9** forms a unit which may be removed bodily from the slide valve **6** and fitted over the latter in any suitable manner, for instance by a force fit as permitted by the comparative elasticity of the plastics forming said parts or by any other means such as cooperating threads.

According to the present invention, it is of advantage to give the surface **29** of the support **7** of the diaphragm a shape which is not flat, but slightly bulging (convex) as illustrated in FIGS. **1** to **3.**

Thus the diaphragm is always subjected to a certain tensioning even when the ejection of the measured amount of liquid is at an end which ensures accuracy of the amount of liquid ejected and prevents the undesired formation of a belated drop of liquid at the end of the ejector.

The measuring system thus constituted operates in the following manner for the ejection of a measured amount of liquid: the liquid being carried under pressure inside the bottle **40,** its pressure keeps during inoperative periods the slide valve, together with the empty measuring bell-shaped member fitted on the latter, in its upper position as illustrated in FIG. **1** while the projections **16** and **17** of the distributing slide valve abut against the ends of the ports **34, 35;** the channel **32** is separated from the inside of the bottle by the toroidal packing **2** which prevents the liquid under pressure from reaching the channel **24.**

In order to eject a measured amount of liquid the system constituted by the measuring bell-shaped member and slidevalve **6** is urged downwardly by hand until said unit occupies the position illustrated in FIG. **2** in which the projections **16** and **17** of the slide valve **6** abut against the shoulder **36** of the sheath **37.** For this position the ends of the channels **31** and **32** are uncovered and interconnected whereas the connection with the ejection channel **21** is prevented by the toroidal packing **3.** The liquid driven out by its pressure may then follow the path defined by the arrows along the channels **23, 31, 32, 24, 12** and it fills the bell-shaped member by expanding, as illustrated in FIG. **2,** the elastic diaphragm **8** which engages the inner wall of the bell-shaped member **9.**

When the operator no longer depresses the measuring bell-shaped member, i.e., when pressure is discontinued, the pressure of the liquid on the lower surface of the slide valve urges the latter upwardly back into the position illustrated in FIG. **1.** The connection is again interrupted between the inside of the bottle and the channels **24** and **32** while the channel **20** in the slide valve registers with the ejecting port **21** in the distributor body which establishes a connection between the measured amount of liquid contained underneath the diaphragm and the ejecting tube **25.**

The expanded elastic diaphragm **8** then drives the liquid out until said diaphragm has returned into contact with the upper surface of the diaphragm support **7.** By reason of the bulging convex shape given to said upper surface the diaphragm retains a certain residual tensioning and is engaged accurately over the latter so that the amount of liquid fed corresponds accurately to the desired amount of liquid and the drawback of a small residual amount of liquid in the shape of drops at the output is avoided. It should be noted that this elimination of any belated drops is obtained in a still more reliable manner by reason of the special shape given in this embodiment to the ejecting tube **25.** Its inner bore **28** terminates in an inner annular ridge **27** within the outwardly flaring opening **26.** It has been found that this particular shape given to the ejector cuts out any dripping phenomena at the end of the ejection stage which thus stops in a clean manner.

When the diaphragm **8** resumes its contracted position in contact with the support **7,** the ejection stage is at an end and the arrangement has returned again into its inoperative position illustrated in FIG. **1** and it is ready for a further cycle of operation. It should also be observed that, by reason of the structure of the distributing slide valve **6** and body **4,** the different operations require only two positions for the slide valve, namely, a lower position and an upper position.

Furthermore the constitution of the movable section formed by two separate parts, to wit on the one hand the measuring bell-shaped member and its support **7** and on the other hand the slide valve **6** provides considerable ease for the filling of the container with liquid under pressure as well as for the assembling and dismantling of the apparatus. It allows also a change in the measured amount while retaining the same bottle by replacing the measuring bell-shaped member by another one of different volumetric capacity; when it is desired to fill the container the unit constituted by the bell-shaped member **9,** its support **7** and the diaphragm **8** is removed from the slide valve **6** which is then manually depressed and held in its lower position illustrated in FIG. **2.** The filling is then performed through the channels **24, 32, 31, 23.** When the filling is completed

the inner pressure urges automatically the slide valve upwardly into its position illustrated in FIG. 1.

It is thus apparent that the two positions of the distributing slide valve are sufficient for all operations since the filling of the container is performed for a position of the slide valve which is the same as that occupied for the filling of the measuring bell-shaped member out of the container.

For the assembling of the apparatus, the operation is as follows: the slide valve 6 to which the member 9 is not yet secured is urged slidingly through its lower end into the cylindrical section of the body 4 and the latter is then urged downwardly into the sheath 37 which has been provided with its incurved tube 38. Care should be taken for the axial plane containing the tube 38 to be set through said operation in the same axial plane as the ejecting port 21. The collar 42 is positioned and accurately set angularly through the agency of the stud 13. The unit thus assembled is fitted on the container with the interposition of the packing 41. The edge 43 of the collar or flange 42 is then crimped over the neck of the bottle and it is now sufficient to insert the ejecting tube 25 and measuring bell-shaped member 9.

The invention is not limited to the particular embodiment described hereinabove by way of example and in particular the elastic diaphragm 8 of the measuring bell-shaped member 9 may be replaced by a piston held in position against pressure by a spring. Also the shape of the stops defining the two positions of the slide valve may be different and it is also possible to provide on the slide valve 6 above the packing 3 a special nozzle for the filling of the container. These various modifications do not alter the chief features of the distributing slide valve moving between two positions.

In the embodiment illustrated in FIG. 6, the slide valve 6 carries no measuring bell-shaped member but only a presser knob 45 through which a bore 46 forms an atomizing channel as an extension of the channel 24 in the upper portion of the slide valve 6. The body 4 need not be provided with any lateral ejecting port and the port 20 illustrated in FIGS. 1 to 3 may be eliminated. The channel 24 then communicates only with the transverse channel 32. The toroidal fluidtight packings 2, 3 and scraper ring 5 are held entirely or partly. As in the example illustrated in FIGS. 1 to 3, the body of the valve is provided with a bore through which the slide valve slides longitudinally, which bore is broader in its lower portion. The lateral projections 16 and 17 are also guided in the ports 34, 35 provided in the lower portion of the body 4.

To produce atomization of the liquid, the knob 45 is depressed against the pressure exerted by the liquid which results in bringing the slide valve into the same lower position as that illustrated in FIG. 2. The liquid passing through the channels 31, 32, 24, 46 is atomized; the atomization stops as soon as the operator releases the pressure exerted on the knob 45.

What is claimed is:

1. An automatic closing slide valve for containers carrying a liquid under pressure comprising: a valve body for sealing an opening in the container, and having a transverse liquid discharge channel; an elongated distributor slidably mounted in said valve body for sliding movement between a lower position in which liquid in said container may be discharged or said container may be filled through said slide valve and an upper position in which said slide valve prevents escape of said liquid from said container, said distributor being operable to be urged outwardly of the valve body to said upper position by the internal pressure of the container and to be manually depressed against said internal pressure by downward pressure on its upper end, said distributor having transverse channel means and an axial channel extending through said distributor from the upper end of the distributor to and into said transverse channel means; a longitudinally extending slideway formed in the valve body and terminating in upper and lower shoulders, and a lateral projection near the lower end of the distributor extending into said slideway, the lateral projection engaging said upper and lower shoulders when the distributor is in the upper and lower positions, respectively, thereby to limit the distributor from sliding beyond said upper and lower positions, said slideway and said lateral projection cooperatively preventing angular rotation of the distributor as it slides between said upper and lower positions; conduit means for establishing communication between said container and said transverse channel means when the distributor is in the lower position; sealing means between the distributor and the valve body and below said transverse channel means for disconnectng said transverse channel means from said conduit means when the distributor is in the upper position; said transverse channel means being effective to communicate with said liquid discharge channel when the distributor is in the upper position and to be disconnected therefrom when the distributor is in the lower position; a support member fitted over the upper end of the distributor via an opening therein sized to snugly fit over said upper end, dose-measuring means on said support member for storing a predetermined amount of liquid flowing into said measuring means through said axial channel when the distributor is in the lower position and dispensing means carried by said support member for dispensing through said axial channel, said transverse channel means and said liquid discharge channel said predetermined amount of liquid stored in said measuring means when the distributor is in the upper position, said support member being replaceably detached from said upper end being operable to carry said measuring means and said dispensing means when so detached.

2. Apparatus according to claim 1, wherein the upper end of the slide valve detachably carries a member operable when engaged manually to depress the slide valve against the pressure inside the container.

3. Apparatus according to claim 1, wherein said measuring means comprises a hollow cap member fitted on the upper end of the support member and defining therewith a space of predetermined volume, and a resilient diaphragm fitted on the upper end of the support member and operable to move between a normal collapsed position and a stretched position, in which latter position said diaphragm conforms to the shape of the cap member and defines a chamber with the upper end of the support member having a volume which corresponds to that of said space; said distributor being effective in the lower position to permit liquid under pressure to flow from the container to the underside of the diaphragm through said conduit means, said transverse channel means, and said axial channel and thereby force said collapsed diaphragm to the stretched position, and being effective in the upper position to permit liquid to flow from said chamber underneath said diaphragm to said liquid discharge channel

through said axial channel and said transverse channel means; said diaphragm, when stretched, comprising said dispensing means for expelling liquid from said chamber.

**4.** Apparatus according to claim **1,** wherein said valve body extends at its lower end into an incurved dip tube lying in the same plane as said liquid discharge channel.

**5.** Apparatus according to claim **1,** wherein said slideway forms part of said conduit means, said slideway being arranged to communicate with said transverse channel means when the distributor is in the lower position.

**6.** Apparatus according to claim **1,** wherein said transverse channel means comprises upper and lower transverse channels, the upper transverse channel and said liquid discharge channel being connected when the distributor is in the upper position and disconnected when the distributor is in the lower position.

**7.** Apparatus according to claim **6,** wherein said distributor is cylindrical and said sealing means is provided by upper and lower toroidal sealing rings mounted on said distributor, one sealing ring being above said upper transverse channel and the other sealing ring being below said lower transverse channel.

**8.** Apparatus according to claim **1,** further including a liquid ejection tube having an inlet end connected to said liquid discharge channel and a broader outlet portion, said ejection tube having an inner bore starting at the inlet end of the ejection tube and terminating in an annular inner ridge projecting into said broader outlet portion.

**9.** Apparatus according to claim **8,** wherein a metal collar supports said valve body for insertion into a container, said metal collar having a lateral opening through which said ejection tube projects, a stud is provided on said valve body and a positioning hole is provided in said metal collar for receiving said stud, and said metal collar has means for securing the metal collar to the neck of a container into which said slide valve is inserted.

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