LIQUID SPRAYING DEVICES

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ABSTRACT
A liquid spraying device of the plunger tube type in which a knob on a plunger tube can be depressed to cause the liquid to be sprayed through a nozzle. The plunger tube is surrounded by a piston which it entrains and which is movable in a chamber to expel the liquid through the tube. The tube has orifices in its wall which communicate with the interior of the piston and with the chamber through a valve. The piston has a portion which is elastically and transversely deformable and which in the inoperative condition closes the orifices and also closes the space communicating with the chamber through the valve.

7 Claims, 4 Drawing Figures
1 LIQUID SPRAYING DEVICES

This invention relates to liquid spraying devices. A liquid spraying device of the kind with which the present invention is concerned is disclosed in U.K. Specification No. 1,008,612. This Specification shows a plunger-tube vapouriser which is fully sealed in the inoperative condition and which comprises two obtruding elements connected operationally to one and the same control element and arranged, one between the front of the tube and the vapouriser nozzle, and the other in a passage which provides communication with the atmosphere for the vessel containing the liquid being vapourised, biasing means being used to bias these elements into their closed positions.

In an embodiment described more particularly in the Specification referred to, this vapouriser comprises a pumping chamber connected to the plunger tube through the medium of a non-return valve, a piston slidably assembled in said chamber, a tube slidably assembled in said piston connected thereto by a lost-motion link so that when the tube is axially displaced, it entrains the piston after travel, a control knob comprising a nozzle communicating with the tube and designed to displace same when depressed, a valve carried by that end of the tube opposite to the end at which the knob is located and arranged to be applied against the seat formed at the end of the piston, the tube comprising in the neighbourhood of said end at least one orifice opening into the interior of the piston, and a spring arranged between the valve and the base of the chamber which springs, on the one hand tends to apply the valve against its seat and on the other hand to place the piston in a rest position in which it closes off an opening through which the vessel containing the liquid for vapourising communicates with the atmosphere.

To use this vapouriser, the tube is displaced against the action of the spring, by means of the knob. The valve immediately lifts from its seat placing the pumping chamber in communication with the nozzle; then, the piston is driven in turn, so that the liquid in the chamber is delivered to the nozzle which atomises it.

If the tube is displaced slowly, the delivery pressure is initially very small and the atomising is poor; it is even possible that the liquid may exit from the nozzle in the form of an unatomised jet. The same drawback can occur at the end of the atomising operation, when the user ceases the pressure on the knob.

It is an object of the invention to provide an improvement in the vapouriser of the kind disclosed in the Specification referred to which is designed to overcome this drawback.

In accordance with the present invention, the piston comprises a portion which is transversely and elastically deformable and which, in the inoperative condition, closes off the orifice or orifices provided in the neighbourhood of the end of the tube, and closes a space communicating with the chamber through the medium of the valve.

Under these conditions, when the tube carrying the valve is displaced, the valve lifts from its seat but the communication between the pumping chamber and the tube, and thus with the nozzle, remains interrupted because the deformable part of the piston closes off the communicating orifice or orifices.

When the pressure in the pumping chamber reaches a sufficient level to distort said portion, the communicating orifices are uncovered and the liquid then arrives at the nozzle with a sufficient pressure to achieve correct atomising.

At the end of the movement, the delivery pressure drops; the deformable portion regains its initial shape and pulservation stops suddenly, with no risk of the liquid "spurting" out of the nozzle.

In the following, by way of a non-limitative example, an embodiment of an improved vapouriser in accordance with the present invention has been described making reference to the attached drawings in which:

FIG. 1 is an axial sectional view of the pump of the vapouriser, the left hand half showing it in the inoperative position its right hand half showing it in the delivery position;

FIG. 2 is a transverse section on the line 11-11 of FIG. 1;

FIG. 3 is a sectional view of a detail of the pump, in the case where the delivery pressure is insufficient to deform the piston, and;

FIG. 4 is a sectional view on a larger scale of the piston and the pump chamber, on the line IV-IV of FIG. 1.

As shown in the drawings a pump chamber 4 is connected to a plunger tube 5 through the medium of a non-return valve 6, and in which a piston 7 is slidably assembled. A tube 9 is slidably assembled within the piston with a predetermined longitudinal clearance e and at its internal end carries a valve 10 which can be applied against a seat 13 formed at the end of the piston 7. The tube 9, in the proximity of the valve 10, contains orifices 15 designed to place the pump chamber 4 in communication with the tube 9. A spring 11 arranged between the valve 10 and the base of the chamber 4, biases the valve on its seat.

That portion of the piston 7 which is fitted on the tube 9 and can slide thereon against heavy frictional resistance through the distance e which is limited by a shoulder 9a of the tube 9, has portions 7a of reduced thickness and orifices 15 are formed in the tube 9 opposite said portions 7a. A clearance 65 is provided between the tube 9 and the portion 7b of the piston which links said reduced portions 7a with the piston proper.

When the tube 9 is displaced, the valve 10 lifts from its seat and the liquid cannot flow from the pump chamber 4 to the tube 9 because the reduced portions 7a are applied over the orifices 15 (FIG. 3).

When the clearance e has been taken up, the tube 9 entrains the piston 7 which exerts a pressure on the liquid contained in the chamber 4. The liquid pressure is exerted upon the reduced portions 7a; when this pressure is sufficiently high, said reduced portions move transversely away from the orifices 15, uncovering them and allowing the liquid to flow to the nozzle at a pressure which has at least one determined value, this being a function of the flexibility of the portions 7a. It should be observed that during this operation, the thick parts separating the thin parts 7a, prevent longitudinal distortion of the piston and a variation in the interval existing between the valve 10 and its seat 13. Atomising takes place as the piston 7 descends and delivers the liquid to the tube 9. At the end of the movement, the pressure in the chamber 4 drops and the reduced portions 7a return to close off the orifices 15 and cut off.
the delivery of liquid to the nozzle as soon as the delivery pressure reaches a certain value.

During the first utilisation, the air contained in the pumping chamber 4 is compressed as the piston descends. It could happen that the pressure of this air is insufficient to cause the reduced portions 7a to lift; there would then be no discharge of air from the nozzle 15 and the pump would not prime. To avoid this drawback, the wall of the pump chamber 4 contains internal bosses 4a at the lower end (FIG. 4). These bosses distort the piston 7 creating passages 66 which enable the air to escape from the chamber 4.

It goes without saying that the invention is in no way limited to the embodiment described and illustrated, and in fact extends to all the possible variant embodiments.

What we claim as our invention and desire to secure by letters patent of the United States is:

1. A liquid spraying device comprising a passage which can extend into a vessel for the liquid to be sprayed, a pumping chamber connected to the passage through a non-return valve, a piston slidable in the chamber, a tube slidable in the piston and adapted to move and entrain the piston, a valve mounted on the end of the tube in the chamber and engaging a seat formed on the piston, at least one orifice in the tube adjacent one end thereof and opening into the interior of the piston, means for biasing the valve against the seat and for closing an opening through which the vessel communicates with the atmosphere, the piston having a portion which is transversely and elastically deformable and which in the inoperative position closes off the orifice and closes a space communicating with the chamber through the valve, that portion of the piston which is fitted over the tube having portions of reduced thickness opposite which the at least one orifice is located.

2. A liquid spraying device as claimed in claim 1, in which the piston is connected to the tube through a lost motion link whereby the tube entrains the piston after the tube has travelled a predetermined distance.

3. A liquid spraying device as claimed in claim 1 in which the tube carries a control knob comprising a nozzle communicating with the tube and adapted to depress the tube.

4. A liquid spraying device as claimed in claim 1 in which the means for biasing the valve against its seat and for closing the opening comprises a spring arranged between the valve and the base of the chamber.

5. A liquid spraying device, which comprises:
   a. a pumping chamber;
   b. a piston slidable in the chamber having a seat at one end thereof and having a portion which is transversely and elastically deformable;
   c. a tube slidable in the piston and operative to move and entrain the piston, the tube having at least one orifice therein adjacent one end thereof and opening into the interior of the piston, the deformable portion of the piston being operative to selectively open and close the orifice.

6. A liquid spraying device according to claim 5, further comprising:
   a. a valve mounted on the end of the tube in the chamber and engaging the piston seat, a space being provided between the seat and the valve communicating with the chamber, the space being closed when the tube is in a first position; and
   b. means for biasing the valve against the piston seat and for opening the space between the valve and the seat when the tube is in a second position.

7. A liquid spraying device according to claim 6 wherein the deformable portion of the piston is operative to selectively open and close the orifice when the tube is in the second position.