July 18, 1967 R. FEDIT 3,331,559

LIQUID ATOMIZERS

Filed May 7, 1965 2 Sheets-Sheet 1

Fig. 1.

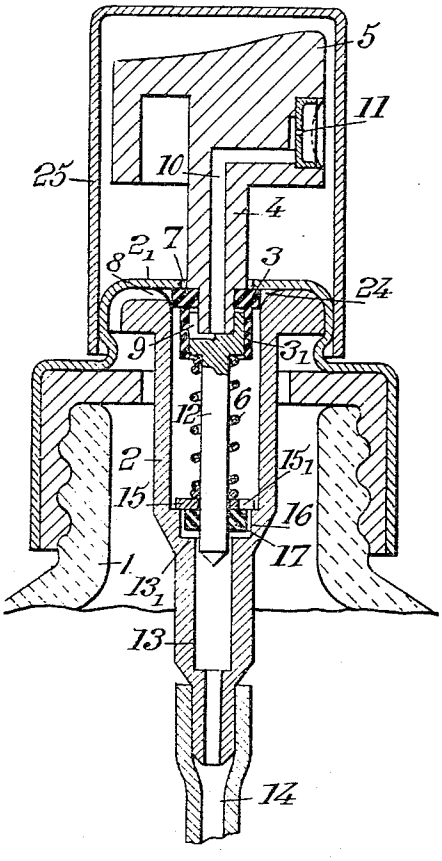
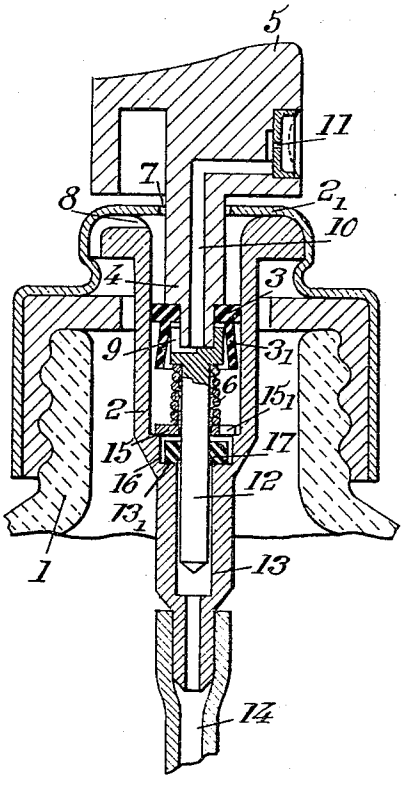


Fig. 2.



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Filed May 7, 1965 2 Sheets-Sheet 2

Fig. 3.

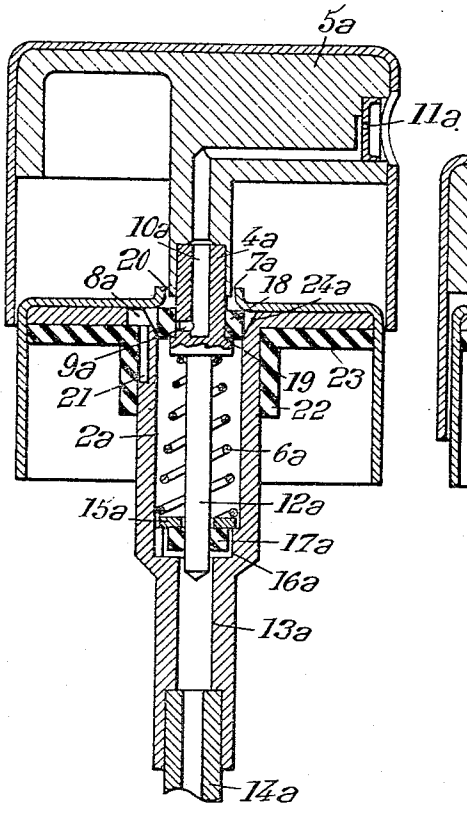
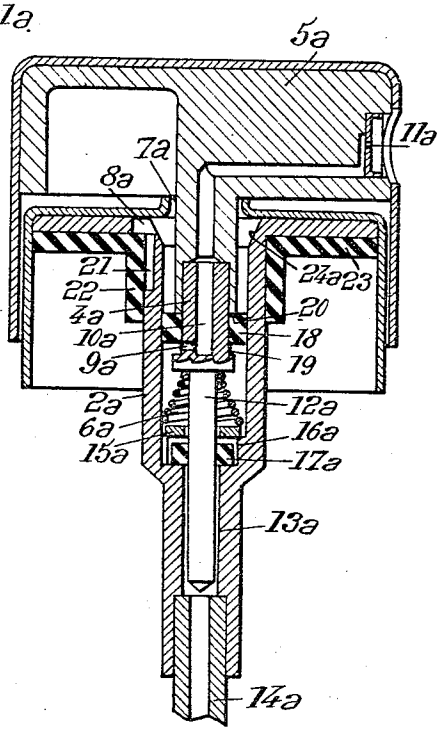


Fig. 4.



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LIQUID ATOMIZERS

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6 Claims. (Cl. 239—333)

The present invention relates to liquid atomizers comprising a piston pump mounted on a reservoir and wherein the piston moves on its suction stroke under the action of a return spring. The invention is more especially, but not exclusively concerned with atomizers of this kind wherein the pump, disposed in the plug of a container, carries above it a push-piece the driving in of which produces the liquid delivery stroke of the piston.

The chief object of the present invention is to provide an atomizer of this kind which is better adapted than those known up to this time to meet the requirements of practice.

The chief feature of the invention consists in closing the air intake of the reservoir, while stopping the passage through which the cylinder communicates with the delivery conduit leading to the atomizing nozzle by means of the piston of the pump when it is in its position of rest.

According to a preferred embodiment of the invention, the portion of the inside of the cylinder which is located at the end thereof toward which the piston is urged by its return spring belongs to the air intake conduit of the reservoir and is of flaring shape so that said air intake conduit is closed and the piston is not radially compressed when the piston is in its position of rest for which it is located in this porton of the cylinder.

According to another feature of the present invention, there is provided in the air intake conduit of the reservoir, a suction valve which opens only when there is produced, in the reservoir, a subatmospheric pressure due to the suction of the pump.

According to a third feature of the present invention, the piston rod extends axially through the cylinder and slides with a snug fit in a packing ring disposed at the end of the cylinder and forming a suction valve.

Preferred embodiments of the present invention will be hereinafter described with reference to the appended drawings, given merely by way of example, and in which:

FIG. 1 is an axial sectional view of a portion of an atomizer made according to a first embodiment of the invention, the piston of the pump being at the end of its upward stroke;

FIG. 2 is a view similar to FIG. 1 but showing the piston at the end of its downward stroke;

FIGS. 3 and 4 are views, similar to FIGS. 1 and 2 respectively, showing another embodiment of the invention.

The atomizer illustrated by the drawings is secured in a fluidtight manner on the neck **1** of a container.

The plug of the atomizer contains an axial cylinder **2** in which is slidable a piston **3** connected through a rod **4** with a push-piece **5** located above the plug.

In cylinder **2**, piston **3** is urged upwardly by a return spring **6**.

Piston **3**, in its position of rest, closes, on the one hand, the air intake **7**, **8** of container **1** and, on the other hand, passage **9** through which delivery conduit **10** communicates with cylinder **2**.

According to a preferred embodiment of the invention, the upper end of cylinder **2**, toward which piston **3** is urged by return spring **6**, belongs to the air intake conduit of container **1**, whereby this conduit is closed when piston **3** is in its position of rest.

The inlet orifice **7** of the air intake of container **1** consists of an opening provided in the closure piece 2_1 of cylinder **2**, through which opening extends the control rod **4** of piston **3**. The diameter of said rod **4** is smaller than that of said opening in closure piece 2_1, whereby intake orifice **7** is of annular shape. On the other hand the diameter of said orifice **7** is smaller than the diameter of piston **3** so that when said piston is applied against closure piece 2_1 by spring **6** it closes orifice **7**.

Advantageously, delivery conduit **10** is located in rod **4** and communicates with passage **9** through which the liquid delivered by the pump reaches atomizing nozzle **11**.

In the embodiment illustrated by FIG. 1, piston **3** is made of a flexible and resilient material, such as rubber, polyethylene of the like, and it comprises, below the portion that cooperates with the wall of cylinder **2**, a skirt **3**, covering passage **9** in rod **4**.

The whole is arranged in such manner that when, through push-piece **5**, piston **3** is moved downwardly, its friction against said cylinder causes skirt 3_1 to move slightly away from rod **4**, thus clearing passage **9** (FIG. 2).

Skirt 3_1 thus plays the part of a delivery valve, controlled by the displacements of piston **3** in cylinder **2**. The opening and the closing of said valve are thus made independent of the pressure existing in cylinder **2**, which makes the operation of the pump safer and its actuation less difficult.

Advantageously the same arrangement is used for the intake valve.

For this purpose, rod **4** carries, beyond piston **3**, in the downward direction, a rod **12** which extends axially into cylinder **2** and the free end of which is engaged with some clearance in a conduit **13** coaxial with cylinder **2** and in line therewith, forming a connection with dipping tube **14**. A rigid ring **15**, surrounding rod **12** and applied by spring **6** against the lower end of cylinder **2** covers an annular cavity **16** provided at the bottom of cylinder **2** and communicating with conduit **13**. A packing ring **17** mounted slidable on rod **12** is housed with some play in annular recess **16**. This ring **17** acts as a suction valve which is applied against the inlet of conduit **13** by rod **12** when piston **3** moves downwardly in cylinder **2**.

The atomizer of FIGS. 1 and 2 works in the following manner.

First a cap **25** serving to protect push-piece **5** is removed.

Push-piece **5** is moved downwardly. Piston **3** clears air intake **7**, **8**.

At the same time, ring **17** applied by rod **12** against the top edge 13_1 of suction conduit **13** cuts off the communication between cylinder **2** and the inside of container **1**. Simultaneously the skirt 3_1 of piston **3** moves away from delivery conduit **9** (FIG. 2). The liquid present in cylinder **2** is ejected during the downward movement of piston **3** through conduits **9** and **10** and it is atomized when flowing to the outside through nozzle **11**.

When push-piece **5** is released piston **3** is moved upwardly in cylinder **2** by return spring **6**. At the beginning of this movement the skirt 3_1 of the piston, coming back upon conduit **9**, stops delivery conduit **10**, whereas rod **12** lifts ring **17** slightly away from the top of conduit **13**. The liquid present in container **1** is thus sucked through tube **14**, conduit **13** and recess **16**, flowing past ring **15** through a notch 15_1 provided in the periphery of said ring. The above described cycle of the pump may then be repeated by driving push-piece **5** downwardly.

When the operation is finished, the atomizer is automatically closed in a fluidtight manner by piston **3** which on the one hand stops the air intake by being applied against the edges of openings **7** and **8** and, on the

other hand, has its skirt 3_1 applied against the orifice of conduit **9** which leads to nozzle **11**.

In the embodiment of FIGS. 3 and 4 the piston **18** of the pump is slidable along control rod **4***a*, so that it can be moved between two abutments **19** and **20**.

Between said abutments **19** and **20** is located the orifice **9***a*, provided in rod **4***a* near the lower abutment **19**, of delivery conduit **10***a* which leads to atomizing nozzle **11***a*. Thus, when rod **4***a* is pushed upwardly by return spring **6***a*, piston **18**, applied against abutment **19**, stops outlet **9***a* but, as soon as push-piece **5***a* is moved downwardly, piston **18**, braked by friction against cylinder **2***a*, slides on rod **4***a* until it comes into contact with abutment **20**, opening outlet **9***a* (FIG. 4).

Outside of this the operation of the pump is analogous to that above described with reference to FIGS. 1 and 2.

In the embodiments of FIGS. 3 and 4, there is further provided, in the air intake, a valve which opens only when, due to the suction of the pump there is a subatmospheric pressure in the container, which permits of atomizing the liquid whatever be the inclination of the container, without risk of the liquid flowing down by gravity through the air intake **7***a*, **8***a*.

For this purpose the air intake **8***a* of the container opens on the external wall of cylinder **2***a* through an opening **21** covered by a resilient sleeve **22**, for instance of rubber, slipped on cylinder **2**. In the embodiment that is shown by the drawings, sleeve **22** is rigid with the packing joint **23** of the plug which may be fixed on the container (not shown) in any suitable known manner, for instance by screwing, setting or the like. This embodiment has the advantage that air intake **8***a* and opening **21** may consist of mere grooves provided in cylinder **2** and covered by packing joint **23** and sleeve **22**.

It will be understood that when the pump, by suction of the liquid, creates a subatmospheric pressure in the container, the atmospheric pressure, transmitted through passages **7***a*, **8***a*, **21** under sleeve **22**, lifts the latter and enters the container.

On the contrary, sleeve **22** opposes any passage of air or liquid in the opposed direction.

In both of the above described embodiments, wherein the piston is made of a flexible and resilient material, the upper end of cylinder **2** or **2***a* is advantageously given a flaring shape such as shown at **24** and **24***a*, respectively, so as to free the piston, in its position of rest, from any radial pressure in order to protect it against any deformation which might reduce its liquidtight fit in the cylinder.

In a general manner, while the above description discloses what are deemed to be practical and efficient embodiments of the present invention, said invention is not limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the invention as comprehended within the scope of the appended claims.

What I claim is:

1. An atomizer pump for use on a container of liquid to be atomized which comprises, in combination,

a cylinder adapted to be fixed in the neck of said container,

a piston of a flexible and resilient material slidable in said cylinder to form therewith a pump chamber of variable volume,

conduit means for connecting the inside of said container with said pump chamber,

spring means between said cylinder and said piston for urging said piston in a first direction toward its position in said cylinder where said pump chamber has its maximum volume,

a rod carrying said piston and coaxial therewith,

push-piece means rigid with said rod for driving said piston in a second direction toward its position in said cylinder where said pump chamber has its minimum volume,

valve means for closing said conduit means in response to the movement of said piston in said second direction,

an atomizing nozzle carried by said push-piece,

said rod being provided with a longitudinal conduit leading at one end to said atomizing nozzle and the other end of which opens into the outer surface of said rod through an orifice,

a deformable skirt carried by said piston adapted to control said orifice to close it when said piston is moving in said first direction and to clear it when said piston is moving in said second direction, and

conduit means on the outside of said cylinder for connecting the external atmosphere with the inside of said container,

said piston being arranged to cooperate with said last mentioned conduit means to close them when said piston is at the end of its movement in said first direction.

2. An atomizer pump for use on a container of liquid to be atomized which comprises, in combination,

a cylinder adapted to be fixed in the neck of said container,

a piston slidable in said cylinder to form therewith a pump chamber of variable volume,

first conduit means for connecting the inside of said container with said pump chamber,

spring means between said cylinder and said piston for urging said piston in a first direction toward its position in said cylinder where said pump chamber has its maximum volume,

push-piece means fixed with respect to said piston for driving it in a second direction toward its position in said cylinder where said pump chamber has its minimum volume,

a rod rigid with said push-piece means and extending axially through said cylinder and into said first conduit means,

valve means between said pump chamber and said first conduit means comprising an annular packing ring slidable on said rod with a snug fit for closing the communication between said pump cylinder and said conduit means in response to the movement of said piston in said second direction,

an atomizing nozzle,

second conduit means for connecting said pump chamber with said atomizing nozzle during the movement of said piston in said second direction, and

third conduit means on the outside of said cylinder for connecting the external atmosphere with the inside of said container,

said piston being arranged to cooperate with said second and third conduit means to close them when said piston is at the end of its movement in said first direction.

3. An atomizer pump for use on a container of liquid to be atomized which comprises, in combination,

a cylinder adapted to be fixed in the neck of said container,

a piston slidable in said cylinder to form therewith a pump chamber of variable volume,

first conduit means for connecting the inside of said container with said pump chamber,

spring means between said cylinder and said piston for urging said piston in a first direction toward its position in said cylinder where said pump chamber has its maximum volume,

push-piece means fixed with respect to said piston for driving it in a second direction toward its position in said cylinder where said pump chamber has its minimum volume,

valve means for closing the communication between said pump cylinder and said conduit means in response to the movement of said piston in said second direction,

an atomizing nozzle,

second conduit means for connecting said pump chamber with said atomizing nozzle during the movement of said piston in said second direction, and

third conduit means on the outside of said cylinder for connecting the external atmosphere with the inside of said container,

said piston being arranged to cooperate with said second and third conduit means to close them when said piston is at the end of its movement in said first direction,

said piston being made of a flexible and resilient material compressed radially in said pump cylinder, the end of the cylindrical wall of said cylinder close to its upper end wall being of flaring shape.

4. A liquid atomizer according to claim **3** wherein the axial height of said piston is substantially of the same order of magnitude as the height in the axial direction of the flaring portion of the cylindrical wall of said cylinder.

5. A liquid atomizer according to claim **3** wherein said third conduit means comprise a longitudinal groove

provided in the external surface of said cylinder, further comprising a sleeve of a resilient expansible material extending along said longitudinal groove and forming a suction valve which is moved away from the cylinder and clears said groove when a subatmospheric pressure is produced in the container.

6. A liquid atomizer according to claim **5** further comprising, integral with said sleeve, an annular disc acting as packing joint between the pump and the container.

References Cited

UNITED STATES PATENTS

3,117,700	1/1964	Gorman	239—350 XR
3,161,329	12/1964	Fedit et al.	239—333 XR
3,194,447	7/1965	Brown	239—333 XR
3,239,151	3/1966	Boris	239—333
3,248,022	4/1966	Schulman et al.	239—333 XR

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