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Schultz

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[54] **CAPTIVE TIP-SEAL VALVE**

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[51] **Int. Cl.**..... **B65d 55/02;** B65d 83/14

[58] **Field of Search**..... 222/153, 402.11, 402.12, 222/402.21, 402.22, 402.23, 513, 521

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[57] **ABSTRACT**

The invention comtemplates valve structure for a container of liquid products, for enabling selective dispensing of such products, upon tilting or tipping the dispensing axis with respect to the container axis. A closure cap has a central aperture in its closed end, for open-close coaction with the dispensing end of the valve structure, and the closure cap is captive assembled with and threadedly engaged to an exposed part of the valve structure. The relationship is such that upon full threaded advance of the engagement, the cap skirt is non-tiltably abutted to a part of the container and the cap aperture is closed by engagement to valve structure; on the other hand, upon cap-unthreading displacement, the cap aperture is opened and product may be dispensed upon tilting the valve structure.

16 Claims, 6 Drawing Figures

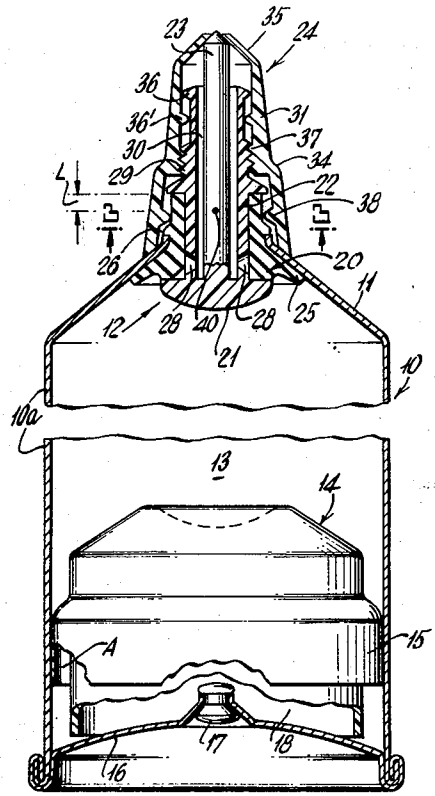


Fig.1.

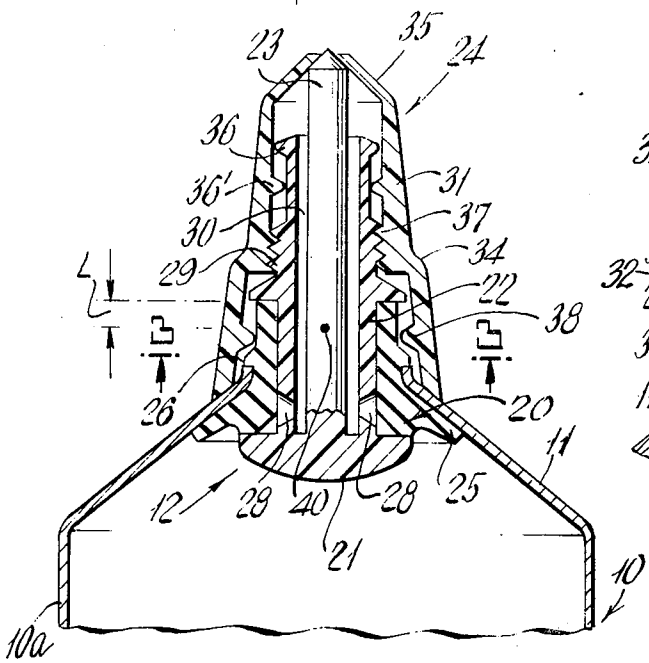


Fig.2.

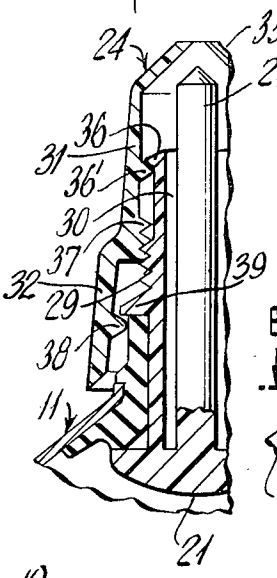
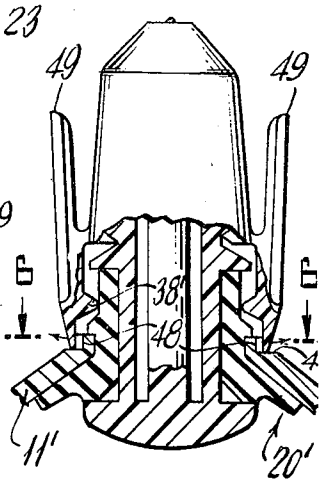


Fig.5.



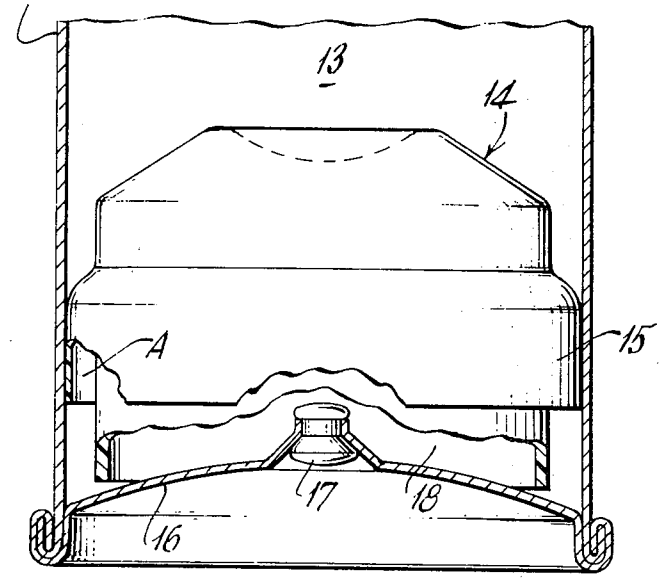


Fig.6.

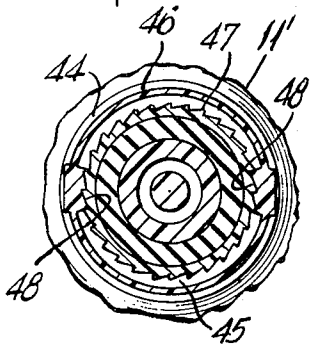
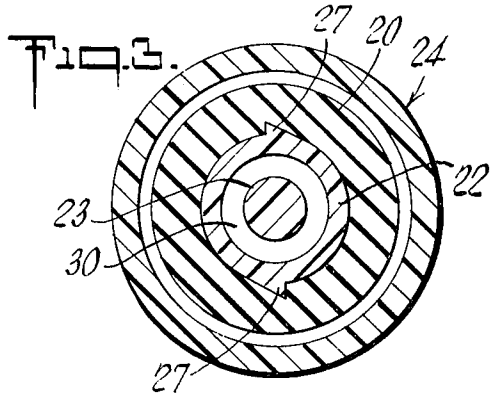


Fig.3.



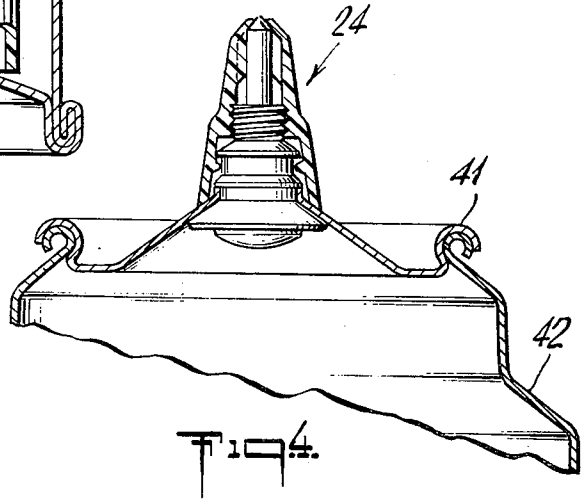


Fig.4.

CAPTIVE TIP-SEAL VALVE

The present invention relates to valve structure for a container of liquid products, such as a pressurized container for viscous products, and the invention is particularly concerned with safety features of such valve structure.

It is an object of the invention to provide improved structure of the character indicated.

Another object is to provide in such structure for positive locking of the valve against accidental dispensing of product.

A further object is to provide in such structure means for positively closing the product-dispensing opening at the point of product dispensing, when the mechanism is in locked condition.

A specific object is to produce an improved valve and container construction of the character indicated, wherein pressure in the container inherently enhances valve-seal effectiveness both to the container and to a manipulable dispensing-valve member.

A further specific object is to provide such a valve construction with a captively retained selectively operable locking screw cap in such manner that placement of the cap inherently enhances valve-seal effectiveness both to the container and to the valve member.

Another object is to produce such a construction with inherent child-safety features.

A general object is to achieve the foregoing objects with a structure which inherently simplifies container assembly, which enables smooth and reliable operation, and which also ensures against product-seepage in the valve-closed condition of the valving region.

Other objects and various further features of novelty and invention will be pointed out or will occur to those skilled in the art from a reading of the following specification, in conjunction with the accompanying drawings.

IN SAID DRAWINGS

FIG. **1** is a longitudinal sectional view of a pressurized container and valve of the invention;

FIG. **2** is a fragmentary sectional view similar to FIG. **1** to show a different relation of the same parts;

FIG. **3** is a sectional view, taken at **3—3** in FIG. **1**;

FIG. **4** is a fragmentary view similar to FIG. **1** to illustrate application of the invention to a different-style container; and

FIGS. **5** and **6** are respectively longitudinal and transverse sectional views to show a modification, FIG. **6** being taken at **6—6** in FIG. **5.**

Referring to FIG. **1,** the invention is shown in application to a pressurized container or can **10** formed with an integral conical top-end wall **11** and provided with a valve, referred to generally by the reference number **12.** The valve **12** is of the variety in which a valve stem is pressed laterally in a wellknown manner in order to release the valve seal and permit container contents, which may be a viscous product **13,** under superatmospheric pressure, to be expelled to the atmosphere. As disclosed in detail in my copending application, Ser. No. 290,977, filed Sept. 21, 1972, a generally tubular hollow piston **14,** which may be constituted of a low-density polyethylene or a polypropylene material, may be used to drive product **13** through the dispensing valve **12.** As also disclosed in said application, piston **14** includes a relatively thin annular-shaped

flange **15** provided with a depending skirt portion having a large surface area for dependable but light sealing contact with the inner wall **10***a* of the container **10.**

The container **10** is of the bottom-fill variety, being closed by a bottom wall **16** with a central opening having a sealing grommet **17** through which a gas **18,** such as nitrogen, is introduced after the viscous product **13** and the piston **14** are inserted into the container. The gas **18** presses against the interior surfaces of the top of piston **14** as well as in the space A, beneath flange **15** and between the outer vertical walls of the piston and the inner wall **10***a* of the container **10.** It will be apparent that the pressure of the gas **18** present in the space A will force the thin resilient flange **15** into light sealing contact with the inner wall **10***a* of the container **10,** and that the nature of the thin resilient flange **15** is to flex in and out of any indentations and over any projections or other imperfections that might be present on the interior wall surfaces of the pressurized container.

More specifically, the valve **12** of FIG. **1** is shown to comprise three parts, namely, an elastomeric bushing **20,** a valve member **21** with an integral valve-stem portion **22** and central-pin portion **23,** and a captive locking closure cap **24.** Bushing **20** has a central bore communicating between the inside and outside of the container. A flared inner flange **25** of bushing **20** resiliently seats upon and is conformed to the concave conical shape of the end-closure member **11,** and a circumferential bead **26** is the means of completing axial location of bushing **20** at the central opening of member **11** preferably, in its unstressed state the taper of the bushing flange **25** is at a greater included angle than that of the taper of end closure member **11.** The valve member **21** has a truncated spherical lower surface which nests in the spherical concavity of the closed end of piston **14,** as product **13** nears complete expulsion from the container. The outer diameter of valve member **21** is such as to present a flat annular sealing seat to the inner axial end of the bushing bore, sealing contact being normally urged by the pressure charge upon product **13.** The valve-stem portion **22** is annular, extending integrally upward from and coaxial with valve member **21.** Portion **22** is cylindrical and of reduced thickness within the bushing bore, and it includes one or more local outward splines, nibs or ribs **27** for non-rotatable retention in the bushing bore, valve-stem portion being particularly well held against counter-clockwise rotation with respect to bushing **20.** Stem portion **22** is thus resiliently suspended by bushing **20** and may be tilted to locally unseat the valve member **21** and allow product **14** to pass via one or more local ports **28** to the interior of stem **22.** The outer exposed end of stem portion **22** is slightly enlarged, for axial retention with respect to bushing **20** and for definition of cap-engageable threads **29.** Within the bore of stem **22,** the pin portion **23** extends integrally from valve member **21** in such radial clearance as to define an annular passage **30** for product dispensing. Pin **23** extends beyond the outer end of stem portion **22** and is preferably conically formed at its end, for a sealing purpose to be explained.

The closure cap **24** is shown as comprising first and second shirt portions **31–32** which flare outwardly, with an integral offsetting connection at **34,** and the outer closure end **35** is centrally apertured and characterized to define a conical seat for coaction with the end of pin **23.** Threads **37** in the skirt portion **31** engage the stem threads **29,** and a circumferential inward bead

or rib **38** in the bore of the second skirt portion **32** has lost-motion axially capturing relation with the flange **39** of stem portion **22,** the extent of lost-motion being suggested by legend L in FIG. **1**; rib **38** also has circumferential seal contact with the adjacent cylindrical surface of bushing **20,** to resist product entry into (and therefore product drying in) the skirt of cap **24.** An outward flange **36** at the end of stem **22** interferes with and sealingly engages an inward flange or bead **36'** in cap **24,** at the outer limit of cap propulsion (see FIG. **2**). Finally, the base end of cap **24** is beveled to substantially match the locally engaged contour of end-closure member **11,** for use in the fully locked and sealed relationship depicted in FIG. **1.**

The described valve parts are basically simple and are manufactured by well-understood techniques. The valve member **21** with its integral stem and pin projections **22–23** may be a single piece of injection-molded plastic. Similarly, cap **24** may be a single injection-molded part. The material of bushing **20** should be relatively soft, the particular durometer being dictated by the product viscosity and by the desired valve action; in general, the durometer is selected in the range from **40** to **80,** and **60**-durometer material has been found satisfactory in a hand-lotion application of a tilt-valve bushing as at **20.**

It will be appreciated that in the locked condition shown in FIG. **1,** cap **24** has been so downwardly advanced by threads **29–37** that the lower skirt portion **32** is firmly set against container end member **11.** At the same time, stem portion **22** has been drawn upwardly, to force valve member **21** into more firm seating and sealing engagement with bushing **20** and also to enhance the wedged sealing contact of bushing **20** between the concave cone of member **11** and the cylindrical fit of the bushing to stem **22.** Still further, at the same time, the parts will be understood to have been so proportioned that in this closed condition the cap aperture at **35** is fully closed by the fit of pin **23.** Of course, in this closed and locked condition, it is not possible to tilt the valve mechanism, and so no product has a chance of being dispensed. Furthermore, sealed closure at the tip seal provided by pin **23** means that neither air nor contaminant dust or the like have any chance of degrading product within the dispensing channel within the total described valve structure.

To ready the article for dispensing use, the cap **24** is manually unthreaded within the lost motion L, thereby elevating the skirt portion **32** from member **11** and also withdrawing pin **23** from engagement with the dispensing aperture at cap end **35.** To dispense product, the cap **24** is tilted within the available skirt-to-container clearance (**32** to **11**), about a "center" of rotation suggested by a heavy dot **40,** all as permitted by the yieldable suspension afforded by bushing **20.**

In the arrangement of FIGS. **5** and **6,** many parts correspond to those already described and have, therefore, been given the same reference numbers, with primed notation. The container end **11'** has been formed with a short annular platform **44** to receive the seating of the cap skirt, in its closed position, at which time a radial clearance **45** will be observed between cap skirt **46** and radially outwardly directed ratchet-tooth formations **47** on the limited central neck of cont-ainer end **11'**. Diametrically opposed inward ratchet-locking teeth **48** have escaping coaction with teeth **47** in the cap-thread-on direction of rotation, while the direction of cap unthreading is frustrated by teeth **48** positively locking to teeth **47**; in the said escapement, the cap skirt is transiently distorted to oval shape, clearance **45** being reduced in the process. A locked cap **24** is released for unthreading only by radially inwardly squeezing or pressing tabs **49** (in angular register with locking teeth **48**), to lift teeth **48,** i.e., to outwardly displace them from their locked engagement to teeth **47,** the action being that of a lever fulcrumed at bead **38'**, as will be understood, the local lever action being permitted by clearance **45** as the cap skirt transiently deforms to elliptical shape in response to the lever action (ratchet-tooth disengagement). Once the ratchet lock is disengaged, the cap may be unthreaded, and product dispensed, by mere tilt of valve member **21.**

The described structures will be seen to have achieved all stated objects with a basic economy of parts and fabrication cost. At the same time, seal effectiveness is enhanced, particularly if skirt portion **32** contacts container-end member **11** before pin **23** closes the apertured end of the cap. And, the cap **24** is never disassembled from, and indeed coacts to perform an important functioning part of, the valve and its operation.

While the invention has been described in detail for a preferred form, it will be understood that modifications can be made without departure from the invention as defined in the appended claims. For example, the end-closure member **11** may be a separately fabricated part, for chime connection (**41**) to a container **42** of the top-filled variety, as suggested by the fragmentary showing of FIG. **4.** And even if member **11** is of wider conical flare, or even flat, the jacking nature of cap skirt engagement thereto, prior to pin closure of the apertured end of the cap, means an enhanced seal of the locked container.

What is claimed is:

1. In combination, for use in a pressurized container, a rigid centrally apertured container closure member having a conical taper in the direction of the aperture, an elastomeric bushing fitted to the concave taper and extending through the aperture, said bushing having a central longitudinal bore extending axially through the aperture region of the closure member, a valve member seated in axial abutment with said bushing and including a dispensing stem with an outer annular body portion fitted to and extending through and beyond the outer end of the bore of the bushing, said stem further comprising an elongate pin radially spaced within the bore of said outer body portion to define an annular passage for flow of dispensed container contents, and a closure cap having a centrally apertured end and a skirt surrounding exposed parts of both said stem and said bushing, axially interfering rotatable means coacting between an exposed part of said annular body portion and said skirt for captive axial retention of said cap on said stem, and threaded means coacting between an exposed part of said annular body portion and said skirt for relative axial threaded positioning of said cap and stem, said pin being so formed as to coact with the aperture of said cap end to effectively close the aperture for such advance of said threaded engagement that said skirt abuts said closure member; whereby, upon retraction of threaded engagement and in the presence of internal pressure within a container of which said closure member forms a part, said valve member and bushing are pressure-loaded against the convergent taper, and

said cap is caused to relieve itself from contact with said closure member and to effectively open the cap-end aperture, so that product may then be selectively dispensed upon tipped displacement of said cap and stem against the yielding support provided by said bushing.

2. The combination of claim **1,** in which said closure member is the integral frusto-conical top-end wall of a cylindrical container which is open at its other end, for bottom-fill application.

3. The combination of claim **1,** in which said closure member is a circular end-wall member having peripheral formations adapted for assembly to a container open at its top end, for top-fill application.

4. The combination of claim **1,** in which said bushing has a conically tapering formation adapted to circumferentially continuously extensively and yieldingly engage said closure taper.

5. The combination of claim **4,** in which the unstressed taper of said bushing is at a greater included angle than that of the taper of said closure.

6. The combination of claim **1,** in which said bushing has a reduced circumferential waist at which it is received in the aperture of said closure.

7. The combination of claim **1,** in which said pin projects axially beyond the axially outer end of said annular body portion.

8. The combination of claim **1,** in which said pin and cap end are tapered at their interfit for aperture closing.

9. The combination of claim **1,** in which said stem has projecting formations engaging the bore of said bushing to resist relative rotation and to permit axial displacement of said stem within the bushing bore.

10. The combination of claim **1,** in which adjacent radially spaced surface regions of said container-closure member and of the skirt of said cap include coacting ratchet-tooth formations having escapement action in the thread-advancing direction of cap rotation and having locking engagement in the retracting direction of cap rotation, said skirt being resiliently deformable to permit such escapement action and to permit such deliberate deformation by manual actuation as to relieve ratchet engagement for a cap-retracting unthreading rotation.

11. In combination, for use in a container of liquid product, a rigid centrally apertured container closure member having inner and outer sides, an elastomeric bushing in axially-retaining fitted relation to said member and extending through the aperture and between inner and outer sides, said bushing having a central longitudinal bore extending through the aperture region of the closure member, a valve member seated in axial abutment with the inner end of said bushing and including a dispensing stem with an outer annular body portion fitted to and extending through and beyond the outer end of the bore of the bushing, said stem further comprising an elongate pin portion extending beyond the axially outer end of said annular portion, and a closure cap having a centrally apertured end and a skirt surrounding outwardly exposed parts of both said stem and said bushing, axially interfering rotatable means coacting between an an exposed part of said annular body portion and said skirt for captive axial retention of said cap on said stem, and threaded means coacting between an exposed part of said annular body portion and said skirt for relative axial threaded positioning of said cap and stem, said pin being so formed as to coact with the aperture for such advance of said threaded engagment that said skirt abuts said closure member; whereby, upon retraction of threaded engagement, said cap is caused to relieve itself from contact with said closure member and to effectively open the cap-end aperture.

12. The combination of claim **11,** wherein the parts are so longitudinally dimensioned that, upon advance of the threaded engagement, said skirt abuts said closure member before said pin completes full closure of the cap-end aperture, whereby said valve member is driven into axially squeezing sealing contact with the adjacent end of said bushing and said bushing is compressionally sealed to the inner surface of said closure member upon aperture closure.

13. The combination of claim **11,** in which the durometer hardness of the material of said bushing is selected in the range 40 to 80.

14. The combination of claim **11,** in which the durometer of the material of said bushing is approximately **60.**

15. The combination of claim **10,** in which said ratchet-tooth formations comprise a circumferential series of radially outward teeth carried by the container-closure member, and at least one radially inward ratchet-engaging member carried by said cap skirt.

16. The combination of claim **15,** in which said ratchet-engaging member is one of two carried by said cap skirt at diametrically opposed locations.

* * * * *