July 6, 1954 C. D. WISE ET AL 2,683,060

SPRAYER AND SPRAYER PUMP

Filed April 24, 1953 2 Sheets-Sheet 1

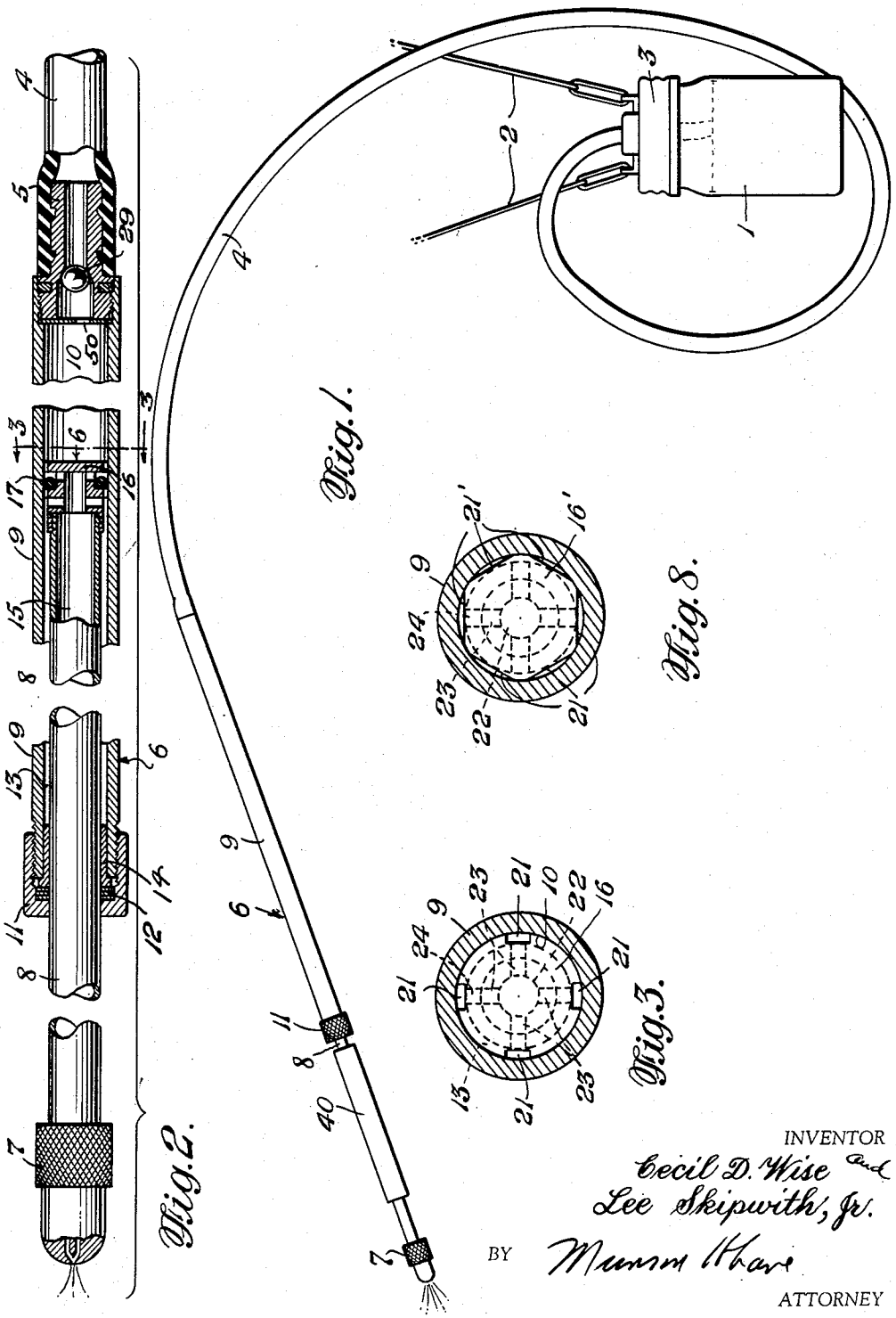


Fig. 2.

Fig. 1.

Fig. 8.

Fig. 3.

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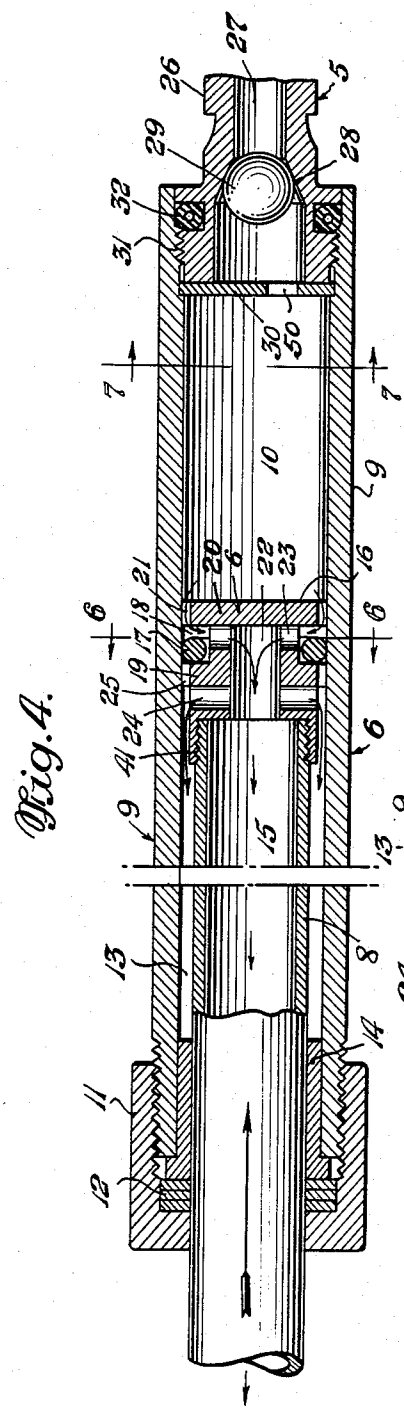


Fig. 4.

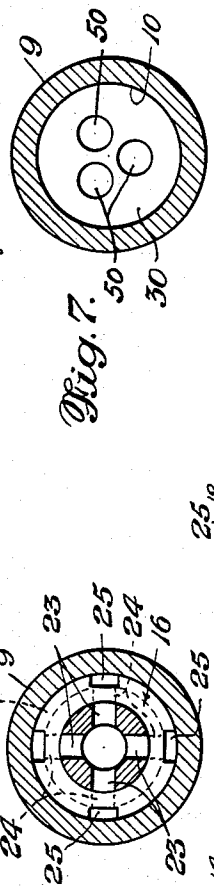


Fig. 7.

Fig. 6.

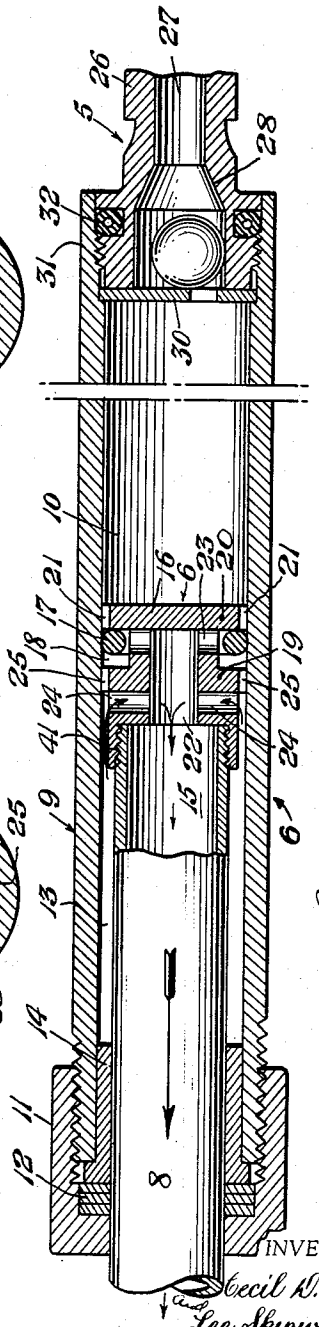


Fig. 5.

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SPRAYER AND SPRAYER PUMP

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Application April 24, 1953, Serial No. 350,836

1 Claim. (Cl. 299—97)

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The invention relates to improvements in portable hand sprayers intended for garden use, and more particularly to sprayers which are equipped with a reciprocating type pump including an outer tubular or cylindrical portion into one end of which a spray liquid is drawn through a flexible conduit from a suitable source of supply, and an inner tubular plunger slidable within the outer cylindrical portion through which spray liquid is forcibly expelled axially as the inner and outer tubes are reciprocated relative to each other.

One of the objects of the invention is to provide a sprayer pump having larger orifices than are generally employed in devices of this type, enabling the user to pump spray materials containing considerable solid matter in suspension, without clogging the mechanism.

Another object is to provide a sprayer pump which is simple in design, inexpensive to manufacture, and which includes relatively few parts.

A further object of the invention is to insure an even flow of fluid from the pump by the use of a ring type check valve, resulting in quicker closing action than the usual ball type check valve. By the use of a ring type valve there is less dimunition of ejected fluid when the direction of the stroke is changed than occurs where a ball type check valve is employed.

A further object is to provide a spray pump having a ring valve which may be readily replaced without the use of tools, merely by sliding it off and sliding a new valve on when the old valve ring has become worn.

A further object is to provide a sprayer pump employing a valve ring composed of durable synthetic material, such as neoprene or Hy Car, thus greatly increasing the period during which the pump may be used without servicing, such ring being capable of resisting abrasion on the cylinder tube wall for an indefinite period of time.

Other objects and advantages will appear from a consideration of the accompanying drawings and the following detailed description, in which a specific embodiment of the invention is set forth by way of illustration rather than by way of limitation.

In the drawings:

Fig. 1 is a view, somewhat diagrammatic in character, showing the assembled sprayer including a source of liquid supply adapted to be carried by means of a strap over the shoulder of a user, and a reciprocating spray pump operatively connected at one end to the source of supply through a flexible tube, such pump discharging at its opposite end through a spray nozzle;

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Fig. 2 is a view partially in section and partially in elevation, on a larger scale than Fig. 1 and with parts broken away, showing the reciprocating pump and its associated parts;

Fig. 3 is an enlarged sectional view on line 3—3 of Fig. 1 showing one arrangement of longitudinal recesses formed in the plunger head;

Figs. 4 and 5 are longitudinal vertical views of the pump on a still larger scale than Fig. 2, showing the positions assumed by the ring valve on opposite strokes of the plunger;

Figs. 6 and 7 are sections on lines 6—6 and 7—7 of Fig. 4, respectively; and

Fig. 8 is similar to Fig. 3 of a slightly modified form of that portion of the invention.

Referring to the drawings, wherein a preferred embodiment of the invention is set forth by way of illustration rather than by way of limitation, the hand sprayer as shown consists of a liquid supply chamber 1 which may be in the form of a Mason jar equipped with a screw cap and adapted to be carried by an operator by means of a shoulder strap 2 attached to the cap 3. A flexible tubing 4, which may be formed of synthetic rubber such as neoprene or suitable durable material not readily attacked by spray chemicals, communicates between the supply chamber 1 and a removable ball check valve member 5 at the inlet side of a reciprocating pump generally indicated at 6. Pump 6 is arranged so that liquid flows longitudinally through its cooperating parts and is ejected through the nozzle 7, all of which parts are in series with the flexible tubing 4.

As shown, the pump 6 consists of an inner hollow plunger tube 8 having an enlarged plunger head or piston at one end and being equipped with a hand piece in the form of a sleeve 40 near its other end to facilitate the reciprocating operation. The plunger is adapted to be reciprocated in co-axial relation within the discharge end of a hollow cylinder or outer tube 9 which is provided with a central passage providing a chamber 10 of variable length beyond the plunger head. The cylinder 9 is provided at its inlet end with a removable ball check valve assembly 5.

The internal diameter of the cylinder 9 is sufficiently greater than the external diameter of the plunger tube 8 to provide an intermediate space or annular chamber, the length of which is varied as the parts 8 and 9 are reciprocated

relative to one another. The discharge end of the cylinder 9, which is slidable over the tube 8, may be sealed in any suitable manner, as by means of a screw cap 11 containing packing material 12. The annular chamber between the plunger tube and cylinder 9 is designated 13 and extends lengthwise from the enlarged head of the plunger tube 8 to the end of a sleeve forming part of a packing nut 14 which, in conjunction with the screw cap 11, serves to hold the packing material 12 in compressed condition so as to prevent leakage of fluid from the space 13. The plunger tube 8 has a central passage or chamber 15 through which the outgoing liquid is forced on both strokes of the plunger tube. The diameters of the plunger tube 8 and cylinder 9, and the wall thickness of the tube 8 are preferably so related that the amount of liquid forced through the pump will be substantially the same on both the in and out strokes of the sprayer pump.

In accordance with our invention the plunger tube is provided with a piston or plunger head 16 equipped with a ring valve member 17 loosely fitting within an annular groove or undercut portion 18 formed in the piston head between a pair of shoulders formed by front and rear flanged head portions 20 and 21 which are spaced apart a distance greater than the cross sectional diameter of the ring 17, while the depth of the groove is also greater than the cross sectional diameter of the ring 17. The ring is adapted to slidably engage the inner surface of the cylinder 9 as the piston head is reciprocated relative to the cylinder, so as to provide a liquid seal. The ring 17 has also a limited sliding movement relative to the piston head owing to the length of the groove or undercut portion 18, and because of the depth of such groove the ring does not at any time come in contact with the bottom or base of the groove. The ring 17 serves as a valve for the plunger head 16 and one of its functions is to alternately admit or cut off the flow of fluid through ports and passages in the piston head, depending on the direction of reciprocation of the plunger tube 8. The valve ring 17 may be made of any suitable flexible and durable material, but is preferably composed of a synthetic rubber such as neoprene or Hy Car.

As shown, the piston head 16 is formed as a separate piece from the plunger tube and is assembled in coaxial relation with the plunger tube by means of a screw threaded connection 41.

End slots or recesses 21 formed in the head flange 20 provide communication between the cylinder chamber 10 and the ring valve groove 18 when the ring valve is in the position shown in Fig. 4, and an internal passage or chamber 22 is provided within the piston head extending lengthwise thereof from the flanged head portion 20 and opening directly into the outlet passage or chamber 15 extending through the flange tube 18. A modified form and arrangement of end slots or recesses is shown in Fig. 8, wherein end slots 21' correspond to the end slots 21 illustrated in Fig. 3. The function of both is the same.

Communication between the passage 22 in the piston head and the ring groove 18 is provided by means of radial ports 23 drilled through the inner wall of the ring groove. Similar radial ports 24 are provided in the enlarged portion 19 of the piston head to permit communication between the central piston head passage 22 and a series of longitudinal recesses 25 aligned with

recesses 21 which provide passages connecting the piston groove 18 with the annular chamber or recess 13 intermediate the piston tube 8 and the cylinder 9. The ring 17 has two functions: (1) to form a seal between the piston head 16 and the interior of cylinder 9, and (2) to act as a double action check valve in conjunction with slotted ports 21 and slotted ports 25 preventing liquid flow therethrough, depending on the direction of movement of the piston head.

The assembly previously referred to as the ball check valve member 5 comprises a valve housing 26 having a central fluid passage 27 extending therethrough, a cone shaped valve seat 28, a ball valve 29, and portal valve retainer 30 having apertures 50 formed therein to permit passage of fluid. As shown, valve housing 26 is removably connected internally to cylinder 9 by means of a screw threaded connection 31, and is provided with a liquid sealing ring 32 to prevent leakage from the cylinder chamber 10.

The manner of operation is illustrated in Figs. 4 and 5. At the start of operation there is no liquid in the pump 6. Each time the plunger tube 8 is pulled out as indicated in Fig. 5 by holding one hand on the cylinder and the other on the gripping sleeve or handle 40 of plunger tube and pulling in opposed directions, ring valve 17 slides in a direction to seal off the longitudinal ports 21 of the piston head 16, thus cutting off communication with cylinder 10. This creates a vacuum in chamber 10 which, in turn, sucks check ball 29 off of its seat 28 and brings in liquid from the supply chamber 1 (Fig. 1).

When chamber 10 of cylinder 9 is filled with liquid then the plunger tube 8 on its inbound stroke (Fig. 4) forces the piston head 16 into chamber 10. The pressure of the liquid at once closes check valve 29. The liquid in chamber 10 then passes through the slots 21 in the shoulder 20 of the valve piston head 16 and, in turn, forces the valve ring 17 off of its seat so that liquid passes through the radial ports 23 and enters the chamber 22 in piston head 16. As chamber 22 fills with liquid further inward movement of the piston head 16, by displacement of the liquid in chamber 10, combines to force more liquid into chamber 22. As chamber 22 fills the liquid passes through ports 24 and fills the annular chamber 13. The remainder of the liquid is forced into plunger chamber 15 and out through the hollow plunger tube to sprayer nozzle 7.

When the plunger tube reaches the inward extreme of its stroke and starts in the opposite direction the ring valve 17 returns to its seat against the shoulder in the flange 20 of the valved piston head 16, performing two functions at the same time. (1) A vacuum is again created in the chamber 10, thus drawing in more liquid from supply chamber 1 and keeping the chamber 10 full. (2) By sealing off the ports 21 of the piston head 16 the liquid in chamber 13 is forced through the ports 24 and through slots 25 and ports 23 into chamber 22 and out through chamber 15 and the nozzle 7.

The invention has been described in detail for the purpose of illustration but it will be obvious that numerous modifications and variations may be resorted to without departing from the spirit of the invention.

We claim:

In a double acting reciprocable hand sprayer pump comprising an outer cylinder having a check valve member at its inlet end adapted to

be connected to a source of spraying liquid, a plunger tube reciprocable within the cylinder and spaced from the inner wall thereof to provide an annular chamber intermediate the inner and outer tubes, said plunger tube being adapted to be operatively connected at its outlet end to a sprayer nozzle, an enlarged valved plunger head carried at the inner end of the plunger tube and slidably fitting the interior of the cylinder, said plunger head being closed at its remote end, an annular recess formed in said head, a ring valve loosely mounted within said recess, spaced slightly from the inner wall of the recessed portion and adapted to slidably and snugly engage the inner wall of the cylinder when the plunger is reciprocated therein, said recess being of such size as to permit substantial sliding movement of the ring, end passages formed in said head connecting the interior of the cylinder with said annular ring receiving recess, transverse ports in said head connecting said recess with the interior of the head and with the central passage in the plunger tube, and other passages connecting the interior of the plunger tube with the annular chamber between the tube and cylinder, said loosely mounted ring valve slidably engaging the walls of the cylinder as the plunger tube

is reciprocated relative to the cylinder and serving to close the end passages of the plunger as the plunger tube is moved outward with reference to the cylinder, whereby fluid contained within the annular chamber is forced into the central passage of the plunger and out through its discharge end to the sprayer nozzle, while on movement of the plunger tube in the opposite direction the ring valve is moved away from the end passages, allowing the fluid to flow from the cylinder chamber through the end passages and through the ports connecting the annular recess with the interior of the plunger rod, and thence from the outlet end of the plunger tube to the spray nozzle.

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