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Davidson et al.

[11] **3,726,442**

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[54] **TRIGGER PUMP AND BREATHER VALVE DISPENSING ASSEMBLY**

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[52] **U.S. Cl.**.....**222/207,** 220/44 A, 222/209, 222/481.5

[51] **Int. Cl.** **B65d 37/00**

[58] **Field of Search**.....220/44 A, 44 B, 44 C, 220/44 D, 44 E, 44 R, 89 R, 89 A; 222/207, 209–212, 214, 383, 397, 481, 544; 137/525, 588; 251/320, 321

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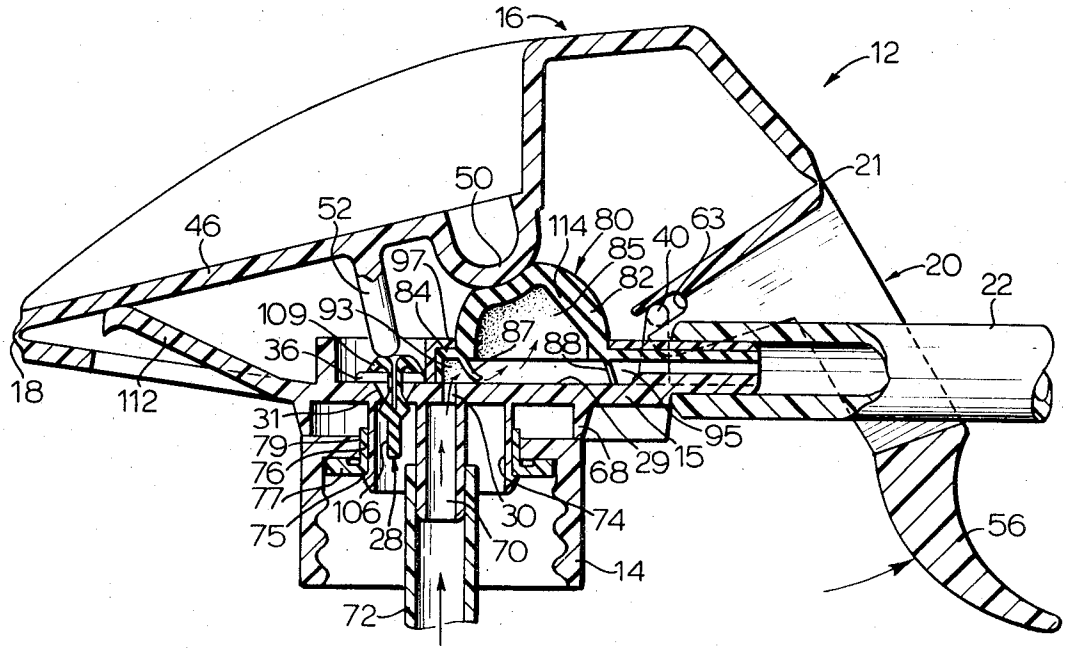
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[57] **ABSTRACT**

A vent-valve for use with a plate member having an aperture therethrough. The vent-valve consists of a stem extending loosely through the aperture, and having on one side of the aperture an enlargement converging toward the aperture and adapted to seal the same. On the other side of the aperture of the stem has a resilient mushroom-like cap which bears against the plate member to bias the enlargement toward and into sealing relation with the aperture.

9 Claims, 7 Drawing Figures



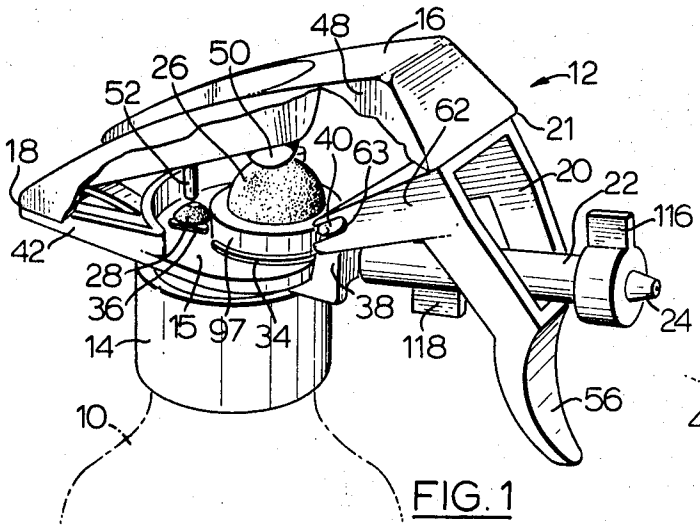
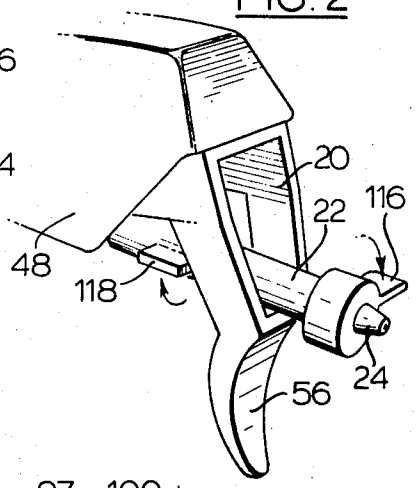


FIG. 1

FIG. 2



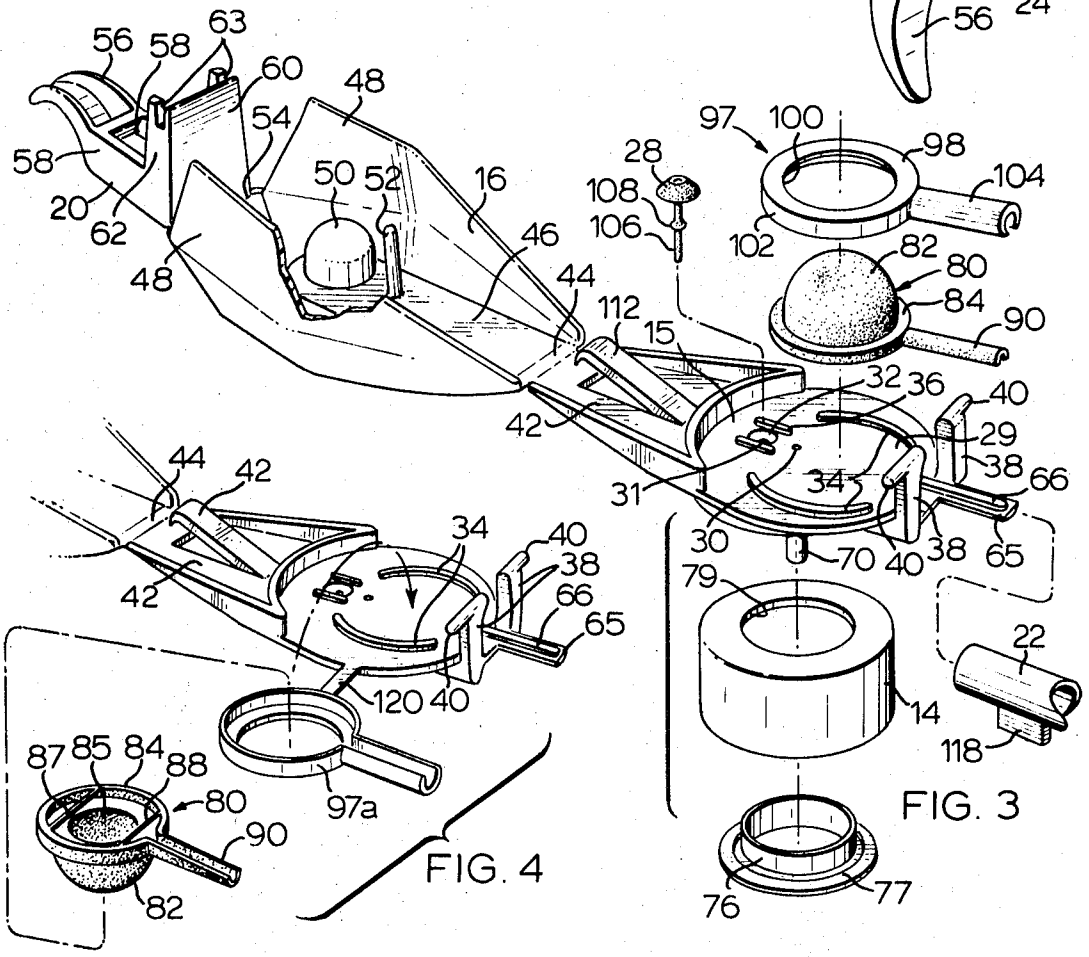


FIG. 3

FIG. 4

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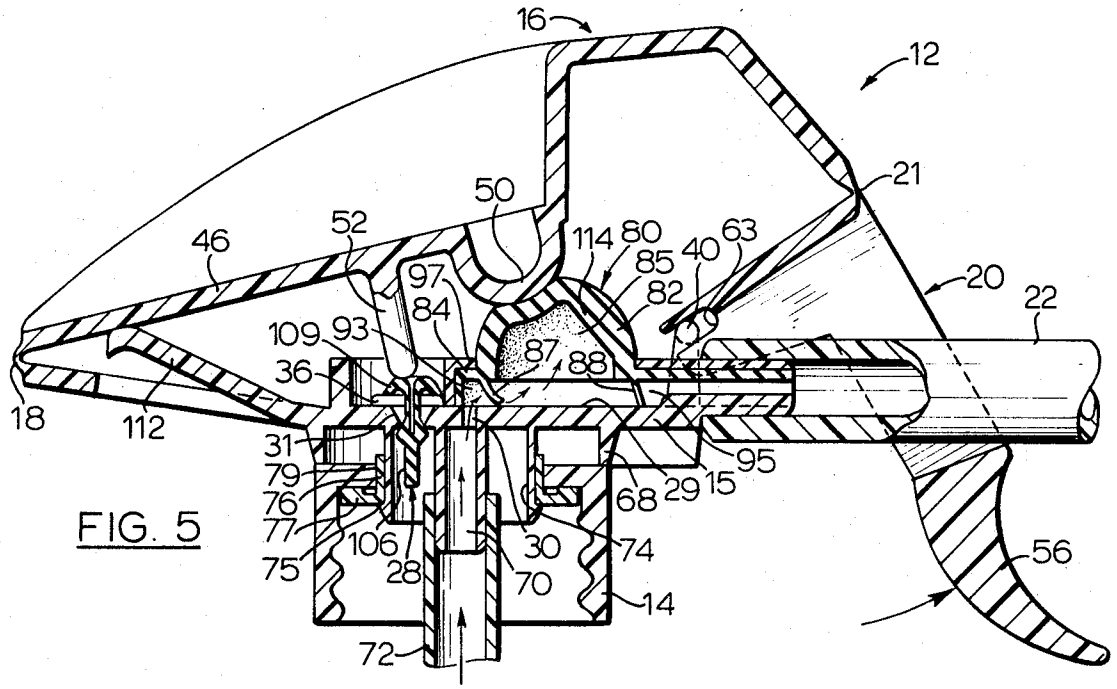


FIG. 5

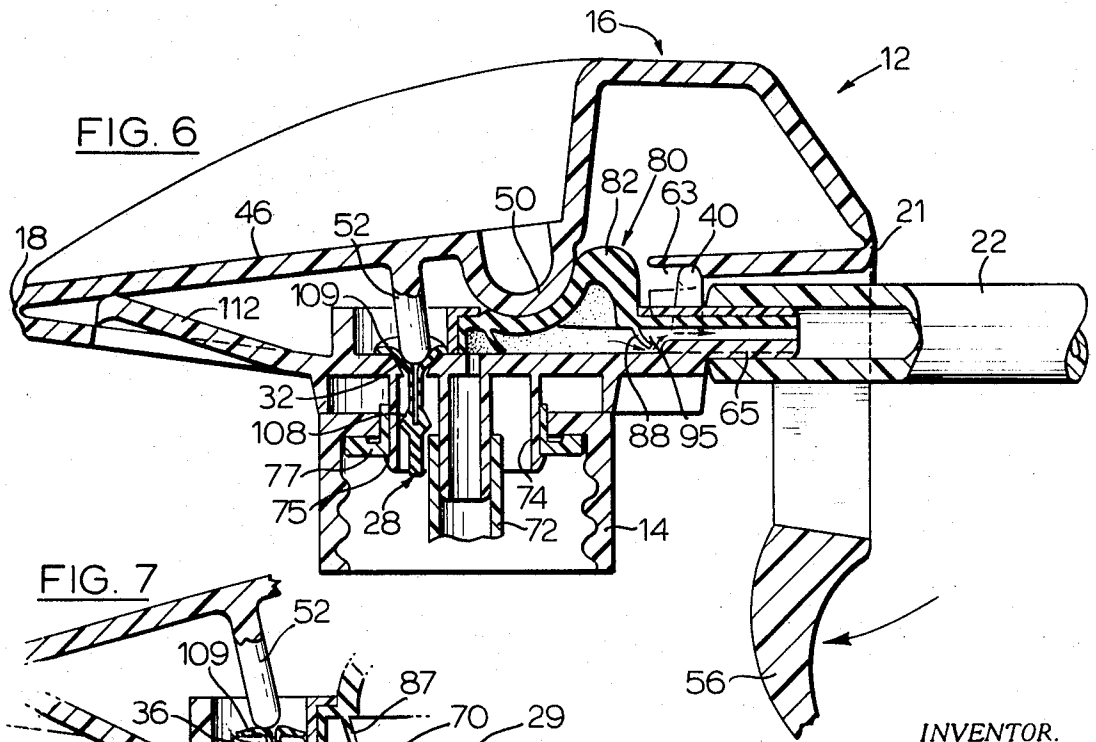


FIG. 6

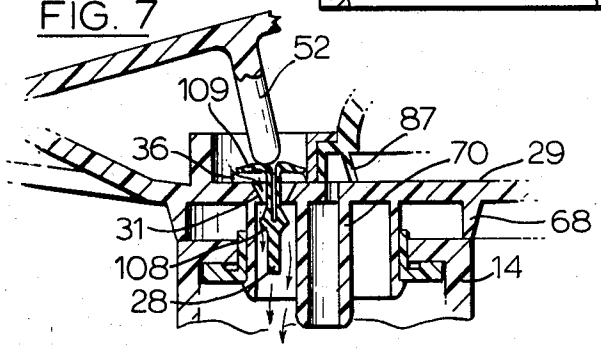


FIG. 7

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TRIGGER PUMP AND BREATHER VALVE DISPENSING ASSEMBLY

This invention relates generally to dispensing assemblies adapted to dispense liquid or semi-liquid contents from a container in which they are stored. More specifically, this invention relates to an articulable triangular trigger construction in which mutual reciprocation of the sides both pumps the contents from a container and admits air to the container to occupy the space from which the contents have been removed. A special feature of this invention is the construction of the vent-valve per se.

One object of this invention is to provide an articulable triangular construction which may be finger-actuated to both dispense the contents from a container and admit air to the container.

A further object of this invention is to provide a means of locking the articulable triangular construction in a position where pumping cannot take place, for purposes of shipping, handling, etc.

A still further object of this invention is to provide a vent-valve construction in which the vent is normally resiliently closed by the valve.

The last of these objects is accomplished by providing, in combination, a plate-like member having an aperture therethrough, a vent-valve having a stem extending loosely through said aperture, the stem having on one side of the aperture an enlargement converging toward the aperture and adapted to seal the aperture, the stem having on the other side of the aperture a resilient mushroom-like cap of which the periphery extends outwardly and toward the plate-like member and bears against the plate-like member, thereby to bias the enlargement into sealing relation with the aperture.

The first of the above objects is accomplished by the provision of a container having pump means for pumping the contents of the container from the interior to the exterior, the container including a plate portion separating the interior of said container from the exterior thereof, the plate portion constituting one side of a triangular linkage in which the first and second sides are of constant length and the third side is of changable length by virtue of a pin-and-slot connection with the first side, the plate portion defining said first side, the second side being defined by a first swingable member hinged to said plate portion at the vertex between said first and second sides, the third side being defined by a second swingable member hinged to said first swingable member at the vertex between said second and third sides and slidably pivoted to said plate portion at the vertex between said third and first sides, the second swingable member having an integral trigger which may be moved digitally to swing the first swingable member closer to said plate portion.

Two embodiments of this invention are shown in the accompanying drawings, in which like numerals denote like parts throughout the several views, and in which:

FIG. 1 is a perspective view, partly broken-away, of one embodiment of the dispensing assembly of this invention;

FIG. 2 shows a portion of the assembly of FIG. 1, with one of the parts in a locking position;

FIG. 3 is a partly broken-away, exploded view of the components of the assembly, in accordance with the first embodiment;

FIG. 4 is a partial view similar to FIG. 3, showing the second embodiment of this invention;

FIG. 5 is a longitudinal vertical sectional view of the assembly of this invention in one phase of a pumping cycle;

FIG. 6 shows the assembly of FIG. 5 in the second phase of a pumping cycle; and

FIG. 7 shows a portion of the assembly of FIGS. 5 and 6 at a phase intermediate between those shown in FIGS. 5 and 6.

In FIG. 1, a container 10 shown in dotted lines has mounted thereon a dispensing assembly 12 which includes an internally threaded cap member 14, a plate portion 15, a first swingable member 16 pivoted to the plate portion 15 at a first pivot axis 18, a second swingable member 20 pivoted to the first swingable member 16 at a second pivot axis 21, a spray barrel 22, a spray nozzle 24, a depressable, self-restoring pump 26, and a vent-valve 28. Preferably, the first and second pivot axes 18 and 21 are integral web-hinges, and the first and second swingable members are moulded integrally with each other and with the plate portion 15. FIG. 3 shows the position of these latter three integral elements in the as-moulded position. The plate portion 15 has a relatively flat upper surface 29 and has a first circular aperture 30 and a second circular aperture 31. The second aperture 31 is counter-sunk at 32 as shown. Two curved positioning ribs 34 are integral with and extend upwardly from the upper surface 29. Two breather ribs 36 are integral with and extend upwardly from the surface 29 on either side of the counter-sunk second aperture 31. Extending upwardly from the right-hand edge of the plate portion 15 are two arms 38 which support two oppositely extending, coaxial pivot pins 40. Extending leftwardly from the flat upper surface 29 is support structure 42 which terminates in an integral web-hinge 44, constituting the first pivot axis 18 in FIG. 1.

Connected to the support structure 42 through the web-hinge 44 is the first swingable member 16 which has an upper wall portion 46, two substantially vertical side walls 48, a substantially hemispherical push member 50, and a rod-like probe member 52. At its leftward end in FIG. 3 the first swingable member 16 is integral through an integral web-hinge 54 with the second swingable member 20. The integral web-hinge 54 constitutes the second pivot axis 21 shown in FIG. 1.

The second swingable member 20 includes a trigger 56, two spaced-apart brace members 58, and an arm 60 oriented substantially perpendicularly to the brace members 58 and having two edge flanges 62 which are cut away to define two slots 63.

Projecting rightwardly from the flat upper surface 29 between the arms 38 is an elongated member 65 having a raised central portion 66.

FIGS. 5 and 6 show the lower construction of the plate portion 15. A downwardly depending circular rim 68 is adapted to bear against the outer upper periphery of the cap member 14. The first aperture 30 is surrounded, on the lower side of the plate portion 15, by a downwardly extending integral tube 70, which is adapted to communicate in turn with a suction tube 72 extending downwardly into the container 10. The plate portion 15 also has on its lower side a cylindrical extension 74 which is coaxial with the integral tube 70 and

encloses both the first and second apertures 30 and 31. At its lower edge, the cylindrical extension 74 has an outwardly extending rib 75 which is adapted to catch under the inner, lower edge of a flanged collar 76 (shown in perspective in FIG. 3). The flange 77 of the flanged collar 76 is adapted to bear against the inner underside of the cap member 14, while the collar 76 itself extends upwardly through a central opening 79 in the cap member 14, in snug relation therewith. As can be seen in FIG. 5, when the rib 75 catches beneath the flanged collar 76, the cap member 14 is clamped, so to speak, between the circular rim 68 and the flange 77 of the flanged collar 76.

The depressable self-restoring pump 26 shown in FIG. 1 is composed of two elements. The first is the flat upper surface 29 with the first aperture 30 therethrough, the second is an integral elastomeric member 80 shown in perspective in FIGS. 3 and 4. The integral elastomeric member 80 falls within the terms of U.S. Pat. No. 3,486,663, invented by F.H. Humphrey, issued on Dec. 30, 1969, and entitled "Elastomeric Pump and Check-Valve."

As can be seen particularly in FIGS. 4 and 5, the integral elastomeric member 80 includes a bubble portion 82 and a flange 84 which extends outwardly and downwardly from the bubble portion 82. The bubble portion 82 defines a central cavity 85. As seen in FIG. 4, the integral elastomeric member 80 includes a first sloping partition 87 on one side of the cavity 85 and a second sloping partition 88 on the other side of the cavity 85. The partitions 87 and 88 are substantially parallel and, as seen in FIG. 5, are both sloped in the same direction with respect to the flat upper surface 29 against which they are adapted resiliently to rest. The integral elastomeric member 80 includes a U-shaped channel portion 90 extending radially away from the cavity 85 and opening through the flange 84. The integral elastomeric member 80 is adapted to be positioned centrally within the curved positioning ribs 34 with the U-shaped channel portion 90 fitted over the raised central portion 66 of the elongated member 65. When so positioned, it defines with the flat upper surface 29 a first chamber 92 which includes the cavity 85 and the volume between the two sloping partitions 87 and 88, a second chamber 93 located between the first sloping partition 87 and the flange 84, and a third chamber 95 between the second sloping partition 88 and the flange 84, the third chamber 95 communicating with the U-shaped channel portion 90. When the integral elastomeric member 80 is in position as shown in FIGS. 1, 5 and 6, the raised central portion 66 of the elongated member 65 does not totally block up the interior of the U-shaped channel portion 90, and a passageway is left along the elongated member 65 communicating with the third chamber 95.

A shroud 97 is adapted to hold the integral elastomeric member 80 tightly against the flat upper surface 29, and for this purpose includes an annulus 98 defining a central opening 100 adapted snugly to fit around the bubble portion 82, and an axially extending lip 102. The annulus 98 and the lip 102 define a shoulder adapted to bear down against the flange 84 of the integral elastomeric member 80. The shroud 97 also includes a pencylindrical channel 104 which is adapted snugly to surround the U-shaped channel portion 90 and to define a full cylinder with the elongated member 65, the bottom surface of which has the same curvature as the pencylindrical channel 104. Lip 102 of the shroud 97 is adapted to fit snugly within the curved positioning ribs 34, and is adapted to be tack-welded or heat-welded in position therebetween.

Attention is now directed to the vent-valve 28 shown in FIGS. 3, 5, 6 and 7. The vent-valve 28 has a stem 106 dimensioned to extend loosely from the second aperture 31, the stem 106 having part-way along its length an enlargement 108 which flanges conically upwardly as seen in the Figures. At the upper end of the stem 106 as seen in the Figures the vent-valve 28 has a resilient mushroom-like cap 109 of which the periphery extends outwardly and toward the enlargement 108. As best seen in FIGS. 5 and 6, the vent-valve 28 is adapted to be inserted through the second aperture 31 so that the enlargement 108 lies beneath the plate portion 15 while the resilient mushroom-like cap 109 lies above it with its periphery resting on the breather ribs 36. In this position, it is possible for air to pass beneath the mushroom-like cap 109 between the the breather ribs 36. The thickness of the plate portion 15, the depth of the breather ribs 36, and the distance along the stem 106 between the enlargement 108 and the mushroom-like cap 109, are all such that the enlargement 28, whose maximum diameter is greater than the minimum diameter of the second aperture 31, is resiliently biased into the second aperture 31, thereby effectively stopping it up. This is accomplished by reason of the resiliency of the mushroom-like cap 109 which urges the enlargement 108 into sealing relation with the second aperture 31 by getting a purchase on the breather ribs 36. So long as the enlargement 28 is in sealing relation with the second aperture 31, as shown in FIG. 5, it is not possible for air or liquid to pass through the aperture 31. As soon as the vent-valve 28 is moved downwardly with relation to the plate portion 15, however, the enlargement 108 is displaced below the second aperture 31, and the latter is opened for the passage of air or liquid. Naturally, it is not intended that liquid (i.e., the contents of the container 10) should pass out of the container through the second aperture 31. What is intended is that air from the outside should pass into the container through the aperture 31 when the vent-valve 28 is lowered, in order to make up the extra volume created by the dispensing of the contents of the container 10.

Present-day moulding techniques require that the plate portion 15, the first swingable member 16 and the second swingable member 20 be integrally moulded in the position shown in FIG. 3. When the vent-valve 28 has been inserted into the second aperture 31, and the integral elastomeric member 80 has been secured in place by tack-welding (or otherwise securing) the shroud 97 in the position indicated in FIGS. 1 and 5, the assembly is "closed" into operating position by articulating the first swingable member 16 about the integral web-hinge 44 so that it closes upon the plate portion 15 as shown in FIG. 1, and by causing the slots 63 in the second swingable member 20 to register with the pivot pins 40 supported on the arms 38 extending from the plate portion 15. As can be particularly well seen in FIGS. 5 and 6, the pivot pins 40 are slidably received within the slots 63, and this permits the second swinga-

ble member 20 to pivot slidingly about the pivot pins 40 between a first position shown in FIG. 5 and a second position shown in FIG. 6. It will be noted that as the second swingable member 20 moves from the FIG. 5 position to the FIG. 6 position, the pivot pins 40 slide more deeply into the slots 63. Also, as the second swingable member 20 pivots about the pivot pins 40 in the clockwise sense, the first swingable member 16 is caused to pivot about the first pivot axis 18 (defined by the integral web-hinge 44) in the clockwise sense, which brings it closer to the plate portion 15.

As can be seen in FIGS. 3, 5 and 6, the support structure 42 of the plate portion 15 includes a depressable tongue 112 which, when the mechanism is assembled as shown in FIG. 5, bears resiliently against the upper wall portion 46 of the first swingable member 16, and tends to bias the latter in the counter-clockwise direction with respect to the plate portion 15.

It will be appreciated that, when the first plate portion 15 and the first and second swingable members 16 and 20 are assembled in the position shown in FIG. 5, they define a hypothetical articulable triangle mechanism of which the vertices are defined by the first pivot axis 18, the second pivot axis 21 and the pivot pins 40. This hypothetical triangle is articulable because of the pin-and-slot connection between the second swingable member 20 and the plate portion 15. In effect, one side of the triangle is defined by the plate portion 15 between the pivot pins 40 and the first pivot axis 18, a second side of the triangle is defined by the first swingable member 16 between the first pivot axis 18 and the second pivot axis 21, and a third side of the hypothetical triangle is defined by the second swingable member 20 between the second pivot axis 21 and the pivot pins 40. It will be appreciated that the first and second sides of the hypothetical triangle are of constant length, whereas the third side as defined above is of adjustable length due to the pin-and-slot connection.

Attention is now directed to FIGS. 5 and 6, which illustrate the manner in which the pump operates. In the position shown in FIG. 5, it is assumed that the trigger 56 has just completed its swing in the counter-clockwise direction to these positions shown, and thus that the first swingable member 16 has just moved upwardly to the position shown in FIG. 5 from the position shown in FIG. 6. In so doing, the distorted and depressed bubble portion 82 has restored itself almost to the natural condition, and in so doing has caused the volume of the first chamber 92 to increase. When the volume of the first chamber 92 increases, it draws liquid (if such is the contents of the container) upwardly through the suction tube 72 and through the integral tube 70 and aperture 30 into the second chamber 93, whence it passes beneath the first sloping partition 87 and into the first chamber 92. Upon the downstroke from the position shown in FIG. 5 to the position shown in FIG. 6, the bubble portion 82 is distorted and depressed, thereby diminishing the volume in the first chamber 92, causing the first sloping partition 87 to seat or wedge firmly against the flat upper surface 29, and simultaneously forcing liquid out of the first chamber 92 into the third chamber 95 beneath the edge of the second sloping partition 88, as shown particularly in FIG. 6. From the third chamber 95, the liquid passes outwardly within the U-shaped channel portion 90 in the passageway defined between the latter and the elongated member 65. The cycle is then recommenced by releasing the trigger 56 and permitting the depressable tongue 112 to restore the first swingable member 16 to the position shown in FIG. 5, thereby also permitting the bubble portion 82 to restore itself to the position shown in FIG. 5.

It will be noted that the wall of the bubble portion 82 is thickened over a certain portion of its area as shown at 114, and this is merely to provide increased resilience in the bubble portion 82, to permit it more readily to spring back to its original as-molded position.

Attention is now directed to the movement of the vent-valve 28 as the mechanism moves between the FIG. 5 position and the FIG. 6 position. In the FIG. 5 position, the probe member 52 rests lightly against the mushroom-like cap 109, and does not interfere with the tendency of the latter to urge the enlargement 108 into sealing relation with the second aperture 31. As the trigger 56 is moved leftwardly to bring the first swingable member 16 closer to the plate portion 15, the probe member 52 pushes downwardly against the mushroom-like cap 109 and in so doing pushes the stem 106 downwardly with respect to the plate portion 15. Downward movement of the stem 106 brings the enlargement 108 out of sealing engagement with the second aperture 31, and the vent-valve 28 reaches an intermediate position shown in FIG. 7, in which the enlargement 108 is displaced downwardly out of sealing relation with the second aperture 31, and in which the mushroom-like cap 109 is partially flattened but not so as to obstruct the passage of air beneath the mushroom-like cap 109 and through the now opened second aperture 31, as shown by the flow arrows.

Further downward movement of the probe member 52 pushes the mushroom-like cap 109 downwardly into the counter-sink at 32, as shown in FIG. 6. Alternatively, the probe member 52 could be shortened somewhat so that in its lowermost position the vent-valve 28 is positioned as shown in FIG. 7.

As shown in FIGS. 1, 5 and 6, the spray barrel 52 fits snugly over the pencylindrical channel 104 and the elongated member 65, the grip being such as to prevent leakage of the liquid.

It will be noted in FIG. 1 that the spray barrel 22 is provided with a first key 116 and a second key 118, the two keys extending in opposite directions at two locations spaced along the spray barrel 22.

In FIG. 2 it can be seen how the spray barrel 22 with the keys 116 and 118 can be used to lock the trigger 56 and the second swingable member 20 in the open non-pumping position, should this be desirable for purposes of handling or shipping. The grip of the spray barrel 22 around the pencylindrical channel 104 is not so tight as to prevent rotation about their common axes, and it can be seen in FIG. 2 that rotation of the spray barrel 22 through an angle of 90° brings the second key 118 up to a position in which it interferes with the leftward movement of the trigger 56 and the second swingable member 20. The first key 116 is useful to provide a finger grip upon the spray barrel 22 for purposes of rotation.

Attention is now directed to FIG. 4, in which the second embodiment of this invention is shown. In the

second embodiment, the shroud **97** is moulded integrally with the plate portion **15** by means of a connecting strap **120**. The remaining parts of the assembly are unchanged.

In putting together the assembly shown in FIG. **4**, the integral elastomeric member **80** is fitted snugly into the shroud **97*a*** while both are in the inverted position shown in FIG. **4**, and then the shroud **97*a*** with its contained elastomeric member **80** is pivoted around to lodge snugly between the curved positioning ribs **34**. The remaining steps of assembly are unchanged.

It will be noted in FIGS. **5**, **6** and **7** that the vent-valve **28** has a central bore extending from the middle of the mushroom-like cap **109** to a location within the stem at approximately the position of the enlargement **108**. This bore is not essential, but arises because of the moulding technique used in making the vent-valve **28**.

It is to be understood that, while the vent-valve **28** has been disclosed as a separate item mechanically operated, it would be a simple matter to construct the vent-valve in such a way that the increased pressure developed inside the elastomeric member **80** on the downstroke presses the vent-valve downwardly to open the second circular aperture **31**. For example, the vent-valve could have the periphery of its mushroom-like cap **109** sealed against the flat upper surface **29** and vent air could be communicated to the underside of the cap **109** by a lateral bore centrally between the surfaces of the plate portion **15**.

It will also be appreciated that the breather ribs **36** can be replaced by such expedients as providing at least one hole in the cap **109**, a lateral bore in the plate portion **15** as mentioned above, or serrated edges on the cap **109**.

The vent-valve **28** and the elastomeric member **80** are preferably manufactured from a material marketed by Shell Oil under the Registered Trade Mark "-KRATON," the material being primarily a styrene butadiene block copolymer. The vent-valve **28** and the elastomeric member **80** can also be made from PVC, EVA polyurethane and other elastomeric rubber and plastic compounds. The preferred material for the manufacture of the plate portion **15**, the first and second swingable members **16** and **20**, the shroud **97**, the spray barrel **22** and the spray nozzle **24** is polypropylene, with High Density Polyethylene as a satisfactory alternative.

What we claim is:

1. In combination:

a container having pump means for pumping the contents of the container from the interior to the exterior,

said container including a plate portion separating the interior of said container from the exterior thereof, said plate portion having an aperture therethrough,

a vent-valve having a stem extending loosely through said aperture, the stem having on one side of the aperture an enlargement converging toward the aperture and adapted to seal the aperture, the stem having on the other side of the aperture a resilient mushroom-like cap of which the periphery extends outwardly and toward the plate-like member and bears against the plate-like member, thereby to bias the enlargement into sealing relation with the aperture,

the pump means including a probe member adapted to move toward and into displacing contact with said cap in the general direction from the cap to the enlargment as the pump means is activated, thereby to unseal the said aperture and permit the passage of fluid therethrough.

2. The combination claimed in claim **1**, in which the enlargement tapers substantially conically toward the cap, and in which the aperture has a circular cross-section with a diameter less than the maximum diameter of the conically tapering enlargement.

3. The combination claimed in claim **2**, in which the vent-valve is a single integral item of resilient material.

4. The combination claimed in claim **3**, in which the plate portion has discrete, raised breather ribs adjacent the aperture on the side remote from the enlargement, the breather ribs being disposed to contact parts of said cap, thereby to permit the free passage of air at all times between the cap and the plate.

5. The combination claimed in claim **4**, in which the aperture is counter-sunk on the side of the plate portion remote from the enlargement.

6. The combination claimed in claim **1**, in which the pump means includes a first swingable member pivoted to said plate portion about a first pivot axis remote from said aperture and adapted to swing toward and away from said vent-valve on the side of said plate portion remote from the enlargement, a second swingable member pivoted to said first swingable member about a second pivot axis parallel to said first pivot axis, said plate portion rigidly supporting pin means spaced from said first pivot axis, said second swingable member having slot means adapted to receive said pin means and to establish sliding pivotal motion thereabout, thereby to permit said first swingable member to move toward and away from said plate portion as the second swingable member is slidingly pivoted about said pin means, the first swingable member having a probe member adapted to push the vent-valve cap toward the said aperture as the first swingable member approaches said plate portion, the second swingable member having trigger means by which it can be manually rotated to bring the first swingable member toward the plate portion.

7. The combination claimed in claim **6**, in which said pump means includes a depressable pump located on said plate portion and having a part adapted to be moved toward the plate portion by an outside agency, said last-mentioned part being adapted to restore itself upon cessation of the outside agency, said first plate portion also having a push-member adapted to move said part toward the plate portion as the first swingable member moves toward said plate portion.

8. The combination claimed in claim **6**, in which the first swingable member is biased away from the plate portion.

9. The combination claimed in claim **1**, in which the plate portion constitutes one side of a triangular linkage in which the first and second sides are of constant length and the third side is of changeable length by virtue of a pin-and-slot connection with the first side, the plate portion defining said first side, the second side being defined by a first swingable member pivoted to said plate portion at the vertex between said first and second sides, the third side being defined by a second swingable member pivoted to said first swingable

member at the vertex between said second and third sides and slidably pivoted to said plate portion at the vertex between said third and first sides, the second swingable member having an integral trigger which may be moved digitally to swing the first swingable member closer to said plate portion, said probe member being supported on said first swingable member.

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