United States Patent

Lo

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[54] **PRESSURE ACTUATED VALVE**

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[73] Assignee: **S. C. Johnson & Son**, Racine, Wis.

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[52] **U.S. Cl.** **222/94**, 222/402.1, 222/402.25

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

[58] **Field of Search**.....222/402.1, 402.15, 402.18, 222/402.2, 402.24, 402.25, 95, 96, 394, 495, 94

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Assistant Examiner—Thomas E. Kocovsky
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[57] **ABSTRACT**

A package including a container for receiving fluid composition and propellant therein. A dispensing assembly mounted on the container which includes a body formed with a passageway communicating with the interior of the container, a valve member having an enlarged surface which is acted upon solely by the material under pressure in the container normally to close the passageway to prevent the flow of material from the container, and valve actuating means for shifting the valve member to effect fluid flow communication between the passageway and the interior of the container for dispensing said composition.

4 Claims, 12 Drawing Figures

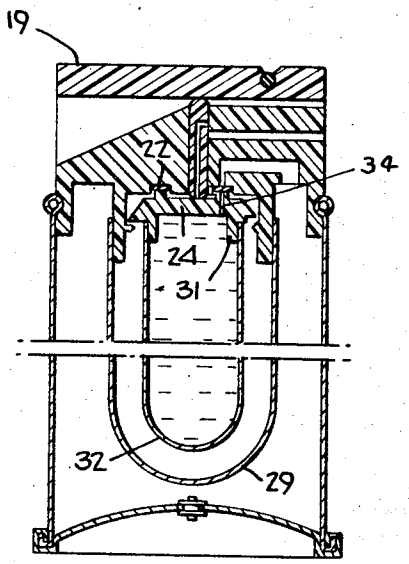


Fig. 1.

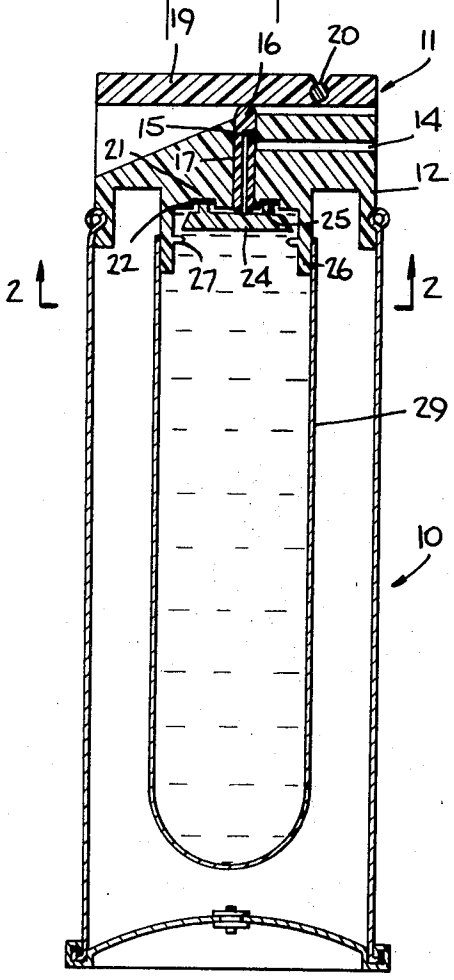


Fig. 2.

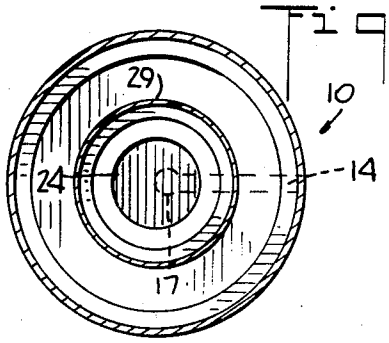


Fig. 3

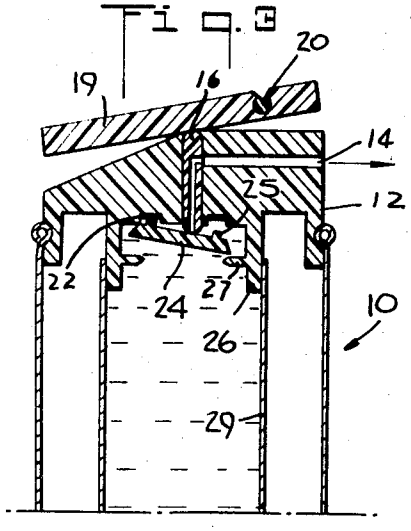


Fig. 4.

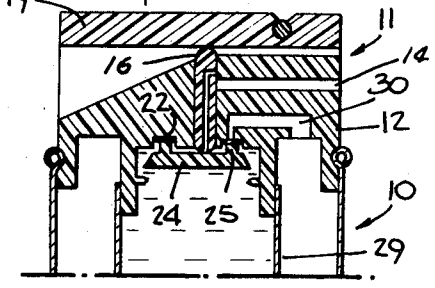


Fig. 5.

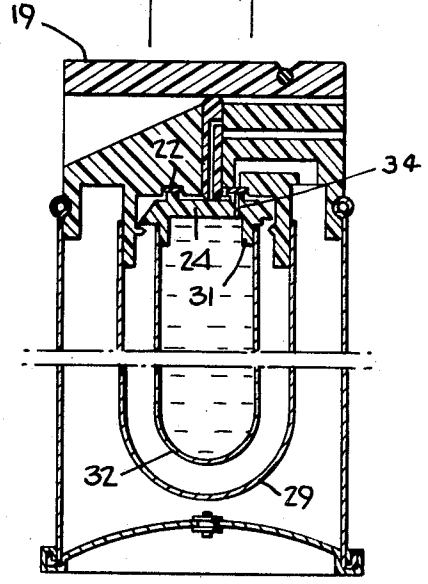


Fig. 6.

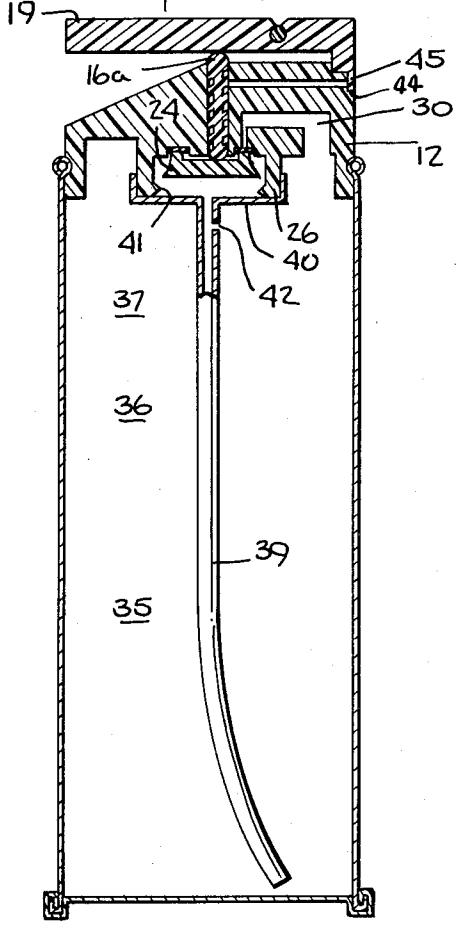


Fig. 7.

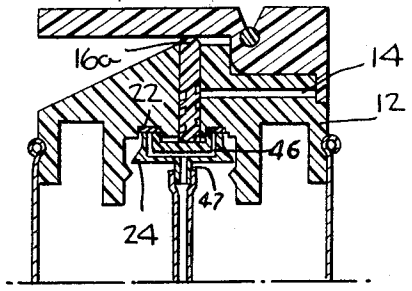


Fig. 8.

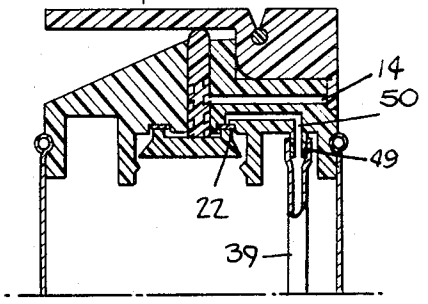


Fig. 9.

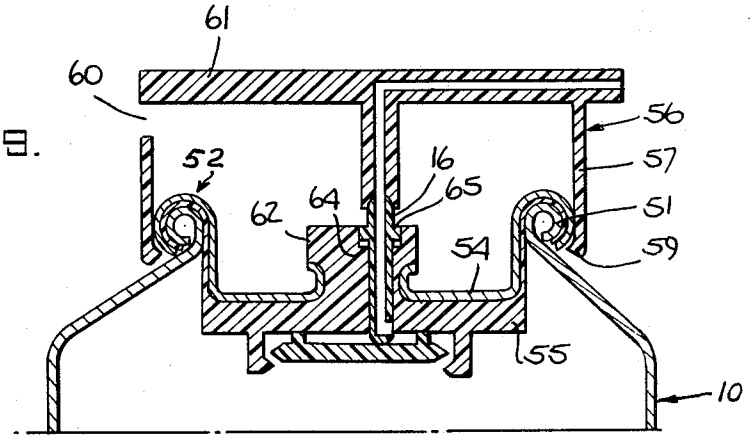


Fig. 10.

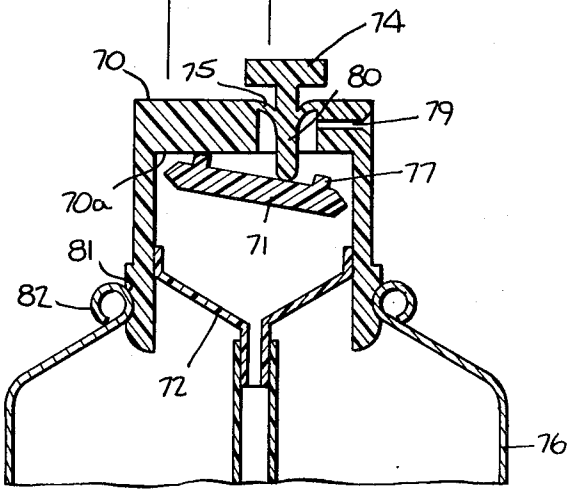


Fig. 11.

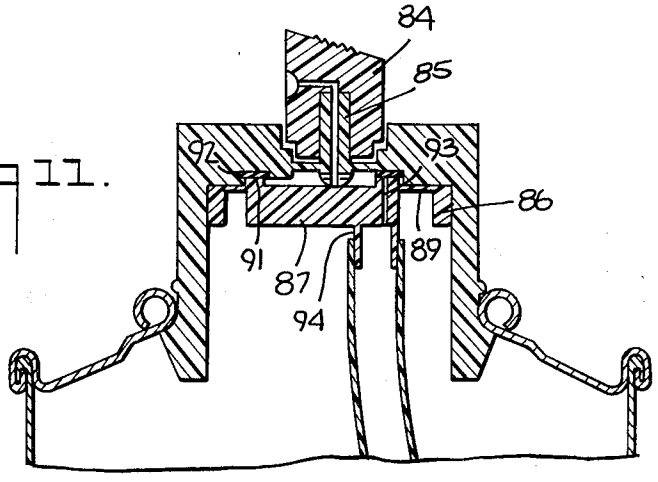
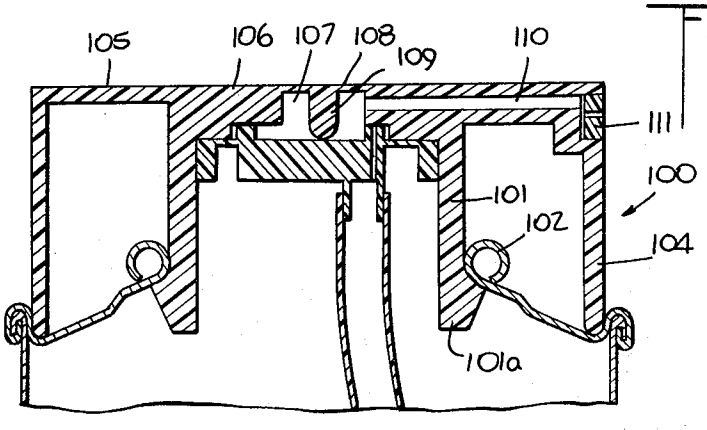


Fig. 12.



PRESSURE ACTUATED VALVE

This invention relates to pressurized packages such as those generally referred to as aerosol dispensers for example, and more particularly to such packages including a container for a fluid composition, a pressurized propellant for discharging same and a dispensing assembly controlling the discharge.

Heretofore, a substantial number and variety of dispensing assemblies have been developed for sealing various types of content in aerosol containers and for dispensing same under various conditions; and while the assemblies themselves are physically small, they are fairly complex and represent an important part of the cost of producing aerosol packages. Thus, efforts are constantly being made to simplify the construction and assembly of such units and to find less costly arrangements.

As far as I am presently aware, all such assemblies employ a rigid passageway, a valve seat and a valve body moveable relative to the seat to open and close the passageway, means, usually a spring or other resilient material to urge the valve body to rest on the valve seat to maintain the passageway closed, and means operable by an external force, such as manual force, to move the valve body against the force of the previously mentioned means to open the passageway.

I have conceived, by my invention, an effective solution to the problems presented and have actually constructed a successful and commercially desirable embodiment of this concept according to which I am able to produce a simpler and less expensive dispensing assembly with fewer components and, therefore a better package of the class described than presently known assemblies of comparable performance.

Essentially, my invention resides in the provision of an aerosol package wherein the dispensing assembly includes a valve member and a valve seat, the two normally cooperating to seal the pressurized content within the container, the net force acting on the valve member being derived solely from the pressure within the container.

Those persons skilled in the art appreciate the fact that the most commonly used propellants are maintained under sufficient pressure to cause same to liquify and, in some instances to be dissolved or emulsified in the product. As the volume of liquid is reduced by usage, some of the liquid propellant vaporizes into the head space of the container. Thus, the pressure of propellant in the container remains substantially constant until all of the fluid composition that contains the active ingredient is expelled. This characteristic of the propellant enables me to employ it to close a valve in the dispensing assembly, and by selecting my parts properly, to seal the contents of the container against leakage.

Thus, I provide a package of the class including a container, a fluid composition in the container, propellant means also in the container for discharging the composition from the container, and a dispensing assembly mounted in the container and comprising a body formed with passageway means communicating with the interior of the container, a valve member formed with a surface constructed and arranged to be acted upon by material under pressure in the container normally to close the passageway to prevent the flow of material from the container, a valve seat against which the valve member bears when in normal passageway closing position, the net force acting on the valve member to seat same being derived solely from the pressure within the container, and means shifting the valve member relative to the seat means and against the force acting upon the valve member from within the container to effect fluid flow communication between the passageway and the interior of the container.

The passageway may comprise simply a bore communicating at one end with atmosphere and at the other with the interior of the container and the valve member may act to close the passageway by engaging a suitable seat surrounding the passageway opening at its entrance to the container. For this latter purpose, the dispenser assembly body may be recessed to receive a resilient seating material and the valve member may be formed with a matching, upstanding rib or bead to engage and seat against same; or the dispenser may be lined with a soft plastic or other suitable material so that it serves as a proper seat and additional resilient materials are not needed.

The means used to unseat the valve member and open the passageway may be a plunger which is formed with a bore that constitutes at least part of the passageway; or it may be threaded and fit within the passageway to improve mixing of propellant and composition when both are discharged. In any case, I prefer that such valve activating means engage the valve member eccentrically so that the valve member tips as it opens. In this way, the force needed to open the valve will be less than the net force acting on the valve member by the internal pressure.

As another feature of my invention, I provide means to assure that the valve member, which may be unattached to the body of the dispenser assembly, will remain in the vicinity of the seat and will not drop to the bottom of the can. Thus, I may form a valve guide on the dispenser assembly body; and this guide may comprise a short sleeve dependent from the body and surrounding the valve member. The sleeve may have an inwardly extending annular rib, or several tabs, so dimensioned that the valve member is confined between the sleeve or tabs and the valve seat. The sleeve or tabs may be formed of resilient material so that the valve member may be snapped into position during assembly of the unit.

It will be appreciated that the present concept takes advantage of Bernoulli's principle to assure positive closing and sealing of the valve. Thus, a pressure drop occurs across the valve member when same is open tending to move it to closed position. As the opening force is relaxed, the valve member moves towards closed position and the pressure on the downstream side decreases as the discharging fluid moves through the more restricted opening, thus further increasing the pressure drop across the valve member and effectively increasing the closing and sealing force.

The present invention lends itself readily to vapor taps, if such are to be used; and these may be formed in the body of the dispenser assembly or in a dip tube or both, as will become apparent hereinafter.

Further specific features and advantages of the invention will be hereinafter more fully set forth with reference to the annexed drawings, showing a presently

preferred embodiment of the invention and certain modifications thereof, in which:

FIG. 1 is a vertical cross-sectional view of a pressurized package according to the present invention with the valve closed;

FIG. 2 is a cross-sectional view taken along the lines 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view similar to FIG. 1, but showing the valve open;

FIG. 4 is a partial vertical cross-sectional view of a package similar to that of FIG. 1, but illustrating the use of a vapor tap;

FIG. 5 is a view similar to that of FIG. 1, but illustrating a further embodiment of the present valve;

FIG. 6 is a vertical cross-sectional view illustrating yet another embodiment of the present valve;

FIG. 7 is a partial cross-sectional view illustrating a variation of the embodiment of FIG. 6; and

FIGS. 8, 9, 10, 11 and 12 are cross-sectional views illustrating still further embodiments.

Referring now to the drawings in detail, and more particularly to FIGS. 1, 2 and 3 thereof, there is shown a pressurized package of the class described comprising generally a container 10 and a dispensing assembly 11 mounted on the container and comprising a body 12 formed with a passageway 14 communicating with the interior of the container. It will be seen that in the present embodiment, the passageway 14 has a horizontal leg, is open to atmosphere at the side of the body and a vertical leg open to the container at the bottom of the body. The vertical leg of the passageway 14 actually is a bore 15 in a vertical pin or plunger 16 slideable in a bore 17 in the body 12. An actuating lever 19 is mounted on top of the body for pivotal movement about a pin 20 and can depress the plunger 16 in the bore 17.

The bottom surface of the body 12 is formed with an annular recess 21 surrounding the opening of the passageway 14 into the container, and in which is positioned a suitable resilient sealing material 22 such as plastic or rubber, or the like.

A valve member 24 in the shape of a circular disc is formed with an upstanding, annular rib 25, adapted to mate with the sealing material 22; and an annular sleeve 26 is shown depending from the base of the body 12 and surrounds the valve member 24. This sleeve 26 extends beyond the valve member and is formed with an inwardly extending rib or ledge 27 that partially underlies the valve member 24. It will be noted that the valve member 24 is not permanently attached to the body 12 and the ledge 27 serves to restrict the movement of the valve member confining it to the vicinity of the passageway opening. The ledge 27 is preferably made flexible so that, in assembly, the valve member may be snapped into position.

In the embodiment shown, fluid composition to be expelled is contained within a bag 29 which is attached to the sleeve 26, and the propellant is in the container surrounding the bag.

In operation, the lever 19 is manually depressed at its left side, as viewed, to pivot about the pin 20 and push the plunger 16 downwardly. The plunger, at its lower end, engages the upper surface of the valve member 24, preferably somewhat off-center, and tilts same downwardly from the position shown in FIG. 1 to that shown in FIG. 3 in which latter position the valve member is unseated relative to the sealing material 22 so that the composition in the bag 29, under pressure of the propellant, can escape to atmosphere through the vertical leg of the passageway 14 in the plunger 16 and the horizontal leg in the body 12.

Upon release of the lever 19, the pressure in the bag acting upon the valve member 24 returns same to its normal, closed position as shown in FIG. 1, thus sealing the content of the bag from further discharge.

The area of the bottom of the valve member will, of course, be of sufficient size, depending upon the pressure in the bag to close and seal the discharge passageway, without the need of a spring or other resilient material, when no pressure is exerted on the lever 19; and yet it will be small enough to permit easy actuation by manual pressure. The radial thickness of the upstanding annular rib 25 should be as small as practical so that the pressure on the face of the rib will be great enough to insure a good seal. Those persons skilled in the art will be readily familiar with the formulae necessary to derive proper valve member size depending upon the particular application. As Bernoulli's principle demonstrates, a pressure drop will occur across the valve member when same is tilted to open position so that the internal pressure acting on the bottom of the valve member will be greater than that on its upper surface, thus tending to move same to its normal, closed position.

Turning now to FIG. 4, there is shown an embodiment similar to that of FIGS. 1 to 3, but utilizing a vapor tap to permit some propellant to mix with the discharging content of the bag. The various parts are substantially the same as those shown in FIGS. 1 and 3, but a vapor tap 30 is provided in the form of a passage in the body 12 communicating at one end directly with the propellant space between the bag and the outer container, and including one or several small holes (not shown) through the sealing material 22. The face of the rib or bead 25 on the valve member 24 normally closes the hole or holes so that no propellant escapes; but when the valve is opened, a quantity of propellant, dependent upon the size and the number of the holes, is discharged along with the bag content.

In FIG. 5, I demonstrate that the principle of the present concept can be applied to an aerosol package which employs a propellant and two materials to be stored separately but discharged simultaneously. The construction of this embodiment is similar to that of FIG. 4 except that the valve member 24 is formed with a depending skirt 31 upon which is mounted a second bag 32 that extends down inside of the bag 29. A vapor tap may or may not be used; but if one is used, it is as described in the discussion of FIG. 4. For discharge of the content of the bag 32, one or more holes 34 is bored through the valve member 24 to communicate at one end with the interior of the bag 32, and at the other end opposite the seal material 22.

It will be seen that the pressure of the propellant is transferred through the content of the bag 29 to the content of bag 32 to act on the valve member to urge same to closed position, and that the bags will collapse as their content is discharged so that a closing pressure is maintained on the valve member.

When the lever **19** is moved to valve opening position, the valve member is tilted away from the seal material **22** at its right, as viewed, to uncover the bore **34** allowing discharge of the content in bag **32**, to permit direct flow of the content of the bag **29** as already described, and to uncover the vapor tap opening, if one is used.

In FIG. **6**, I illustrate the application of my invention to a package of the type that employs a dip tube. Thus, I show the container **10** and dispensing assembly **11**, the package including a fluid composition **35** that sinks to the bottom of the container, a propellant that occurs in liquid phase **36** and/or a vapor phase **37**. In this case, a dip tube adaptor **40** is used to connect the dip tube **39** to the sleeve **26**. Also, in this embodiment, I show the valve member **24** as having outwardly and downwardly tapering side walls to engage a bead **41** formed within the sleeve **26**, thus to limit movement of the member **24**.

It will be seen that when the valve shown in FIG. **6** is open, the propellant forces the composition **35** up through the dip tube **39** to discharge. A vapor tab **30** such as described in discussing FIG. **4** may be used, or a tap **42** may be formed in the dip tube to communicate with the vapor phase **37** of propellant, or both may be used.

I have also altered the construction of the valve actuating plunger which, in the present case, is shown at **16a** and comprises a rod formed with an exterior thread so that fluid winds up around it and reaches the horizontal leg of the passageway **14** for discharge. This feature assures thorough mixing of fluid compositions and is especially recommended where a vapor tap is employed. The body **12** is also recessed as at **44** and the lever **19** has a mating tab **45** that is normally positioned in the recess to close the exit end of the passageway, thus to prevent exposure to atmosphere and consequent drying of any ingredient left in the passageway after discharge.

FIG. **7** illustrates another dip tube arrangement in which the valve member **24** has passageway means **46** that open against the seal material **22** and connects with a downwardly extending nipple **47** to which dip tube **39** is connected. Upon opening of this valve, product is forced up the dip tube through nipple **47** and passageway means **46** to the passageway **14**; and propellant vapor passes between the separated valve member **24** and seal material **22** to mix with product in the groove of the plunger **16a** and the horizontal leg of the passageway **14**.

FIG. **8** also uses a dip tube **39**, but in this case it is connected at its upper end to a nipple **49** forming part of a passage **50** in body **12** and including a hole (not shown) in the seal material **22**. When the valve is open, product flows up through tube **39**, nipple **49**, passage **50** and passageway **14** to atmosphere while propellant vapor can pass through open valve **24** to passageway **14**.

In FIG. **9**, I show an embodiment of my present concept according to which the container **10** has a rolled upper edge **51** about which a valve cup **52** formed of metal **54**, lined with plastic **55** is sealed by conventional rolling. A plastic overcap **56** having a skirt **57** with an internal bead **59** is snapped on to the rolled joint and is recessed at **60** to allow the top **61** to act as a valve lever due to the flexibility of the plastic. In this case, the valve cup is formed with a hub **62** recessed as at **64** to limit movement of the plunger **16** that has wings **65** for the purpose. An important feature of this construction resides in the fact that the plastic lining **55** for the valve cup may be so selected as to provide inherently a good sealing surface for the rib **25** of the valve member **24** so that no further sealing material is needed.

The modification illustrated in FIG. **10** comprises a semi-rigid valve body **70**, valve member **71** and conical dip tube adaptor **72**. The body **70** is generally cup-shaped and includes a depressible button **74** connected to the main section of the body by an annular flexible diaphram **75** so that the body, including the button and diaphram may be of one piece. The valve member **71** is similar to those already described and is normally urged upwardly by pressure within the container **76** so that its upstanding rib **77** bears against the lower surface **70*a*** of the valve body to seal the contents of the container against leakage. The adaptor **72** is press fit into the open end of the body, is funnel-shaped and may have a dip tube attached to its stem.

In FIG. **10**, the valve is shown in open position as would occur when a downward force depressed the button **74**. The pressurized content of the container flows upwardly through the dip tube, the adaptor **72**, around the outer periphery of the valve member **71**, across the rib **77** and to atmosphere through a passage **79** in the body. The button is actually formed with a stem **80** that is off-center relative to the valve member so that when open, the valve member tilts as shown, and also so that less force is required to unseat same than would be required if the stem **80** contacted the valve member at its center.

An important advantage of this embodiment, and the embodiments of FIGS. **1** to **8**, resides in the fact that the body **70** can be formed with an annular external groove **81** so that it can be snapped into the top opening of a container in such a way that the bead **82** on the container enters the groove **81**. I have found that, when so assembled, the pressure acting on the undersurface of the valve member and on the surface **70*a*** of the valve body assures a tight seal between the groove **81** and the bead **82**; while the pressure acting on the vertical side walls of the valve body tends to expand same horizontally thus to prevent dislocation of the body relative to the container.

A similar arrangement is shown in FIG. **11**, but in this case, discharge occurs through the button **84** which is press fit over its stem **85** with the discharge passage consisting of mating bores in each piece. Additionally, an annular ring **86** is press fit into the valve body and is connected to the valve member **87** by a flexible diaphragm **89**. The stem **85** and the valve member **87** are off-center relative to the annular ring **86** so that upon depression of the button **84**, the stem will cause the valve member to tilt downwardly so that rib **91** is moved away from a seat **92** recessed in the valve body to allow product to pass through the dip tube, a bore **93** through the valve body and its rib **91** to the bores in the stem **85** and button **84** to atmosphere. As shown, the dip tube may conveniently be slipped over a short tube **94** depending from the valve member and communicating with the bore **93**.

FIG. 12 illustrates an embodiment utilizing a body member formed for snap-in assemble with a container bead, as in FIGS. 10 and 11, but arranged with an overcap configuration. Thus, the valve body 100 has a depending skirt 101 formed with an enlarged rim 101*a* to engage the bead 102 of the container. Again, the pressure in the container assures a good seal and a firm connection.

The body also has an outer depending skirt 104, the lower edge of which sits on the domed container top just within the crimped connection between it and the container side wall. The body 100 may have a flat top wall 105, as shown, which is somewhat thickened as at 106 within the confines of the inner skirt 101 and centrally recessed, as at 107, to provide a thin region 108. An integral stem 109 depends from the center of the thin region 108 to contact a valve member similar to member 87 shown in FIG. 11; and a discharge passage 110 in the body 100 communicates with the recess 107. An atomizing nozzle 111 may be conveniently positioned at the downstream end of the passage 110, as shown.

In this embodiment, I prefer to form the body 100 of polyethylene or other plastic which has some flexibility so that it can be centrally depressed to cause the stem 109 to unseat the valve member in a manner already described. Product then flows through the dip tube and the valve passage, into the recess 107, through passage 110 and atomizer 111 to atmosphere.

From the foregoing description, it will be seen that I have contributed a pressurized package including a dispensing assembly having a valve arrangement wherein the net force acting on the valve member to close and seal same is derived solely from the pressure within the container, thus obviating the need for the conventional spring or equivalent resilient member. By the various embodiments illustrated and described, I have shown that my present invention can be employed in a variety of types of pressurized packages.

I believe that the construction and operation of my novel package will now be understood, and that the advantages of my invention will be fully appreciated by those persons skilled in the art.

I claim:

1. A package of the class including a container, a fluid composition in the container, propellant means also in the container for discharging the composition from the container, and a dispensing assembly mounted on the container and comprising a body, an outlet passageway formed in the assembly and communicating with the interior of the container and having a recess opening into the container, a plate-like valve member including a section in fixed mating engagement with the interior wall of said recess and formed with an element constructed and arranged to be acted upon by material under pressure in the container normally to close said passageway to prevent the flow of material from the container, said section and said element being integrally connected by flexible means whereby free floating relative movement therebetween may be effected, said plate-like valve element having an upstanding annular rib-like portion, a through bore having one end opening in said rib-like portion and having the other end opening into the interior of the container, said body having an annular recessed valve seat against which said rib-like portion bears when in normal passageway closing position, a valve stem movable in response to a force applied manually for acting eccentrically against the plate-like valve element to tip same to its open position to effect fluid flow communication between the passageway and said through bore leading into the interior of the container, the net force acting on the valve element to seat same on said valve seat and to return said valve stem to its released position being derived solely from the pressure within the container.

2. A package of the class including a container, a fluid composition in the container, propellant means also in the container for discharging the composition from the container, and a dispensing assembly mounted on the container and comprising a body formed with a passageway communicating with the interior of the container and having a recess opening into the container, a plate-like valve member formed with an enlarged surface constructed and arranged to be acted upon by material under pressure in the container, said valve member being free-floating with respect to said body, said body being formed with an annular recess surrounding the passageway opening therein, resilient material positioned within said recess and said valve member having an upstanding annular rib normally engaging said resilient material to seal the passageway against fluid flow communication within the container interior, a plunger mounted in said valve body movable in response to an external force applied manually for acting eccentrically against the plate-like valve member to tip same to its open position to effect fluid flow communication between the passageway and the interior of the container, the net force acting on the valve member to engage said rib with said resilient member and to return said plunger to its released position being derived solely from the pressure within the container.

3. A package according to claim 2, wherein said valve member has a through bore having one end opening in said rib-like portion and having the other end opening into the interior of the container.

4. A package according to claim 2, wherein said body has a passageway communicating at one end with the interior of the container and at the other end with holes through said resilient material.

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