July 17, 1962 D. F. CORSETTE 3,044,413

PUMP PISTONS

Filed Sept. 21, 1959

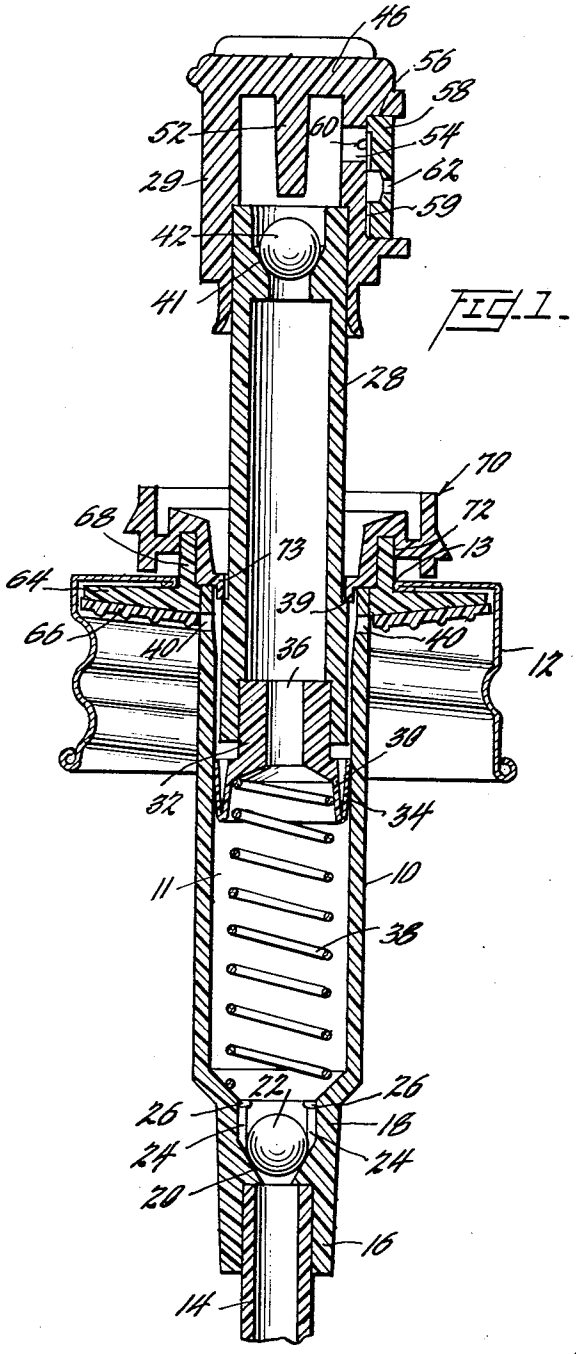


FIG. 1.

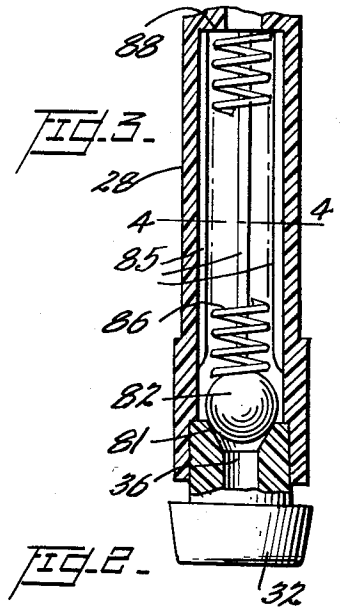


FIG. 3.

FIG. 2.

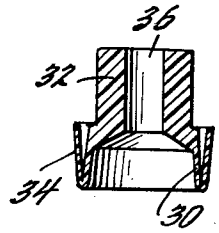
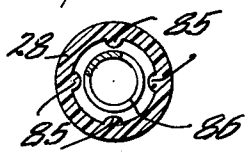


FIG. 4.



INVENTOR

Douglas F. Corsette,

BY Watson, Cole, Grindle & Watson

ATTORNEYS

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PUMP PISTONS

Douglas F. Corsette, Los Angeles, Calif., assignor to The Drackett Company, Cincinnati, Ohio, a corporation of Ohio

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This invention relates to an improved piston for use in fluid dispensing pumps of the type commonly employed for discharging liquids from a container, either as a stream or a spray, by manual reciprocation of a pump plunger in a suitably valved cylindrical barrel. Such pumps are widely used for the spraying of glass cleaners, insecticides, liquid polishes and like material, or for dispensing thicker fluids such as catsup or liquid soap.

It is a primary object of the invention to provide, in a pump of the general character indicated, a piston which can be inexpensively produced from moldable plastic material and which is exceptionally efficient and durable.

More specifically, it is an object of the invention to provide a piston for fluid dispensers having integral cup-shaped portions facing in opposite directions, whereby fluid pressure is applied to expand the cup-shaped portions alternately into sealing engagement with the cylinder as the piston is reciprocated.

Further objects and features of the invention will be apparent from the following description, taken in connection with the accompanying drawings, in which:

FIGURE 1 is a longitudinal sectional view of a fluid pump in which the piston may be used,

FIGURE 2 is a longitudinal sectional view of the piston on an enlarged scale,

FIGURE 3 is a partial longitudinal section of the pump shown in FIGURE 1, illustrating a modification, and

FIGURE 4 is a sectional view on the line 4—4 of FIGURE 3.

The pump illustrated in FIGURE 1 is described and claimed in a copending application, Serial No. 760,042, filed September 9, 1958, now Patent No. 2,956,509, in which I am a joint applicant. The details of the pump structure form no part of the instant invention and may vary widely from that shown and described. It is designed, as is customary practice, to be mounted in a conventional plastic or metal container cap which is threaded for reception on the neck of a container, to dispense the liquid contents in known manner.

The pump comprises a stationary pump barrel 10, which may be molded or cast from a substantially rigid material, such as vinyl plastic. The pump barrel 10 is of hollow tubular construction so that its interior defines a pump cylinder 11. The barrel at its upper end extends through a circular central opening 13 within the container cap 12.

Depending from the lower end of the barrel is a suction tube 14, which may be of plastic or other usual material. It will be understood that the lower end of such tube, which is broken away in the present drawings, will depend into the liquid within the container to a point closely adjacent to the bottom of the container, whereby the liquid contents may be withdrawn and dispensed through the pump structure. The upper end of the tube 14 is received and frictionally or otherwise retained in a depending sleeve portion 16 integral with the pump barrel.

Also formed integrally with and communicating with the interior of the pump barrel at its lower end is a foot valve cage or housing 18 formed with an inclined annular valve seat 20 for cooperation with a foot valve element exemplified by the ball valve 22. It will be noted that the inwardly projecting valve seat portion 20 has a lower surface abutting against and thereby serving to position the upper end of the suction tube 14. The ball valve 22

may, if desired, be guided in its seating and unseating movement by a plurality of guide ribs 24 and its unseating movement is preferably limited by overlying inwardly projecting retainers or detents 26. These retainers have their inner ends disposed about a circle of very slightly smaller diameter than that of the ball valve 22. However, the plastic vinyl or other material from which the pump barrel is formed has sufficient inherent resiliency so that it may be expanded sufficiently to permit forcing the ball 22 downwardly past these retainers into the valve cage 18, during assembly of these parts.

Disposed for reciprocation within the pump barrel is a generally tubular plunger 28, which also may be formed of vinyl or other plastic material. It will be noted that the upper end of this plunger projects upwardly through the open upper end of the barrel 11 and above the container cap 12, where it carries a caplike plunger discharge head 29. At its lower end the plunger carries a piston 32, shown more particularly in FIGURE 2, and described more fully hereinafter.

For the purpose of raising the plunger 28 on its upstroke, there is provided a coil spring 38 under compression between the piston 32 and the lower end of the cylinder within the pump barrel. An upwardly presented annular shoulder 39 on the plunger is disposed for abutting engagement with the wiper ring 73, more fully described hereinafter, to limit the upward stroke of the plunger.

In order that such fluid as may escape upwardly past the piston 30 may be returned into the container, there is provided a breather passage or passages 40 through the side of the barrel 10 just below the horizontal web of the container cap 12 and its associated sealing structure. Such port or ports 40 establish communication between the interior of the container and the interior of the pump barrel above the piston to permit return flow of the fluid, and also permit air from the container to flow into and from the barrel above piston 30, thus preventing an air lock such as might interfere with the plunger reciprocation.

Adjacent the upper end of the plunger 28, the latter is provided with an additional valve seat 41 on which is seated a ball check valve 42 arranged to permit upward flow of fluid from the plunger head. The plunger discharge head 29 is shown as being in the form of an inverted cuplike member having its depending skirt receiving and enclosing the open upper end of the plunger tube 28. The closed upper end 46 of the plunger discharge head is formed as a finger piece of suitable shape to permit actuation of the pump by repeatedly depressing it against the resilient force of its spring 38 and subsequently removing the finger pressure to permit the spring to return the plunger to its raised position. Internally the plunger head is formed with a depending stop 52 to limit unseating movement of ball 42.

It will be seen that on the upstroke of the plunger and plunger head the ball valve 42 will remain seated to apply suction, drawing liquid upwardly through the tube 14, the ball valve 22 being thereby unseated to permit passage of such liquid into the pump cylinder 11. Then, as the plunger and plunger head are depressed, the ball valve 22 will reseat to prevent return flow of the liquid and the ball valve 42 will be opened to permit upward flow of the liquid through plunger tube 28 into the plunger head 29 and thence outwardly through the discharge port of opening 54 in the side wall of the plunger head. While the discharge port 54 may communicate directly with the atmosphere, thereby discharging the fluid as a stream or jet, in the illustrated embodiment it is shown as delivering the fluid into a spray nozzle structure for ejection in the form of a spray. To this end there is provided an annular recess 56 around the outer end of this discharge

opening or port. Pressed into and frictionally retained or cemented within the annular recess 56 is a spray disc 58 having a spray discharge orifice 62, which receives fluid from the discharge passage 54 through usual tangential whirl passages 59 and an annular distributing passage 60.

Reverting now to the connection between the pump barrel 10 and container cap 12, such connection is defined in the preferred embodiment by an annular plastic member 64 cemented or otherwise secured around the upper end of the pump barrel, or formed integrally therewith, for disposition beneath the horizontal web of the container cap and for clamping between said cap and the upper end or lip of the container neck on which the cap is to be applied. A suitable gasket 66 may be applied over the underface of the member 64 for sealing engagement with the bottleneck or lip. Formed integrally with the member 64 is an upstanding annular wall 68 which projects upwardly through the central cap opening 13 for connection to the annular collar member 70, being preferably received and frictionally retained or cemented in a downwardly presented annular groove 72 in the collar 70, so that the cap 12 is effectively clamped between members 70 and 64. The lower end of the collar may conveniently support the wiper ring 73 hereinbefore referred to for sliding wiping engagement with the plunger tube 28 and for abutting engagement with the shoulder 39 of the plunger tube to limit the upward movement of the plunger.

Turning now to the piston which constitutes the improvement claimed herein, it will be seen that it comprises a central hub or body portion 32 having therein an axial fluid passage 36, the hub portion being press fitted into the lower end of plunger 28, or otherwise secured therein. Extending axially from one end of the hub portion 32 is a first cup-shaped skirt portion 30 with its open end facing downwardly. Extending axially in the opposite direction from said first skirt portion is a second cup-shaped skirt portion 34 with its open end facing upwardly. The piston is integrally molded or otherwise formed from a flexible plastic material such as polyethylene, so that the skirt portions thereof, which are constituted by thin annular walls, are capable of expansion by fluid pressure into tight sealing engagement with the cylinder wall 11 of the barrel 12 to afford efficient pumping action and minimize leakage past the piston. Thus on the downward stroke, skirt portion 30 will be distended by the fluid pressure developed within the same, whereas on the upward stroke skirt portion 34, which is reversely directed, will similarly expand under the influence of internally applied fluid pressure.

In FIGURES 3 and 4 is illustrated a modification of the unit shown in FIGURES 1 and 2, involving location of the upper ball valve, shown at 42 in FIGURE 1, at the lower end of the pump plunger 28.

Thus in this form of the invention, piston 32 is formed at the upper end of fluid passage 36 to provide a seat 81 for a ball check valve 82, which acts to prevent discharge of fluid downwardly from the lower end of pump plunger 28. Valve 82 is confined in the lower end of plunger 28 by longitudinally extending circumferentially spaced ribs 85 formed on the interior of the plunger and terminating just above the valve 82. Valve 82 may be seated by gravity, or as illustrated, a coiled compression spring 86 may be introduced above the valve and within the plunger 28 seating at its lower end on valve 82 and at its upper end against an abutment 88 in the upper end of the plunger.

By disposing the upper check valve at the lower rather than the upper end of pump plunger 28, the volume of fluid between the two check valves is substantially reduced with resultant increase in the pumping efficiency of the piston; only minor structural changes are necessary in order to attain this additional advantage.

It will be appreciated that the piston can be cheaply formed in a single molding operation and provides efficient sealing on both strokes of the pump plunger, obviating the leakage and resultant decrease in output experienced with conventional piston structures. It will also be understood that such modifications of the structure are contemplated as may be necessary or desirable to adapt the piston to other pump designs. For instance, where fluid flow through the piston is not required, the central passage therein may be omitted. Other changes in the illustrated structure, such as would normally occur to one skilled in the art, are contemplated as part of the invention.

Having thus described the invention, what is claimed as new and desired to be secured by Letter Patent is:

1. A piston for a fluid dispensing reciprocating pump having a barrel formed to provide an internal cylinder wall within which the piston reciprocates, said piston being integrally molded of flexible plastic material and comprising a central hub portion having a fluid passage extending therethrough, a first skirt portion constituting a thin annular wall projecting axially from said hub portion to provide an open ended cup, and a second skirt portion constituting a second thin annular wall projecting axially from the free end of said first skirt portion and in the opposite direction to provide a reversely facing open ended cup, whereby on movement of said piston in one direction, one of said skirt portions is expanded radially by the pressure of fluid within the same into sealing engagement with the cylinder wall, and on movement of said piston in the other direction, the other of said skirt portions is expanded radially by the pressure of fluid within the same into sealing engagement with the cylinder wall.

2. In a fluid dispensing pump having a cylindrical pump barrel, a check valve adjacent the inlet end of said barrel, a hollow plunger reciprocable in said barrel, a piston mounted on said plunger, said piston having a first annular cup-shaped portion with its open end facing in one direction axially of the plunger, and having a second annular cup-shaped portion integral with said first cup-shaped portion and with its open end facing in the opposite direction, said piston being formed of flexible plastic material, whereby one of said cup-shaped portions is expanded radially by fluid pressure into sealing engagement with said barrel on movement in one direction of said plunger, and the other of said cup-shaped portions is expanded radially by fluid pressure into sealing engagement with said barrel on movement in the other direction of said plunger.

3. A piston for a fluid dispensing reciprocating pump having a barrel formed to provide an internal cylinder wall within which the piston reciprocates, said piston being integrally molded of flexible plastic material and comprising a central hub portion, a first skirt portion constituting a thin annular wall projecting axially from said hub portion to provide an open ended cup, and a second skirt portion constituting a second thin annular wall projecting axially from the free end of said first skirt portion and in the opposite direction to provide a reversely facing open ended cup, whereby on movement of said piston in one direction, one of said skirt portions is expanded radially by the pressure of fluid within the same into sealing engagement with the cylinder wall, and on movement of said piston in the other direction, the other of said skirt portions is expanded radially by the pressure of fluid within the same into sealing engagement with the cylinder wall.

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