LIQUID DISPENSING DEVICE WITH BULB PUMP

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This invention relates to liquid dispensing devices of the type which are adapted to be applied to a container and particularly to constructions which are rendered operable to discharge liquid from a container only when the container and device are inverted.

Liquid dispensing devices as heretofore constructed have generally been designed to dispense liquid when the container and device are in an upright position. However, such constructions are generally complicated and frequently do not give a uniform discharge of liquid. On the other hand, those liquid dispensers which are operable when inverted have not generally served to prevent evaporation or discharge of liquid when the container and device are in an upright position.

In accordance with the present invention a liquid dispensing device is provided which is simple and economical to produce and assemble and is operable on inversion of the container and device to draw liquid from a container and to discharge it in substantially uniform quantities. At the same time the device serves to protect and seal the container and its contents when the container and device are in upright positions.

This result is attained by providing a novel type of pump means including valves and related elements for controlling the flow of fluid to and from the device.

The principal object of the present invention is to provide a novel type of liquid dispensing device which is inexpensive to produce and consistent and uniform in its operation.

Another object of the invention is to provide an improved liquid dispensing device for application to a container so as to be rendered operable only when the container and device are in an inverted position.

These and other objects and features of the invention will appear from the following description thereof in which reference is made to the figures of the accompanying drawing.

In the drawing:

Fig. 1 is a vertical sectional view of a preferred embodiment of the invention as seen when the device and container are in an upright position.

Figs. 2 to 4 are vertical sectional views similar to Fig. 1 but showing the parts in various positions they assume when the container and device are inverted and the device is operated, and

Fig. 5 is a horizontal sectional view of the construction shown in Fig. 1 taken on the line 5--5 thereof.

In that form of the invention illustrated in the drawing, the dispensing device is designed to be applied to the neck of a container and embodies an outer shell or holder 4 having a spout 6 with a discharge opening 8 therein. The dispensing device itself is enclosed within the holder 4 as a self-contained unit and includes a cup shaped member 10 having a discharge opening 12 which communicates with the discharge opening 8 of the holder 4. A disc 14 is located in contact with the upper rim of the cup shaped member 10 and cooperates therewith to form a liquid receiving chamber 16. The disc 14 is provided with inlet openings 18 through which liquid may flow into the liquid receiving chamber 16. The cup shaped member 10 and the disc 14 are held in place by a centrally located tubular element or eyelet 20 which passes through the members 10 and 14 and is flanged or spun over at its upper and lower ends so as to secure the members 10 and 14 together. A flange 22 is located above the disc 14 when the device and container are in the upright position of Fig. 1 while the flange 24 is located beneath the cup shaped member 10.

Gravity responsive valve means 26 is located within the liquid receiving chamber 16 and as shown consists of a disc arranged to close the inlet openings 18 when the liquid dispensing device is inverted. An annular downwardly extending sleeve 28 on the valve means 26 surrounds eyelet 20 and serves to space the valve means from the bottom of the cup shaped member 10 when the liquid dispensing device is in an upright position so that it will move freely within the liquid receiving chamber to close the inlet openings 18 in the disc 14 when the device is inverted.

The tubular element or eyelet 20 serves as a liquid supplying means and is provided with a centrally located passage 30 which communicates at its lower end with the container 2 and is closed at its upper end by a second gravity responsive valve means 32 arranged to bear against the upper face of the flange 22 on the tubular element 20. The flange 22 on the eyelet serves to maintain the valve means 32 in spaced relation to the openings 18 when the device is in an upright position whereas the valve means 32 is movable away from the flange 22 and the passage 30 and openings 18 on inversion of the device. When inverted the valve means 32 comes to rest against the shoulder 34 on the inner face of compressible means or bulb 36. The valve means 32 is therefore movable into and out of engagement with the flange 22 to control communication between the container 2 and the inlet 18 which leads to the liquid receiving chamber 16, while communica-
and the openings 18 in the disc 14 is continuously maintained.

The compressible means 36 is shown to comprise a flexible rubber bulb which normally tends to assume a generally hemispherical shape and thereby tends to return to its normal shape after compression due to the inherent resiliency of the bulb. The bulb is provided with a marginal portion 8 which bears against the upper face of the disc 14 and presents a rim engaged by the outer retaining member 40 which serves to hold the cup shaped member 10, the disc 14, and the bulb 36 together as a unit which comprises the dispensing device and its pump means. The retaining member 40 is provided with an opening 42 which registers with the discharge opening 12 in the cup shaped member 10 of the dispensing device and the discharge opening 8 in the spout of the holder 4.

The dispensing device is thus seen to embody a limited number of parts which can be made easily and economically from sheet metal stamping and they may be assembled and handled as a unitary structure. However, the dispensing device may be assembled with the holder 4 so as to be shipped and applied as a unit. For this purpose a washer gasket 44 is located between the bottom of the retaining member 40 and the upper edge of the neck of the container 2 to seal the space between the dispensing device and the container. The gasket preferably has a forced or frictional fit within the holder 4 and against the shoulder 45 thereof so as to retain the dispensing device within the holder.

The construction shown and described is intended to be applied to a container and is held in a fixed position with respect thereto by suitable means, such as the complementary threads 48 on the holder and container disc 14. Thus secured in place and when the parts are in the upright position illustrated in Fig. 1, the valve means 32 is in contact with the upper flange 22 on the tubular liquid supplying means 30 and serves to seal the container. Moreover, the lower end of the tubular element 30 is located above the liquid in the container when in an upright position so that liquid will not be drawn up into the dispensing device even if the bulb 36 is actuated. Furthermore, the edges of the valve means 32 are spaced from the inlet openings 18 in the disc 14 by the flange 22 and the valve means 32 is in the lowered position shown so that if the bulb 36 is compressed air may flow freely from the bulb about the edges of the valve means 32 to the inlet openings 18 in the liquid receiving chamber 16 and thence may flow through the discharge openings 12, 42 and 8 without causing liquid to be discharged from the container or liquid receiving chamber. In the upright position of the dispensing device the sleeve 26 on the valve means 32 holds the disc 14, and thereof spaced from the bottom of the cup shaped member 10 so that it is freely movable toward the apertured disc 14 when the device is inverted.

When the container and device are inverted for operation, the valve means 26 and 32 move to positions indicated in Fig. 2 in which the disc of the valve means 26 closes the inlet openings 18 of the liquid receiving chamber 16 whereas the valve means 32 moves away from the flange 22 and the liquid supplying means 20 to uncover the opening 18 so that liquid then flows into the central opening 30 in the tubular liquid supplying means and tends to flow outward between the flange 22 and the valve means 32. However, since the valve means 26 closes the inlet openings 18 of the liquid receiving chamber air is trapped in the space above the flange 22 and below the valve means 32 as seen in Fig. 2 so that liquid cannot flow from the container to the liquid receiving chamber.

Up to this point the bulb 36 the parts assume the positions indicated in Fig. 3. At that time air is forced from the container in the bulb 36 so that the valve disc 32 is forced upward into contact with the flange 22 of the tubular element 10 closing the lower end of the passage 30. Air then forces through the flange 22 and between the upper face of the valve means 32 and the apertured disc 14 to the inlet openings 18. The air then raises the cavity actuated valve means 26 so that it may pass from the air and liquid.

Upon subsequent expansion of the bulb 36 the parts assume the positions indicated in Fig. 4 of the drawings. At this time the valve means 26 and 32 are drawn downward in the inverted dispensing device so that the valve means 26 closes the inlet opening 18 in the liquid receiving chamber whereas the valve means 32 is drawn away from the flange 22 of the element 20 and into engagement with the shoulder 34 on the interior of the bulb 36. The valve means 32 is provided with notches 36 in the edges thereof which provide communication between the cavity 50 in the bulb and the space above the valve means 32. Therefore continued expansion of the bulb 36 and its cavity 50 causes liquid to be drawn downward from the container into the space between the upper surface of the valve means 32 and the lower surface of the apertured disc 14. Some of this liquid also may flow through the notches 36 in the edges of the valve means into the cavity 50 so that the cavity will thereafter contain both air and liquid.

When the device has thus been charged with liquid, compression of the bulb 36 causes the elements again to assume the positions shown in Fig. 3 wherein the valve means 26 and 32 are both raised. The valve means 32 then is forced upward into engagement with the flange 22 of the tubular liquid supplying means 20 so as to prevent a return flow of liquid from the dispensing device to the container, whereas the liquid which was previously located in the space between the valve means 32 and the apertured disc 14 is forced upward and outward through the inlet opening 18 and past the valve means 26 to the liquid receiving chamber 16. A portion of the liquid in the bulb cavity 50 also may flow into the liquid receiving chamber 16. The capacity of the liquid receiving chamber is limited and therefore liquid is discharged from the liquid receiving chamber 16 through the discharge opening 12 in the cup shaped member 10 and through the discharge opening 8 in the nozzle 6 of the holder 4.

In actual practice it is found that the quantity of liquid discharged on each compression of the bulb 36 is substantially the same so that the device is consistent and uniform in its operation. When the device is turned upright with the container after discharge of liquid therefrom the elements of the construction again assume the positions shown in Fig. 3. Also the valve means 26 again moves downwardly into engagement with the flange 22 of the element 20 to close and seal the container to prevent evaporation of liq-
uld therefrom. At the same time the expansion of air within the container can lift the valve means so that it can escape through the uncovered inlet opening 18 when necessary.

Compression of the bulb 35 when the device is in an upright position after once having been charged with liquid causes some of the liquid to flow downward through the inlet openings 18 to the liquid receiving chamber 16. However, the discharge opening 12 in the liquid receiving chamber is spaced somewhat above the bottom of the container and the discharge opening 8 in the holder 4 is inclined at such an angle that any liquid which may accumulate in the liquid receiving chamber will be retained thereby rather than expelled from the chamber. Therefore, operation of the bulb 36 does not cause liquid to be discharged from the device when it is upright, whereas the discharge of liquid when the device is inverted is consistent and substantially uniform in character.

The form of the invention illustrated is economical to produce and may be assembled quickly and easily. It may be manufactured as a unit for insertion into holders of different types and shape and may be assembled and held in place in the holder. In order to hold the various elements of the construction in register position the cup shaped member 19 is provided with an outwardly facing groove 54 adjacent the discharge opening 12 which is slidably engageable with the inwardly projecting rib 55 in the retaining member 40. Similarly, registering means are located diametrically opposite the discharge opening 12 and for this purpose the holder 4 is inclined with a longitudinally extending slot 58 which receives an outwardly projecting rib 60 on the retaining member 40. The elements are thus held accurately in place and in registry with respect to each other and with respect to the holder, while the gasket 44 serves to retain the dispensing device, as a unit in position within the holder when it is handled prior to application to a container.

Although a particular embodiment of the present invention is shown in the drawings and herein described, it will be apparent that numerous changes and modifications may be made in the form, construction, and arrangement of the elements employed in the combination. In view thereof it should be understood that the embodiment of the invention herein shown and described is intended to be illustrative only and is not intended to limit the scope of the invention.

We claim:

1. A liquid dispensing device adapted to be applied to a container and movable therewith to inverted and upright positions, said device comprising means having a discharge opening, means for conducting liquid from said container to said opening, valve means controlling the flow of liquid from said container to said opening, a second valve means controlling flow of liquid from said container to said opening, and a compressible bulb having a cavity therein communicating with said valve means, said valve means being movable by gravity only to positions in each of which one of said valve means is closed and the other of said valve means is open, both of said valve means being movable in response to compression of said bulb when the container and dispensing device are in an inverted position to cause liquid to be discharged from said discharge opening, compression of said bulb when the container and dispensing device are in an upright position serving to urge said valve means to positions in which they prevent the discharge of liquid from said discharge opening.

2. A liquid dispensing device adapted to be applied to a container and movable therewith to inverted and upright positions, said device comprising a liquid receiving chamber having a discharge opening therein, liquid supplying means communicating with said container and said liquid receiving chamber, a gravity responsive valve controlling communication between said liquid receiving chamber and said liquid supplying means, a second gravity responsive valve controlling flow of liquid through said liquid supplying means, said valves being arranged so that when the container and dispensing device are upright the first valve is open and the second valve is closed and when the container and dispensing device are inverted the first valve is closed and the second valve is open, and compressible means operable to move said valves against the action of gravity and whereby compression thereof when said container and dispensing device are inverted will cause the second valve to be moved to prevent return flow of liquid to said container and will cause the first valve to be moved to permit flow of liquid to said liquid receiving chamber and discharge opening.

3. A liquid dispensing device adapted to be applied to a container and movable therewith to inverted and upright positions, said device comprising two members having portions thereof spaced apart to form a liquid receiving chamber having a discharge opening, one of said members being formed with an inlet opening, a valve located in said liquid receiving chamber and spaced from said inlet opening when the container and dispensing device are in an upright position but movable under the action of gravity to close said inlet opening when the container and dispensing device are inverted, liquid supplying means communicating with said container and with said inlet opening, a second valve means located outside said liquid receiving chamber and in position to close said liquid supplying means when said container and dispensing device are upright but movable away from the liquid supplying means under the action of gravity when said container and dispensing device are inverted, and a compressible bulb having a fluid receiving cavity therein communicating with both valve means so that compression of said bulb when the container and dispensing device are inverted will raise both of said valve means and prevent reverse flow of liquid through the liquid supplying means to the container and force fluid and liquid from the bulb cavity through said inlet opening and liquid receiving chamber to said discharge outlet.

4. A liquid dispensing device adapted to be applied to a container and movable therewith to inverted and upright positions, said device comprising two members having portions thereof spaced apart to form a liquid receiving chamber provided with a discharge opening, one of said members having an inlet opening therein for admitting liquid to said chamber, a valve located in said chamber above the latter member when the container and device are inverted and movable into and out of position to close said inlet opening, a liquid supplying member communicating with said container and inlet opening, a valve located below said member when the container and device are inverted and movable to control the flow of liquid through said liquid
supplying member, and a compressible member movable to raise said valves when the container and device are inverted to prevent return flow of liquid through said liquid supplying member to said container and to open the valve in said liquid receiving chamber for passage of liquid through said liquid inlet opening to said liquid receiving chamber and discharge opening.

5. A liquid dispensing device adapted to be applied to a container and movable therewith to inverted and upright positions, said device comprising two members having portions thereof spaced apart to form a liquid receiving chamber provided with a discharge opening, one of said members having an inlet opening therein for admitting liquid to said chamber, a gravity responsive valve located in said chamber above the latter member when the container and device are inverted and movable into and out of position to close said inlet opening, a liquid supplying member communicating with said container and inlet opening, a gravity responsive valve located below said member when the container and device are inverted and movable to control the flow of liquid through said liquid supplying member, and a compressible member movable to raise said valves when the container and device are inverted to prevent return flow of liquid through said liquid supplying member to said container and to open the valve in said liquid receiving chamber for passage of liquid through said liquid inlet opening to said liquid receiving chamber and discharge opening.

6. A liquid dispensing device adapted to be applied to a container and operable when the container and device are inverted to discharge liquid from the container, said device comprising a cup-shaped member having a discharge opening therein and compressible means secured to the cup-shaped member, and cooperating therewith to form an enclosure, a disc member dividing said enclosure into a liquid receiving chamber and a compressible chamber, said disc member having an aperture therein providing communication between said chambers, means forming a passage for conducting liquid from said container to said compressible chamber, and a gravity responsive valve means in each of said chambers movable when said container and device are inverted to positions in which said passage is opened to conduct liquid from said container to said compressible chamber and said aperture is closed against flow of liquid from the compressible chamber to said liquid receiving chamber, said valve means both being movable against the action of gravity and in response to operation of said compressible means to positions in which they prevent liquid in said compressible chamber from flowing back through said passage to the container and permit liquid to flow from said compressible chamber into said liquid receiving chamber and through said discharge opening.

7. A liquid dispensing device adapted to be applied to a container and operable when the container and device are inverted to discharge liquid from the container, said device comprising a cup-shaped member having a cavity therein and a discharge opening communicating with said cavity, a compressible member having a cavity therein located adjacent to the cavity in the cup-shaped member, a disc member separating the cavity in the cup-shaped member from the cavity in the bulb and cooperating therewith to form a bulb chamber and a liquid receiving chamber, said disc member having an aperture therein pro-

viding communication between said chambers, means forming a passage extending from said container to said bulb chamber, a gravity responsive valve located in the bulb chamber and positioned to close said passage when the container and device are in an upright position, said valve being movable to a position to permit flow of liquid through said passage when the device and container are inverted, a second gravity responsive valve located in said liquid receiving chamber and positioned to open said aperture providing communication between said chambers when the container and device are in said inverted position but movable on compression of said bulb to permit flow of liquid from the bulb chamber to said liquid receiving chamber and through said discharge opening.

8. A liquid dispensing device adapted to be applied to a container and operable in inverted position to discharge liquid from said container, said device comprising a self-contained pump unit formed to provide chambers with an apertured partition therebetween, said partition being unvariable in size and having a gravity responsive disc valve movable therein and a discharge orifice leading therefrom, the other chamber of the said partition being sealable in part by a compressible member movable to form the size of said second chamber, a disc valve also movable within said second chamber, means conducting liquid from said container to said second chamber through said first chamber, and means for detachably holding said pump unit to the mouth of said container and having a nozzle port aligned with said discharge orifice of said first chamber.

9. A liquid dispensing device adapted to be applied to a container, said device comprising a cup-shaped member, a head comprising a compressible bulb seated against the opposite surface of said disc, said disc being being divided into two chambers by said aperture disc, one chamber having a discharge orifice, the other chamber being formed in part by said bulb, means leading through said first chamber to conduct liquid from said container to said second chamber, a disc valve member located on each of said chambers and responsive to positive and negative forces resulting from compression and expansion of said bulb, and means for detachably holding said pump unit to the mouth of said container and having a nozzle port aligned with said discharge orifice of said first chamber.

10. A construction of the character defined in claim 4 wherein said two members and said compressible member are secured together in the form of a unit which incloses said valves, and means for securing said unit to said container comprising an outer shell provided with a port for retaining the shell in place on a container, the said shell having a recess therein for receiving said unit and formed with an opening through which said compressible member is exposed for operation when said unit is positioned in said recess, said shell further having a discharge port therein aligned with the discharge opening in one of the members forming said unit.

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(References on following page)
### REFERENCES CITED
The following references are of record in the file of this patent:

#### UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>840,925</td>
<td>Falk</td>
<td>Jan. 8, 1907</td>
<td>Oct. 4, 1921</td>
</tr>
<tr>
<td>878,750</td>
<td>Schmidt</td>
<td>Feb. 11, 1908</td>
<td>Feb. 26, 1924</td>
</tr>
<tr>
<td>1,159,605</td>
<td>Sprague</td>
<td>Nov. 9, 1915</td>
<td>Sept. 30, 1932</td>
</tr>
<tr>
<td>1,248,211</td>
<td>Cross</td>
<td>Aug. 3, 1920</td>
<td>Oct. 31, 1933</td>
</tr>
<tr>
<td>1,382,200</td>
<td>Lacina</td>
<td>June 21, 1921</td>
<td>Aug. 2, 1933</td>
</tr>
</tbody>
</table>

#### FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,392,601</td>
<td>Rose</td>
<td>Aug. 3, 1920</td>
</tr>
<tr>
<td>1,484,220</td>
<td>Wolfe</td>
<td>Mar. 10, 1942</td>
</tr>
<tr>
<td>1,878,230</td>
<td>Willshaw</td>
<td>May 1, 1907</td>
</tr>
<tr>
<td>1,932,615</td>
<td>Bumpass</td>
<td>May 1, 1907</td>
</tr>
<tr>
<td>2,125,572</td>
<td>Johnston</td>
<td>May 1, 1907</td>
</tr>
<tr>
<td>2,128,567</td>
<td>Wilson</td>
<td>May 1, 1907</td>
</tr>
<tr>
<td>2,275,972</td>
<td>Maloney</td>
<td>May 1, 1907</td>
</tr>
</tbody>
</table>