United States Patent [19]

Nozawa et al.

[11] 3,797,748

[45] Mar. 19, 1974

[54] **LIQUID SPRAYING DEVICE**

[76] Inventors: **Takamitsu Nozawa; Takao Kishi,** both of Tokyo, Japan

[22] Filed: **Mar. 21, 1973**

[21] Appl. No.: **343,191**

[30] **Foreign Application Priority Data**

Mar. 30, 1972 Japan ..... 47-037544[U]
Mar. 30, 1972 Japan ..... 47-037545[U]

[52] **U.S. Cl.** **239/321,** 239/324, 239/349, 239/350, 239/357, 239/359, 239/360, 222/321

[51] **Int. Cl.** **B05b 1/32,** B05b 11/00

[58] **Field of Search** 239/321, 322, 324, 337, 239/349, 350, 354, 355, 359, 360, 357; 222/321, 385

[56] **References Cited**

UNITED STATES PATENTS

1,845,200	2/1932	Segal	239/357
2,572,213	10/1951	Steinberg	239/349
3,471,065	10/1969	Malone	239/337 X

FOREIGN PATENTS OR APPLICATIONS

1,503,684	10/1967	France	239/350

Primary Examiner—Robert S. Ward, Jr.
Attorney, Agent, or Firm—Edwin E. Greigg

[57] **ABSTRACT**

A refillable hand-operated liquid sprayer of the type which requires no container pressurizing gas nor other foreign propellant. It operates to pump a small quantity of liquid to be sprayed from a container to a small cylindrical chamber wherein the liquid is pressurized by the force of a coiled spring which is stressed during "cocking" stroke preparatory to spraying the liquid from the device. A cover unit is removably mounted on the open end of the container, and a spray head is rotatably mounted on the cover unit, the rotation of the head relative to the unit causing the spring to be compressed thereby sucking liquid up from the container into the chamber. A hollow stem made of rigid material such as metal or hard plastic is provided for communicating the chamber with a discharge valve and also serving as a guide for a piston which moves vertically within the cylindrical chamber. With this arrangement, there is little likelihood that the stem is caught in the spring thereby hindering further compression of the spring or resulting in severance of the stem, as is frequently the case with previous flexible hollow tube.

12 Claims, 6 Drawing Figures

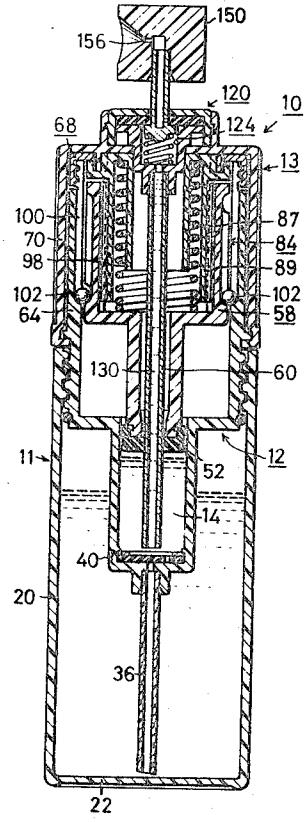


FIG.1.

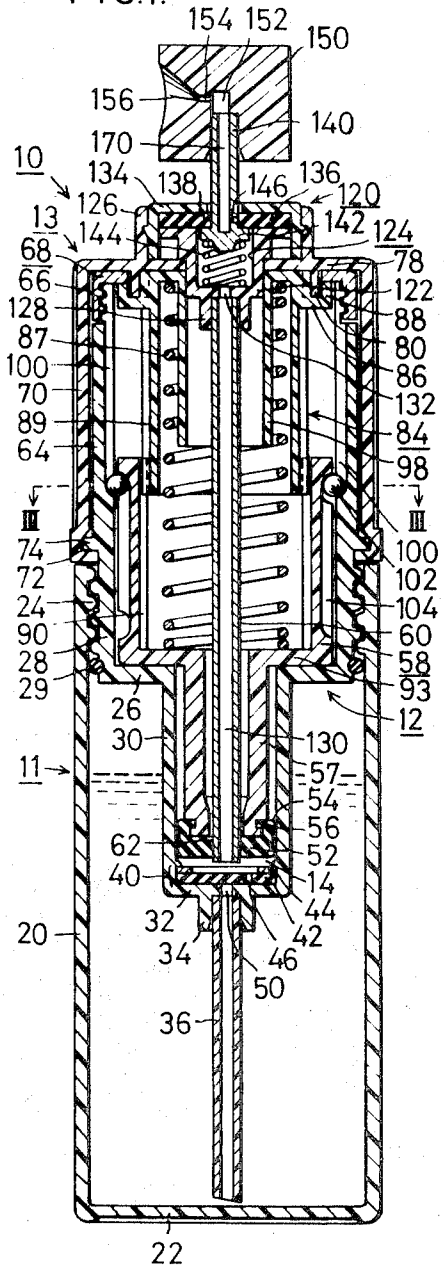

154
152
150
156
140
170
10
134
138
136
146
120
126
142
124
13
144
68
78
66
122
128
88
87
80
100
86
70
132
89
84
64
98
III
III
74
100
72
102
24
104
90
60
28
58
29
93
26
12
30
130
11
57
54
56
62
52
40
14
44
32
42
34
46
20
50
36
22

FIG.2.

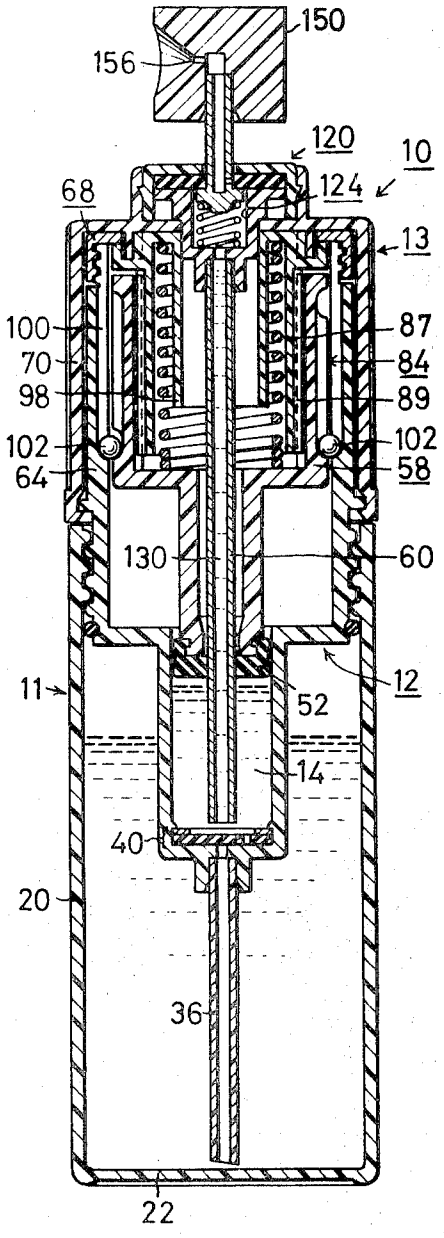

150
156
120
10
68
124
13
100
87
70
84
98
89
102
102
64
58
130
60
12
11
52
14
40
20
36
22

FIG. 3.

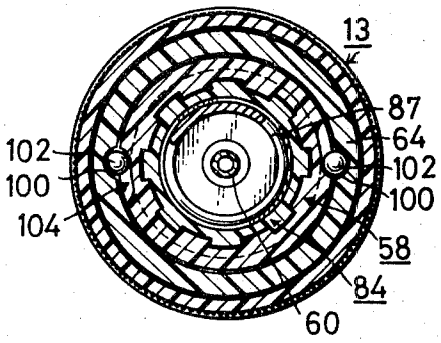
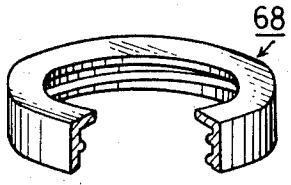


FIG. 4.



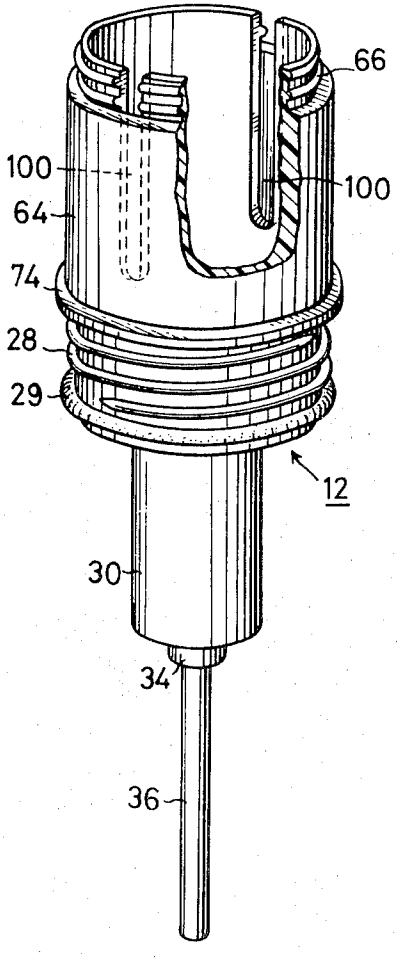


FIG. 5.

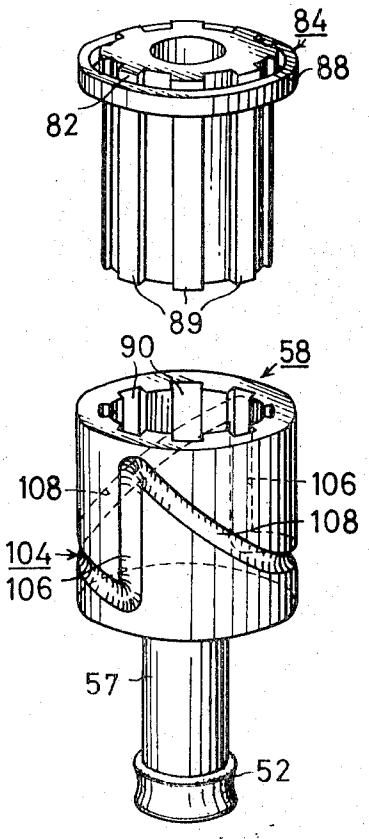
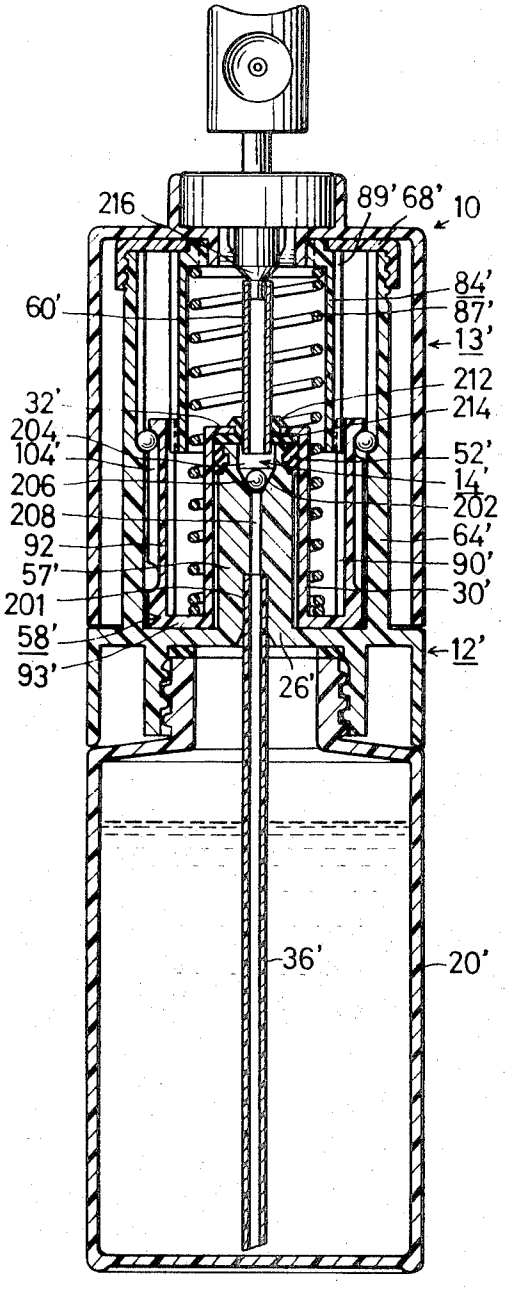


FIG. 6.


216
89'
68'
10
84'
87'
13'
212
214
52'
14'
202
64'
90'
30'
12'
60'
32'
204
104'
206
208
92
57'
201
58'
93'
26'
36'
20'

LIQUID SPRAYING DEVICE

This invention relates to liquid spraying devices and more particularly to an improved spraying device of the type which produces spray mist similar to that produced by the common aerosol bomb and which requires no container pressuring gas nor other foreign propellant.

Heretofore, various liquid spraying devices have been devised which are hand operated, and which can spray in mist form the many liquids commonly used today such as hair sprays, perfumes, toilet waters, deodorants and insecticides. Typical of such devices is one which operates to pump a small quantity of liquid to be sprayed from a container to a small chamber wherein the liquid is pressurized by the force of a spring which is stressed during cocking stroke preparatory to spraying the liquid from the device.

In devices of this type, a spray head rotatably mounted on the container functions to set the device in cocked position, and on being manually rotated relative to the container, causes a liquid pressurizing piston to move within the chamber in a direction to compress the spring, thereby pressurizing the liquid drawn into the chamber. The pressurized liquid is usually conducted through a flexibile tube to a discharge valve and nozzle assembly. Since, however, the flexible tube extends axially through the coil spring and is adapted to be deformed sinuously upon compression of the spring, there is a tendency for the curved portion of the tube to be caught in the spring, hindering further compression of the spring and, in the worst case, leading to severance of the tube. Another disadvantage resulting from the use of such a flexible tube is the difficulty experienced during assembly of the spraying device in slipping the tube of soft material onto a nipple or other coupling for the discharge valve or the pressurizing piston.

Therefore, it is an object of the present invention to provide a new and improved liquid spraying device.

Another object of the present invention is to provide a liquid spraying device which is easily held in the hand and which may be operated by finger actuation of a push button.

It is a further object of the present invention to provide a liquid spraying device of the above character which employs a hollow stem of rigid material to communicate a liquid pressurizing chamber with a discharge valve, thereby avoiding the problem of the stem being caught in a compression spring thereby hindering compression of the spring.

These and other objects will be apparent from the following description of the invention when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a vertically sectioned view illustrating one embodiment of a liquid spraying device constructed in accordance with the present invention;

FIG. 2 is a view similar to FIG. 1 but illustrating the device in cocked position;

FIG. 3 is a horizontal section taken on the line III—III of FIG. 1;

FIG. 4 is a perspective view of a cover unit and a cap ring to be mounted over the unit;

FIG. 5 is a perspective view of a slide member and a rotary cylindrical member to be received in the slide member; and

FIG. 6 is a vertical section of a modified liquid spraying device also constructed in accordance with the present invention.

Referring in more detail to the accompanying drawings, FIGS. 1 and 5 illustrate one embodiment of a liquid spraying device 10 of the present invention which is dimensioned to be conveniently held in the hand.

Briefly, the spray device 10 comprises a cylindrical container 11 for storing a quantity of liquid to be sprayed, a cover unit 12 removably mounted on the container, and a spray head 13 rotatably mounted on the cover unit 12. When the head 13 is rotated to the cocked position of FIG. 2, the device operates to pump a small quantity of the liquid from the container to a small chamber 14 wherein the liquid is pressurized by the force of a spring which is stressed during the cocking stroke. The head 13 also includes a discharge nozzle communicating with the chamber 14 via a discharge valve which is operated by pushing a button at the top of the head to release the spray as required until the pressurized quantity of liquid is exhausted. The device may be cocked again to ready the same for further spraying, as will be explained hereinafter.

As best seen in FIGS. 1 and 2, the container 11 comprises a cylindrical receptacle 20 closed at the bottom by a wall 22 and having an open upper end with internal threads 24 formed therein.

The cover unit 12 includes an imperforate wall 26 having an upwardly extending skirt 28 which is externally threaded (see also FIG. 4) to screw into the threads 18 of the receptable 15 to thereby close the upper end of the container against escape of liquid therefrom. The skirt 28 is grooved below the threaded portion to provide a seat for an O-ring seal 29. The cover unit 12 also includes a cylinder 30 extending downwardly from the wall 26, which is closed at its lower end by a wall 32 spaced above the wall 22 of the receptacle 20. A female coupling 34 is formed on the cylinder 30, which depends from the wall 32 to receive the upper end of an inlet tube 36 with a press fit therein. The lower open end of the inlet tube 36 is disposed closely adjacent the bottom wall 22.

A check valve 40 is mounted in the cylinder 30 at its bottom and, in the illustrated embodiment, comprises a valve member 42 and a pressure ring 44 for holding the valve member in place on the bottom surface of the cylinder. The valve member 42 has an annular opening 46 formed therein, the annular form of which is not complete, a break being provided so that the inner circular portion is elastically connected to the remaining portion of the valve member to provide for valve action. The function of the check valve 40 is to permit flow of the liquid only in one direction, i.e., from the container 11 through the inlet tube 36 and a hole 50 of the wall 32 to the liquid pressurizing chamber 14 which is formed in the cylinder 30 axially between the chcek valve 40 and a piston ring 52.

The piston ring 52 is usually formed of rubber, plastic material or leather and is slidably mounted in the cylinder 30 for reciprocating movement therein. The piston ring has an inwardly directed annular flange 54 which is received in an annular groove 56 of a piston 57 extending downwardly from a slide member 58 for vertical movement therewith. It should be noted that the piston ring may be formed integral with the lower end of the piston.

A hollow stem 60 is provided extending centrally axially within the piston 57 and the slide member 58 and which has a liquid-tight fit in a hole 62 of the piston ring 52. Preferably, the hollow stem is formed of a material that is sufficiently rigid not to cause the stem to bend when subjected to a considerable force acting axially thereon. The function of the hollow stem is not only to serve as a guide for the vertically moving piston ring 52, but also to communicate the liquid pressurizing chamber 14 with the discharge valve 17.

The cover unit 12 also includes a cylindrical guide 64 extending upwardly from the skirt 28 and having an upper end with external threads 66 formed therein (see FIG. 4). A cap ring 68 is screwed on the threads 66 of the cylindrical guide for the purpose to be described below.

The spray head 13 is adapted to telescope onto the cylindrical guide 64 exteriorly thereof to insure that its rotational movement relative to the guide is free sliding and non-biding. The head has a skirt 70 which slips over and slides on the side wall of the cylindrical guide. The lower edge of the skirt 70 is grooved as at 72 to receive a flange 74 which is provided around the cylindrical guide 64 above the threads 66. Thus, the spray head is prevented from vertical movement relative to the cylindrical guide once they are assembled to the position of FIG. 1.

The spray head 13 also includes a top wall 78 having a coupling member 80 which extends downwardly from the wall and formed internally with a plurality of equally angularly spaced, axial grooves (not shown). The axial grooves are adapted to receive corresponding protuberances 82 (see FIG. 5) with a friction fit therein, which are externally formed at the upper periphery of a rotary cylindrical member 84. Thus, when the spray head 13 is rotated, the rotary cylindrical member rotates in the same direction accordingly. The cover unit 12 and the rotary cylindrical member 84 may be preferably moulded integrally.

The rotary cylindrical member 84 includes a radially extending flange 86 which has a skirt 88 extending upwardly from the flange. The skirt 88 is adapted to abut the underside of the top wall of the cap ring 68, when the rotary cylindrical member is mounted within the cylindrical guide, so as not to cause a compression coil spring 87 to move the cylindrical member 84 upwardly for the sake of safety.

As best seen in FIGS. 3 and 5, the rotary cylindrical member 84 also has a plurality of equally angularly spaced, axial protuberances 89 formed exteriorly thereof below the flange 86. The protuberances 89 are slidably received in corresponding grooves 90 internally formed in the slide member 58, thereby preventing the cylindrical member 84 and the slide member 58 against rotation relative to each other.

The slide member 58 includes a wall 93 from which the piston 57 extends downwardly to carry the piston ring 52 at its lower end. The wall 93 serves as a seat for the coil spring 87, the upper end of the spring being slipped onto an inner cylindrical member 98 formed integrally with the rotary cylindrical member 84.

As seen in FIGS. 3, 4 and 5, the cylindrical guide 64 has a pair of diametrically opposite, axial grooves 100 formed internally thereof, each of which is adapted to receive a ball 102 to cooperate with a substantially sinuous groove 104 formed in the outer periphery of the slide member 58 to thereby convert the rotational motion of the spray head into the vertical upward movement of the slide member. The sinous groove 104 comprises a pair of diametrically opposite, axial sections 106 which are connected by two sections 108 each intersecting one axial section at its upper end and the other at its lower end, as is best seen in FIG. 5. When the spray head 13 is rotated relative to the container 11 in a clockwise direction as viewed from above in FIG. 1, the rotational motion of the head is transmitted through the rotary cylindrical member 84 to the slide member 58, causing it to move upward against the action of the compression spring 87.

The spray head 13 is suitably shaped at its top to receive a commercial discharge valve assembly of the type commonly used in aerosol spray bombs. As best seen in FIG. 1 and 2, the valve assembly 120 is a known type of push button discharge valve and comprises a casing 122 having a bore 124 and which is mounted in a cylindrical boss 126 extending upwardly from the top wall 78 of the spray head 13. The casing 122 has formed thereon a female coupling 128 which extends downwardly from the bottom wall thereof to have a press fit on the upper end of the hollow stem 60 so that it is not pulled out from the coupling. The hollow stem 60 has a passage 130 communicating at its upper end with the bore 124 in the casing 122 through a hole 132 formed in the bottom wall thereof. A cover member 134 is tightly fitted in the cylindrical base 126 to hold the casing 122 in place on the bottom wall of the spray head 13 with a gasket 136 interposed between the casing and the cover member. The gasket 136 has a hole 138 centrally formed therein which receives a hollow valve stem 140 with a liquid-tight fit therein. The discharge valve also includes a valve body 142 formed integral with the hollow valve stem 140 and which is shaped to receive the upper end of a spring 144. The spring 144 serves to hold the vertically movable valve body 142 at its upper shoulder against the underside of the inboard part of the gasket 136. The hollow valve stem 140 also has a side port 146 extending through its side wall, the port being normally closed by the inner face of the hole 138 in the gasket 136. When the valve stem is pushed downwardly to the open position, the gasket is peeled and dished downwardly, bringing the side port 146 into communication with the bore 124 in the casing 122.

A trigger push button 150, which comprises a solid piece of plastic, is provided with a vertical hole 152 to receive the upper end of the valve stem 140 with a press fit therein and thereby support the button spaced above the cover member 134. The button 150 has a horizontal bore 154 intersecting the bore 152. A conventional discharge nozzle 156 is formed at the orifice connected to the bore 154 of the button.

Preferably the above described structure of the spray device 10 is made substantially entirely of suitable plastic material, but the hollow stem 60 is formed of rigid material such as metal or hard plastic.

To operate the spray device 10, the container 11 may be grasped in one hand and simultaneously the spray head 13 is rotated relative to the container by the other hand in a clockwise direction as viewed from above in FIG. 1. As the spray head is rotated from the position shown in FIG. 1 to that shown in FIG. 2, the rotary cylindrical member 84 and accordingly the slide member 58 rotate in the same direction, resulting in an upward movement of the slide member within the cylindrical

guide 64. This will compress the coil spring 87 and simultaneously expand the volume of the chamber 14, thus creating a negative pressure in the chamber. This pressure acts to open the check valve 40 so that the liquid under atmospheric pressure in the receptacle 20 is forced upwardly through the inlet tube 36, hole 50 and check valve 40 into the chamber 14. When the slide member 58 is moved to the position of FIG. 2, the axial grooves 106 of the slide member 64 are brought into registry with the axial grooves 100 of the cylindrical guide 64, so that the force of the fully compressed spring 87 acts downwardly on the slide member 58, thereby tending to move the same downwardly. The spring force thus pressurizes the liquid which is trapped in the chamber 14 between the closed check valve 40 and the piston ring 52.

With the spray device 10 now cocked, depression of the push button 150 moves the hollow valve stem 140 downwardly, thereby opening the discharge valve to release pressurized liquid from the liquid pressurizing chamber 14 through the hollow stem 60, hole 132 and bore 124 of the valve casing 122, a passage 170 of the valve stem 140 and nozzle 156. The pressure exerted on the liquid in the chamber 14 by the spring 87 is sufficient to generate a high quality, very fine mist spray comparable to that produced by conventional aerosol boms. During spraying, the slide member 58 is progressively move downwardly by the action of the spring 87 until the wall 93 of the slide member abuts the wall 26 of the cover unit 12, as illustrated in FIG. 1.

In FIG. 6, there is illustrated a modified spray device 10 of the present invention which is different from that shown in FIGS. 1 to 5 in that the cylinder 30' defining the liquid pressurizing chamber 14' therein is vertically movable in response to rotation of the spray head 13' while the piston ring 52' is fixed with respect to the cover unit 12'.

As shown, the sprayer 10' comprises a container 11' made up of a receptacle 20', open at its upper end, and a cover unit 12' removably mounted over the open upper end of the receptacle to serve as a cover for the container. the cover unit 12' includes a cylindrical guide 64' extending upwardly from a wall 26' and having a cap ring 68' mounted on its upper end. The cover unit 12' also includes a piston 57' extending centrally upwardly from the wall 26', which is grooved at its upper periphery to fixedly receive a piston ring 52'. The piston 57' is provided with a vertical hole 201 to receive the upper end of an inlet tube 36' with a press fit therein. A valve seat 202 is formed in an end bore 204 of the piston 57', and a check ball 206 is loosely disposed on the seat. The piston also has a passage 208 extending axially therethrough and communicating the end bore 204 with the inlet tube 36'.

A slide member 58' is mounted within the cylindrical guide 64', and includes an outer cylinder 92' having a sinuous groove 104' formed therein which comprises two axial sections and two intersecting sections, similar to those shown in FIG. 5. The outer cylinder 92' is connected at its lower end by a wall 93' to the lower end of an inner cylinder 30' which is closed at its upper end by a wall 32'. The inner cylinder 30' is adapted to telescope onto the piston 57 having the piston ring 52' provided thereon, and carries a packing member 212 at its top. The packing member 212 has a central hole 214 for slidably receiving a hollow stem 60' in liquid-tight manner. The upper end of the hollow stem 60' is tightly fitted on a male coupling 216 of a discharge valve assembly (not shown in FIG. 6). As in the embodiment shown in FIGS. 1 to 5, the hollow stem 60' is formed of a material that is sufficient rigid not to cause the stem to bend when subjected to a considerable force acting axially thereon.

A rotary cylindrical member 84' is internally mounted on the spray head 13' for rotation therewith and has a plurality of axial protuberances 89' for cooperating with corresponding grooves 90' internally formed in the outer cylinder 92'. The rotary cylindrical member 84' serves as a seat for the upper end of a compression coil spring 87', the lower end of which is received in the slide member 58'.

To fill the container 11' with liquid, the receptacle 20' is unscrewed from the cover unit 12', the required amount of liquid being poured into the open end of the receptacle. To load the liquid pressurizing chamber 14', the spray head 13' is rotated relative to the container 11' in a fixed direction against the pressure of the spring 87'. Rotation of the spray head moves the slide member 58' upwardly, thereby expanding the volume of the chamber 14' and thus sucking liquid up via the inlet tube 36', passage 208 and past the check ball 206 into the chamber. When the spray head is released, the check ball 206 seats and the liquid in the chamber 14' is pressurized by the force of the fully compressed spring 87'. The spray device 10' is now ready for dispensing liquid.

From the foregoing description, it will now be apparent that the present invention provides an improved liquid sprayer which offers many advantages over the prior art devices. For example, the sprayer is completely safe whether or not in the cocked position, and requires no external power source to produce the spray mist. Since the container is not pressurized but rather serves as a convenient reservoir for the liquid to be sprayed, it is not subject to the explosion hazards of the common aerosol spray bombs. Further, since no pressurizing gas or other foreign propellant is required, the liquid is not subject to contamination in the container. Moreover, the device is reliable due to its simplified construction and operation and is capable of producing an extremely high quality spray.

In addition, it should be noted that since the hollow stem which communicates the liquid pressurizing chamber with the discharge valve is formed of a rigid material such as metal or hard plastic, there is little likelihood that the stem is caught in the spring, hindering compression of the spring or resulting in severance of the stem, as is frequently the case with a flexible tube. Further, it is understood that due to the rigidiness of the hollow stem it is an easy matter to connect the stem to a coupling for the discharge valve and the liquid pressurizing chamber.

What is claimed is:

1. A liquid spraying device comprising container means including a receptacle adapted to hold a quantity of liquid and having an opening for filling the receptacle with the liquid, cover means removably mounted on the receptacle to close the opening and including an upwardly extending cylindrical guide, spray head means rotatably mounted on the cover means, slide means movably mounted within the cylindrical guide and operably connected to the spray head means whereby rotation of the spray head means relative to the cover means in a fixed direction moves the slide

means upwardly, liquid pressurizing pump means including a cylinder and a piston defining a liquid pressurizing chamber, the cylinder being operably connected in fixed relation to one of the cover means and slide means and the piston being operably connected in fixed relation to the other of the means, a spring mounted in the spray head means for biasing the slide means in a direction to decrease the volume of the liquid pressurizing chamber to thereby pressurize liquid therein, an inlet conduit adapted to conduct the liquid in the receptacle to the chamber, an inlet check valve in the conduit, a discharge valve in the spray head means for controlling the discharge of pressurized liquid from the chamber in the form of a spray, and a hollow stem made of rigid material and adapted to conduct pressurized liquid from the chamber to the discharge valve.

2. A liquid spraying device as set forth in claim 1, in which the hollow stem is made of metal.

3. A liquid spraying device as set forth in claim 1, in which the hollow stem is made of hard plastic material.

4. A liquid spraying device as set forth in claim 1, in which the hollow stem is fixed with respect to the spray head means.

5. A liquid spraying device as set forth in claim 4, in which the upper end of the hollow stem is fixedly mounted on the discharge valve which in turn is fixedly mounted on the spray head means.

6. A liquid spraying device as set forth in claim 4, in which the lower end of the hollow stem extends into the liquid pressurizing chamber and has a liquid-tight slide fit in the opening formed in one of the cylinder and piston which is operably connected in fixed relation to the slide means.

7. A liquid spraying device comprising a container having a reservoir adapted to hold a quantity of liquid and an opening for filling the same with liquid, a cover unit adapted to close the opening and including a cylinder extending downwardly into the container, the cover unit also including a cylindrical guide extending upwardly therefrom and having a pair of diametrically opposite axial grooves formed interiorly thereof, a spray head rotatably mounted on the cylindrical guide, a slide member mounted in the cylindrical guide for vertical movement therein and including a piston slidably received in the cylinder, the piston and cylinder defining a liquid pressurizing chamber therebetween, the slide member having a sinuous groove formed exteriorly thereof which comprises a pair of diametrically opposite axial sections and a pair of intersecting sections each intersecting at one end the upper end of one axial section and at the other end the lower end of the other axial section, a cylindrical member mounted in the spray head for transmitting the rotational movement of the head to the slide member, two balls each rotatably received in one of the axial grooves of the cylindrical guide and the sinuous groove of the slide member for causing vertical upward movement of the slide member in response to rotation of the spray head, a spring for biasing the slide member in a direction tending to decrease the volume of the liquid pressurizing chamber, an inlet conduit adapted to conduct the liquid in the receptacle to the chamber, an inlet check valve in the conduit, the spray head including a spray nozzle and a discharge valve operable for controlling discharge of liquid under spring pressure from the chamber through the nozzle in the form of a spray, and a hollow stem made of rigid material for communicating the chamber with the discharge valve.

8. A liquid spraying device as set forth in claim 7, in which the upper end of the hollow stem is fixedly mounted on the discharge valve which in turn is fixedly mounted on the spray head.

9. A liquid spraying device as set forth in claim 8, in which the piston had a piston ring mounted thereon, the piston ring being formed with an opening for slidably receiving the lower end of the hollow stem in the liquid-tight manner.

10. A liquid spraying device comprising a container having a reservoir adapted to hold a quantity of liquid and an opening for filling the same with liquid, a cover unit adapted to close the opening and including a piston extending upwardly therefrom, the cover unit also including a cylindrical guide extending upwardly therefrom and having a pair of diametrically opposite axial grooves formed interiorly thereof, a spray head rotatably mounted on the cylindrical guide, a slide member mounted in the cylindrical guide for vertical movement therein and including a cylinder slidably received on the piston, the piston and cylinder defining a liquid pressurizing chamber therebetween, the slide member having a sinuous groove formed exteriorly thereof which comprises a pair of diametrically opposite axial sections and a pair of intersecting sections each intersecting at one end the upper end of one axial section and at the other end the lower end of the other axial section, a cylindrical member mounted in the spray head for transmitting the rotational movement of the head to the slide member, two balls each rotatably received in one of the axial grooves of the cylindrical guide and the sinuous groove of the slide member for causing vertical upward movement of the slide member in response to rotation of the spray head, a spring for biasing the slide member in a direction tending to decrease the volume of the liquid pressurizing chamber, an inlet conduit adapted to conduit the liquid in the receptacle to the chamber, an inlet check valve in the conduit, the spray head including a spray nozzle and a discharge valve operable for controlling discharge of liquid under spring pressure form the chamber through the nozzle in the form of a spray, and a hollow stem made of rigid material for communicating the chamber with the discharge valve.

11. A liquid spraying device as set forth in claim 10, in which the upper end of the hollow stem is fixedly mounted on the discharge valve which in turn is fixedly mounted on the spray head.

12. A liquid spraying device as set forth in claim 11, in which the lower end of the hollow stem has a liquid-tight slide fit in an opening formed in the cylinder.

* * * * *