Fig. 1
United States Patent Office

3,369,757
LIQUID SPRAYING DEVICES
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Filed Oct. 11, 1965, Ser. No. 494,320
Claims priority, application France, Oct. 16, 1964, 3,152
13 Claims. (Cl. 239—355)

ABSTRACT OF THE DISCLOSURE

A liquid sprayer in which the liquid is positively sealed in the bottle when the sprayer is not in use. The sprayer has a closure which fits onto a bottle, a passage which vents the bottle to the atmosphere, another passage which leads from the liquid to an air jet spray and a variable volume air chamber which can be operated to force air to the jet spray and simultaneously through connecting elements cause valves in both of the passages to open and permit the liquid to be pulled into and sprayed out of the air jet spray.

This invention relates to liquid spraying devices and is particularly directed to devices of the kind set forth in co-pending U.S. patent applications Ser. No. 553,994. Spraying devices comprising a passage through which the liquid to be sprayed is sucked and fed to an outlet jet, are already known, and this operation can be executed either by mechanically operated mechanism or by the use of pressurized gas. Sprayers of this type are open to the objection that they are sometimes not fully sealed when not in use. In other words, if the sprayer is inverted the liquid can leak through the passage and escape to the outside. Again, when the sprayer is in the normal position the liquid can slowly evaporate and this situation is aggravated if the liquid is volatile such as in the case of perfumes.

According to the present invention a liquid spraying device has an outlet jet and a passage which can extend into a vessel for the liquid to be sprayed, first obturating means sealing communication between the outlet jet and the passage, second obturating means for sealing a second passage between the interior of the vessel and atmosphere, a common actuating element for unsealing both obturating means, and means for biasing both obturating means towards their sealing positions, and including a support member which carries the various parts and provides the actuating element, the support member being arranged to slide in relation to a stopper or cap for the vessel containing the liquid to be sprayed.

Preferably the device includes an operating element which carries a dip tube which constitutes part of the first passage, and which is arranged to slide in relation to the stopper and which constitutes part of the second obturating means.

Thus, the second obturating means may be provided by a valve formed by the upper end surface of the operating element which can engage a co-operating surface in a bore in the stopper in which the operating element can move to seal the interior of the vessel.

Conveniently the first obturating means may be housed within the operating element, the operating element having limited movement in relation to the support member, and the first obturating means may be provided by a valve member which moves with the support member and which can slide in a bore provided in the operating element.

The invention may be applied with advantage to a device in which spraying is effected by an air blast and thus the outlet jet may be of the air blast type, a variable volume compressed air chamber being provided which is in communication with the outlet jet.

Conveniently the variable volume chamber is formed between the support member and a moveable operating member and this operating member may be resiliently biased in relation to the support member, and the support member may be resiliently biased away from the stopper, the biasing between the operating member and the support member being stronger than that between the support member and the stopper.

Preferably a check valve is arranged between the spray nozzle and the variable volume chamber and a check valve may also be provided to atmosphere in the variable volume chamber.

This latter check valve may be formed as part of a seal for the operating member and is resiliently biased towards an opening in the operating member.

The invention may be performed in various ways but one embodiment will now be described by way of example and with reference to the accompanying drawings in which:

FIGURE 1 is a cross section through the spray in the rest position,
FIGURE 2 is a transverse cross section through the spray on line II—II of FIGURE 1, and,
FIGURE 3 is a cross section of right angles to that FIGURE 1 of part of the spray in the operating position.

The spraying device comprises a component 1, having a threaded sleeve 3 and which forms a closure or stopper for the vessel containing the liquid to be sprayed. This stopper 1 is independent of the body 38 of the spray which provides a support member for the various parts and can slide inside this body. Guides are provided in the form of the integral bosses 39 on the upper end of the stopper 1 which engage holes 40 in a circular disc member 41 attached inside the support member 38. Springs 42 situated in other holes 40 and resting on the stopper 1 resiliently bias the body and the stopper away from each other as shown in FIGURE 1.

The sleeve 3 has a central hole in which a bored cylindrical pin 43 can slide. This pin which acts as an operating element is provided with a shoulder 43a at its upper end whilst the central hole in the sleeve 3 contains internal lugs 3a, this arrangement prevents the bored pin from falling out of the sleeve. In its turn, the stopper or cap 1 is itself provided with a central orifice but the diameter of the latter is less than the external diameter of the pin 43 so that it cannot leave the sleeve in the upward direction. Thus, the sliding movement between the pin and the sleeve 3 is limited, the upper end of the pin providing a surface which acts as a valve surface to seal the operating between the bore and atmosphere, and this constituting the second obturating means referred to.

A spray nozzle 44 is assembled in the disc member 41 which works by compressed air and contains a venturi 44a in the throat of which there opens out a supply passage 45 for the liquid to be sprayed. An annular throat 46 round the periphery of the nozzle communicates on one hand with the passage 45 and on the other with an axial bore 47 provided in a rod 48 which is attached to the disc member 41 which is mounted to slide in the bore in the pin 43 in accordance with movement of the support member 38. A radial drilling 49 opens out into the bore 47.

The rod 48 terminates in a valve head 50 which can slide in a chamber 51, into which a plunger tube 5 is connected and which can penetrate into the vessel holding the liquid to be sprayed, this valve assembly constituting the first obturating means.
A button 52 which acts as an operating member is provided with a seal 53 and is mounted in sliding fashion in the upper part of the support member 38 being biased by a coil return spring 54 which is stronger than the springs 42. A variable volume chamber 55 is disposed between the seal 53 and the disc member 43 and communicates with the jet 44 through drillings 56 and 57. The drillings 57 is normally closed off by a check valve member 58 held on its seat by a spring 59. The button 52 is provided with a central orifice 60 through which the chamber 55 can communicate with atmosphere. A valve 61 moulded in situ with the seal 53 is resiliently biased against the internal end of the orifice 60, allowing air to enter the chamber 55 but not to leave it.

The springs 42 tend to displace the support member 38 upwards away from the stopper 1 but this movement is limited by the valve head 50, which is rigidly connected to the support member 35 coming up against its seat, which is formed by a step in the bore of the pin 43, and the movement upwards of the pin 43 is itself limited by its upper surface contacting the stopper 1.

It will thus be seen that in the rest state as shown in FIGURE 1, the valve head 50 is applied against its seat and thus isolates the plunger tube 5 from the nozzle 44. In its turn, the upper surface of the pin 43 is applied against the co-operating surface of the stopper 1 and this isolates the interior of the vessel upon which the spray device is mounted from atmosphere.

When the user presses the button 52, the support member 38 initially moves downwards with the button, thus moving the rod 48 and the valve head 50, because the spring 54 is stronger than the springs 42. The bored pin 43 now freed, moves downwards also until it rests on the lugs 3a the valve head 50 then lifting away from its seat as the movement is continued, as shown in FIGURE 3.

The movement of the support member 38 is halted when the disc member 41 engages the stopper 1 and the button 52 then moves into the support member 38 compressing the air in the chamber 55 which is discharged through the nozzle 44 via the drillings 56 and 57.

The pressure drop created in the throat of the venturi 44a causes the liquid contained in the vessel to rise through the plunger tube 5, the bore 47 and drilling 49, the annular throat 46 and the passage 45 to the nozzle 44 where it is atomised.

Air enters the vessel to compensate for withdrawn liquid passing between the support member 38 and the stopper 1, through the second obturating means provided by the end of the pin 43 between the lugs 3a as indicated by the arrow 62.

When the user releases the button 52, the various parts of the spray are returned to their rest positions by the springs 42 and 54 so that the vessel is again completely sealed by the obturating means. At the same time, air enters the variable volume chamber 55 through the orifice 60, the valve 61 being lifted from the seating.

What I claim is:

1. A liquid spraying device adapted to be mounted on a vessel to spray liquid therefrom, said device comprising a closure for said vessel, an air blast jet, a variable volume compressed air chamber in communication with said jet, a first passage adapted to said jet in communication with said liquid, a first obturating means for selectively closing said communication, a second passage adapted to vent the interior of said vessel with the atmosphere, a second obturating means for selectively closing said ventilation, means urging both of said obturating means into closed position, an actuating element for opening both of said obturating means, and a support member slidably mounted on said closure and manually slideable to actuate said element to open both of said obturating means.

2. A liquid spraying device as claimed in claim 1 further comprising an operating element which carries a diaphragm which constitutes part of the first passage, which is arranged to slide in relation to said closure and which constitutes part of the second obturating means.

3. A liquid spraying device as claimed in claim 2 in which the second obturating means comprises a valve formed by the upper end surface of the operating element and a co-operating surface in a bore in the closure in which the operating element can move to seal the interior of the vessel.

4. A liquid spraying device as claimed in claim 2 in which the first obturating means is housed within the operating element, the operating element having limited movement in relation to the support member.

5. A liquid spraying device as claimed in claim 4 in which the first obturating means comprises a valve member which moves with the support member and which can slide in a bore provided in the operating element.

6. A liquid spraying device as claimed in claim 3 in which means are provided to limit the movement of the operating element away from the co-operating sealing surface on the closure.

7. A liquid spraying device as claimed in claim 6 in which the limiting means are in the form of lugs projecting in the bore of the closure.

8. A liquid spraying device as claimed in claim 1 further comprising a movable operating member, said variable volume chamber being defined by said support member and said movable operating member.

9. A liquid spraying device as claimed in claim 8 in which the operating member is resiliently biased in relation to the support member and the support member is resiliently biased away from the closure, the biasing between the operating member and the support member being stronger than that between the support member and the closure.

10. A liquid spraying device as claimed in claim 1 in which a check valve is arranged between the spray nozzle and the variable volume chamber.

11. A liquid spraying device as claimed in claim 1 in which a check valve to atmosphere is provided in the variable volume chamber.

12. A liquid spraying device as claimed in claim 11 in which the check valve is formed as part of a seal for the operating member, and is resiliently biased towards an opening in the operating member.

13. A liquid spraying device as claimed in claim 1 in which the spray nozzle has a venturi, said first passage being in communication with said venturi, and said variable volume chamber being in communication with said venturi whereby said chamber volume may be decreased to force air through said venturi and draw up liquid through said first passage and spray said liquid out of said spray nozzle.

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