

[54] **PUMP FOR SPRAYING**

[75] Inventors: **Rinnosuke Susuki**, Tokyo; **Hiroshi Hoshi**, Narashino; **Shinichi Araki**, Funabashi; **Shinzo Miyamoto**, Soka, all of Japan

[73] Assignee: **Raion Yushi Kabushiki Kaisha**, Tokyo, Japan

[22] Filed: **Jan. 5, 1972**

[21] Appl. No.: **215,634**

Related U.S. Application Data

[63] Continuation of Ser. No. 12,825, Feb. 19, 1970.

[52] U.S. Cl. **222/385, 239/333**

[51] Int. Cl. **B67d 5/40**

[58] Field of Search **222/263, 309, 385, 400.5, 400.8; 239/333, 353, 579**

[56]

References Cited

UNITED STATES PATENTS

3,239,151	3/1966	Boris	239/333
3,680,790	8/1972	Boris	239/353

Primary Examiner—Robert B. Reeves

Assistant Examiner—Larry Martin

Attorney—David W. Brinkman

[57]

ABSTRACT

A pump fixed to the opening of a liquid container in which both of a suction port and a liquid discharge passage are firmly opened and closed in response to the movement of a piston which has a considerable axial length so as not to deform itself upon its downward movement in a cylinder for exerting pressure on the liquid therein. Spraying operation is effective; leakage of liquid from the container is prevented even when the container is turned upside down; and the pump may be comprised of a lesser number of parts, which are fabricated at less costs.

2 Claims, 3 Drawing Figures

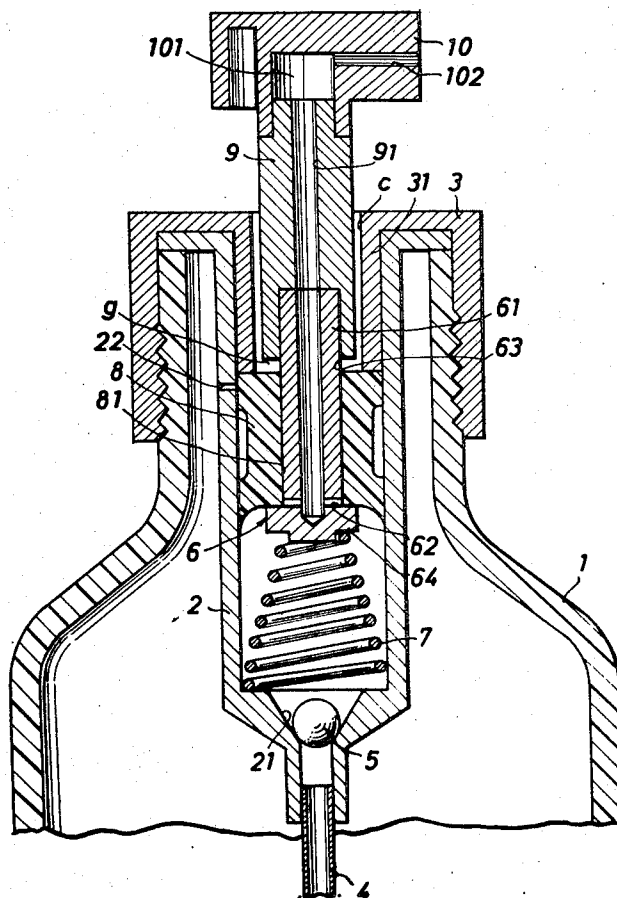


FIG. 1

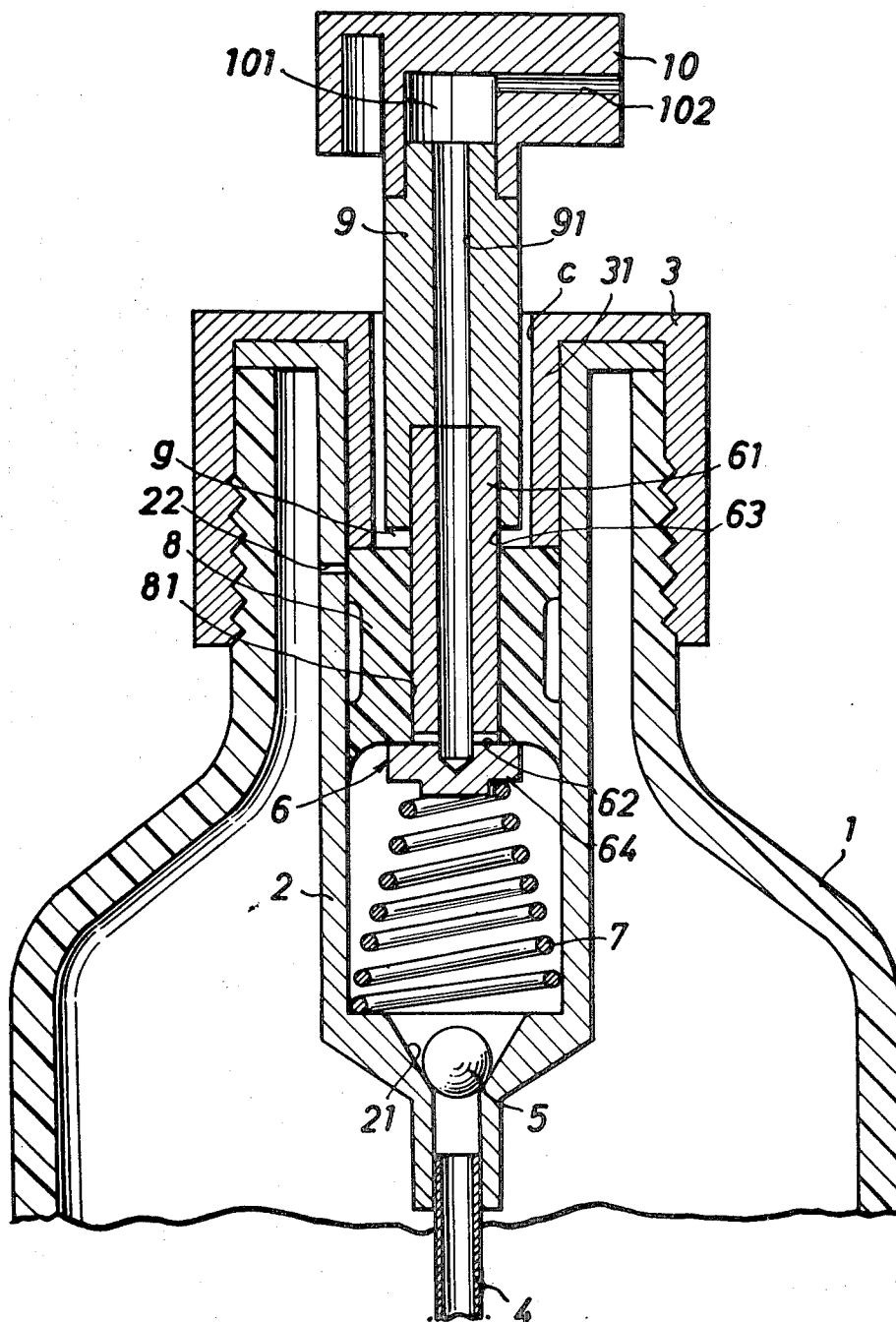


FIG. 2

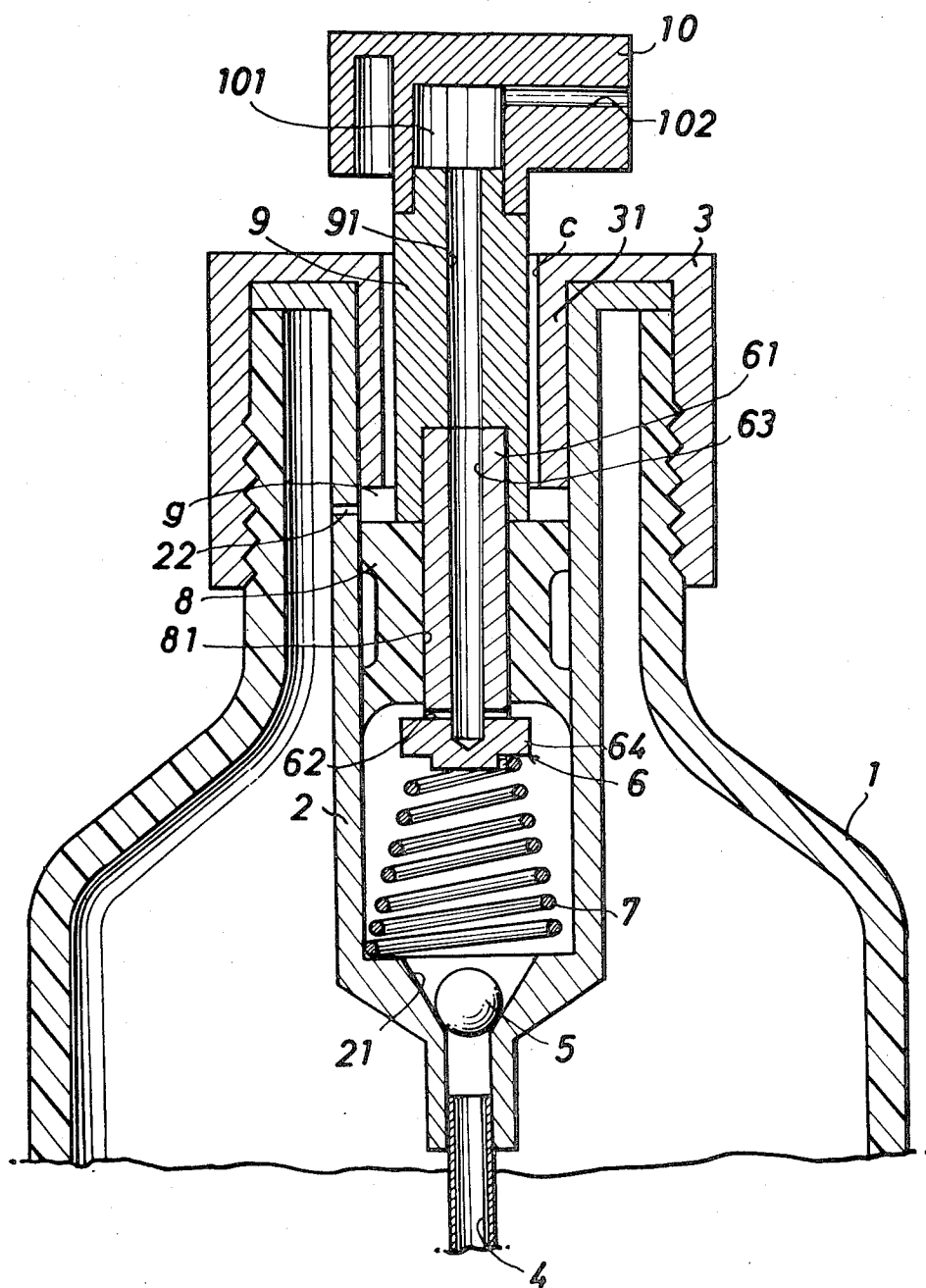
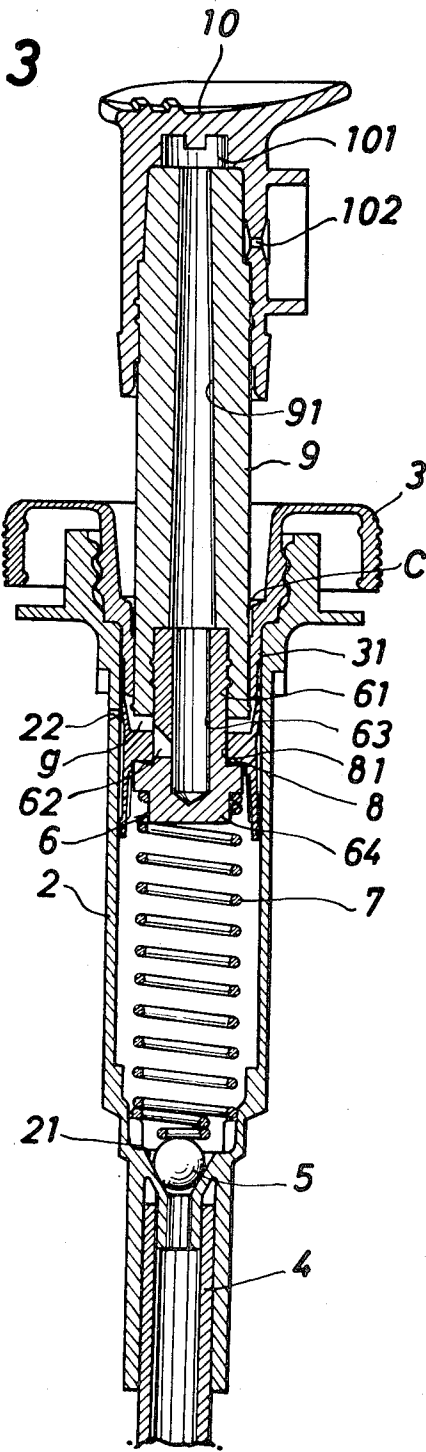


FIG. 3



PUMP FOR SPRAYING

This is a continuation, division, of application Ser. No. 12,825 filed Feb. 19, 1970.

BACKGROUND OF THE INVENTION

The present invention relates generally to a pump and more particularly to a pump for spraying adapted to be fixed to the opening of a liquid container. Various types of pumps for spraying have been proposed and widely used, but their common defects are that they are assembled from a large number of parts; that they are very expensive to manufacture; that leakage of the liquid tends to occur when they are turned upside down; and that the piston tends to deform itself easily so that the positive pumping action is not ensured.

SUMMARY OF THE INVENTION

In view of the above, the primary object of the present invention is to eliminate such defects as described above. Another object of the present invention is to provide a pump for spraying consisting of a lesser number of inexpensive parts. A further object of the present invention is to provide a pump for spraying in which a piston can contact intimately with the inner wall of a cylinder without causing any deformation upon vertical reciprocal movement of the piston, thereby ensuring the improved pumping action.

A still further object of the present invention is to provide a pump for spraying which will not cause any leakage of liquid even when the container is turned upside down. In brief, the present invention provides a pump for spraying comprising a cylinder fixed to the opening of a liquid container, the cylinder having a suction tube fixed to the lower end thereof and a suction port bored through the side wall thereof, a generally cylindrical piston which is fitted into the cylinder and has an axial length at least 1.5 times the diameter thereof, a valve rod having a lower larger diameter portion and an upper smaller diameter portion and a discharge passage bored axially therethrough and a passage extending from the discharge and opening at the outer periphery of the valve rod adjacent to the lower end thereof, a plunger disposed in coaxial relation with the valve rod and having a passage in communication with said discharge passage of said valve rod and a push button fixed to the upper end of the plunger and having a nozzle in communication with said discharge passage of said plunger, both of the suction port and the discharge passage being closed when the piston is in its first position while they are open when said piston is in its second position, the discharge passage being opened sooner than the suction port when the piston is moved from the first position to the second position.

The pump for spraying in accordance with the present invention is simple in construction requiring a minimum number of parts, inexpensive to manufacture and highly reliable in operation. The piston will not deform itself so that the pumping action is remarkably improved, thereby moving a large amount of air upon downward stroke of the pump, whereby the discharge of liquid is exceedingly improved.

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

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic sectional view of one embodiment of a pump in accordance with the present invention;

FIG. 2 is a view similar to FIG. 2 illustrating a pump being at its lowermost position; and

FIG. 3 is a sectional view of a pump in accordance with the present invention which is best suited for mass production.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 to 3, the flange of a generally cylindrical cylinder 2 is fixed to the opening of a container 1 by means of a cap 3 which consists of two coaxial outer and inner cylindrical portions or walls 31. The inner cylindrical wall 31 of the cap 3 is closely fitted into the cylinder 2 and the lower end of the inner cylindrical wall 31 serves as a stopper which limits the uppermost end of a vertical movement of a piston 8 to be described hereinafter.

A conical recess 21 is formed at the bottom of the cylinder 2 and has a ball valve 5 disposed therein. A suction tube 4 which extends in the vicinity of the container 1 is fixed to the bottom of the conical recess 21. A piston 8 which is fitted slidably into the cylinder 2 has a lower skirt portion which extends in the form of a cone. The axial length of the piston 8 must be at least 1.5 times the diameter thereof so that the distortion of the piston 8 may be prevented upon the movement thereof in the axial direction, thereby ensuring the smooth movement in the cylinder 2. A throughbore 81 is drilled through the piston 81 in coaxial relation therewith and a valve rod 6 is fitted into this throughbore 61 in such a manner that the upper end of the valve rod 6 extends beyond the upper face of the piston 8. It should be noted that the piston 8 is not limited to being a regular cylinder insert A-1, but may consist of an upper portion and a lower portion each having a diameter to be snugly fitted into the cylinder and being connected by a smaller diameter portion having a diameter less than that of the cylinder.

The lower end of the valve rod 6 is formed into an enlarged portion 64 and only the smaller diameter portion 61 of the valve rod 6 is closely fitted into the throughbore 81 of the piston 8. An opening 63 is bored through the valve rod 6 in the axial direction thereof and a radial passage 62 whose one end is opened immediately above the enlarged portion 64 is opened through the valve rod 6 into the throughbore 63. In FIG. 1, the hole 62 is closed by the inner wall of the piston body 8. Insert A-2 the piston 8 is in the position illustrated in FIG. 1 (this position will be referred to as "first position" hereinafter). Over the portion of the valve rod 6 extending beyond the upper face of the piston 8 is coaxially fitted a plunger 9 having a discharge passage formed therethrough in the axial direction in communication with the throughbore 63 of the valve rod 6. The outer diameter of the plunger 9 is so selected that a small annular spacing C may be defined between the inner cylindrical wall 31 of the cap 3 and the plunger 9. In the first position of the piston 8 as shown in FIG. 1, an annular space g is defined between the lower end of the plunger 9 and the upper end of the piston 8. A push button 10 mounted upon

the plunger 9 has a downwardly opening recess 101 in communication with the discharge passage 91 of the plunger 9 and a nozzle bore 102 in communication with this recess or cavity 101.

The piston 8 is normally held in the first position shown in FIG. 1 by means of a coiled spring 7 whose lower end is seated upon the bottom of the cylinder 2 and whose upper end is normally pressed against the lower surface of the enlarged portion 64 of the valve rod 6. Therefore, under the force of the coiled spring 7, the enlarged portion 64 of the valve rod 6 is normally pressed against the undersurface of the piston 8 so that the passage 62 is maintained firmly closed. In turn the piston 8 is pressed against the lower end of the inner cylindrical wall 31 of the cap 3 so that the upward movement of the piston 8 is stopped or limited. Next the mode of operation will be described hereinafter. When the push button 10 is depressed, the plunger 9 is moved downwardly so that the valve rod 6 is also moved downwardly, thereby opening the hole or passage 62. Upon downward movement of the enlarged portion 64 of the valve rod 6, the pressure is exerted to the liquid within the cylinder 2 so that a part of the liquid is caused to rise through the axial opening 63. After the plunger 9 is moved downwardly a distance equal to the space g, the lower end of the plunger 9 contacts with the upper end of the piston 8 so that thereafter the piston 8 is caused to move downwardly, thereby immediately opening the suction port 22. Therefore, the surrounding atmosphere is introduced into the container 1 through the space C around the plunger 9 and the suction port 22 so that the discharge of liquid from the cylinder in response to the downward movement of the piston is further facilitated. The liquid is discharged out of the container 1 through the passages 63, 91, 101 and 102 in the order named.

The present invention has been so far described with particular reference to the illustrative embodiment 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 pump for spraying fluid comprising:

a container cap for securement in an opening of a container partly filled with fluid; said container cap being annular and including an inner tubular wall having downwardly facing annular shoulder means formed thereon adjacent the radially inner surface thereof below the upper extent thereof;

a tubular cylinder fixedly located with respect to the inner tubular wall of the container cap and depending below said downwardly facing annular shoulder means; means defining an upwardly facing shoulder within the tubular cylinder;

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

a longitudinal throughbore; said tubular piston being arranged to engage said downwardly facing annular shoulder means for limiting and stopping upward sliding movement of said tubular piston;

a tubular valve rod slidably received in the throughbore of said tubular piston and extending axially beyond said tubular piston in both directions; said valve rod, below said tubular piston, including means defining a radially enlarged portion upwardly terminating in means defining an upwardly facing shoulder; means defining a longitudinal bore in said tubular valve rod, opening through the upper end thereof and extending downwardly to the level of said upwardly facing shoulder of said tubular valve rod; means defining a radially directed passageway communicating between said longitudinal bore and the exterior of the tubular valve rod adjacent said upwardly facing shoulder of said tubular valve rod;

a compression coil spring received and mounted between and bearing against the radially enlarged portion of the valve rod and said upwardly facing shoulder within said tubular cylinder, the compression coil spring normally biasing the tubular valve rod upwardly so that the upwardly facing shoulder thereof engages the tubular piston peripherally of the lower end of the throughbore thereof and said radially directed passageway thereof is blocked at the radially outer extent thereof by contact with said piston within the throughbore of the piston;

means defining a tubular plunger having a longitudinal throughbore; said plunger being secured to and extending axially upwardly from said valve rod as an axially upward extension thereof with the throughbore thereof in communication with the longitudinal bore of the valve rod; means defining a downwardly facing shoulder between said valve rod and said plunger, oriented to be spaced axially above contact with the piston when the piston is in engagement with the downwardly facing shoulder of said container cap and to contact said piston after an axially short amount of downward travel of said tubular plunger and said valve rod; the outer diameter of said plunger above said downwardly facing shoulder thereof being sufficiently smaller than the radially adjacent inner diameter of the inner wall of the container cap as to define an annular passageway therebetween;

combined spray head and push button means mounted upon said plunger and having means defining a fluid outlet passageway therein in communication with the throughbore of said plunger;

means defining an opening through said tubular cylinder at such a level that, when the piston is in engagement with the downwardly facing shoulder of said container cap, the last-mentioned opening is closed at the radially inner end thereof by said piston and that, when the piston is moved downwardly an axially short distance by contact of the downwardly facing shoulder between the valve rod and the plunger therewith as the combined spray head and push button is pushed down, the radially outer extent of the radially directed passageway in the tubular valve rod is first un-

blocked and then opening through the tubular cylinder communicates between the container above the fluid level therein, and the atmosphere via said annular passageway;

whereby fluid admitted via said suction tube to the cylinder, below the piston, via the check valve, may, when the combined spray head and push button is depressed against resilient force provided by the compression coil spring, pass from the cylinder through the radially directed passageway in the valve rod, into and up the longitudinal bore of the plunger and out through the fluid outlet passageway of the combined spray head and push button, further depression of the combined spray head and push button communicating the head space of the container with the atmosphere so that

release of depression of the combined spray head and plunger will result in refilling of the cylinder via the suction tube as said compression coil spring recovers.

- 5 2. The pump of claim 1 wherein said tubular piston includes peripheral side wall means comprising an upper and a lower band of larger diameter respectively nearer the upper and lower extents of the piston, and an intermediate band of lesser diameter extending
10 between said upper and lower bands; and wherein said piston, radially outwardly of where the lower extent thereof engages the upwardly facing shoulder of said tubular valve rod curves downwardly to provide a circumferentially extending wedge-shaped surface at the
15 outer periphery of the lower extent of said piston.

* * * * *

20

25

30

35

40

45

50

55

60

65