

[54] **SPRAY PUMP**

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[58] Field of Search.....222/263, 309, 385, 400.5, 400.8, 222/401, 402; 239/333, 579; 417/548, 545, 550; 92/194, 195, 246

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[57] **ABSTRACT**

A pump for spraying liquid finishing agents used in washing, medicines and the like comprising a cylinder consisting of an upper larger diameter portion, a lower larger diameter portion and a tapered portion interconnecting integrally said upper and smaller portions and having a suction port, and a piston axially movably fitted into said cylinder and having a tapered portion which is adapted to engage with said tapered portion of said cylinder. The positive spraying is ensured; the leakage of the liquid through the suction port can be positively prevented; and the air can be introduced through the suction port for replacement of the discharged or sprayed liquid.

**3 Claims, 3 Drawing Figures**

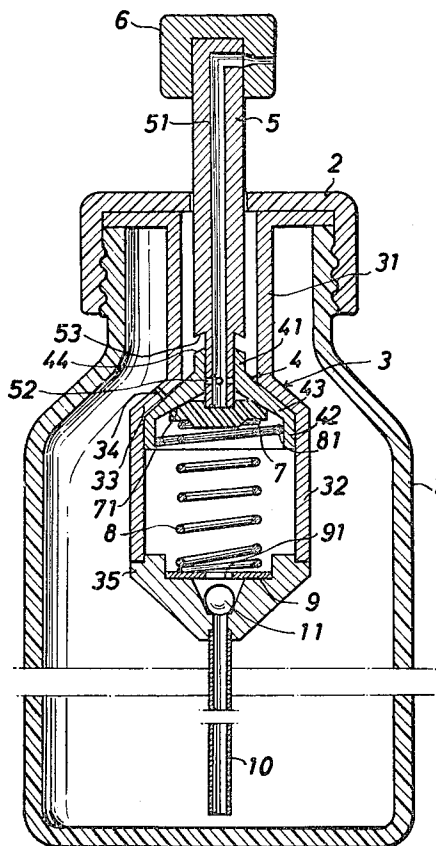


FIG. 1

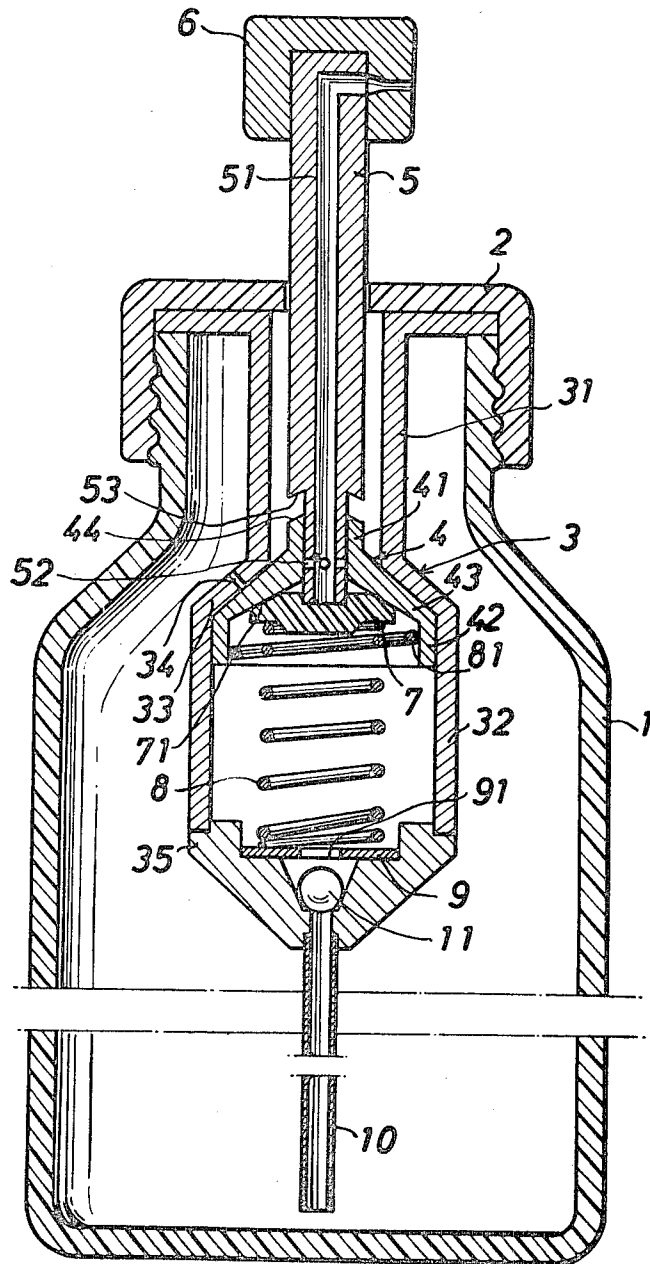


FIG. 2

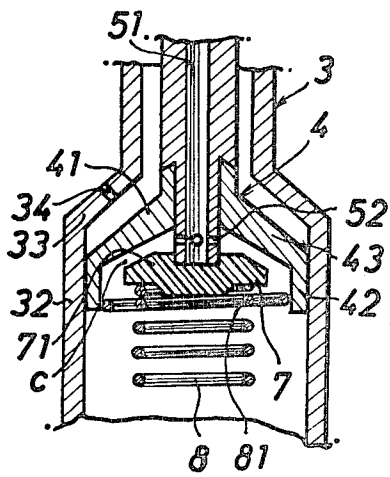
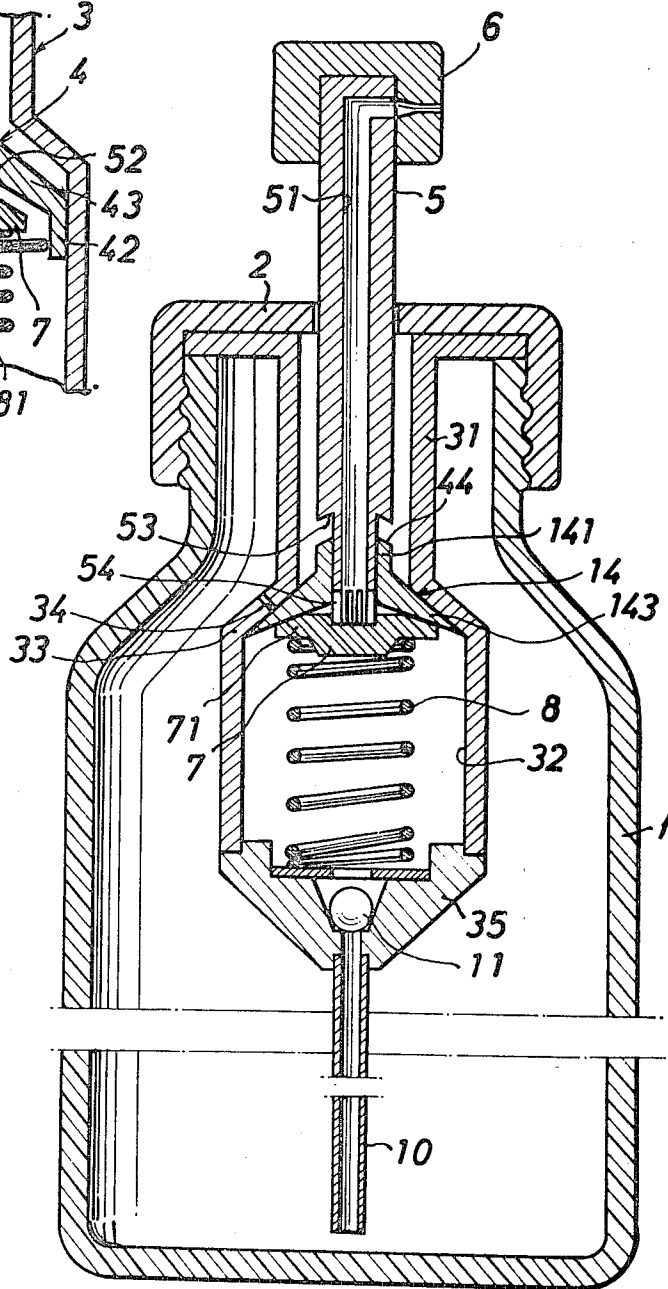


FIG. 3



## SPRAY PUMP

## BACKGROUND OF THE INVENTION

The present invention relates to generally a pump and more particularly a pump for spraying liquid finishing agents used in washing, medicines and the like.

The conventional pump for spraying or dispenser comprises generally a cylindrical cylinder and a piston fitted therein for axial movement. A suction port is formed through the sidewall of the cylinder and is adapted to be closed and opened depending upon a first (normal) position and a second (pushed) position of the piston. Therefore, when the suction port is opened, the air is introduced therethrough so as to replace the liquid within the cylinder. When the suction port is closed, the container will not cause any leakage even it is turned upside down. However, the suction port is formed through the sidewall of the hollow cylindrical body so that there must be provided special means for pressing the piston radially against the sidewall of the cylinder in order the suction port may be positively opened and closed depending upon the axial movement of the piston. Alternatively, the piston must be comprised of two members which are spaced apart from each other in the axial direction so that the suction port may be interposed between said two axially spaced apart members and that said two members may be more firmly pressed against the inner wall of the cylinder. Thus, the conventional pump for spraying or dispenser is complicated in construction and expensive to manufacture.

## SUMMARY OF THE INVENTION

In view of the above, a primary object of the present invention is to provide a pump for spraying having a cylinder and piston assembly simple in construction in which the piston can positively open and close a suction port, thereby eliminating the leakage of liquid through the suction port even when the container is turned upside down.

Another object of the present invention is to provide a pump for spraying in which the piston can be maintained in more intimate contact with the inner wall of the cylinder so that no leakage is caused when the piston is actuated and that a higher liquid spraying pressure may be produced within the cylinder.

A further object of the present invention is to provide a pump for spraying consisting of a minimum number of parts so that the manufacture and assembly of the parts into pumps are much facilitated at less cost. In brief, the present invention provides a pump for spraying having a cylinder consisting of an upper smaller diameter portion, a lower larger diameter portion and a tapered portion integrally connecting said two portions and having a suction port formed therethrough and a piston which is slidably fitted into the cylinder and which has also a tapered portion which is normally biased by spring means so as to intimately contact with the tapered portion of the cylinder, the tapered portion of the piston being moved away from the tapered portion of the cylinder only when a plunger is depressed, thereby improving the suction port opening and closing operation.

It is therefore readily seen that the piston can normally firmly close the suction port by the spring means so that even when the container is turned upside down, the leakage of liquid can be completely prevented.

The above and other objects, features and advantages of the present invention will become more apparent from the following description of some illustrative embodiments thereof taken in conjunction with the accompanying drawing.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional view of a first embodiment of the present invention illustrating a piston in its normal position; FIG. 2 is a view similar to FIG. 1 illustrating the piston in its depressed or lower position; and FIG. 3 is a sectional view of a second embodiment of the present invention.

Same parts are designated by same reference numerals throughout the figures.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a container 1 has a cylinder 3 secured to the opening of the housing 1 by means of a cap 2. The cylinder 3 consists of two coaxial hollow small and large diameter sections 31 and 32 which are integrally connected with each other by a tapered portion 33 having a suction port 34. A plunger 5 which is coaxially fitted into the cylinder 3 is generally in the form of a hollow cylinder having a liquid passage 51 formed therein and a nozzle head 6 fixed to the upper end thereof. Below a stepped portion 53 a piston 4 is slidably fixed to the plunger 5. A hole 52 in communication with the fluid passage 51 is formed through the lower end portion of the plunger 5.

The piston 4 consists of two hollow smaller and larger diameter portions 41 and 42 coaxially formed into a unitary construction. The small diameter portion 41 of the piston 4 has such a shape that the radial space may be defined between the smaller diameter portion 41 and the smaller diameter portion 31 of the cylinder 3. On the other hand, the larger diameter portion 42 of the piston 4 is so dimensioned that it may be snugly fitted into the larger diameter portion 32 of the cylinder 3. The tapered portion 43 of the piston 4 is normally made in close contact with the inner wall of the tapered portion 33 of the cylinder 3. The upper end 44 of the piston 4 is normally spaced apart from the stepped portion 53 of the plunger 5.

One or two coils 81 of a coiled spring 8 have a large diameter and are pressed against the inner wall of the larger diameter portion 42 of the piston 4, thereby facilitating the more intimate contact of the larger diameter portion 42 with the inner wall of the cylinder 3.

The lower end of the coiled spring 8 is supported by a washer 9 having an opening 91 and being disposed upon the bottom member 35 of the cylinder 3. To the bottom member 35 is fixed a suction tube 10 and upon the upper end of the section end is placed a ball valve 11.

Next the mode of operation will be described hereinafter. Upon depression of the plunger 5 by pressing down the spray nozzle head 6 by the finger, the stepped portion 53 of the plunger 5 is lowered and contacted with the upper end 44 of the piston 4 so that the piston 4 is caused to move downwardly. When the finger is removed from the spray nozzle head 6, the piston 4 is caused to move upwardly by the coiled spring 8 so that a liquid in the container or housing 1 is sucked into the cylinder 3. When the piston 4 is moved downwardly again, the pressure is applied to the liquid within the cylinder 3 so that the liquid is sprayed through the spray nozzle head 6 through the space C between the inner wall of the tapered portion 43 of the piston 4 and the washer 7, the hole 52 and the liquid passage 51. As best shown in FIG. 2, the tapered portion 43 of the piston 4 is moved away from the tapered portion 33 of the cylinder 3 so that the suction port 34 is opened, thereby introducing the atmospheric air into the container 1 through the port 34. Thus, the discharged liquid is smoothly replaced by the introduced air.

Since the coil 81 of the coiled spring 8 pushes the piston 4 radially outwardly toward the cylinder 3 so that much pressure is exerted to the liquid within the cylinder 3. Since the peripheral edge 71 of the washer 7 serves to press the tapered portion 43 of the piston 4 against the tapered portion 33 of the cylinder 3, the leakage of the liquid through the suction port 34 and/or the leakage through the spacing between the piston 4 and the cylinder 3 may be effectively prevented. Next the second embodiment of the present invention will be described hereinafter with reference to FIG. 3. In the second embodiment only the piston, the hole formed through the plunger and the coiled spring are different from those in the first embodiment. A piston 14 has no larger diameter portion as in the first embodiment and is in the form of a cone as a whole consisting of a small diameter portion 141 and a tapered portion 143. At the lower end of the plunger 5 is formed a plurality of notches 54 and the coiled spring 8 has no coil which presses the piston 14 radially outwardly. Other parts are substantially similar to

those described in the first embodiment. The mode of operation of the second embodiment will be readily apparent from the description of the first embodiment so that no further description will be made.

The present invention has been so far described with particular reference to the illustrative embodiments thereof, but it will be understood that variations and modifications can be effected without departing from the true spirit of the present invention as described hereinabove and as defined in the appended claims.

What is claimed is:

1. A spray pump for spraying fluid comprising:

a container cap for securement in an opening of a container partly filled with liquid; said container cap having an annular end wall with a central opening;

a tubular cylinder extending down from the underside of the container cap; said tubular cylinder including an upper, smaller diameter cylindrical portion and a lower, larger diameter portion and an intermediate, tapering portion extending between the lower extent of the upper portion and the upper extent of the lower portion, said tapering portion having means defining an annular internal, downwardly and radially inwardly facing, tapered surface;

means defining a suction opening through the tapering portion intermediate the axial extent thereof;

a suction tube communicating with the tubular cylinder adjacent the lower end of the tubular cylinder and adapted to depend into a body of liquid in the container;

means defining a one-way check valve between said tubular cylinder and said suction tube, oriented to permit fluid flow from said suction tube to said tubular cylinder;

a tubular piston slidably received in said tubular cylinder; said tubular piston having means defining an upwardly and radially outwardly facing tapered surface configured to engage the tapered surface on the tubular cylinder intermediate portion in sealing engagement therewith at the upper extent of the sliding of said tubular piston, said tapered surface on the tubular piston surrounding means defining a throughbore of the tubular piston;

a tubular plunger slidably received in the throughbore of the tubular piston and extending axially beyond said tubular piston in both directions;

said plunger, above said tubular piston, including means defining a radially enlarged portion having a downwardly facing shoulder positioned to engage the tubular piston;

said plunger, below said tubular piston, including means defining a radially enlarged portion having an upwardly facing shoulder positioned to engage the tubular piston;

the vertical distance between said downwardly facing shoulder and said upwardly facing shoulder being greater than the thickness of the tubular piston where it is engaged by the two shoulders, thereby providing for limited axial movement between the tubular plunger and the tubular piston and alternative engagement of the tubular piston by the two shoulders;

means defining an opening through said tubular plunger communicating between the throughbore thereof and the exterior thereof intermediate the two shoulders, this opening being so positioned that when the upwardly facing shoulder is in engagement with the tubular piston, the opening is closed by contact with the wall of the throughbore of the tubular piston and that when the downwardly facing shoulder is in engagement with the tubular piston, the opening communicates between the throughbore of the plunger and the interior of the tubular cylinder, under the tubular piston;

said plunger proceeding upwardly through said central opening in the container cap;

a combined spray head and pushbutton means mounted upon the valve rod above said central opening, and having means defining a fluid outlet passageway therein in communication with the throughbore of said plunger;

means blocking the throughbore of the plunger below said opening thereof;

a compression coil spring received and mounted, within the tubular cylinder, and arranged to obtain purchase against the tubular cylinder to resiliently force the plunger and the tubular piston upwardly to the upper positions thereof wherein the upwardly facing shoulder engages the tubular piston and forces the piston upwardly so that the recited sealing achievement is achieved, and so that, when the pushbutton means is depressed, the plunger moves downwardly further resiliently compressing the coil spring, thus establishing communication through the opening in the plunger and then permitting communication between the exterior of the cap and the exterior of the intermediate, tapered portion of the tubular cylinder through said opening in said intermediate, tapered portion.

2. A spray pump comprising a hollow cylinder having a suction port and being secured to the opening of a container by means of a cap; a piston axially movably fitted into said cylinder; a plunger axially movably fitted into said cylinder and provided with a liquid passage formed therethrough and with a radial hole in communication with said passage and opening at the outer periphery at the lower end portion thereof; a coiled spring which normally biases said piston axially and which has at least one coil biasing the lower end portion of said piston radially outwardly, said coiled spring being supported at the lower end by a washer having an opening and disposed upon the bottom member of said cylinder, to which is fixed a suction tube together with a ball valve placed upon the upper end of it; and a spray head fixed to the upper end of said plunger, having a nozzle in communication with said liquid passage of said plunger, characterized by that:

a. said cylinder comprises an upper small diameter portion, a lower large diameter portion and a tapered portion with said suction port on it, interconnecting integrally said both portions;

b. said piston comprises a tapered portion which is adapted to engage with said tapered portion of said cylinder, a smaller diameter portion which forms a radial space between it and the small diameter portion of said cylinder, and a larger diameter portion which is adapted to engage with said large diameter portion of said cylinder;

c. said plunger is slidably fitted into said piston at the lower portion thereof and is provided with a stepped portion at the same portion, which is normally spaced apart from the upper portion of said piston; and

d. said plunger is provided with a washer supported by said coiled spring at the lower end, which has a peripheral edge serving to press firmly said tapered portion of said piston against said tapered portion of said cylinder.

3. A spray pump comprising a hollow cylinder having a suction port and secured to the opening of a container by means of a cap; a piston axially movably fitted into said cylinder, a plunger axially movably fitted into said cylinder, having a liquid passage formed therethrough in the axial direction; a coiled spring normally biasing said piston axially, being supported at the lower end by a washer having an opening and disposed upon the bottom member of said cylinder, to which is placed a suction tube with a ball valve upon it; and a spray head being fixed to the upper end of said plunger and having a nozzle in communication with said passage of said plunger, characterized by that:

a. said piston cylinder comprises an upper small diameter portion, a larger diameter portion and a tapered portion with said suction port on it, interconnecting said both portions integrally;

b. said piston comprises a tapered portion which is adapted to engage with said tapered portion of said cylinder and a smaller diameter portion which forms a radial space between it and the said large portion of said cylinder;

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- c. said plunger is slidably fitted into said piston at the lower portion thereof and is provided with a stepped portion at the same portion which is normally spaced apart from the upper portion of said piston;
- d. said plunger is provided with a washer supported by said 5 coiled spring at the low end thereof, which has a peripheral edge serving to press firmly said tapered por-

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- tion of said piston against said tapered portion of said cylinder; and
- e. said plunger is provided with a plurality of notches in communicating with said liquid passage of said plunger at the lower end thereof.

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