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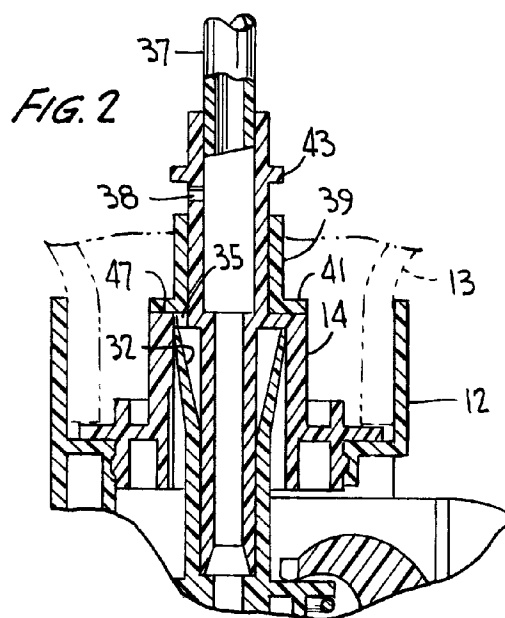
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(54) Upright/inverted sprayer

(57) A manually actuated liquid pump sprayer is capable of use in both upright and inverted positions without leakage through the vent port (35) by the provision of an auxiliary inlet passage including an inlet port (38) in the path of a slider valve (39). In accordance with one embodiment a vent port is likewise located in the path of that slider valve. The vent port (35) is open while the inlet port (38) is closed while the slider valve (39) is in the upright attitude of the sprayer, while the converse is effected by the slider valve (39) when operating the sprayer in an inverted position. In accordance with another embodiment a second slider valve (75) is located within the pump body for uncovering the vent port (58) which is in the pump cylinder in the upright position of spray, and for uncovering that vent port (58) in the inverted position to avoid leakage.



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Description

BACKGROUND OF THE INVENTION

This invention relates generally to a sprayer capable of being effectively operated during pumping in both upright and inverted positions without leakage through the container vent passage which is sealed closed in the inverted position by the provision of a slider valve.

Such sprayers of this general class are known, as disclosed in U.S. patent 5,467,901 in which a ball check valve is movable along a secondary passage communicating with a primary inlet passage to a pump chamber. In downward and inverted positions, the ball valve is seated against a second valve seat at a vent passage so as to open the secondary passage. In the upright position the ball valve is seated against a valve seat at the secondary passage to open the vent passage.

The secondary inlet passage and the opposed ball valve seats are, however, formed integrally with the pump housing thereby requiring special molding of a part or parts of the sprayer assembly which only increases the cost of production and assembly of the sprayer. Besides, often times a ball check valve does not seat quickly enough or tightly enough against its ball seat unless its travel distance to an open position away from its valve seat is limited, or unless the ball check valve is spring biased closed.

Dispensers are also known as having a slide valve which in an upright position during the dispensing operation closes an auxiliary inlet port in the primary inlet passage leading to the pump chamber. In an inverted position of the dispenser, the slider valve uncovers that inlet port, located near the upper end of the container, thereby admitting product into the primary inlet passage to effect dispensing while inverted.

Rather than a ball valve, Australian patent 208597 provides a sleeve valve which axially shifts under the force of gravity when the dispenser is inverted to uncover an auxiliary inlet port in the dip tube to facilitate dispensing of liquid stored under pressure.

U.S. patent 2,792,974 discloses a liquid pump dispenser having a central inlet pipe as well as separate dip tubes for upright and inverted use. The dip tubes are mounted on a sleeve which shifts axially under gravity on a central pipe to uncover alternate inlet ports. In the upright mode, the sleeve seats on a frusto-conical bottom portion of the central pipe.

U.S. patent 4,019,661 discloses a slide valve for a dispenser as generally described above.

The known slider valves, however, function only to cover and uncover an auxiliary inlet port in upright and inverted attitudes of the dispenser. Thus, for those dispensers having a container vent passage provided to avoid paneling and hydraulic lock during pumping, the product will leak through the open vent passage during the dispensing operation while the dispenser is in an attitude other than substantially upright.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a manually actuated liquid pump sprayer capable of being operated in both upright and inverted positions, without leakage, by the provision of a slider valve which shifts under gravity in an inverted position of the sprayer to close the vent passage to thereby avoid leakage of product through the vent path. The shifting slider valve controlling the opening and closing of the vent is, according to one embodiment, a single slider valve which likewise opens and closes an auxiliary inlet. According to another embodiment, separate slider valves are provided for controlling the auxiliary inlet and the vent.

The container vent passage, which includes a vent port, lies in the path of the shifting slider valve so as to be opened and closed thereby in inverted and upright positions of the sprayer.

The vent port may be located in a tube retainer of the pump body which suspends the dip tube extending into the container, or the vent port may be located in a gasket seal provided between the pump body and the container neck. In both these versions a single slider valve is provided which closes the inlet port in the upright position, the valve having a flange covering the vent port in the inverted position. The valve may otherwise have inner and outer sleeves which respectively close the inlet port and the vent port in the upright and inverted positions.

Otherwise first and second slider valves may be provided, the first closing the inlet port of the auxiliary liquid inlet passage which leads to the primary inlet passage, in an upright spring position, and opening that port in an inverted position to permit spray irrespective of the attitude of the sprayer. The second slider or shuttle valve may be located within the pump body for closing a vent port in an inverted position of the sprayer to avoid leakage along a vent passage and through that port when spraying in a position other than substantially upright.

The second slider valve is guided within a vent passage of a pump body without rotation about its central axis to assure vent port closing effectively and quickly during each inverted spray. The vent passage has opposing flat walls, and the second slider valve is complementarily shaped. The vent passage having such guide is an existing structure requiring no modification and retooling of the improved pump sprayer according to the invention.

Other objects, advantages and novel features of the invention will become more apparent from the following detailed description of the invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side elevational view, mostly in section, of one embodiment of a trigger sprayer incorporat-

ing the invention;

Figure 2 is a view of part of the Fig. 1 trigger sprayer, in vertical section, shown in its inverted position with the slider valve closing the vent port;

Figure 3 is a side elevational view, mostly in section, of another embodiment of a trigger sprayer incorporating another embodiment to the invention;

Figure 4 is a view similar to Fig. 3 of a similar trigger sprayer incorporating yet another embodiment according to the invention;

Figure 5 is a sectional view taken substantially along the line 5-5 of Fig. 4; and

Figure 6 is a view similar to Fig. 4 of the trigger sprayer in its inverted position with the vent port closed.

DETAILED DESCRIPTION OF THE INVENTION

Turning now to the drawings wherein like reference characters refer to like and corresponding parts throughout the several views, one embodiment of the invention is shown in Fig. 1 assembled to a trigger actuated sprayer generally designated 10 having a pump body 11 with a closure 12 for mounting the sprayer to the neck of a container 13 of liquid to be sprayed. A tube retainer 14 is fixed to the pump body as at 15, its flange 16 overlying edge 17 of the container neck. A gasket seal (not shown) may underlie flange 16.

The pump body has a pump cylinder 18 in which a pump piston 19 is reciprocated in sliding sealing engagement to therewith define a variable volume pump chamber 21. The piston may be mounted at the upper end of an elongated stem 22 having a flange 23, a piston return spring 24 extending between this flange 23 and an opposing upper portion of the pump body for resiliently biasing the piston out of its cylinder.

A trigger actuator 25 is pivotally mounted to the pump body in some normal manner, and has a forked arm 26 engaging in the underside of flange 23.

The pump body has a discharge passage 27 extending from the pump chamber through which product is discharged from a discharge orifice (not shown) located in nozzle cap 28. An inlet passage 29 is formed in stem 22 and is valved as at 31 for valving product into the pump chamber during each suction stroke of the dispenser. Valve 31 may be in the form of a spider valve having connected legs formed integrally with the piston, although a flap valve or a ball check valve or the like could otherwise be provided without departing from the invention.

The stem has a depending container vent valve 32 which may be in the form of a downwardly diverging conical lip seal sometimes referred to as a chevron seal in sliding sealing engagement with the wall of a cup member 33 of the tube retainer. Formed on the inner wall of the cup member is one or more longitudinal vent grooves 34, or equivalent longitudinal vent ribs, and the bottom wall of the cup member has one or more vent

ports 35 formed therein.

The tube retainer has a retainer sleeve 36 suspending a dip tube 37 which extends into the container and normally curls against a bottom wall of the liquid container, as known in this art. A primary fluid path is established through the dip tube, longitudinally through the tube retainer and along passage 29 into the pump chamber.

In accordance with one embodiment of the present invention, an auxiliary liquid inlet passage is established as by the provision of an inlet port 38 which may be located in sleeve 36 at the upper end of the container interior. A slider valve 39, in the form of a simple sleeve surrounding sleeve 36, and having a transversely extending flange 41 at one end, is capable of sliding between bottom wall 42 of the tube retainer and a stop 43 formed on sleeve 36, which stop may be in the form of an external flange.

In operation, slider valve 39, in the upright position of the sprayer of Fig. 1, bears against stop 43 and covers secondary inlet port 38 such that, during pumping upon trigger actuation, product is expelled from the pump chamber through the discharge passage. During each pressure stroke vent chevron valve 32 is juxtaposed to vent groove 34 to thereby establish an open vent path from the atmosphere into the interior of the container via vent port 35. Thus, the product expelled from the container during pumping is replaced by air to avoid a sub-atmospheric pressure condition within the container thereby avoiding container paneling and hydraulic lock of the piston. At the end of each suction stroke, vent valve 32 returns essentially to the position shown in Fig. 1 whereupon it reseals with the inner wall of cup member 33 of the tube retainer, to seal the vent passage closed such as during conditions of shipping and storage to avoid leakage of product through the vent.

In an inverted attitude of the sprayer such as that shown in Fig. 2, valve 39 shifts under gravity into bearing engagement with wall 42 thereby uncovering inlet port 38. Since the inlet port is located in the vicinity of the upper end of the interior of the container, product is drawn into the primary inlet passage through port 38 during each suction stroke of the piston permitting pumping without ingesting air into the pump chamber as would be the case if the free end (not shown) of the dip tube were no longer immersed in the liquid within the container in the Fig. 2 position.

Also, in the Fig. 2 inverted position, vent port 35 is covered by the slider valve to prevent leakage of product through the vent passage during pumping while the trigger is actuated with the sprayer fully or partially inverted.

When the trigger is again uprighted as in Fig. 1, the slider valve simply slides back under the force of gravity into bearing engagement with flange 43 to reclose inlet port 38 and to reopen vent port 35.

A trigger sprayer generally designated 44 in Fig. 3 incorporates another embodiment of the invention incorporated therein. The trigger sprayer details are dis-

closed in U.S. patents 4,747,523 and 5,507,418, commonly owned herewith, the entirety of the disclosures of which being specifically incorporated herein by reference.

Trigger sprayer 44 has a pump body 45 mounted on a container 46 by the provision of a container closure 47, with an intervening gasket seal 48.

A tube retainer 49 is fixed to the pump body, and suspends a tube adaptor 51 which in turns suspends a dip tube 52 extending into the interior of container 46 as in a manner and for the purpose known in this art.

Tube retainer 49 has an external flange 53 which supports the gasket seal at a central opening 54 thereof which, unlike that disclosed in the 5,507,418 patent, is circular and seals tightly against the surrounding portion of the tube retainer.

A trigger actuator 55 is hingedly mounted to the pump body in some known manner, and functions to reciprocate pump piston 56 within its cylinder bore 57 for the dispensing of liquid from the pump chamber through the discharge passage and out through the discharge orifice located in the nozzle cap. The pump cylinder has a vent port 58 formed in its wall which establishes a vent passage into the interior of the container via another vent port 59 which, according to the invention, is located in the gasket seal. The vent passage is opened to the atmosphere during pumping as a vent seal 61 on the piston is deformed during each pressure stroke as it is juxtaposed to one or more longitudinal vent ribs 62 located on the inner wall of the cylinder bore, as described in more detail in the 4,747,523 patent.

In accordance with the second embodiment of the invention, an auxiliary liquid inlet passage is established by the provision of an inlet port 63 which may be located in tube adaptor 51 at the frusto-conical section 64 thereof and in the vicinity of the upper end of the interior of the container.

Slider valve 65 has an inner sleeve 66 with a frusto-conical section which matches that of section 64, and an outer sleeve 67. The outer sleeve is of a diameter as to be in alignment with vent port 59, and spaced away therefrom as in the open vent condition of Fig. 3.

In operation, slider valve 65 covers inlet port 63 while the sprayer is being operated in its Fig. 3 upright position. Liquid is ejected from the sprayer during each squeeze of the trigger, and is ingested into the pump chamber during each piston suction stroke as liquid flows through the inlet passage established by the dip tube, tube adaptor and tube retainer. And, since the dip tube is stationary, slider valve 65 remains spaced away from vent port 59 such that during each pressure stroke the vent passage is opened to establish venting of the interior of the container from the atmosphere through the open vent passage.

While pumping during an inverted attitude of the trigger sprayer, slider valve shifts under gravity until its outer sleeve 67 bears against the underside of the gasket seal. Since vent port 59 is in alignment with the outer

sleeve, the vent passage is thereby closed, and inlet port 63 is correspondingly opened. Thus, during pumping, liquid is ingested into the pump chamber via the auxiliary inlet passage through open inlet port 63 which is located in the vicinity of the upper end of the interior of the container. At the same time any leakage of product through the vent passage is prevented by the outer sleeve of the slider valve which now blocks port 59.

Fig. 4 discloses a trigger sprayer which is essentially the same as that shown in Fig. 3, except that Fig. 4 incorporates yet a further embodiment of the present invention. Like parts shown in Fig. 4 will therefore be designated with the same reference numerals as those in Fig. 3.

Unlike that of Fig. 3, gasket seal 68 of the Fig. 4 embodiment has a central opening 69 of rectangular shape, similarly as that disclosed in U.S. patent 5,507,418. Thus, when opening 69 surrounds the circular portion of the lower end of tube retainer 15, four ports (not shown) are formed at the four corners of the rectangular central opening.

Pump cylinder 71 has vent port 58 formed in its wall as part of a vent passage 72 extending through a hollow section 73 of the pump body (see also Fig. 5) and communicating with the interior of the container via the port established in the gasket seal at the four corners as aforescribed. The vent passage is open to the atmosphere during pumping as vent seal 61 on the piston is deformed during each pressure stroke as is juxtaposed through one or more longitudinal ribs 62 (or longitudinal grooves) located on the inner wall of the cylinder bore, as described in more detailed in the U.S. 4,545,523 patent.

As in the Fig. 3 embodiment, an auxiliary liquid passage is established by the provision of inlet port 62 located in tube adaptor 51 at frusto-conical section 64 thereof and in the vicinity of the upper end of the interior of the container.

In accordance with the invention incorporated into the trigger assembly of Fig. 4, a first slider valve 74 is provided in the form of a sleeve having frusto-conical section which matches that of section 64 and which surrounds tube adaptor 51 for sliding movement therealong between the Fig. 4 and Fig. 6 positions. In the upright position of Fig. 4, the lower portion of slider valve 74 tightly engages frusto-conical section 64 to cover inlet port 63 such that product during each suction stroke inlets to the pump chamber via the dip tube and through the tube adaptor which together comprise a primary liquid inlet passage.

A second slider valve 75 is provided within the pump body of the Fig. 4 trigger sprayer. Specifically, slider or shuttle valve 75 is mounted for sliding movement within vent passage 72 which is delimited by hollow section 73 of the pump body (see also Fig. 5). Upper end 76 of valve 75 is concave and is sloped to match that of cylinder 71. And end 77 (Fig. 6) of outer flange 78 of tube retainer 49 is located in the path of valve 75 and func-

tions as a limit stop for maintaining the valve in its Fig. 4 position.

As shown in Fig. 5, valve 75 has opposing flat sides confronting opposing flat side walls 79 of section 73 to avoid any rotation of valve 75 about its central axis during its sliding movement. And, the valve may have a longitudinal cutout 81 at one end to maintain uninterrupted air flow through the open vent passage into the container in the Fig. 4 position.

While pumping during an inverted attitude of the trigger sprayer, second slider valve 75 shifts under gravity until its concaved and sloped end 76 bears against the confronting convexed and matching slope surface of the pump cylinder to thereby close vent port 58. Since the vent port is in alignment with the solid portion of valve 75, the vent passage is thereby closed as shown in Fig. 6, while inlet port 63 is opened as valve 74 shifts to its vent port open condition of Fig. 6 under gravity.

From the foregoing it can be seen that a simple and efficient yet highly effective valve arrangement to facilitate upright and inverted spray has been devised by the provision of a single slider valve or a pair of independent slider valves. In the single slider valve embodiments, the valve simultaneously closes an auxiliary inlet port and opens a vent port during spraying while the dispenser is upright, and simultaneously closes the vent port and opens the auxiliary inlet port while spraying in an inverted attitude of the sprayer. The vent and inlet ports are located in the path of the single slider valve, and molding modifications of the sprayer are limited and minimum number of parts are required when carrying out the invention.

As for the independent slider valves, one is provided for closing and opening an inlet port respectively during upright and inverted spray, and the other is provided for opening and closing the vent port respectively during upright and inverted spray. Since the pump body need not be modified to accommodate second slider valve 75, and since the gasket seal is the same as in the prior art, the cost of adapting the known trigger sprayer of Fig. 4 is minimal. In addition to the slider valves, the only additional part required is a tube adaptor.

Obviously, many other modifications and variations of the present invention are made possible in the light of the above teaching. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

Claims

1. A manually actuated liquid pump sprayer capable of spraying during pumping in an upright position and in an inverted position, comprising a pump body having means for mounting the body to a container of liquid to be dispensed, said body having a pump chamber, means defining a primary liquid inlet pas-

sage extending to said chamber and means defining a liquid discharge passage extending from said chamber, the sprayer having a container vent passage including a vent port establishing communication between an interior of the container and the atmosphere during operation of the sprayer in the upright position, an auxiliary liquid inlet passage including an inlet port extending between the interior of the container at an upper end thereof and said primary passage, characterized in that said primary inlet passage means has slider valve means mounted thereon for sliding movement for closing the inlet port in the upright position and for closing the vent port in the inverted position.

2. The sprayer according to claim 1, wherein said primary inlet passage means comprises a retainer for suspending a dip tube extending into the container, further characterized in that said ports are located in said retainer in the path of said valve means.

3. The sprayer according to claim 1, wherein said vent port is located in a pump cylinder wall defining said pump chamber, said primary inlet passage means comprising a retainer for suspending a dip tube extending into the container, further characterized in that said valve means comprises independently slideable first and second slider valves, said inlet port being located in said retainer in the path of said first valve to be opened thereby in the inverted position, and said vent port being located in the path of said second valve to be opened thereby in the upright position.

4. The sprayer according to claim 3, characterized in that said vent passage means includes means for guiding said second valve during its sliding movement.

5. The sprayer according to claim 4, characterized in that said guiding means comprises a hollow section of said pump body having opposing flat walls, said second valve having opposing sides parallel to said flat walls.

6. The sprayer according to claim 2, characterized in that said valve means comprises a slider valve which closes said inlet port in said upright position, said valve having a flange closing said vent port in said inverted position.

7. The sprayer according to claim 2, characterized in that said valve means comprises a slider valve having an inner sleeve which closes said inlet port in said upright position, said valve having an outer sleeve closing said vent port in said inverted position.

8. The sprayers according to claim 6 or 7, characterized in that said retainer has a stop for positioning said slider valve when closing said inlet port.
9. The sprayer according to claim 8, characterized in that said stop comprises an external flange on said retainer. 5
10. The sprayer according to claim 8, characterized in that said retainer has a conical section defining said stop, a conical section of said valve bearing against said stop in said upright position. 10
11. The sprayer according to claim 1, wherein said primary inlet passage means comprises a retainer for suspending a dip tube extending into the container, and a gasket seal is provided between said pump body and said container, characterized in that said inlet port is located in said retainer and said vent port is located in said gasket in the path of said valve means. 15 20
12. The sprayer according to claim 11, characterized in that said valve means comprises a slider valve having an inner sleeve which closes said inlet port in said upright position and has an outer sleeve which closes said vent port in said inverted position. 25

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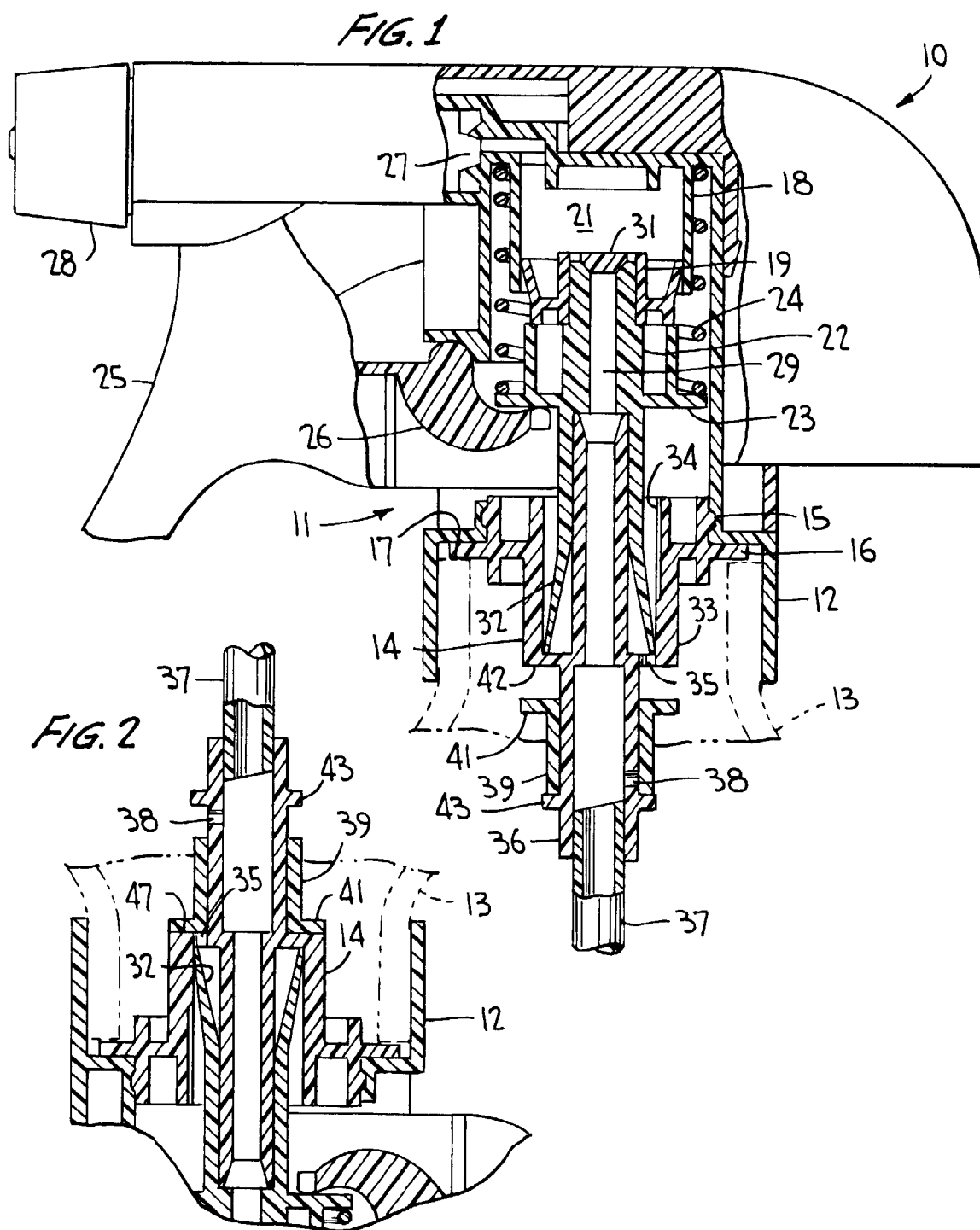


FIG. 3

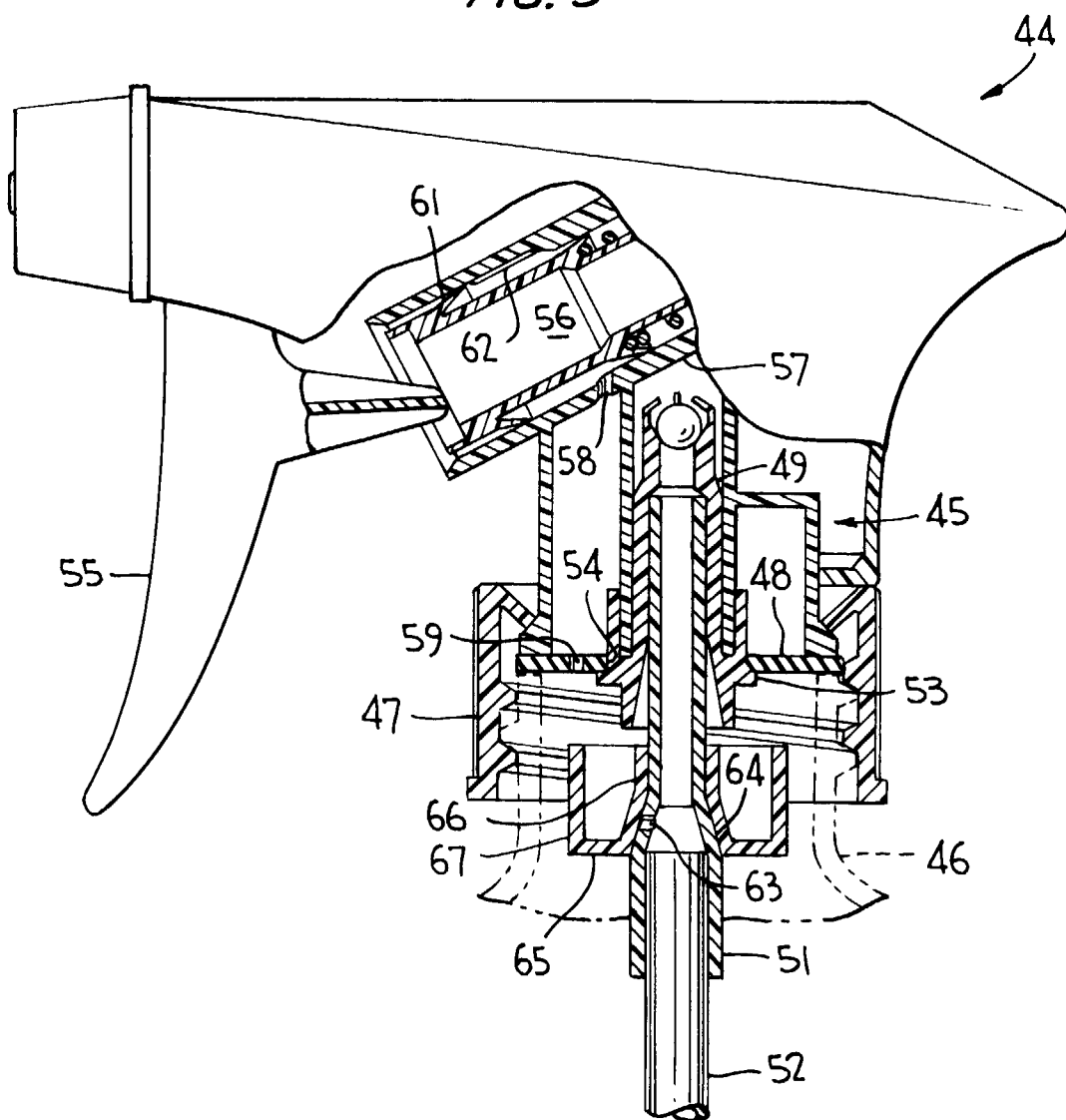


FIG. 4

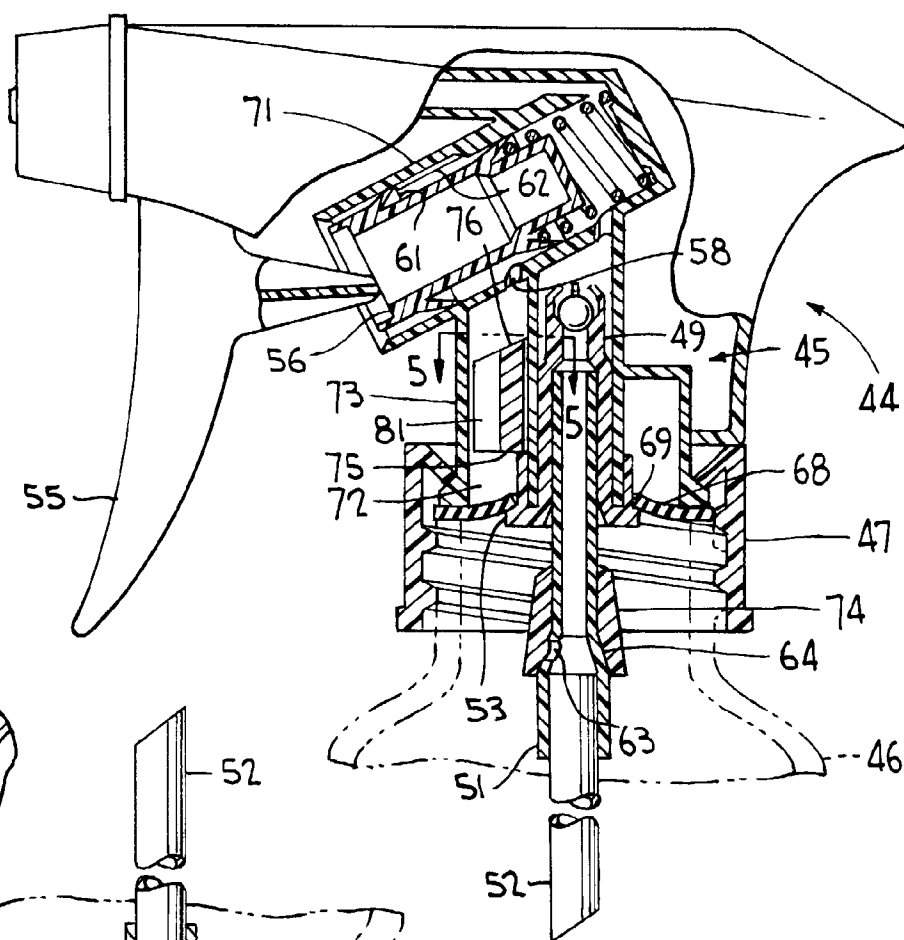


FIG. 5

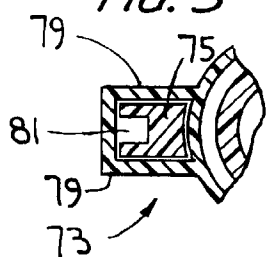


FIG. 6

