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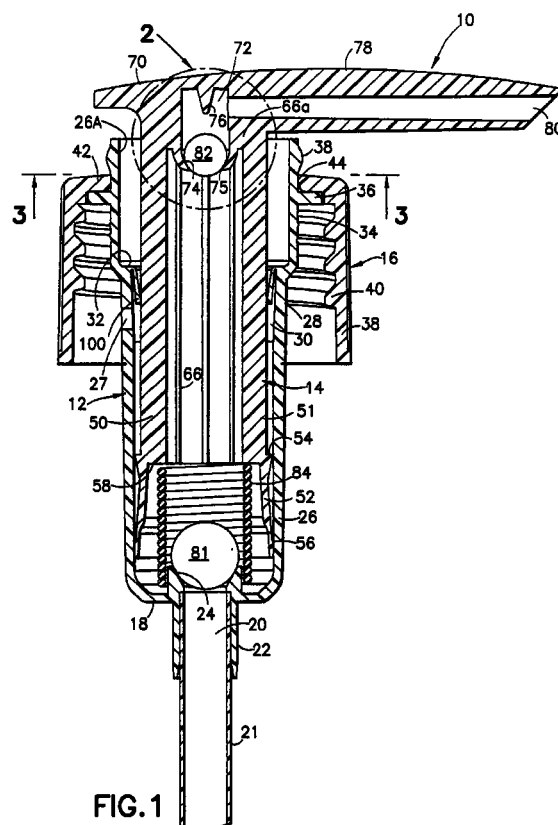
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(54) **Pump dispenser having vertical plunger with molded outlet check seat**

(57) One-piece tubular plunger (14) has outlet valve compartment (72) comprising a hollow barrel (73) having an annular lip (74) at its lower end. The lip (74) forms a seat for the outlet ball check (82). Ribs (66A) extend inward to meet and reinforce the barrel above the lip (74).



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Description

FIELD OF THE INVENTION

[0001] This invention relates to a pump dispenser. More specifically, this invention relates to a pump dispenser in which a plunger reciprocates inside a hollow cylindrical body. The plunger includes an outlet check valve with a molded seat.

BACKGROUND OF THE INVENTION

[0002] The U.S. patent 3,062,416 to Coopridger, issued November 6, 1962, discloses a liquid dispenser comprising a hollow body and a one-piece plunger including an actuator/piston. The piston has an enlarged head at its lower end inside the hollow body. Inlet and outlet check valves are provided and a spring urges the plunger upward.

[0003] In the co-pending patent application Serial No. 09/079,481 filed May 15, 1998, assigned to our assignee, there is disclosed such a dispenser in which the outlet check is a ball disposed in the upper end of the plunger in a compartment defined by an annular lip comprising the seat of the outlet valve.

SUMMARY OF THE INVENTION

[0004] The present invention is, of course, defined in the claim language. In summary, it relates to the annular lip and the structure of the plunger thereadjacent. In a pump dispenser the invention is a plunger having a longitudinal axis with a piston head at its lower end and an actuator at its upper end, the upper end including an outlet check valve compartment defined by a hollow cylindrical barrel extending axially downward in the actuator. The barrel has at its lower end a downward annular lip inclined toward the axis, the lip having its inner end defining an opening and adapted to serve as a seat for a ball check in the compartment. The tubular plunger has inward ribs formed along its interior, the ribs being spaced outward from the lip and extending radially inward above the lips to meet and reinforce the barrel, whereby the lips are adapted to flex outward to permit forceful passage of said ball in assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Further objects and features of the invention will be clear to those skilled in the art from a review of the following specification and drawings, all of which present a non-limiting form of the invention. In the drawings:

Fig. 1 is a centerline sectional view of the plunger and the body of a dispenser embodying the invention;

Fig. 2 is an enlarged fragmentary sectional view of

the area of the outlet check valve compartment as shown in Fig. 1. The lip is shown in phantom widened as in permitting passage of a ball;

Fig. 3 is an enlarged sectional view taken on the line 3-3 of Fig. 1; and

Fig. 4 is a fragmentary sectional view taken on the line 4-4 of Fig. 3.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENT

[0006] A pump dispenser embodying the invention is generally designated 10 in Fig. 1. It comprises a hollow cylindrical body 12 and a cooperating one-piece plunger 14. Rotatably surrounding the upper end of the body is the threaded closure 16.

[0007] Referring more specifically to the body 12, it is essentially cup-shaped including a bottom wall 18 which is centrally formed with an inlet opening 20 surrounded by a downward tubular connector 22 receiving a dip tube 21. Above the opening 20 is formed an upward bevelled annular seat 24. A cylindrical side wall 26 extends upward from the perimeter of bottom wall 18 and terminates in a circular mouth 26A.

[0008] The sidewall 26 (Fig. 1) extends upward to include a vent opening 27 and a tapered zone 28 at which the wall flares slightly outward on the inside of the body at surface 30 (Fig. 5) and is thickened as the upper end of the body 12 is approached. Above the tapered zone 28 the side wall is formed on the inside of the body with an annular radial shoulder 32. From the periphery of the shoulder the side wall extends upward in a cylindrical sleeve 34. Outward from a midpoint of the sleeve portion extends an integral annular flange 36, and spaced above the flange the cylindrical sleeve is formed with an outward peripheral bump 38.

[0009] The closure 16 is a threaded cap comprising a sidewall 40 and a top wall 42 which is formed with an aperture 44 to receive the cylindrical sleeve 34 at the upper end of the body. In installation, there is sufficient "give" in the bump 38 and the margin of the aperture 44 to permit the top wall 42 to snap by the bump so that the cap is entrapped between the bump 38 and the flange 36.

[0010] The cap is loosely enough disposed on the sleeve 34 so that it can spin as it is screwed onto the finish (not shown) of a container. The flange 36 will, of course, sit on the top of the finish and be sealingly compressed thereagainst when the cap is screwed tight.

[0011] The plunger 14 comprises an elongate tubular piston 50. The piston 50 is defined by a stem 51 and an enlarged tubular piston head 52. Intermediate the head and the stem there is formed a narrow annular upward shoulder 54. The lower end of the head is formed with an annular seal 56 sealingly engaging the inside of the side wall 26 of the body 12. Inside, above the seal 56, the head presents an annular downward face 58.

[0012] As stated, the plunger 14 is tubular, formed

with an axial passage 64 which may be provided with integral inward ribs 66.

[0013] At the upper end of the plunger 14 and unitary therewith is the actuator 70. The actuator 70 is formed therein with a check valve compartment 72 (Fig. 4) defined by a recess in the actuator and a downward barrel 73 at the lower end of which is an inward annular lip 74. The inner end of the lip comprises a discharge opening 75 and the upper surface of the lip is adapted to serve as a seat for the ball 81.

[0014] A central ball stop 76 extends downward from the actuator head into the upper portion of the compartment 72. A laterally extending portion of the actuator 70 forms the spout 78 (Fig. 5) having a discharge passage 80.

[0015] The ribs 66 are formed along the interior of the tubular plunger stem 51. In the area of the lip 74, the ribs 66 are spaced outward from the lip whereby the lip is free to flex outward to permit passage of the ball as explained in assembly.

[0016] The ribs have upper inward radial portions 66A (Fig. 4) which meet and reinforce the barrel 73 in a cylindrical portion of the compartment 72.

[0017] The inner face of the seat formed by the preferred form of lip has an angle α (Fig. 4) in a range of 10 degrees to about 40 degrees with the axis of the plunger. Preferably angle α is about 25 degrees. The opening for the ball is 0.144 inch while the diameter of the ball 81 is .156 inch. The inner edge 75A of the lip may be rounded with a radius in the range of .002 inch to .020 inch. Preferably the radius is about .005 inch.

[0018] Both the body 12 and the plunger 14 are molded of a plastic (the body may be polypropylene, while the plunger may be high density polyethylene) which is resilient in thin sections and rigid in thick section. The resilience in thin sections is used to advantage in the lip 74.

[0019] The discharge valving for the dispenser comprises the inlet check ball 81 which seats on seat 24 at the lower end of the body 12, and the discharge check ball 82 which seats on the inward lips 74 at the upper end of the plunger. In assembly, the ball 82 is installed by being forcibly inserted through the lip 74 from below. A spring 84 is compressively disposed between the annular face 58 and the bottom wall 18 of the body and urges the plunger upward. Flap 100, molded with the body 12, serves as a stop, limiting the upward travel of the plunger when the shoulder 54 hits it.

[0020] The operation of the pump dispenser is as well known in the art exemplified by the Coopridier patent. The method by which the dispenser of the invention is made is disclosed in the patent application referred to above.

[0021] While the invention has been shown in only one embodiment, it is not so limited but is of a scope defined by the following claim language which may be broadened by an extension of the right to exclude others

from making, using or selling the invention as is appropriate under the doctrine of equivalents.

Claims

1. A pump dispenser comprising a unitary vertical tubular plunger having a longitudinal axis with a piston head at its lower end and an actuator at its upper end, the upper end including an outlet check valve compartment defined by a hollow cylindrical barrel extending axially downward in the actuator, the barrel having at its lower end a downward annular lip inclined toward the axis, the lip having its inner end defining an opening and adapted to serve as a seat for a ball check in the compartment, the tubular plunger having inward ribs formed along its interior, the ribs being spaced outward from the lip and extending radially inward above the lip to meet and reinforce the barrel, whereby the lips are adapted to flex outward to permit forceful passage of said ball in assembly.
2. A plunger as claimed in Claim 1 wherein the seat defined by the inside surface of the lip is at an angle in a range of 10 degrees to 40 degrees from the axis.
3. A plunger as claimed in Claim 2 wherein the angle is about 25 degrees from the axis.
4. A plunger as claimed in Claim 1 wherein the inner edge of the lip about the opening is formed with a radius in a range of .002 inch to .020 inch.
5. A plunger as claimed in Claim 4 wherein the radius is about .005 inch.
6. A method of assembly of a pump dispenser comprising:
 - a. providing a unitary vertical tubular plunger having a longitudinal axis with a piston head at its lower end and an actuator at its upper end, the upper end including an outlet check valve compartment defined by a hollow cylindrical barrel extending axially downward in the actuator, the barrel having at its lower end a downward annular resilient lip inclined toward the axis, the lip having its inner end defining an opening and adapted to serve as a seat for a ball check in the compartment, the tubular plunger having inward ribs formed along its interior, the ribs being spaced outward from the lip and extending radially inward above the lip to meet and reinforce the barrel,
 - b. providing a measured ball small enough to fit in the compartment yet large enough to occlude the opening when it engages the lip

