March 31, 1959 "D" FLAVIUS BACHELLER 2,879,924

DISPENSING DEVICE

Filed Feb. 12, 1954 2 Sheets-Sheet 1

Fig. 1.

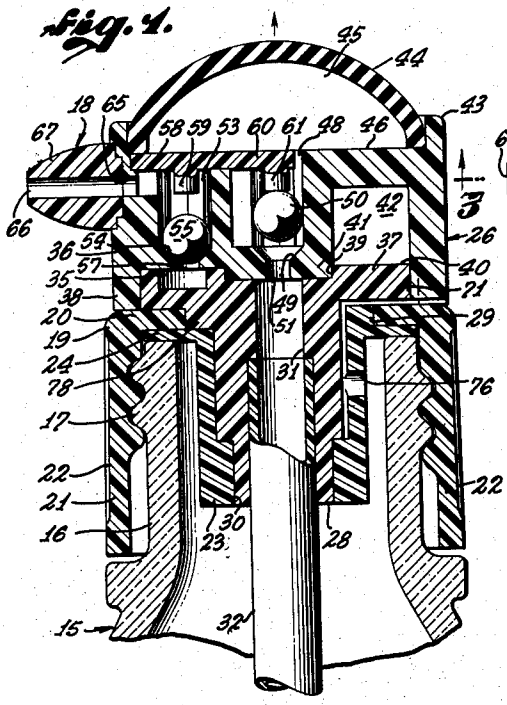


Fig. 2.

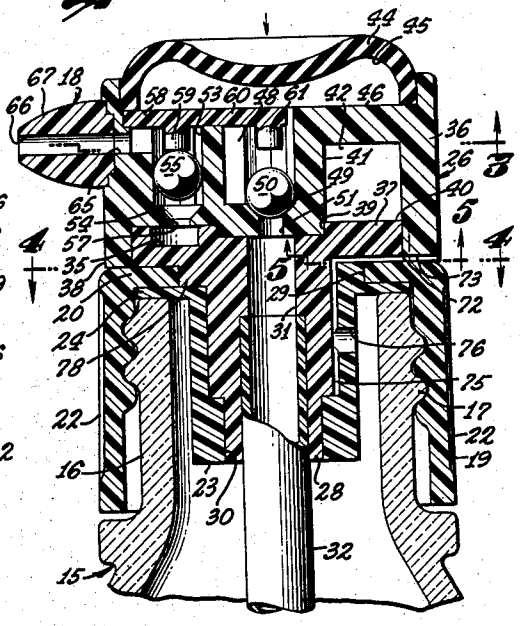


Fig. 3.

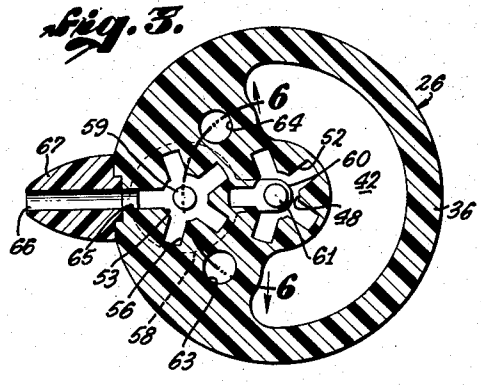


Fig. 4.

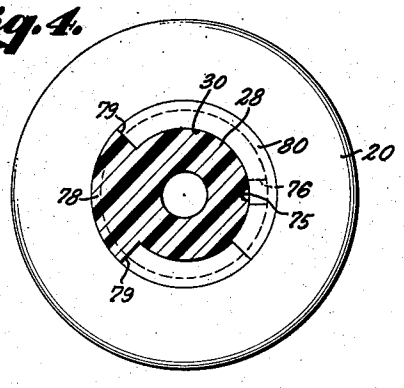
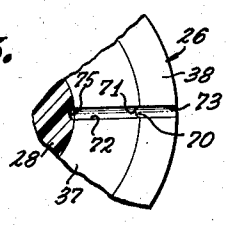


Fig. 5.



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DISPENSING DEVICE

Filed Feb. 12, 1954 2 Sheets-Sheet 2

Fig. 6.

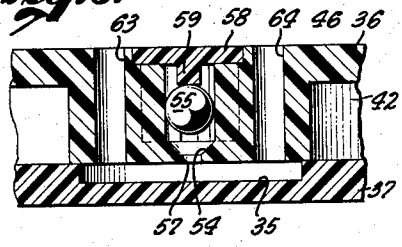


Fig. 7.

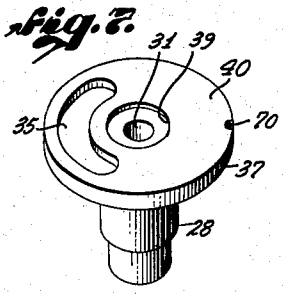


Fig. 8.

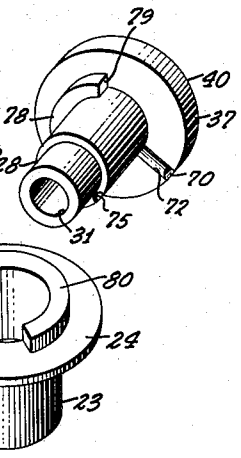


Fig. 9.

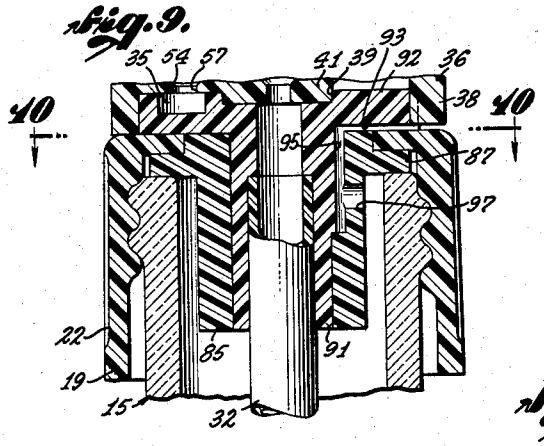


Fig. 10.

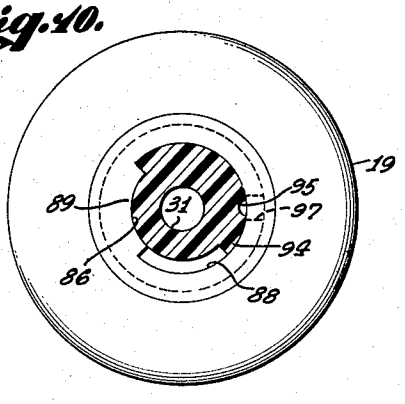
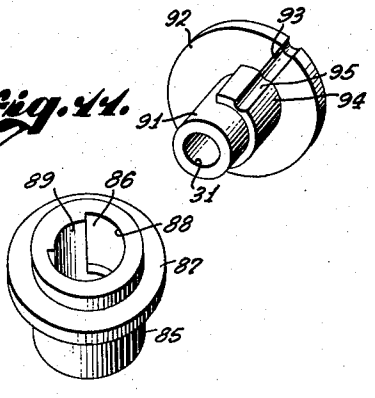


Fig. 11.



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2,879,924

DISPENSING DEVICE

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Application February 12, 1954, Serial No. 409,947

8 Claims. (Cl. 222—207)

This invention relates to improvements in container closures serving as dispensing pumps for intermittently ejecting small amounts of liquid from containers.

The invention has particular utility when employed as a dispensing closure for a bottle or other container holding liquid medicators, cosmetics, or toilet preparations such, for example, as hand lotion and similar liquids, although the invention is not limited in use to dispensing liquids of this type, but is suited to the dispensing of liquids generally and of widely varying viscosity.

A variety of dispensing pumps have heretofore been employed for similar or related purposes, but these pumps for the most part often cause the liquid to be ejected in short spurts or jets characterized by a squirting or sputtering action of the liquid. An important object of the invention is to provide a dispensing device which is adapted to dispense liquid in smooth, small and controlled amounts free from any sputtering action.

Another object of the invention is to provide an improved device of the above-mentioned character which will serve as a suitable closure for a bottle not only when it is desired to dispense liquid from the bottle but also during shipment of the bottle.

A further object is to provide a device of the above mentioned character which is practical and reliable, and which is so constructed that it may be produced inexpensively and automatically with the view to supplying the public with an efficient dispensing closure at small cost.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings, forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a central vertical sectional view of the uppper portion of a bottle having a dispenser embodying the invention attached to the top thereof.

Figure 2 is a similar sectional view but showing the movable parts of the dispenser in their relative positions at a time when the dispenser is operated to eject a small amount of liquid from the bottle;

Figures 3 and 4 are transverse views through the dispenser taken respectively on lines 3—3 and 4—4 of Figure 2.

Figure 5 is a detail section taken on line 5—5 of Figure 2.

Figure 6 is a developed section taken on circular line 6—6 of Figure 3.

Figure 7 is a perspective view of one form of a stem piece for the dispenser showing the construction of the top surface of such piece.

Figure 8 is an exploded view of one form of mating stem pieces shown in separated relationship.

Figure 9 is a fragmentary central vertical section of the upper portion of a bottle having a dispenser embodying the invention attached to the top thereof, and wherein the dispenser has a stem construction of a modified form.

Figure 10 is a transverse view through the modified dispenser taken on line 10—10 of Figure 9.

Figure 11 is an exploded view of the modified mating stem pieces shown in separated relationship.

In the drawings, wherein for the purpose of illustration is shown two preferred embodiments of my invention, the numeral 15 designates a conventional container, herein a bottle, having a neck 16 provided with a threaded exterior 17. A dispensing unit 18 is shown attached to the bottle and it includes a top member 19 having a top wall 20 and a skirt portion 21 threaded on its interior wall to engage the threads 17 on the neck of the bottle. In the embodiment shown in the drawings the cap member is circular in cross-section and is knurled around its exterior, as indicated at 22, to aid in gripping the cap.

Extending axially into the neck of the bottle is a sleeve member 23 which is formed preferably of a resilient material such, for example, as any of a number of commercially available plastics of the soft or elastomeric type (e.g. polyethylene). Adjacent its upper end, member 23 is provided with a horizontally extending annular flange 24, the upper surface of which engages the flat inside face of the top wall 20 of the cap member, while its under surface is seated on the rim of the bottle 15, whereby the flange 24 serves as a washer insuring a tight joint between the cap member and the bottle.

The dispenser unit 18 includes an upper unit 26 mounted upon the cap member 19 and which, for purposes to be later described, is preferably made capable of being turned about its vertical axis on the cap member. Such upper unit is separable from the cap member and has a tubular stem piece 28 extending downwardly and axially from it for supporting the unit 26 in a manner permitting it to be turned on its vertical axis on top of the cap member. There is a centrally arranged circular opening 29 through the top wall 20 of the cap member for accommodating the stem 28 which in turn fits snugly in an axial bore 30 through the elastomeric sleeve member 23, whereby the stem is frictionally held in the bore of the sleeve and may be turned on its axis in the sleeve member. The sleeve member in turn is held by its flange 24 from being rotated in the neck of the bottle when the unit 26 is turned. As explained above, flange 24 is held tight between the rim of the bottle and the inside face of the pump member.

The stem piece 28 has an axial bore 31 which is of enlarged diameter at its lower end for receiving an end of a tubular conduit 32 formed preferably from a suitable flexible material such, for example, as the same type of elastomeric material from which the sleeve member 23 may be formed. For frictionally holding the tube 32 in the bore 31, the outer diameter of the tube 32 may be made slightly larger in diameter than that of the enlarged portion of the bore. The lower end of the tube 32 becomes immersed in the liquid in the bottle when the dispensing device is fitted on the bottle.

There is a horizontally arranged portion 35 of a fluid passageway in the body of upper unit 26, which portion is entirely internal of the body. To facilitate forming of the passageway 35, the lower wall of the body is made as a separate piece, which upon assembly of the dispensing pump is suitably fixed to an upper part 36 of the body. In the embodiment shown in the drawing, the said lower wall of such body constitutes a horizontally extending annular flange member 37 around the upper end of the stem 28 and is retained within a rim 38 on the lower end of part 36 and secured thereto by a suitable adhesive substance. There is an annular rabbet 39 formed in the inside face 40 of the flange 36 around the upper end of bore 31. Such rabbet receives a boss 41 which further assists in holding the flange on the lower side of part 36. Body part 36 is preferably hollowed out to provide a space 42 for making the dispensing unit light in weight.

Around the upper or outer edge of the body part 36 is

an upstanding annular rim 43 within which is positioned a hollow deformable dome 44 formed preferably of rubber, or one of the acceptable synthetic materials such as neoprene or perhaps a suitable plastic material. The inside wall of the rim 43 is cylindrical. The dome 44 preferably constitutes a segment of a hollow sphere of a radius slightly larger than that of the inner wall of the annular rim 43, and the circle which defines the lower edge of the dome is of slightly larger diameter than that of the inner wall of rim 43, whereby the dome must be contracted radially inwardly in order to be fitted within the rim. Such construction for the dome permits it to be held within the rim without requiring any adhesive or special flange arrangement, and provides an air-tight seal between the rim and the lower edge of the dome due to expansion of the edge of the dome resiliently outwardly against the rim. Also such construction for the dome causes it to be bulged outwardly when placed within the rim 43, and such bulging of the dome increases the resilient or elastic forces of the material of the dome which causes the dome to assume its normal configuration upon release of pressure against the top of the dome. An interior space 45 within the dome constitutes a chamber in which the dome itself comprises a movable wall. Upper surface 46 of the body part 36 forms the bottom wall of the chamber. The surface 46 is circular.

Centrally disposed in the body part 36 and opening into the surface 46 of the body is a depression 48. At its lower end the depression terminates in a frusto-conical valve seat 49 against which a ball check 50 seats, the ball check being one controlling a suction port 51 which provides for the flow of liquid from the bottle up through the port past the ball check and into the chamber 45. Surrounding the depression 48 at its interior wall, there is provided a series of flutes 52 for the purpose of guiding the ball check 50 during its movement up and down in the depression and also for providing between the flutes sufficient space to permit easy flow therethrough of relatively viscous liquids.

There is another depression 53 formed in the body part 36 and spaced radially from and extending parallel to the axially arranged depression 48. Like in the depression 48, the depression 53 terminates in a frusto-conical valve seat 54 in which a ball check 55 seats. Ball check 55 is guided in its up and down axial movement in the depression 53 by a circumferentially arranged series of axially directed flutes 56 on the interior wall of the depression. The ball check 55 controls a port 57 formed in axial alignment with the depression 53. Port 57 communicates with the horizontally arranged fluid passageway 35 referred to above.

The depression 53 is closed from the chamber 45 by means of a disc member 58 which covers the top of the depression. Disc 58 has a boss 59 which serves as a stop to limit upward motion of the ball check 55. Also, the disc carries an ear 60 projecting radially from the periphery of the disc and arranged to extend into the top end of the depression 48. Ear 60 has a boss 61 depending from its lower face and serving as a stop to limit upward motion of the ball check 50. The ear 60 does not cover the top of the depression 48 and thus liquid is free to travel from the depression 48 upwardly into the chamber 45.

Arranged one on each side of the depression 53 are two bores 63 and 64 which extend downwardly into the body part 36 from its upper surface 46 whereby the bores are open to the chamber 45. At their lower ends the bores are open to the horizontally arranged passageway 35 which in turn is in communication with the port 57 of the depression 53, as explained previously. Thus communication between the chamber 45 and the interior of the depression 53 is established by a fluid passageway comprising the bores 63 and 64, the horizontal section 35 and the port 57. The body part 36 is also provided with a horizontally arranged discharge conduit or bore

65 which communicates with the depression 53 near the top of the depression as shown and which extends to an outlet opening 66 in a discharge member, such as the spout 67 suitably secured on the exterior surface of the body.

The horizontal portion 35 of the passageway which extends from the chamber 45 to the outlet opening 66, as explained above, is conveniently formed as a recess in the upper space of the flange 37. When the upper section 26 of the dispensing unit is assembled and the flange 37 is fitted within the rim 38 to form the lower wall of the section 26, it is necessary that the recess 35 be arranged in a position which will insure communication thereof with each of the bores 63 and 64 and with the port 57. Thus the flange 37 is provided with a notch 70 on its periphery for engagement with a projection 71 on the inside wall of the rim 38, and such notch and projection are so located that upon alignment one with the other the recess 35 becomes aligned with the bores 63 and 64 and with the port 57. Such alignment of parts also brings into alignment two radially extending grooves 72 and 73 formed in the underside face of the flange 37 and in the end surface of the rim 38, respectively, as is shown best in Figure 5 of the drawings. These aligned grooves constitute a vent for admitting air into the interior of the bottle as the liquid is dispensed therefrom.

In operation, as thus far described, the dispensing pump is mounted as shown upon a container such as the bottle 15 with the conduit 32 extending to a position only slightly elevated above the bottom of the container (not shown). To eject liquid from the bottle the pump is manipulated by depressing the dome 44 down and up in alternate strokes. On the downward stroke the volume within the chamber 45 is reduced and initial air therein is ejected through the outlet passageway established by the bores 63 and 64, the horizontal recess 35, axial port 57, depression 53, and thence out through the discharge bore 65, which extends through the spout 67. When the dome is released, the inherent resiliency of the dome and the pressure developed by the dome being bulged outwardly, causes the dome to rise to its initial position, as shown in Figure 1. The ball check 55 seats closing off air which might otherwise be drawn back through the spout and thereupon the liquid in the bottle is drawn up through an intake passageway comprising tube 32, stem bore 31, suction port 51, and depression 48, and thence into the chamber 45. Ball check 50 is unseated by this flow permitting the liquid to enter the depression 48. Two or three initial operations of the dome may be necessary in order to fill the chamber to a suitable degree.

After the chamber has received a sufficient quantity of liquid from the bottle, a succeeding depression of the dome as shown in Figure 2 will force the liquid from the chamber through the outlet passageway, which previously had conducted the air from within the chamber to the outlet opening in the spout. Liquid flowing into the port 57 will cause the ball check 55 to become unseated thereby allowing the liquid to flow through the outlet passageway. Meanwhile, the ball check 50, as the result of the force of gravity on it coupled with pressure exerted in the chamber 45, will become seated, thus preventing flow of liquid downwardly through the conduit 32. As liquid is discharged from the bottle, it is replaced by air entering the bottle through the vent provided by the aligned grooves 72 and 73.

An important feature of the arrangement of valves and fluid passageways provided by this invention is that liquid being discharged through the outlet passageway will at no time during its travel become mixed with the liquid contained in the intake passageway. Also air initially contained in the chamber 45 can leave the chamber only through the outlet passageway and will not enter the inlet passageway where it could mix with fluid contained in the inlet passageway. Mixing of air with the liquid

causes bubbles to be formed in the liquid and such bubbles, when being ejected along with liquid through an outlet for pumps of the general type herein disclosed, causes squirting or sputtering of the liquid when being discharged by the pump. The present invention eliminates the cause of such sputtering action since as explained above any air that may be trapped in the chamber will not become mixed with liquid in the intake passageway.

For shipment of bottles as herein contemplated it is the usual practice to pack dispensing pumps separately from a bottle on which the pump is ultimately to be used. Under such conditions the bottle containing a liquid is closed with a conventional cap and prior to use of the contents of the bottle such conventional cap is replaced by a dispensing pump. As all dispensing devices of this general character require that there be a suitable vent provided for admitting air into the bottle as the liquid is dispensed therefrom, it is found that in cases where the pump has been used as a closure for the bottle during shipment, liquid escapes through the vent opening during shipment.

The dispensing device of this invention is designed to serve as a bottle closure which will not leak during shipment of the bottle and therefore it is not necessary to provide a separate closure cap for each bottle. To this end the device is constructed so that its vent opening may be closed simply and when in the hands of the user the vent may just as simply be opened again.

In the embodiment shown in Figures 1 to 8 inclusive, the stem **28** is provided with an axially directed groove **75** formed in its outer surface and which communicates with the groove **72** in the flange **37** of the stem. There is a radially extending opening **76** in the wall of the sleeve member **23** which opens into the interior of the bottle and is selectively registrable with a section of the groove **75**, i.e., the stem is turned on its longitudinal axis within the sleeve member so as to align the groove **75** with the opening **76** when it is desired to open the vent passageway. To close the vent, the stem is rotated in the sleeve so as to position the groove **75** out of alignment with the opening. So that the operator may be sure that the vent groove and opening **76** are in registration, the stem and the sleeve are provided with cooperating stop means which function to prevent turning of the stem in the sleeve in one direction beyond a position where alignment of the groove and opening **76** is established. Thus the neck part of the stem has a portion of an annular collar **78** projecting therefrom providing two annularly spaced end faces, one of which is indicated at **79** in Figure 8. Such portion of the collar **78** is preferably of an arcuate length of about 90°, and when the upper section of the pump is placed on the cap member **19**, the collar **78** is received within the cap opening **29**. The collar portion **78** is turnable, with the stem, between opposite ends of a ridge **80** which extends upwardly from the top face of the flange **24** of the sleeve member and half way around the opening provided by the bore **30** of the sleeve. When the cap member **19** is attached on the end of a bottle, the semi-circular ridge **80** extends into the cap opening **29** along with the collar portion **78**. As the collar portion **78** is of shorter arcuate length than the ridge **80**, it is clear that when the stem is fully seated in the sleeve, it can be turned by a quarter turn only, i.e., when the stem is turned in one direction, one end of its collar portion **78** will abut against an end shoulder of the ridge **80**. When next the stem is turned in an opposite direction in the sleeve, the other end of its collar portion will become engageable with an end shoulder of the ridge **80**. For insuring alignment of the opening **76** and groove **75** when desired the opening **76** is formed at a location in the sleeve which is in alignment with the groove **75** of the stem when the collar piece **78** of the stem is positioned in abutting relation against an end shoulder of the ridge **80** of the sleeve.

In the modification shown in Figures 9, 10 and 11 of the drawing, the sleeve and stem parts of the closure dispenser have their cooperating stops disposed within the sleeve. Thus there is provided a sleeve **85** formed of elastomeric material having an axial bore **86** and an annular flange **87** for fitting over the rim of a bottle. At its top end the bore **86** is cut away to provide a recess **88** extending approximately three-fourths of the way around the bore to leave a portion **89** which serves as a stop member limiting the extent to which a stem **91** may be turned in the bore of the sleeve. Stem **91**, like stem **28** previously described, has a flanged portion **92** and a vent groove **93** therein. Extending half-way around the neck of stem **91** is a semi-circular collar portion **94** which is received within the recess **88** of the sleeve **85** when the stem **91** is placed into the bore **86** of the sleeve. Thus the stem may be turned back and forth in the sleeve to the extent of approximately 90°, i.e., when turned in one direction, one end of the collar portion **94** of the stem will abut against one side edge of the projecting portion **89** in the sleeve and when turned in an opposite direction by approximately 90°, the other end of the collar **94** will abut against the other side edge of the projecting portion **89** thus limiting the extent to which the stem may be turned in the sleeve. The stem has an axially directed groove **95** in the outer periphery of its collar portion **94** which is aligned with the vent groove **93** of the stem. An opening **97** is formed in the wall of the sleeve at a location where such opening will be registrable with the groove **95** when the collar portion of the stem is in abutment with the projecting part **89** of the sleeve as is illustrated in Figure 10 of the drawing.

Prior to shipment of bottles closed by a closure dispenser as provided by this invention the body portion of the pump is turned in a sleeve so that the opening **97** is not in registry with vent groove **95** in the stem of the pump. This action closes the vent and thus prevents liquid from leaking out of the bottle. When it is desired to eject liquid out of the bottle, the pump is turned in the stem to align the stem opening with the vent groove to provide an open vent for admitting air into the bottle as liquid is dispensed by the pump. In cases where the bottle contains a liquid which may develop gas pressure within the bottle during shipment, it may be desirable to close the free end of the tubular conduit **32** as with cork (not shown) to prevent flow of liquid into the housing of the dispenser pump. Prior to using the pump it will be necessary to remove such cork or other suitable stopper from the tube to permit flow of liquid from the bottle into the pump.

While I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A closure for dispensing liquid from a container comprising a body portion adapted to cover an opening in the container, said body portion having an upper surface and a lower surface facing toward the interior of the container, a hollow dome of resilient material on said top surface providing a chamber between said upper surface and the inside wall of said dome, a first depression formed in said body portion and extending downwardly from said upper surface and opening into said chamber, a suction port extending from the lower end of said depression and opening in the lower surface of said body portion, a first valve seat around the upper end of said port, a ball check in said depression for seating on said seat, a second depression formed in said body portion and extending downwardly from said upper surface, said body portion having a passageway formed therein opening at one end thereof in said top surface and extending to a

point in said body portion below said second depression, a second port extending from the lower end of said second depression to said passageway, a second valve seat around the upper end of said port, a ball check in said second depression for seating on said second seat, means closing the upper end of said second depression, and a discharge conduit from said second depression to the exterior of said body.

2. The closure of claim 1 wherein said ports extend in axial alignment with their respective depressions.

3. The closure of claim 1 wherein the interior of each of said depressions is provided with a circumferentially arranged series of flutes for guiding said ball checks in their respective depressions.

4. In a dispenser for closing an opening in a container, a sleeve member adapted to be inserted in said container opening, means for removably holding said sleeve member in said opening, an axially directed bore through said sleeve member, at least the walls defining said bore being formed of resilient material, a dispensing pump for removing liquid from said container and including a cylindrical stem portion fitted in said bore, at least a section of said stem portion being of an outside diameter substantially equal to the diameter of a corresponding section of said bore whereby said stem portion is frictionally held in said bore and is rotatable therein, and stop means for limiting the extent of rotation of said stem in said sleeve member.

5. In a dispenser for closing an opening in a container, a sleeve member adapted to be inserted in said container opening, means for removably holding said sleeve member in said opening and for closing that portion of said opening around said sleeve member, an axially directed bore through said sleeve member, at least the walls defining said bore being formed of resilient material, a dispensing pump for removing liquid from said container and including a cylindrical stem portion fitted in said bore, at least a section of said stem portion being of an outside diameter substantially equal to the diameter of a corresponding section of said bore whereby said stem portion is frictionally held in said bore and is rotatable therein, stop means associated with said sleeve member and said stem portion for limiting the extent of rotation of said stem portion in said sleeve member, a vent passageway in said stem portion opening into the atmosphere, and an opening through said sleeve member opening into the interior of said container and selectively registrable with said passageway upon rotation of said stem portion.

6. In the dispenser set forth in claim 5 and wherein said opening in said sleeve portion is positioned for registry with said passageway when continued rotation of said stem in one direction is prevented by said stop means.

7. In a dispenser for closing an opening in a bottle, a sleeve adapted to be inserted in said bottle opening, an annular flange around said sleeve covering the rim of said bottle opening, a cap member having a top wall and bottle-engaging means for removably holding said cap member on said bottle and over the periphery of said flange, a central opening in said top wall, a bore in said sleeve and co-axial with said bottle opening, said sleeve being formed of resilient material, a dispensing pump for removing liquid from said bottle and including a cylindrical stem extending through said top wall opening and fitted in said bore, said stem being rotatable in said bore, stop means for limiting the extent of rotation of said stem in said bore, a groove formed in said exterior surface of said stem and in communication with the atmosphere, an opening through said sleeve, said sleeve opening being so positioned as to be in registry with said groove when continued rotation of said stem in one direction is prevented by said stop means.

8. In a dispenser for closing an opening in a container, a sleeve formed of resilient material and adapted to be inserted in said container opening, means for removably holding said sleeve in said opening, an axially directed bore through said sleeve, a body portion, means forming a chamber on one end of said portion with at least a part of said body portion constituting a wall of said chamber, and including a movable wall for altternately contracting and expanding the chamber, a first passageway through said body portion and opening into said chamber, a one-way valve in said passageway arranged to permit flow of liquid into said chamber and to prevent reverse flow of liquid, a discharge port in said body portion opening into the atmosphere, a discharge passageway in said body portion independent of said first passageway and providing flow communication from said chamber to said discharge port, a one-way valve in said discharge passageway arranged to permit flow of liquid from said chamber to said discharge port when said chamber is contracted, a cylindrical stem on said body portion and fitted in said bore of said sleeve, said stem being rotatable in said bore, and stop means for limiting the extent of rotation of said stem in said sleeve.

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