Oct. 19, 1937. A. DE WEAL 2,096,227

SPRAYER CONSTRUCTION

Filed May 11, 1933

Fig. 1.

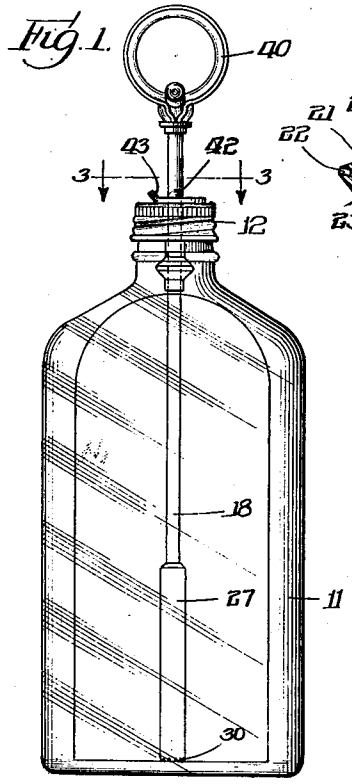


Fig. 2.

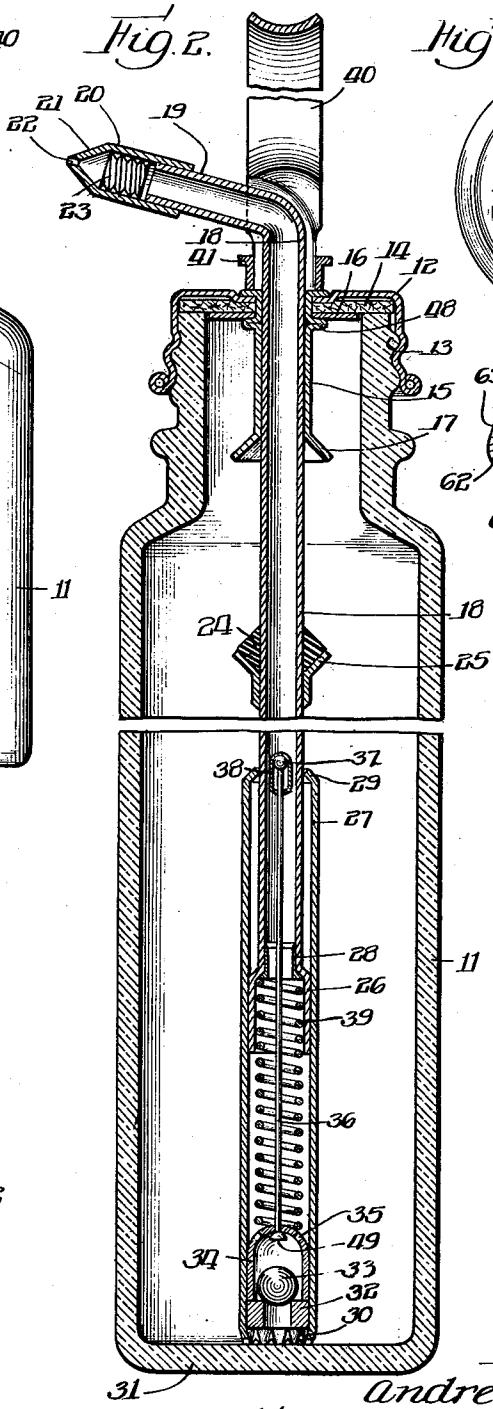


Fig. 3.

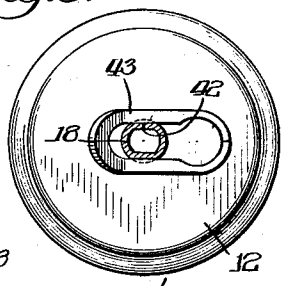


Fig. 6.

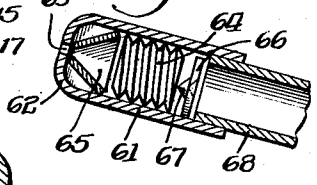


Fig. 4.

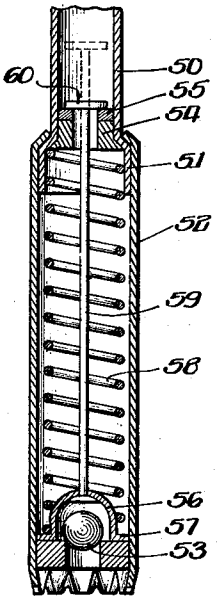
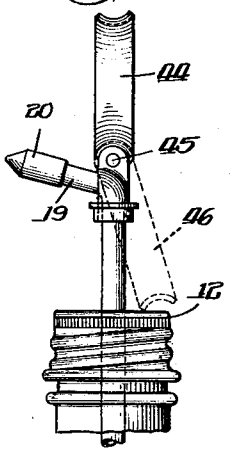


Fig. 5.



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SPRAYER CONSTRUCTION

Andre de Weal, Chicago, Ill.

Application May 11, 1933, Serial No. 670,433

17 Claims. (Cl. 299—97)

This invention relates to a new and improved sprayer construction, and more particularly to a sprayer which is proof against leakage of the contents of the receptacle with which it may be associated.

The present improved sprayer is of a type adapted to be used in connection with receptacles such as bottles, cans or the like, for manual operation to spray or atomize the contents of the receptacle. It is adapted for use in connection with a wide range of materials, among which may be mentioned polishing fluids or the like, insecticides, paints and lacquers.

Liquids of the character described are in general quite volatile and it has heretofore been the usual practice to ship the liquids in closed containers with separate sprayers which might be inserted into the containers for use. Usual types of sprayers have pistons fitting loosely in covers for attaching to the receptacle so that there may be leakage between the cover and piston. Such devices also are liable to leakage through the sprayer itself if the latter is placed in the fluid container for shipment.

The use of a separate cap or closure and sprayer requires larger cartons and boxes for shipment and also adds to shipping costs. The older types of sprayers also cause losses of volatiles where the sprayer stands idle, as the sprayer is not ordinarily inserted and removed each time it is to be used. In addition, if the device is accidentally knocked over the leakage may damage or destroy material with which it may come in contact.

It is an object of the present invention to provide a new and improved device for spraying liquids.

It is a further object to provide a sprayer having a leakproof connection to a receptacle.

It is an additional object to provide a sprayer in which internal sealing means serve to prevent leakage through the sprayer.

It is also an object to provide a sprayer in which the return spring acts to yieldingly seal the piston opening.

It is a further object to provide a sprayer construction having an internal valve construction seated by the sprayer return spring.

It is an additional object to provide a sprayer construction including means for locking the sprayer in closed position.

It is also an object to provide a sprayer having a discharge valve closed throughout a limited range of movement, and having a valve member movable relative to its securing means.

Other and further objects will appear as the description proceeds.

I have shown certain preferred embodiments of my invention in the accompanying drawing, in which—

Figure 1 is an elevation of a bottle provided with one form of my improved sprayer;

Figure 2 is a vertical section of the construction of Figure 1, taken at right angles to Figure 1 and shown on an enlarged scale partly broken away;

Figure 3 is a view taken on line 3—3 of Figure 1 but shown on the scale of Figure 2;

Figure 4 is a fragmentary sectional view showing the valve and pump portions of a modified form of construction;

Figure 5 is a fragmentary elevation showing the upper portion of the sprayer assembly with a modified form of holding means; and

Figure 6 is a fragmentary section showing a modified nozzle construction.

Referring first to Figures 1, 2 and 3, the bottle 11 is provided with a metallic closure member 12 which is screwed onto the threads 13 on the neck of the bottle. This cap or closure 12 contains a sealing washer 14 and a guide member 15 held in place in a perforation formed in the center of the closure member. The washers 14 and 16 and the guide member 15 are held in place by the crimped end of the member 15 and its upset portion 48.

The lower end of the guide member 15 is flared, as shown at 17. The tubular piston member 18 extends through the opening in the closure member 12 and through the guide member 15. This tubular piston has an outwardly turned discharge end 19 upon which is fitted the discharge nozzle 20. The discharge nozzle has a sloping discharge face 21 which is conical in form and provided with a central discharge opening 22. The conical form of this discharge face as shown has been found particularly efficient in giving a uniformly atomized or vaporized spray. The threaded member 23 is fitted into the nozzle 20, the spiral threads on the member 23 serving to form spiral passages for the fluid. This also aids in properly breaking up the fluid before it is discharged as spray.

The intermediate portion of the tubular piston 18 carries the packing 24 which rests against the collar 25 which is fixedly secured to the tubular piston member 18. The lower end of the piston 18 has an integral enlarged portion 26 which is fitted into the upper end of a cylinder 27. The piston is provided adjacent the enlarged portion

with the valve seat 28. The upper end 29 of the cylinder 27 is turned in to prevent separation of the piston from the cylinder. The lower end of the cylinder 27 is crimped as shown at 30 to provide a plurality of passages for fluid. This lower end 30 rests against the bottom 31 of the bottle or other receptacle. The perforate member 32 is fitted in the bottom of the cylinder 27 and the ball valve 33 is adapted to close the opening in the member 32.

The cup-shaped member 34 constitutes a cage to hold the ball 33 adjacent the member 32. The member 34 is provided with perforations 35 to permit passage of the fluid. The valve stem 36 extends through the central upper portion of the member 34 and is held in place by an enlarged lower end 49. This valve stem extends through the valve seat 28 in the piston and its upper end 37 is enlarged and has loosely fitted thereon a tubular valve member 38. The lower edges of this member 38 are crimped so as to prevent the member from slipping off the enlarged head 37 of the valve stem. The coil spring 39 has its lower end engaging the cage 34 and its upper end fitted into the enlarged portion 26 of the piston. The operating ring 40 extends above the bend in the piston 18 and the lower ends of the ring are clamped to the piston by means of the collar 41.

In one form of construction the piston 18 is provided with indentations 42 on opposite sides thereof as shown in Figure 3. A split flat spring clip 43, having a keyhole opening therein, is slipped upon the piston 18 as shown in Figures 1 and 3, this clip bearing against the outer face of the closure member 12 and serving to maintain the packing ring 24 against the flared portion 17 of the guide member 15. This clip prevents depression of the piston against the spring 39 accidentally, such as might be the case if the container were shipped or stored upside down. Such depression might unseat the packing 24 and possibly also the valve, and permit leakage.

A modified form of construction for retaining the packing ring clamped between these two members is shown in Figure 5. In this case the modified form of operating ring 44 is hingedly supported at 45. In order to maintain the piston in its upper position and the packing ring properly clamped, the member 44 is swung down to the position indicated in dotted lines at 46. It then engages the top of the closure member 12 and maintains the parts in the desired position.

A modified form of valve construction is shown in Figure 4. Here the piston 50 has an enlarged end 51 fitted in the cylinder 52. The lower end of the cylinder is provided with the ball check valve 53. A valve seat 54 is formed in the lower end of the piston 50, this valve seat carrying a rubber or other suitable packing ring 55. A spider or cage 56 for holding the ball valve 53 in place is fitted into the cylinder, and has an outturned circular flange 57 which is held down by the coil spring 58, the opposite end of which engages the under side of the enlarged end 51 of the piston. The valve stem 59 is secured to the spider 56 and extends through the valve seat 54. The upper end of this valve stem carries the valve disc 60 which is brought against the washer 55 by the force of the spring 58.

In the modified form of nozzle construction shown in Figure 6, the tubular piston 68 is fitted with the nozzle cap 61 having the rounded outer face 62 with the spray opening 63 formed therein. The threaded member 64 is fitted in the nozzle cap 61, this member being similar to the member 23 in Figure 2, and having the same function. The conical member 65 is fitted in the outer portion of the nozzle, this member 65 having an opening registering with the opening 63 in the nozzle. The valve disc 66 is loosely fitted between the member 64 and the end of the tubular member 68. This disc is formed with a center projection 67 which may be punched from the metal of the disc, the projection engaging the member 64.

In the operation or use of the form of construction shown in Figures 1 to 3, it will be understood that the design is such that there will be no leakage in the ordinary use or handling. However, for shipping purposes it may be desirable to use the clip 43 to positively lock the parts in closed position. The length of the combined pistons and cylinder are normally so designed relative to size of the container in which they are to be used, that the lower end of the cylinder rests on the bottom of the container and the collar 25 on the piston firmly forces the packing ring 24 against the lower end 17 of the guide member 15. In this position the enlarged portion 26 of the piston does not engage the inturned upper end 29 of the cylinder 27, but permits the piston to be urged resiliently by the force of spring 39 to properly contact the packing ring 24.

In the use of the sprayer the tubular piston 18 is depressed by forcing down the operating ring 40, this being accomplished, in using containers of the size shown, by grasping the container in the hand and inserting the forefinger through the ring 40. As the piston is forced down, liquid which was contained in the cylinder is trapped therein by the check valve 33 and is forced out past the valve 38 as the seat 28 moves away from the valve. The liquid is forced on through the atomizing nozzle 20 and emitted as a fine spray. As the piston is released, the spring 39 forces it upwardly until the packing 24 again engages the portion 17 of the guide member. During this upward movement the suction in the cylinder causes fluid to flow past the check valve 33 and the cylinder is again filled with fluid. As the parts reach their upper position the tubular valve member 38 passes into the tubular opening in the valve seat 28. It will be apparent that this valve will effectively close the opening in the valve seat throughout an appreciable range of movement between the cylinder and piston, since the valve and seat both extend along the line of relative movement. This construction makes it possible to have a tight seal at this upper valve even though the containers vary in size or the thicknesses of the bottoms of the bottles vary.

The form of construction shown in Figure 4 is operated in the same manner. There is not, however, an effective closure in this form of construction throughout as great a range of variation in position of the parts as there is in the form of construction shown in Figure 2. The effective closure is limited in Figure 4 by the compressibility of the washer 55.

The fact that the valve member 38 is loosely fitted on the valve stem 36 has been found in practice to be important in imparting a smooth and even operation to the device. In a construction with a fixed valve and a tubular seat of the character shown, or a yielding seat, when the piston is depressed with the cylinder full of fluid, due to the fact that the valve acts as a closure through an appreciable range of movement, there

is a tendency at first to compress the fluid, with a noticeable click or jerk as the valve finally clears the seat and the fluid is released. It has been found that the valve 38 having play effectively prevents this occurrence and gives a smooth and efficiently acting device. This play may be at the connection of the valve to the stem or may be at the lower end of the valve stem, the enlarged head 49 on the lower end of the stem permitting a limited play at that point.

In both forms of upper valve construction, these upper valves form a water-tight and air-tight seal at the lower portion of the piston or upper portion of the cylinder. This seal prevents any leakage from the nozzle of fluid in the piston above the valve, the fluid being retained in the piston by the outside air pressure. The tubular form of valve shown in Figures 1 to 3 does not depend on spring pressure to hold it closed but makes a fluid tight sliding fit in its tubular seat.

A secondary purpose of the upper seal valve is to prevent fluid pressure which may develop in the bottle from being communicated to the fluid in the piston and to prevent such pressure from forcing any fluid from the piston through the nozzle. Such fluid pressure might be created in the container when shipped in warm climates or placed in heated storage places. With the upper valve construction such expansion could, at most, force out some small part of the fluid trapped at the portion of the piston above the valve due to expansion of that fluid itself, but the expansion of the main body of fluid in the container would have no effect.

This positive sealing of the fluid in the container is highly important as without such a seal there will be a very material leakage through the discharge orifice no matter how small that orifice may be, as has been proven by repeated tests.

The fact that the packing 24 on the piston moves with the piston is important in affording a sprayer which will operate with moderate operating pressure and yet remain tight. Any fixed packing through which a piston may move will cause undesirable friction losses of power if the packing is tight enough to be effective. Such a hard working piston is impractical in small, manually operated devices of the type shown, where it is intended to operate the pump with one finger.

The form of nozzle construction shown in Figure 6 may be manufactured more cheaply than the forms shown in Figure 2. The pointed discharge end of Figure 2 requires additional annealing and drawing operations not required with the form shown in Figure 6. The member 65 may be made cheaply by a single operation and its slope is similar to that of the nozzle shown in Figure 2. It has been found to have a similar result in forming the fine spray desired. The valve member 66 serves to prevent liquid from being drawn down from the piston by closing off the external air pressure and to insure the pump cylinder filling properly during the up stroke of the piston. The valve at this time seats on the end of the member 68. During the spraying stroke the point 67 engages the member 64 and the valve tilts to provide additional passage for the fluid.

While I have shown certain preferred embodiments of my invention, these are to be understood to be illustrative only, as it is capable of change and modification to meet varying requirements and conditions and I contemplate such changes and variations as come within the spirit and scope of the appended claims.

I claim:

1. In a sprayer construction, a fixed closure assembly, a piston movable through the closure, packing around the piston on one side of the closure, a member carried by the piston for engaging said packing, and means bearing against the other face of the closure for locking the piston in fixed relation to the closure with the packing against the closure.

2. In a sprayer construction, a fixed closure assembly, a piston movable through the closure, packing around the piston on one side of the closure, a member carried by the piston for engaging said packing, a shoulder on the piston on the other side of the closure, and a member engaging the shoulder and the closure for locking the piston in fixed relation to the closure with the packing against the closure.

3. In a sprayer construction, a fixed closure assembly, a piston movable through the closure, packing around the piston on one side of the closure, a member carried by the piston for engaging said packing, indentations on opposite sides of the piston on the other side of the closure and a member having a keyhole slot therein fitted about the piston in said indentations, said member engaging the closure for locking the piston in fixed relation to the closure with the packing against the closure.

4. In a sprayer construction, a pump cylinder, an abutment adjacent the lower end of the cylinder, a piston fitted therein, a compression spring fitted in the cylinder, bearing at its lower end upon the abutment and bearing at its upper end against the piston, a valve stem having its lower end retained in the cylinder, a port in said piston, a valve seat about said port, and a valve member carried by the valve stem and adjacent the valve seat, and adapted to engage the valve seat when the spring forces the piston to the upper portion of the cylinder.

5. In a sprayer construction, a pump cylinder, an abutment adjacent the lower end of the cylinder, a piston fitted therein, a compression spring fitted in the cylinder, bearing at its lower end upon the abutment and bearing at its upper end against the piston, a valve stem having its lower end retained in the cylinder, a port in said piston, a valve seat about said port, and a valve member loosely carried by the valve stem and adjacent the valve seat, and adapted to engage the valve seat when the spring forces the piston to the upper portion of the cylinder.

6. In a sprayer construction, a pump cylinder, an abutment adjacent the lower end of the cylinder, a piston fitted therein, a compression spring fitted in the cylinder, bearing at its lower end upon the abutment and bearing at its upper end against the piston, a valve stem having its lower end secured to the abutment in the cylinder, a port in said piston, a valve seat about said port, and a valve member carried by the valve stem and adapted to engage the valve seat, the spring serving to maintain the valve normally in engagement with its seat.

7. In a sprayer construction, a pump cylinder, a tubular piston fitted therein, a port in said piston, a reduced portion in the piston about the port serving as a valve seat, a compression spring in the cylinder and engaging the piston, a valve stem having one end held in place in the cylinder, the other end of the valve stem extending through the valve seat in the piston, and a valve member

on said stem adapted to coact with the valve seat, the spring serving to maintain the valve normally in engagement with its seat.

8. In a sprayer construction, a pump cylinder, a tubular piston fitted therein, a reduced portion in the piston serving as a port and tubular valve seat, a spring in the cylinder and engaging the piston, a valve stem having one end held in place in the cylinder, the upper end of the valve stem extending through the valve seat in the piston, and a valve member slidably carried on said stem and adapted to coact with the valve seat, the spring serving to maintain the valve normally in engagement with its seat.

9. In a sprayer construction, a pump cylinder, a tubular piston fitted therein, a reduced portion in the piston serving as a port and tubular valve seat, a compression spring in the cylinder and engaging the piston, a valve stem having one end held in place in the cylinder, the other end of the valve stem extending through the valve seat in the piston, and a tubular valve member on said stem adapted to fit within the tubular valve seat to coact with the valve seat to retain the liquid in the pump cylinder during a range of relative movement between the valve and seat.

10. In a sprayer construction, a pump cylinder, a piston fitted therein, a port in the piston, a valve seat about said port, the opposite end of the cylinder having a reduced opening therein, a ball valve on said opening, a cage for retaining said ball valve in place, a spring engaging the cage and the lower end of the piston, and a valve associated with the valve seat in the piston.

11. In a sprayer construction, a pump cylinder, a piston fitted therein, a port in the piston, a valve seat about said port, the opposite end of the cylinder having a reduced opening therein, a ball valve on said opening, a cage for retaining said ball valve in place, a spring engaging the cage and the lower end of the piston, a valve associated with the valve seat in the piston, and a valve stem connecting said valve and the ball valve cage.

12. In a sprayer construction, a pump cylinder, a piston fitted therein, a port in the piston, a tubular valve seat about said port, the opposite end of the cylinder having a reduced opening therein, a ball valve on said opening, a cage for retaining said ball valve in place, a spring engaging the cage and the lower end of the piston, a tubular valve associated with the valve seat in the piston, and a valve stem loosely connecting said valve and the ball valve cage.

13. In a sprayer construction, a cylinder, a piston fitted in said cylinder, a port in the piston, a valve seat formed about the port, a member loosely fitted in the lower portion of the cylinder, a valve stem secured to the member and extending through the valve seat, a valve disc secured to the upper end of the stem, and a spring having one end engaging the member in the cylinder and the other end engaging the piston to maintain the valve against the seat.

14. In a sprayer construction, a cylinder, a piston fitted in said cylinder, a port in the piston, a valve seat formed about the port, a ball valve in the lower end of the cylinder, a cage loosely fitted over the ball valve, a valve stem secured to the cage and extending through the valve seat, a valve disc secured to the upper end of the stem, and a spring having one end engaging the cage and the other end engaging the piston to maintain the valve against the seat.

15. In a sprayer construction, a closure having an opening therein, a piston extending through the opening, a packing secured to the piston and adapted to engage the lower side of the closure, and a member pivotally secured to the piston above the closure and adapted to be swung to engage the upper side of the closure to urge the packing against the lower side of the closure.

16. The combination with a container having a closure cap, of a pump mounted in said container and having a cylinder engaging with the bottom of the container and a spring pressed tubular rod extending out through the cap of the container, of means for fastening the rod in normally raised position, comprising a catch resting against the top of the container and engaging with grooves in the sides of the rod for holding the rod in raised position.

17. The combination with a container having a removable cap, of a tubular bearing having one end extending through a hole in the cap and fastened to the cap, the lower end of the bearing being bell shaped, a pump having a cylinder resting on the bottom of the container, an inlet valve for said cylinder, a hollow pump rod coacting with the cylinder, a spring which holds the rod in normally raised position, said rod extending outwardly through the bearing and having a restricted discharge opening, an abutment on the rod adjacent to the lower end of the bearing when the rod is in raised position, a gasket between the abutment and lower end of the bearing for making a tight closure between the rod and the bearing when the rod is in raised position, and means for fastening the rod in raised position.

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