

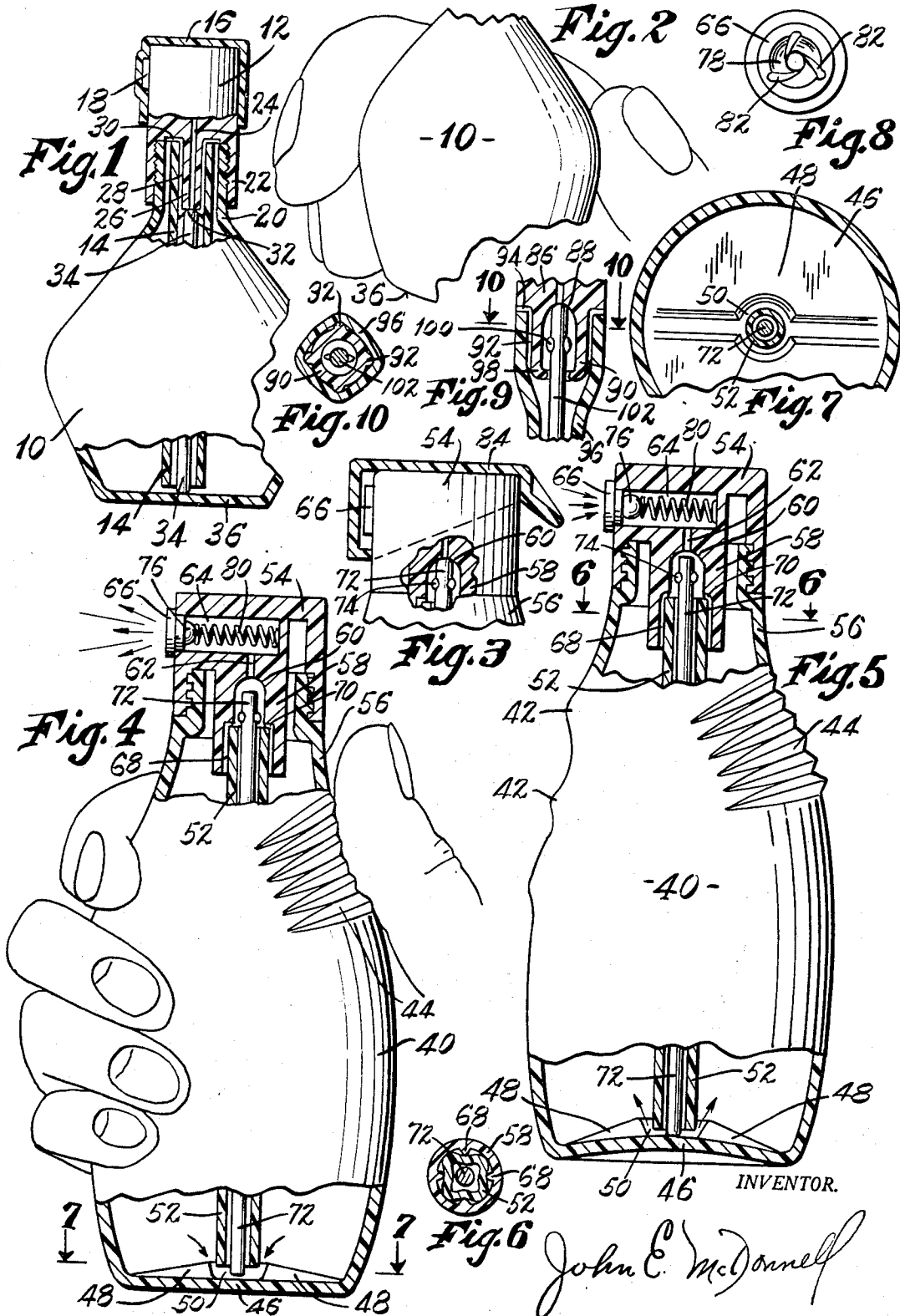
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SQUEEZE BOTTLE DISPENSER

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SQUEEZE BOTTLE DISPENSER

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ABSTRACT OF THE DISCLOSURE

A self-closing squeeze bottle dispenser having a dip tube extending inward to the bottom wall from the stopper cap at the neck, and having a valve seat in the stopper cap. The bottom wall of the bottle shifts outward when the bottle is squeezed to dispense its contents. Carried in the dip tube is a valve stem which is engageable with the valve seat to close the same, and engageable with the bottom wall to be actuated thereby. During squeezing of the bottle, the bottom wall releases its force against the valve stem, which then falls by gravity and opens the valve seat to permit discharge of the liquid through the dip tube and stopper cap.

This invention relates to plastic squeeze bottle dispensers.

Objects are to provide an improved spray or squirt type dispenser and automatic closure valve operated by a wall of the bottle; and improved dispenser with novel automatic sealing that needs no stopper cap to prevent leakage or evaporation, with improved check valve arrangement in the discharge cap to effect better spraying and fast recovery; to provide a novel wall-operated automatic valve in the dispenser cap; to provide sealing of the contents by said valve; to provide a novel and simplified combination orifice and air intake construction; to provide simple, improved gas-passage means below the automatic valve; and a dispenser having all of the foregoing, which is exceptionally simple, involves fewer parts, is not costly to make, and is reliable in operation.

Other objects will become apparent to those skilled in the art when the following description is read in connection with the accompanying drawings, in which:

FIG. 1 is a fragmentary view, partly in side elevation and partly in vertical section, of a dispenser made in accordance with the invention.

FIG. 2 is a fragmentary side elevational view of the dispenser of FIG. 1 being squeezed and discharging.

FIG. 3 is a fragmentary side elevational view of the upper portion of another dispenser according to the invention, shown partly in vertical section to reveal the closed valve.

FIG. 4 is a view partly in side elevation and partly in vertical section, of the dispenser of FIG. 3 being squeezed and discharging.

FIG. 5 is a view like that of FIG. 4 but showing the bottle released and sucking in air.

FIG. 6 is a horizontal section on line 6-6 of FIG. 5.

FIG. 7 is a horizontal section on line 7-7 of FIG. 4.

FIG. 8 is an inside elevational view of the orifice piece of the dispenser of FIGS. 3-7.

FIG. 9 is a fragmentary vertical sectional view of an automatic valve and gas passage construction illustrating a modification of the invention.

FIG. 10 is a horizontal section on line 10-10 of FIG. 9.

In FIGS. 1 and 2 the squeeze bottle is 10, the cap is 12 and the discharge or dip tube is 14. A plastic tear-away

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membrane 16 covers the orifice 18. The bottle neck 20 has outer circular ribs mating with inner circular grooves in the inside of the skirt 22 of the cap, there being a press fit.

The cap 12 has a discharge passage 24 in a depending boss 26 which is press-fitted in the discharge tube 14. The boss 26 has four exterior vertical ribs 28 and radial ribs 30 which space the tube 14 and permit gas or air from the upper part of the bottle to flow into the upper part of the tube 14 so as to mix with the liquid being forced up through the tube from the bottom. This means of spacing the tube to admit air is one feature of the invention.

The invention provides an automatic valve operated by the bottle wall when the bottle is squeezed, to close or open the passage 24. The bottom of the boss 26 has a socket or valve seat 32 which is engaged by a valve stem 34 whose bottom end engages the bottom wall 36 of the bottle. In FIG. 1 the bottom 36 is pressing up on the stem 34, causing the top of the stem to press in the valve seat 32 and close the same. Neither liquid or air can now pass through the passage 24, so the bottle is stoppered.

When the bottle 10 is squeezed as in FIG. 2, the bottom wall 36 and the valve stem 34 move down, the latter under the action of gravity, and the seat 32 is uncovered. At the same time, the inside pressure forces the liquid up the tube 14, and forces air past the ribs 28, 30 to mix with the liquid. The mixture passes out the orifice 18. When the bottle is released, it sucks air into it through the passage 24, and as the bottom wall 36 again raises toward its normal shape it lifts the valve stem up against the seat 32, closing the same. There is only one movable part, the valve stem 34 which is loosely carried in the dip tube 14. If the ribs 28, 30 are eliminated, there will be no air mixing with the liquid, and the dispenser will squirt instead of spraying. In the small size shown, the plastic parts need not be too accurate to secure reliable operation. The stopper action is wholly automatic, and the user does not know that the liquid and air are being stoppered each time the bottle is let go of. The parts are very few, simple, easily made and assembled, so the cost is very low. The user does not have to be bothered with a removable and replaceable cap, at any time. The membrane 16 is torn off at the beginning, and thrown away. The small bottle is sturdy enough to quickly suck in air and restore itself, after being squeezed. The dispenser can also be a limited use item, dispensing sample quantities, one-shot charges and the like, or it can dispense drop by drop if the nozzle is made pointed.

Another embodiment of the invention is shown in FIGS. 3-8. The bottle 40 has finger grips 42 and a ribbed depressible wall 44. The bottom wall 46 has two inwardly displaced or upwardly displaced half-conical portions 48 which form a well 50 in which the bottom end of the discharge tube 52 is disposed and guided. The bottom 46 is normally bowed upward as in FIG. 5.

The cap 54 is screwed onto the bottle neck 56, and has a depending hollow boss 58 provided with a valve seat 60 and a discharge passage 62 communicating with a horizontal discharge passage 64, according to the invention. An orifice 66 is pressed into the passage 64.

The discharge tube 52 is press-fitted into an enlarged bore of the boss 58, said bore having vertical and radial ribs 68, 70 which space the tube 52 from the boss at the sides of the ribs. The invention provides a valve stem 72 engageable with the valve seat 60 and extending through the tube 52 to engage the bottom wall 46 of the bottle. During squeezing the stem 72 is

away from the seat 60 whereby liquid can flow up the tube 52 and through the passages 62 and 64, and out through the orifice 66, as in FIG. 4. When the bottle is released, as in FIG. 5, the air rushes in through the orifice 66, passages 64 and 62, and into the bottle. Air or gas passes alongside the ribs 68, 70 during the squeezing, to mix with the liquid rising in the tube 52. FIG. 3 shows the stem 72 against the seat 60, after entry of air to replace the discharged liquid. The bottom wall 46 has pushed the stem 72 up, and now holds it against the seat 60 to seal the bottle. The stem 72 has pinched portions or projections 74, engageable with the top edge of the tube 52 to hold the stem captive in the tube.

By the invention the orifice 66 includes a back check or air inlet member 76 normally seated in a socket 78 of the orifice and held therein by a spring 80 disposed in the passage 64. The socket 78 has tangential grooves 82 which swirl the liquid-air mixture as it flows past the outside of the member 76, which is in the form of a ball. But when the bottle 40 is sucking in air, the ball 76 is shifted out of the socket 78, compressing the spring 80. This provides an enlarged passage for the incoming air, so that the bottle quickly recovers its shape, ready for the next squeeze.

The arrows in FIGS. 4 and 5 show the flow of the fluid for the two conditions. In FIG. 3 a removable cap 84 insures against leakage during storage and shipment. It is discarded when the discharge is first placed in use.

FIGS. 9 and 10 show another embodiment, wherein a hollow boss 86 of a cap has a seat 88 and a reduced portion 90 provided with exterior vertical ribs and radial ribs 92, 94. The discharge tube 96 is press-fitted over the portion 90, and the latter has an intumed bead 98 cooperable with projections 100 of the valve stem 102 to hold the stem captive.

It will now be seen that the invention provides a unique dispenser with automatic wall-operated valve by which the bottle is automatically stoppered after each use without requiring a conscious act on the part of the user. A very quick recovery time is had in a simple manner by the orifice with the check-valve ball. Very few moving parts are involved, all parts being simple and easily, economically produced. No capping is needed to prevent leakage or evaporation. Both a liquid and a gas seal are effected by the one valve even though gas mixing is utilized. The gas passage means is simple and can be accurately predetermined. The valve stem 72 (or 102) can be rigid plastic, can be molded if desired, and can be of larger diameter than shown, to prevent bending. The construction of FIGS. 9 and 10 is especially adaptable to a larger diameter valve stem.

In most circumstances a sufficiently quick recovery of the bottle to its rounded-out shape is had even though the check valve ball 76 and spring 80 are not incorporated at all.

A feature is that a certain amount of pressure builds up in the container before the bottom wall moves down, allowing the valve stem to move down and open the discharge. This results in a "puff" type of discharge which is often desirable.

Having thus described the invention, what is claimed is:

1. A squeeze bottle dispenser which includes a squeeze bottle having a resilient depressible wall which can be pressed inward to pressurize the interior of the bottle, means including an orifice providing a discharge passage from the bottle, a flow-restricting member in said passage spring urged against the inside of the orifice, said member and orifice when engaged under spring action providing a restricted discharge channel, said member being movable against spring action away from the orifice, thereby effecting an enlargement of the restricted channel to admit air rapidly through the discharge passage into the bottle when the squeezing is discontinued and the bottle tends to return to normal shape.

2. The article set forth in claim 1, in which the orifice has a socket at its inside, and grooves in said socket, leading to the opening in the orifice, said flow-restricting member comprising a ball; and a spring in said discharge passage, engaged with said ball.

3. The article set forth in claim 1, in which the bottle has a bottom wall to stand on, a discharge tube extending from the bottle neck to a point near the bottom wall to receive the liquid from the bottom of the bottle, a cap supported on the bottle and supporting the discharge tube and the orifice, said cap containing part of said discharge passage, a valve seat supported by the cap and a valve stem movable in the discharge tube and engageable with the bottom wall and with the valve seat to close the latter and control flow through the discharge tube, said bottom wall and valve stem moving downward when the bottle is squeezed, and the stem separating from the valve seat to open the passage therethrough for liquid in the discharge tube.

4. A squeeze bottle dispenser for dispensing liquids out of its top, which includes a squeeze bottle having a top neck portion and resilient depressible side walls which latter can be pressed inward, and having a resilient bottom wall to stand on, said bottom wall flexing and moving outward and downward when said depressible walls are pressed inward, a discharge passage means including a dip tube extending from the bottle neck portion downward to a point near the bottom wall, the bottom end of the dip tube being directly exposed to the bottom wall to receive the liquid directly from said bottom wall of the bottle, a cap having a discharge passage, said cap being supported on the top neck portion of the bottle and supporting the dip tube in communication with said discharge passage, a valve seat supported by the cap and a valve stem movable in the dip tube and laterally guided solely thereby, said valve stem being loosely carried in the dip tube and constituting a loose disconnected valve part responsive to gravity by moving longitudinally in said tube, said stem being engageable with and directly abutting the central portion of the bottom wall and being engageable with the valve seat to close the latter and control flow through the dip tube, said valve stem being unattached to said bottom wall and said bottom wall and valve stem moving downward when the bottle is squeezed and the stem thereby separating from the valve seat to open the passage therethrough for liquid in the dip tube.

5. The article set forth in claim 4, in which the dip tube is press-fitted to the cap, said valve seat being disposed in the cap above the press-fit connection, and in which there are means for admitting gas past said press-fit connection, for flow through the valve seat with liquid from the dip tube.

6. The article set forth in claim 5, in which the cap has a tubular portion press-fitted to the dip tube, said gas-admitting means including a rib on the tubular portion, spacing the dip tube slightly from the said portion at a side of the rib.

7. The article set forth in claim 6, in which the dip tube is press-fitted to the outside of said tubular portion.

8. The article set forth in claim 4, in which means are provided for holding the valve stem captive in the dip tube.

9. The article set forth in claim 8, in which the means holding the valve stem captive comprises projections on said stem, and cooperable projections in the cap,

10. The article set forth in claim 4, in which the stem extends the length of the dip tube, said valve seat being disposed in said cap.

11. The article set forth in claim 4 in which the bottom wall of the bottle has upward projections engaging and guiding the dip tube, all the interiorly exposed surfaces of the bottom wall being integral with each other and being fully and completely exposed to both the dip tube and the entire interior of the bottle, said bottom wall

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constituting the sole axially-movable actuator for said valve stem, said stem directly abutting said bottom wall and having force continuously exerted on it by the bottom wall when the bottle is not being squeezed.

References Cited

UNITED STATES PATENTS

1,778,291	10/1930	Burke	-----	222—211	X
2,113,695	4/1938	Krannak	-----	222—518	X

6

2,631,064	3/1953	Tupper	-----	239—327
2,980,342	4/1961	Armour	-----	222—211 X
3,154,222	10/1964	Heckman	-----	222—213

FOREIGN PATENTS

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329,477	6/1958	Switzerland.
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