Dec. 14, 1965 R. S. WADDINGTON ETAL 3,223,296

LIQUID HANDLING DEVICES

Filed June 17, 1963 2 Sheets-Sheet 1

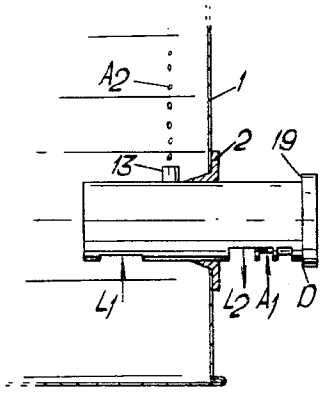


Fig. 1.

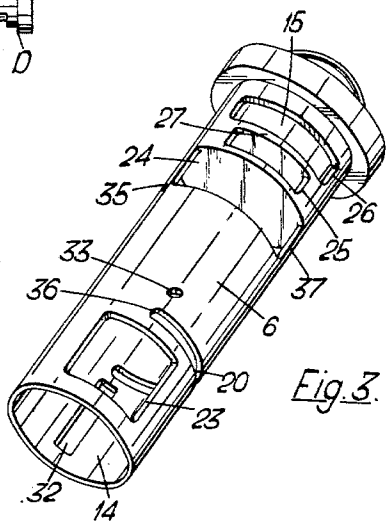


Fig. 3.

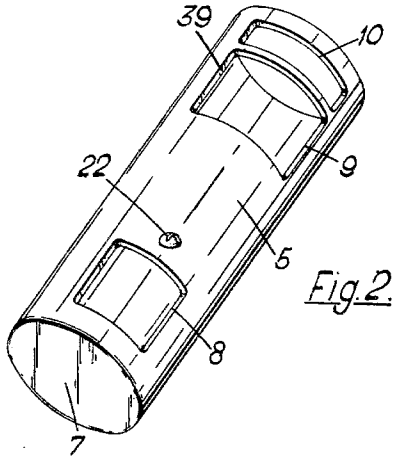


Fig. 2.

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LIQUID HANDLING DEVICES

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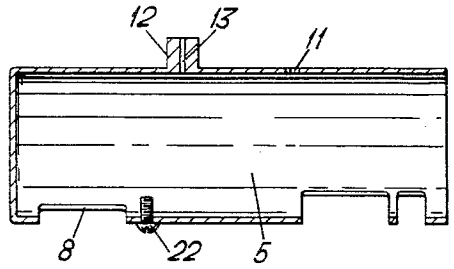


Fig. 4.

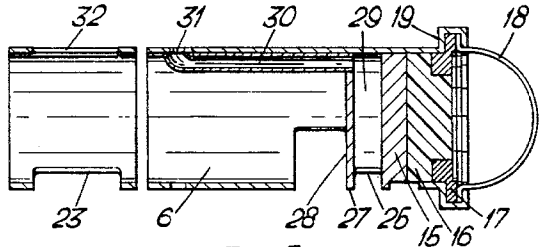


Fig. 5.

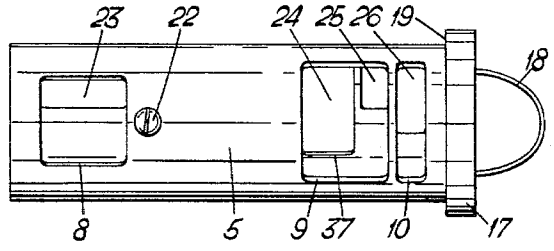


Fig. 6.

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3,223,296

Patented Dec. 14, 1965

3,223,296

LIQUID HANDLING DEVICES

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Filed June 17, 1963, Ser. No. 288,413
Claims priority, application Great Britain, June 19, 1962, 23,609/62
2 Claims. (Cl. 222—442)

The present invention relates to devices for handling liquids and especially to devices which when arranged through the wall of a closed container holding a liquid, being for example held in the filling aperture of a can, present a liquid entrance and an air exit to the liquid and enable the liquid to be delivered as required from an exit aperture positioned outside the container. Examples of such devices are described in our United States Patents 2,708,058 and 2,842,291. With one type a continuous flow of the liquid is obtained by pulling the device outwardly through the container wall until the exit aperture is exposed; with another type, described in said patent 2,842,291, pulling the device outwardly delivers a fixed quantity of the liquid and a continuous flow is obtainable when required by opening a valve provided at the liquid entrance.

In accordance with the present invention there is provided a device for withdrawing a liquid from a closed container which comprises a barrel having a liquid entrance, an air exit and an exit aperture, and within the barrel a rotary valve member (preferably in the form of an apertured liner for the barrel) formed to leave the liquid entrance and the exit aperture open when in one rotational position to provide an air reflux pathway to the air exit and to close the exit aperture when in another rotational position. By rotation of the valve member between the two positions, a stream of liquid accompanied by air reflux to the container, may be obtained as required.

For best results the reflux pathway should include an air chamber communicating between an air entrance and the air exit, the resistance to air flow through the air entrance into the chamber being small compared with the resistance to air flow from the chamber to the air exit. With this arrangement the tendency for the liquid to be delivered at a cyclically varying rate is minimised or sensibly eliminated and the withdrawal of a particular quantity correspondingly facilitated.

In a preferred construction, the air chamber is provided as part of the rotory valve member and communicates with a port which registers with the air exit from the barrel when the valve member is positioned to leave the liquid-entrance and exit apertures open.

The device is readily provided in a form such that it may be held in liquid tight relationship with the filling aperture of a container by a gland for example a sealing member as described in our United States Patent No. 2,980,300. In one convenient arrangement it is formed so as to be held reciprocably by the gland and is provided with limiting abutments which define an outer, or working, position and an inner or retracted position, preferably an inner position in which the outlet is unexposed.

In a preferred form of the device the rotary valve member is formed when in different rotational positions (1), (2) and (3).

(1) to close the exit aperture whilst leaving the liquid entrance and the air exit open,

(2) to close the liquid entrance and the air exit whilst leaving the exit aperture open,

(3) to leave the liquid entrance and the exit aperture open and provide an air reflux pathway to the air exit.

By turning the valve member to and fro between rotational positions (1) and (2), liquid may be withdrawn

from a closed container in a series of equal quantities. The interior of the device is filled with the liquid when the valve member is in position (1), air passing from the interior to within the container via the open air axit. To withdraw the liquid in a continuous flow the valve member is placed in position (3). Liquid flows continuously from the liquid entrance to the exit aperture and simultaneously air flows through the reflux pathway to the air exit, via which it enters the container.

Advantageously the rotary valve member is so formed that as it is turned into position (3), the exit opens before the liquid inlet. If the exit is arranged to open before or at the same time as the liquid inlet, the liquid tends sometimes to be forced out as a jet under pressure as the exit begins to open. This occurs when, for example, the container has been exposed to the sun.

The following description of a preferred embodiment of the device, in which description reference is made to the accompanying drawing, is given by way of illustration.

In the drawing:

FIGURE 1 shows a partly sectional elevation showing the device in operation,

FIGURE 2 shows the barrel of the device in perspective,

FIGURE 3 shows the rotary valve member in perspective,

FIGURE 4 is a longitudinal cross section of the barrel,

FIGURE 5 is a longitudinal cross section of the rotary valve member, and

FIGURE 6 is an underneath plan of the device.

In FIGURE 1 there is shown part of a closed container **1** having the device held in reciprocable fluid-tight relationship with its filling aperture by means of a gland **2** of elastomeric material as described in our said Patent 2,980,300. Liquid is entering the device at L_1 and emerging in the form of a smooth flowing stream at L_2. Air to replace the liquid so withdrawn enters the device at A_1 and passes upwardly through the liquid as bubbles A_2.

The device itself consists of an outer barrel **5** (FIGURE 2) and a rotary valve member **6** (FIGURE 3) having a close mating fit with the inner surface of the barrel. In each of FIGURES 2 and 3 the part is shown from the side which is undermost when the device is operating as in FIGURE 1.

The barrel **5**, which is closed at end **7** thereof and open at the opposite end, is formed in its cylindrical wall with a liquid inlet **8** near the closed end, and near the open end with an outlet **9**. Between the outlet **9** and its open end the barrel is formed with a narrow opening **10**, the purpose of which is to prevent liquid running along the cylindrical outer surface of the barrel to drip from the end of the device at D (FIGURE 1). On its upper side as seen in FIGURE 1, the barrel is formed with a small air aperture **11** whose purpose will be described later; it also has a projecting peg **12** bored longitudinally to provide an air outlet **13** from the barrel.

The rotary member **6** (see especially FIGURES 3 and 5) consist of a rotary body part, open at end **14**, and closed at the opposite end by a metal disc **15** and a plug **16** of hard plastic material held in position by a fitting **17** provided with a wire handle **18**. The annular surface **19** of the fitting **17** is dimensioned to project radially beyond the outer surface of the barrel **5** and thereby provide an abutment facing the gland **2**. The peg **13** also serves as an abutment. Between them, the two abutments provide inner and outer limits for reciprocation of the device through the gland **2**.

Limits to the rotation of the valve member **6** within the barrel **5** are provided by engagement of the ends of a circumferential slot **20** with the internally projecting shank of a screw **22** held in the wall of the barrel.

Along its underside, the valve member is formed near

its open end with a port **23** of such size and shape as to register with the liquid inlet **8** of the barrel and near its closed end with a wide slot **24**, an air entrance **25** and a slot **26**. The slot **26** corresponds in axial position with the slot **10** of the barrel. The ends of the outlet **9** of the barrel correspond in the axial direction with the ends of the slot **24** and air entrance **25**—see FIGURE 6.

Between the slot **24** and the air entrance **25**, the rotary valve member is divided internally by a circular partition **28** to define an air chamber **29** in communication with the air entrance **25**. From the top of the air chamber a tube **30** passes forwardly along the inside of the valve member to communicate with an air exit port **31** positioned to register with the peg **13** of the barrel when liquid is being drawn as described with reference to FIGURE 1.

With the device installed as shown in FIGURE 1 and pushed inwardly as far as is permitted by the surface **19**, all openings through the wall of the barrel are positioned within the container or the gland. The arrangement is sufficiently liquid-tight to render a separate transit seal superfluous.

Before the device is installed the valve member is turned to one extreme position, determined by the slot **20**, so that the outlet **9** is closed. In this position a longitudinal slot **32**, diametrically opposite the aperture **23** in the valve member allows access of liquid from the inlet **8** to the interior of the valve member and a small vent **33** in the valve member registers with the peg **13** to allow air to escape as liquid enters.

To prepare for delivery of liquid, the device is pulled outwardly until the peg **13** abuts the inner end of the gland (FIGURE 1). If the barrel is turned through 90° anti-clockwise the aperture **23** is closed and the outlet **9** is opened sufficiently by the slot **24** to allow delivery of the contained liquid. Delivery is facilitated by registration (in this position only) of a hole at **35** in the valve member with the vent **11** in the barrel. Turning the barrel back through 90° allows the interior of the device to refill with the same volume of liquid as before. By turning the barrel to and fro through 90° the liquid is withdrawn from the container in equal portions whose volume depends upon the dimensions of the device.

To withdraw liquid in a continuous stream, the valve member is turned anti-clockwise through 180° to a position corresponding with the end **36** of the slot **20**. In this position the liquid inlet **8** registers with the aperture **23** and air entrance **25** and slot **24** register with the outlet **9**. Additionally the air exit port **31** registers with the peg **12**. Liquid from the container is delivered at the outlet as a continuous stream and air flows into the container as described with reference to FIGURE 1. The tube **30** and the peg **12** by which air leaves the chamber **29** give a greater resistance to the flow of air than does the air entrance **25** so that the liquid flows smoothly.

As will be seen from FIGURE 6, the angular position of the end **37** of the slot **24** is such that the outlet **9** is already widely open to the interior of the device before the interior is opened to the container via the inlet **8** and the aperture **23**. If the interior of the device were opened to the container first, any excess pressure in the container would force out liquid sideways as the edge **37** cleared the edge **39** of the outlet **9**.

As will be understood, withdrawal of liquid from the container, whether in successive portions or as a stream, is, in contrast with the devices described in said Patents 2,708,058 and 2,842,291, obtained without axial reciprocation of the device through the gland once it has been

placed in the delivery position. The provision of a gland may accordingly be avoided where preferred. For example the barrel may be provided with a screw threaded flange enabling it to be applied to a container in place of a screw cap. One arrangement which avoids the provision of a gland but nevertheless enables the device to be retracted is to provide the barrel with a flange of flexible material, securable by its periphery in sealing relationship with a hole in the container, and dished to provide a snap-over action.

In yet another arrangement, the device is provided in a knock-in form, for example by providing the barrel with a taper or stop by which its penetration into the container is limited. The transit closure for the container is in the form of a gland having a bung designed to be driven inwardly when the device is inserted. A sealing member as described in our said Patent 2,980,300 provided with a rigid bung, which may be shouldered to prevent removal in the outward direction, constitutes a transit closure which is both secure and convenient to fit.

We claim:

1. A device for withdrawing a liquid from a closed container which device comprises a barrel formed with a liquid entrance and an exit aperture mutually spaced apart along one side thereof and with an air exit on the opposite side thereof, and within the barrel a hollow rotary valve member formed along one side thereof with a liquid entry port, a liquid exit port and an air entry port, the liquid entry port being positioned to correspond in the axial direction of the barrel with the liquid entrance, and the liquid exit port and the air entry port being positioned to correspond in the axial direction of the barrel with the exit aperture, and along the opposite side thereof with an air exit port positioned to correspond in the axial direction of the barrel with the air exit and with a liquid filling aperture positioned to correspond in the axial direction of the barrel with the liquid entrance, an air chamber within the rotary valve member communicating between the air entry port and the air exit port, said exit aperture and said liquid exit port being circumferentially wider than said liquid entrance and said liquid entry port, rotation of the valve member within the barrel giving firstly a position in which the liquid filling aperture registers with the liquid entrance whilst the liquid exit port and the air entry port are out of register with the exit aperture and the liquid entry port is out of register with the liquid entrance, secondly a position in which the liquid filling aperture and the liquid entry port are out of register with the exit aperture and a part of the liquid exit port is in register with the exit aperture, and thirdly a position in which the liquid entry port is in register with the liquid entrance, the liquid exit port and the air entry port are both in register with the exit aperture and the air exit port is in register with the air exit.

2. A device according to claim **1** in which the rotary valve member has an additional air exit port which registers with the air exit when the liquid filling aperture registers with the liquid entrance.

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