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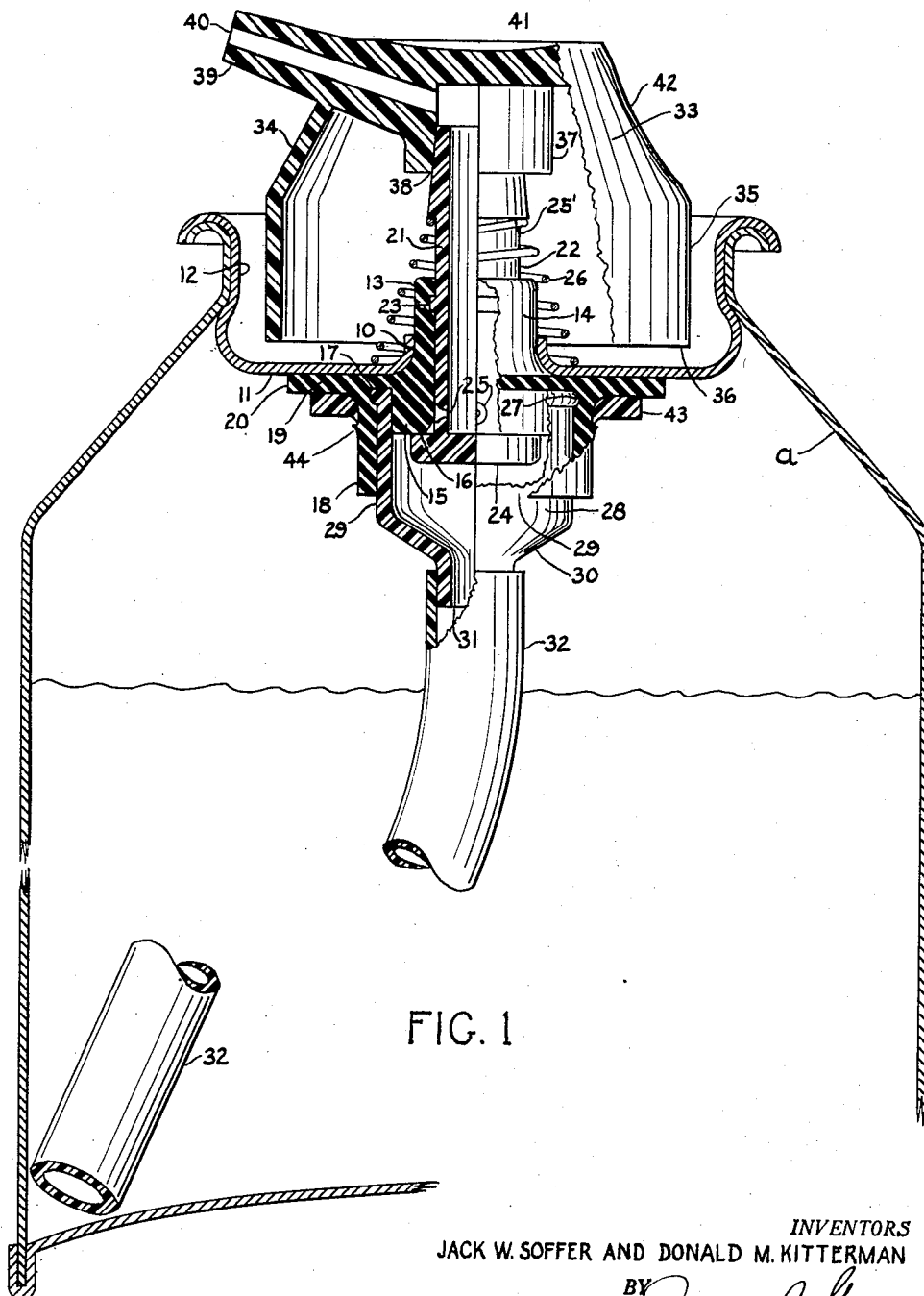
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2,831,618

DISPENSING VALVE DISCHARGEABLE IN UPRIGHT POSITION

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

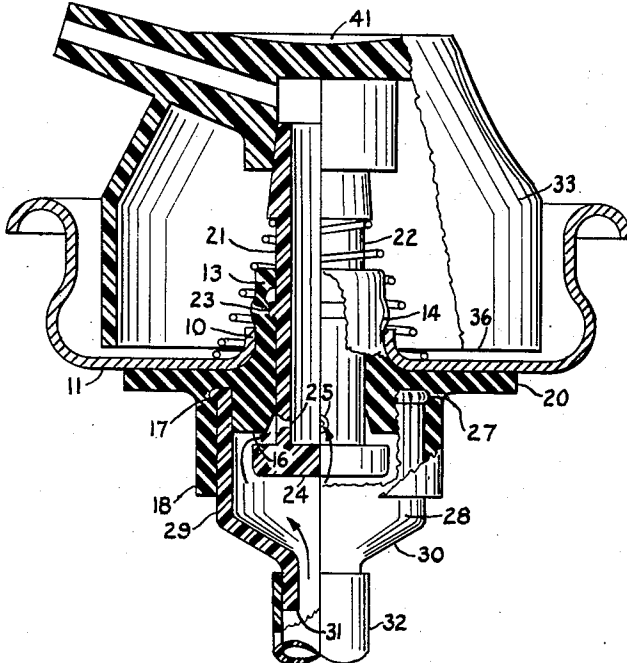


FIG. 2

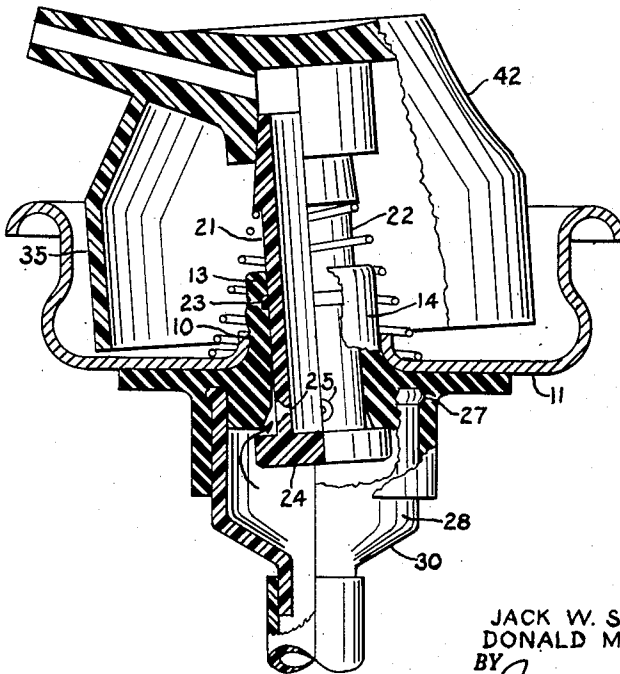


FIG. 3

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DISPENSING VALVE DISCHARGEABLE IN UPRIGHT POSITION

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14 Claims. (Cl. 222—394)

This invention relates to improvements in dispensing valves, and particularly to those for containers in which substances are packed to be expelled under the pressure of gas.

In using many "pressure-propelled" products, consumers find it natural to invert the dispenser; whereas for other types of products, a dispenser which operates in upright position may be preferred. For upright operation, a valve which presses sideward may be easier to use than a mechanism which must be pressed downward, for in the latter case the entire container may slip through the user's fingers. However, many consumers have become accustomed to discharge valves which are depressed downward. Those who sell pressure-propelled products are rightfully concerned with consumer convenience and preference in these matters.

Of the dispensing valves heretofore available for such products, one class required the dispensers to be inverted; these were generally simple, efficient tilt valves having tubular elastic seals mounted in apertures in the container tops. The second class of available dispensing valves permitted dispensing in the upright position; these utilized dip-tubes leading up from near the bottom of the container to the valve mechanism. Usually such "dip-tube" valves were operated by pressing downward, but in some cases they might be operated by pressing sideward instead. Such valves which operated in upright position have generally used several internal metal parts, which were subject to corrosion.

A principal purpose of the present invention is to modify and convert the simpler tilt valves for use in upright position, to be discharged either by a down force or by a side force. A further purpose is to mount such a valve, adapted for "push-down" operation, in a dispenser top wall without the necessity of clamping the valve in place. A still further purpose includes providing a valve for dispensing in upright position wherein the parts exposed to the container contents are corrosion-resistant and entirely compatible with the container contents. Still further purposes will be apparent from this specification.

In the accompanying drawings:

Figure 1 is an enlarged side view, the left side being in section, the right side being partly in elevation and partly fragmentary, showing a preferred form of valve mechanism embodying the present invention, mounted in a single-use pressure dispenser, the drawing including at the top of the valve mechanism a preferred form of valve operator cap.

Figure 2 is a somewhat fragmentary view similar to Figure 1, showing the valve mechanism pressed downward, the right side of the valve seat portion of the rubber seal also being in section.

Figure 3 is a view similar to Figure 2, showing the valve mechanism operated by tilting, without pressing downward.

The keeper ring shown in Figure 1, which is optional, is omitted from Figures 2 and 3.

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Referring now to Figure 1, the left half of the illustration shows the valve mechanism in section whereas the right half shows the mechanism in more fragmentary form with annular elements thereof broken away. The valve mechanism as a whole is mounted, without clamping or any other mechanical attachment to its edge, within an outwardly flanged central circular opening 10 in a mounting cup 11 whose outer rim 12 is adapted to be crimped sealingly to the mouth of a low-pressure single-use container generally designated *a*. Through the central flanged opening 10 passes the sleeve portion 13 of a rubber-like elastic tubular seal generally designated 14. It has an enlarged body portion 15 on the inner side of the mounting cup 11 which body portion terminates centrally in an annular valve seating face 16. Radially outward of the valve seating face 16 is an annular groove 17 presented downward, whose inner wall consists of the seal body portion 15 and whose outer wall is a flexible annular skirt 18 which extends down substantially below the valve seating face 16. At the base of the sleeve portion 13, and extending radially outward therefrom substantially beyond the flexible annular skirt 18, is an annular sealing flange 19, presented flat against the inner surface of the mounting cup 11. The edge portion 20 of the flange outward of the annular skirt 18 is thin and flexible and well adapted to maintain a tight seal against the mounting cup 11 under the pressure of gas within the container.

Mounted in the tubular seal 14 is a substantially rigid valve spout generally designated 21, having a substantially cylindrical tubular stem portion 22 which passes through and is sealingly encompassed by the sleeve portion 13, and has an external bead 23 received within the sleeve portion 13 outward of the flanged central opening 10 of the mounting cup 11. The function of these portions will be described hereinafter. At the inner end of the spout 21 is an imperforate valve head 24 which closes against the annular valve seating face 16. Adjacent the head 24 are a plurality of stem ports 25, through which contents within the container *a* pass into the stem when the valve head 24 is displaced from the seating face 16.

Near the outer end of the valve spout 21 is a downward-facing shoulder 25' against which bears the upper coil of a volute compression spring 26, whose lower coil bears against the outer surface of the mounting cup 11.

Within the annular groove 17 in the under surface of the seal 14 is received the upper rim 27 of a hollow nipple generally designated 28 having beneath the rim 27 a substantially cylindrical wall portion 29, terminating in a funnel portion 30 having a downwardly-presented tubular orifice 31. The tubular orifice 31 is graspingly engaged by the upper end of a somewhat elastic dip-tube 32 which may be formed of extruded polyethylene.

It is to be noted that the nipple 28 and the valve spout 21 are preferably molded of some hard rigid plastic which, like the polyethylene-dip-tube 32, may be selected for compatibility with the substance to be packaged in the container. Likewise, a valve operator cap, generally designated 33, is formed of some such compatible plastic material; and the elastic tubular seal 14 is molded of a suitable natural or artificial rubber compound. The only part made of a material which might be subject to corrosion, namely, the spring 26, does not come in contact with the container contents. The construction shown insures freedom from corrosion and contamination.

Atop the outer end of the tubular stem 22 there may be mounted a variety of valve operator caps. The cap 33 is novel in that it operates the valve mechanism either by depressing or by tilting sideward. It consists of a molded plastic hollow dome 34 having a somewhat cylindrical lower wall portion 35 terminating in a bottom edge 36 as shown in Figure 1. When the valve mecha-

nism is in closed position, the lower wall portion 35 will have clearance within the outer rim 12 sufficient to permit the valve to open fully by tilting; while its bottom edge 36 will have clearance above the upper surface of the mounting cup 11 sufficient for the valve to open by pressing down.

Projecting downward within the dome 34 of the operator cap 33 is a collar portion 37 having a slightly tapered annular recess 38 which fits snugly over the upper end of the tubular stem 22. A nozzle 39, projecting side-ward from the cap 33, has a passage 40 which commu- nicates inward to within the collar portion 37 above the level of the end of the tubular stem 22.

On the outer surface of the valve operator cap 33 are formed two finger pads: a push-down pad 41 which is dished slightly into the upper surface of the operator cap 33, and a side-tilt pad 42 which is formed in the outer surface diametrically opposed to the nozzle 39.

In assembling the valve mechanism, the tubular seal 14 is first assembled to the mounting cup 11 by passing its sleeve portion 13 through the cup central opening 10. The tubular stem 22 of the valve spout 21 is pressed outwardly through the tubular seal 14 until the valve head 24 abuts the seating face 16. The volute spring 26 is pressed over the outer end of the tubular stem 22 until its upper coil springs over and engages against the shoulder 25'. The nipple 28 is then inserted within the flexible annular skirt 18 and pressed so that its upper rim 27 seats within the annular groove 17 of the seal 14.

At this stage, if it is desired to fasten the nipple 28 with greater security, a keeper ring 43 having an inner diameter slightly less than the outer diameter of the flexible skirt 18 is pressed thereon until the upper surface of the keeper ring 43 contacts the lower surface of the sealing flange edge portion 20. Optionally, as shown in Figure 1, the skirt may be provided with an external annular shoulder 44 in which the keeper ring may set. The upper inner surface of the keeper ring 43 may be formed taperingly as shown, so as to provide for easy "flow" of the rubber-like material of the skirt 18 as the keeper ring is passed over it. A very slight compression exerted by the keeper ring 43 against the skirt 18, at a level slightly below the nipple rim 27, has proved sufficient to lock the nipple 28 securely in place. The valve operator cap is added after the mounting cup 11, with the valve mechanism assembled, has been crimped onto the filled container *a* and the container gassed.

The length of the dip-tube 32 is such that its lower end will rest near the juncture of the side wall and bottom of the container *a*, preferably on the side corresponding with the projecting nozzle 39. Thus, gas pressure within the container above the level of its fluid contents will drive the container contents upward through the dip-tube 32 whenever the valve is open.

Figure 2 illustrates the portion of the valve parts when the valve operator cap 33 is depressed by finger pressure on the top pad 41. The tubular stem 22 is lowered somewhat, opening the valve by moving the valve head 24 down from its seating face 16.

The dip-tube 32 and nipple orifice 31 offer some restriction to flow into the nipple 28; and the stem ports 25 restrict the flow from the nipple into the stem 22. With the valve open, the pressure within the nipple 28 will drop somewhat nearer to atmospheric. If the ports 25 are quite small, the pressure within the nipple 28 will remain relatively high when the valve head 24 is open.

For additional assurance against leakage between the sleeve portion 13 and the outer wall of the tubular stem 22, when subjected to such relatively high pressure, the annular external bead 23 is located at such level that, as the valve spout 21 is depressed, the bead 23 exerts increasing sealing force on the sleeve portion 13, pressing it against the outwardly flanged central opening 10 of the mounting cup 11.

However, if the stem ports 25 are of sufficient size to permit pressure drop within the nipple 28 to nearly atmospheric pressure, there is presented the new problem of maintaining the elastic tubular seal tightly in place against the inner surface of the mounting cup 11. With the valve closed, the pressure within the nipple 28 is the same as generally throughout the container; it presses the valve head 24 and valve seating face 16 upward against the mounting cup 11. When the valve is open, a substitute force is desired. This is provided by the rigidity of the nipple 28.

With such a pressure drop within the nipple 28, the differences between outside and inside pressures exerted over the area of the funnel portion 30 are accumulated and directed, as a concentrated annular compressive force, by the upper rim 27 against the upper surface of the groove 17. Thus, a pressure drop within the nipple 28 does not result in loosening of the elastic seal; what force was exerted in the seal 14 by the valve head 24 and valve seating face 16 is now exerted by the rim 27. Of course, when the seal 14 is provided with a suitably large edge portion 20 as shown, the gas pressure exerted on it gives assurance that the entire mechanism will be held sealed in place.

Regardless whether the valve is open or closed, the flexible skirt 18 seals against the cylindrical wall portion 29 of the nipple 28. However, when there is a pressure drop within the nipple 28 (when the valve is open) the skirt sealing force is increased. Also, at such times, the pressure differential on the funnel portion 30 presses the rim 27 tightly against the sealing groove 17. Thus, gas will not leak into the nipple 28 above its rim 27.

When the valve is operated by lateral pressure on the side pad 42, the valve head 24 is opened by tilting as shown in Figure 3. This tilts and distorts the seal sleeve portion 13. However, the bead 23 and flange of the mounting cup opening 10 cause the rubber-like material of the sleeve portion 13 to flow sealedly between them, assuring there will be no leakage along the outer wall of the stem portion 22, regardless how small the ports 25 may be. And if the ports 25 are so large as to result in substantial pressure drop within the nipple 28 when the valve spout 21 is tilted, the pressure differential, accumulated over the surface of the funnel portion 30, applied by the nipple rim 27, and reacted by the mounting cup 11, maintains the seal 14 fixed in place regardless of the tilting of its sleeve portion 13.

Inasmuch as the keeper ring 43 is provided as a measure of additional security, and may be dispensed with in many applications, it is not illustrated in either Figure 2 or Figure 3.

An important application of certain principal inventive features herein disclosed, is in connection with modifying that type of dispensing valve, generally shown in the patent to Geiss, No. 2,487,434, wherein a rigid, solid-stem valve having a head at its lower end is mounted spacedly within a tubular elastic sleeve which extends outward through the container top from an annular seal body portion having a seating face within the container. Like the embodiment shown in the drawings, such valve operates by unseating the head from the annular seating face of the seal body portion. It is not necessary to illustrate such an alternate embodiment of the principles of this invention, for persons skilled in the art will readily be able to modify the construction of such seal body portion to make provision for attaching a rigid nipple and dip-tube precisely in the manner as herein disclosed.

By the valve structure which has been described, many new advantages are obtained. The gas pressure within the container is utilized to permit "push-down" operation of the valve whose seal is not "built in" to the container. For use with products which may contain corrosive substances, the few parts which are exposed to such sub-

stances may be made of compatible materials, and there-

fore be corrosion-proof. The valve spring is not subjected to chemical action by the container contents.

The form of valve operator cap shown has the advantage that users can operate the valve by pressing either downward or to the side, to suit their personal experience or preference. However, the producers of products to be packed in such dispensers may select from a variety of valve operator caps a type which would restrict the user to either "push-down" operation or operation by pressing sideward. Flexible sealed diaphragm-type caps may be utilized for pressing downward; lateral sliding caps may be used in which tilting would be impossible; and in any event the producer of the product has the advantage of being able to select and adopt a unique, distinctive valve operator, still using the basic valve mechanism disclosed.

The same valve may be employed upon other types of dispensers, such as seam-top cans and glass or plastic pressure bottles. Optionally, the flexible outer sealing flange may be crimped to the rim or mouth of the container selected. In the claims which follow, it has been necessary to select certain language to describe spatial and directional relationships which could be readily varied. Thus it is assumed that the discharge valve mechanism will be installed in the top wall of a dispenser, with the annular seal 14 in a substantially horizontal plane, and with the tubular stem portion 22 of the valve spout 21 vertical when in closed position. Thus, in the claims the term "upward," or sometimes "outer," refers to a direction taken along the tubular spout from the portion within the container to the portion outside the container; whereas "radially outward" refers to the annulus of the seal 14 or to directions perpendicular to the axis of the stem portion 22. The other terms of direction used in the claims will be understood as relating to these which have been defined.

The claims are intended to cover the same operating relationships even though valves may be installed sideways or slantingly, or in some container wall other than the top wall.

Many other modifications will occur to those skilled in the art. Thus the scope of the present invention is not to be limited by the embodiments illustrated, the materials mentioned, or the uses discussed; but should be constructed as fully co-extensive with the claims which follow.

We claim:

1. For use with a container for dispensing substances under the pressure of gas therein, a discharge valve mechanism adapted to be installed within an opening in the top wall of such container, comprising a tubular stem discharge spout having a valve head within such container and a lateral passage through the spout wall adjacent the valve head, further comprising an elastic tubular seal having a sleeve portion encompassing the stem of said discharge spout and extending outward through such top wall opening, an enlarged body portion including a flexible, radially-outer edge presented upward against the inner surface of such top wall and there retained sealedly by such gas pressure, a downward-presented annular valve seat, and an annular dip-tube support portion located radially outward of the valve seat, further comprising dip-tube means supported thereby.

2. A discharge valve mechanism as defined in claim 1, the dip-tube support portion including a groove in the under side of said seal and a flexible depending skirt on the radially outer side thereof, the upper portion of the dip-tube means being received within said groove and accommodated sealedly within the flexible skirt.

3. For use with a container for dispensing substances under the pressure of gas therein, a discharge valve mechanism as defined in claim 2, said upper portion of the dip-tube means including a substantially rigid cylindrical wall, together with a keeper ring about the skirt portion radially outward of said wall, the keeper ring exerting

compressive force on said skirt portion whereby the dip-tube means is more securely attached to the seal.

4. For use with a container for dispensing substances under the pressure of gas therein, a discharge valve mechanism adapted to be installed within an opening in the wall of such container, comprising a tubular stem discharge spout having a valve head within such container and a lateral passage through the spout wall adjacent the valve head, further comprising an elastic tubular seal encompassing the stem of said discharge spout and having a sleeve portion extending outward through such wall opening, an enlarged body portion including a downwardly-presented annular valve seat, and an annular dip-tube support portion located radially outward of the valve seat and including a groove thereat, together with dip-tube means including a nipple having a rigid upper rim received within said groove and having a lower orifice, the dip-tube means further including a dip-tube communicating with said orifice and having an outer diameter substantially less than the diameter of said rigid nipple, whereby a pressure drop within the nipple results in the application of force over the nipple surface and transmitted to the seal by the nipple rim, by which force the seal is pressed upward against the inner surface of such container wall.

5. A discharge valve mechanism as defined in claim 4, the seal further having a flexible, radially-outer edge presented upward against the inner surface of such wall by which the seal is held with additional security against said wall despite movement of the discharge spout.

6. A discharge valve as defined in claim 5, in combination with a container wall having a flat annular disc portion, a radially outward edge portion thereof adapted for pressure-tight securement to the mouth of a container and a central circular opening in which the discharge valve mechanism is installed, together with a volute compression spring bearing against the outer side of said container wall, surrounding the stem of the discharge spout, and urging it upward to closed position.

7. For use with a container for dispensing substances under the pressure of gas therein, a discharge valve mechanism adapted to be installed within an opening in the wall of such container and adapted to be opened either by being depressed or by being tilted, comprising a tubular stem discharge spout having a valve head within such container and a lateral passage through the spout wall adjacent the valve head, further comprising an elastic tubular seal encompassing the stem of said discharge spout and having a sleeve portion extending outward through such wall opening, an enlarged body portion including an annular valve seat and a flexible, radially-outer edge presented upward against the inner surface of such wall, by which the seal is held securely pressed against said wall despite movement of the discharge spout, further comprising dip-tube means communicating with the under side of the tubular seal, the discharge spout stem having an annular external bead located within the sleeve portion of the seal at such level as to be spaced outward of the container wall when the valve head is closed upward against the valve seat of the seal, and to exert increased sealing pressure on the sleeve portion between it and the container wall when the discharge spout is depressed downward.

8. A discharge valve as defined in claim 7, in combination with a container wall having a flat annular disc portion, a radially outward edge portion thereof adapted for pressure-tight securement to the mouth of a container and a central circular opening in which the discharge valve mechanism is installed, together with a volute compression spring bearing against the outer side of said container wall, surrounding the stem of the discharge spout, and urging it upward to closed position.

9. A discharge valve mechanism for containers for dispensing substances under gas pressure, which mechanism includes an elastic tubular seal having within the container

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a radially enlarged body portion having an annular valve seat, which mechanism further includes a rigid valve member having a stem within the seal and a valve head adapted to close against the valve seat, the seal having a flexible depending skirt positioned radially outward of the valve seat whereby to support resiliently and sealedly attached a dip-tube means, together with a dip-tube means including an upper rim supported and sealedly attached thereby.

10. The mechanism defined in claim 9, the dip-tube support means of the seal including a groove in the under side of said seal radially inward of said flexible skirt, the upper rim of the dip-tube means being part of a rigid nipple having a wall grasped by said flexible skirt, the rim being received within said groove on the radially inner side of said flexible skirt.

11. The mechanism defined in claim 10, the rigid nipple having a lower orifice, the dip-tube means further including a tube communicating with and depending from said orifice, the outer diameter of the tube being substantially less than the diameter of the rigid nipple.

12. The mechanism defined in claim 10, together with a keeper ring pressed about the skirt portion radially outward of the wall of the rigid nipple, the keeper ring exerting compressive force on said skirt portion whereby the dip-tube means is securely attached to the seal.

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13. For use on top of the dispensing spout of a valve adapted to open by pressing either downward or side-ward, a valve operator cap comprising a molded plastic hollow dome having a collar portion projecting downward from the dome top and adapted to fit over such spout, a sideward-projecting nozzle having a flow passage communicating with the collar portion above the end of such spout, a push-down portion molded into the exterior of the dome top, and a side-tilt push portion molded into the exterior of the dome side.

14. For use on top of the dispensing spout of a valve adapted to open by pressing either downward or side-ward, such valve being mounted on the bottom of a mounting cup having a rim projecting upward around the spout, a valve operator cap as defined in claim 13, the dome further having a bottom edge raised above the bottom of the mounting cup a distance at least as great as the distance such valve must be pressed downward to open same, the diameter of the dome being sufficiently less than the inner diameter of such mounting cup rim as to permit tilting of the dome sufficient to open such valve.

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