Nov. 17, 1953 T. T. GRAHAM 2,659,629

RECHARGEABLE PRESSURE SPRAY DEVICE

Filed Aug. 10, 1949

Fig. 1

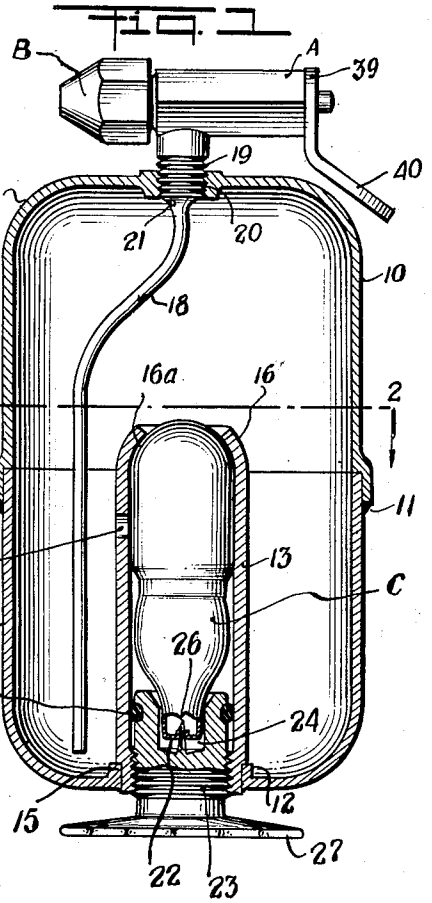


Fig. 3

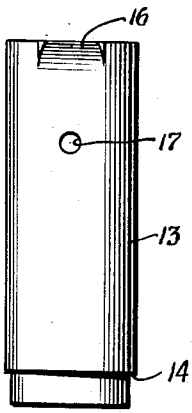


Fig. 5

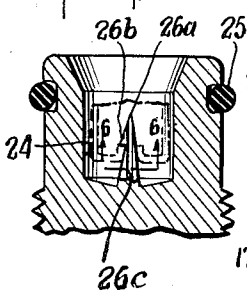


Fig. 6

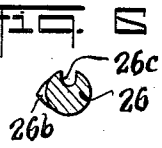


Fig. 2

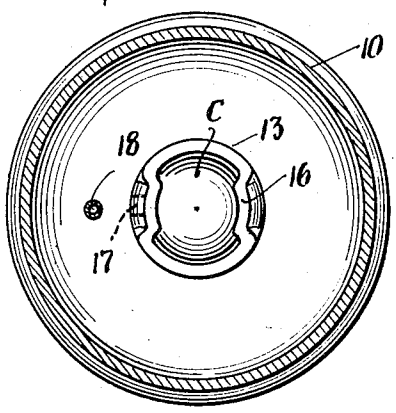
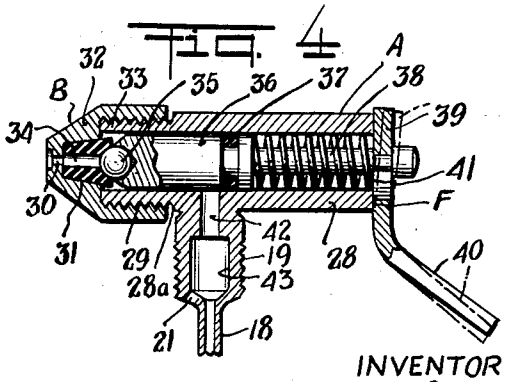


Fig. 4



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RECHARGEABLE PRESSURE SPRAY DEVICE

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3 Claims. (Cl. 299—95)

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This invention relates to new and useful improvements in rechargeable pressure spray devices.

One object of the invention is to provide an improved pressure spray device which is adapted to receive any suitable liquid to be sprayed such as an insecticide, paint, liquid wax, etc., which is so constructed that the device may be properly pressurized or charged, whereby the liquid within the device may be sprayed or dispensed as desired; the device being adapted to be charged at relatively high pressures.

An important object of the invention is to provide an improved spray device which is adapted to receive a liquid to be sprayed and which has means for repressuring or recharging the device with the usual pressure charge cartridge, whereby the device may be continuously refilled and recharged and need not be discarded as is usual with the "pressure bomb" type of spray devices now in general use.

A further object is to provide a spray device, of the character described, wherein the recharging cartridge containing a pressure medium is mounted in a position in communication with the interior of the liquid container of the device and remains in such position until the liquid has been entirely dispensed or used, whereby all of the pressure medium in the cartridge is utilized in operating the device.

Still another object is to provide an improved rechargeable spray device, of the character described, having an improved filling arrangement whereby the device may be filled with the liquid to be sprayed to a desired level whereby the allowable air space for the reception of the pressure medium gas is controlled thereby to control the pressure to which the device is charged and also to control within certain limits the liquid to pressure medium ratio.

Still another object is to provide an improved spray device wherein the liquid and pressuring medium are brought together in a mixing chamber in advance of the ejection nozzle; said mixing chamber functioning to thoroughly admix the liquid and pressure medium to assure proper atomization of the liquid being sprayed.

A still further object is to provide a spray device, of the character described, wherein the opening establishing communication between the liquid eduction tube and the pressure medium chamber may be varied in size to provide a control of the liquid to pressure medium ratio of the mixture which is to be discharged from the outlet nozzle of the device.

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A still further object of the invention is to provide an improved control valve for a spray device which controls the discharge of the pressure liquid from the device, said valve providing for an instantaneous release when opened and an automatic shut-off when closed; the structure of said valve being such that the valve does not close directly against the pressure in the device which assures a more efficient closing action.

A further object is to provide a spray device which is constructed so that it may be more economically manufactured and which includes an improved type of puncturing element for opening the repressuring cartridge and for assuring that said cartridge will remain open until the contents of the device are dispensed; said puncturing element also having means engageable with the cartridge, whereby said cartridge may be withdrawn from the device by means of said element.

Other and further objects of this invention will appear from the following description.

In the accompanying drawings which form a part of the instant specification and which are to be read in conjunction therewith and wherein like reference numerals are used to indicate like parts in the various views:

Figure 1 is a transverse vertical sectional view of a spraying device constructed in accordance with the invention,

Figure 2 is a horizontal cross-sectional view taken on the line 2—2 of Figure 1,

Figure 3 is an elevation of the cartridge receiving tube,

Figure 4 is an enlarged vertical sectional view of the control valve,

Figure 5 is an enlarged sectional detail of the closure member for the cartridge receiving tube, and

Figure 6 is an enlarged horizontal cross-sectional view taken on the line 6—6 of Figure 5.

In the drawings, the numeral 10 designates a container or vessel which forms the main part of the spraying device and which is preferably constructed of an upper half 10*a* and a lower half 10*b* which are connected together with a slip joint connection and then suitably welded along an annular bead 11. The bottom of the container is formed with an axial opening 12 which receives the lower end of a tube or sleeve 13 and the extreme lower portion of said tube is preferably reduced to provide an external shoulder 14 on said tube which engages an upstanding annular rim 15 provided within the container. The tube 13 may be welded or otherwise secured within the

opening 12 and the upper or inner end of the tubing has its peripheral portion indented or curved inwardly as indicated at 16, with the indented portions 16 being preferably located diametrically opposite each other. As will be explained, the tube 13 forms a receptacle for a gas cartridge C, and the inner surfaces 16a of the indented portions 16 provide a seating surface for said cartridge.

The tube 13 is provided with a port or opening 17 in its wall and the position of this opening with respect to the bottom of the container 10 may be varied. An eduction or discharge tube 18 extends from the bottom of the container and has connection with a threaded nipple or fitting 19 which is secured into an opening 20 formed axially in the top of the container 10. A control valve A having a discharge nozzle B is connected with the upper end of the nipple 19 and said valve is disposed exteriorly of the vessel as is clearly shown in Figure 1. As will be hereinafter explained, when the valve A is opened liquid is drawn upwardly through the tube 18 while the gas or other pressure medium in the upper portion of the container may pass into the tube through an opening 21 located just below the nipple 19. Actually, when the valve is opened the pressure medium in the upper portion of the container passes through the opening 21 and functions to siphon or withdraw liquid upwardly through the eduction tube 18. The mixture of the pressure medium and the liquid is then discharged through the nozzle B in the form of an atomized spray.

In filling the container 10, said container is inverted from the position shown in Figure 1 and the liquid to be sprayed, which may be an insecticide, paint, liquid wax or any other non-coagulating, non-viscous liquid, is introduced through the open end of the tube 13. The liquid will enter the container until its level reaches the elevation at which the port or opening 17 is located and with the container inverted it will be evident that air will be trapped between the plane in which the opening 17 is located and the bottom of the container. This trapped air prevents any further liquid from being introduced into the interior of the container and assures that a desired space will be allowed within the container for the reception of a pressuring medium.

After the liquid is introduced into the container 10 a gas cartridge C, such as may be purchased on the open market, is inserted into the tube and the rounded inner end of the cartridge will engage the seat 16a. The cartridge C may contain any suitable gas under pressure, such as CO_2 or Freon, and the length of the tube is such as to locate the reduced end 22 of the cartridge within the tube. As is well known, the reduced end 22 of the cartridge C is normally closed by a lead or other soft metal closure.

Following insertion of the cartridge C a plug element or closure 23 is adapted to be threaded within the end of the tube 13 and this closure has a cylindrical sump or recess 24 formed in its inner end for receiving the reduced end of the cartridge C. An O-ring or other elastic sealing member 25 which is mounted within a peripheral groove on the plug element is adapted to form a pressure-tight seal between the element 23 and the wall of the tube or sleeve 13. In the base of the recess 24 of the plug element an axial pin 26 is provided and when the plug element is threaded into the tube as illustrated in Figure 1, the pin 26 is arranged to puncture the lead closure 22 of the cartridge C. The pin 26 is of a particular construction being formed with a pointed end 26a and having an overhanging prong 26b at one side thereof. The pin also has a vertical channel or groove 26c (Figure 6) formed therein. When the pin punctures the material at the end of the cartridge C said pin enters the interior of the cartridge and the prong 26b overhangs the material which has been displaced by the entry of the pin as indicated in dotted lines in Figure 2. Because the pin is substantially cylindrical in cross-section and because the material which closes the cartridge is relatively soft, there might be a possibility of said material closing around the pin, and the groove or recess 26c in said pin prevents any possibility of an unintentional closure of the cartridge. Thus, once the cartridge is punctured said cartridge is open and the pressure medium therein may escape through the tube and then into the interior of the main container 10.

The parts are so proportioned that when the plug element 23 is threaded into the tube or sleeve 13 as shown in Figure 1, the pin 26 has opened the cartridge C and has released the pressure medium into the container 10. The plug element 23 is formed with an enlarged circular disc or flange 27 which has its peripheral edge uniformly scalloped to provide a firm hand gripping surface whereby threading of the plug element into the tube or sleeve is facilitated. The enlarged flange or disc 27 is of sufficient area so that it may function as a support or base member for the entire device after the same has been re-pressured and is ready for use.

After the device has been properly filled and pressured by means of the cartridge C the liquid may be dispensed or sprayed as desired by manipulation of the control valve A. The details of the valve A are clearly shown in Figure 4 and include a cylinder or housing 28 having one end threaded at 29 to receive the discharge nozzle B. The nozzle is generally conical in shape and has a restricted discharge opening or orifice 30 and inwardly of the orifice is a recess 31 which is adapted to receive a valve seat member 32. The valve seat member is preferably constructed of an elastic material such as neoprene and has an annular seating surface 33 at its inner end with an axial passage 34 communicating with the orifice in the discharge nozzle. A ball valve 35 is adapted to engage the seat 33 and is carried by the inner end of a plunger 36. The bore 28a of the housing is slightly larger than the plunger and a seal between said plunger and said bore is formed by an O-ring or other elastic sealing member 37. An operating stem 38 of reduced diameter extends from the plunger and has its outer end projecting from the end of the housing or cylinder, said outer end having connection with the upper end 39 of an operating handle 40. A coil spring 41 which surrounds the stem 38 is confined between the plunger and the upper end 39 of the handle and constantly exerts its pressure to hold the valve 35 in a seated position.

With the valve 35 engaging its seat, the annular packing 37 around the plunger is disposed beyond a passage 42 which extends through the connecting nipple 19 and one end of this passage communicates with the bore 28a of the cylinder 28. The other end of the passage is in communication with a mixing chamber 43 which is formed within the connecting nipple 19 and said

chamber has its opposite end communicating with the eduction or discharge tube 18. The opening 21 in the upper portion of the tube 18 communicates with the mixing chamber 43 and thus when the valve 35 is opened the pressure medium from within the upper end of the container 10 flows through the opening 21 into the mixing chamber and then into the bore of the cylinder through the reduced passage 42. This pressure medium creates a suction effect and also due to its pressure upon the liquid level forces liquid upwardly through the tube 18; it is apparent that the pressure medium and the liquid are admixed within the mixing chamber 43 and then flow outwardly around the plunger 36 past the unseated valve 35 and through the orifice 30 in the nozzle B. The mixing chamber assures proper atomization of the liquid so that efficient spraying from the nozzle is assured. Opening of the valve is effected by depressing the handle to the dotted line position shown in Figure 4 with the handle fulcruming at the point F. When the handle 40 is released the spring 41 immediately returns the valve to a seated position and because the plunger 36 and valve 35 are moving in the direction of flow, the flowing liquid under pressure will actually assist in moving the valve 35 to a seated position. In other words, the valve plunger 36 and valve 35 are not moved directly against the pressure liquid but are rather moved along the line of flow of the discharging liquid with the result that a quick closing action on the valve is had.

As has been noted the coil spring 41 acts against the valve plunger 36 to hold the valve 35 in a seated position and the O-ring 37 confines the pressure in the area between the O-ring and the ball 35 so that this pressure is acting against that end of the piston in which the ball is mounted. It is evident that by controlling the size and strength of the spring 41, the valve plunger 36 is maintained seated against a desired pressure; however, if the pressure in the area around the ball 35 and acting against the end of the plunger exceeds the pressure of the spring 41 the plunger will be moved to an open position automatically so that pressure may escape from the vessel. In this manner, the valve and the particular arrangement of pressure acting thereon, together with the spring 41, provides an automatic relief valve which will prevent excessive pressure building up within the container. This structure eliminates the necessity of requiring a separate relief valve since the relief feature for relieving excessive pressure is incorporated in the single control valve.

It is pointed out that the opening 21 in the upper portion of the tube 18 may be varied in size to vary within certain limits the ratio of pressure medium to liquid; obviously, if this opening is larger, a larger volume of pressure medium will be permitted to flow into the mixing chamber to admix with the liquid, whereas if the opening is smaller a lesser volume of pressure medium is introduced into the chamber.

It is apparent that the valve A may be manipulated as desired to spray or dispense the liquid within the container 10 in a desired manner. The pressure medium cartridge C remains in position within the device and the pin 26 maintains the end 22 of said cartridge open at all times. Thus, all of the pressure within the cartridge C will ultimately be discharged into the container and will subsequently be ejected along with the liquid through the discharge nozzle B.

It might be noted that unless the cartridge C remains in communication with the liquid chamber of the device at all times the entire gas supply within the cartridge C would not be utilized.

From the foregoing it will be seen that a simple and efficient spraying device is provided. The opening 17 in the tube not only controls the amount of liquid which may be introduced but also by its position will control the final pressure medium to liquid ratio. After the liquid is introduced the cartridge C is inserted within the tube 13 and the plug element 23 threaded into the tube whereby its pin may puncture the cartridge C and permit escape of the pressure medium into the container. The parts remain in this position until the container has been emptied through the discharge of fluid through the spray nozzle. Due to the overhanging prong 26*b* of the puncturing pin 26 removal of the plug element from the tube will result in a withdrawal of the cartridge C. The cartridge may then be disconnected from the pin and discarded, after which the container may be refilled with the desired liquid and properly repressured by insertion of a new cartridge in position within the tube.

The control valve A is of exceptionally simple construction and is arranged to provide for quick opening and quick closing. Before being discharged the liquid under pressure is passed through the mixing chamber 43 where it is thoroughly admixed with the pressure medium which assures efficient atomization of the liquid being discharged from the nozzle B.

It is pointed out that by locating the charging cartridge within a receptacle which is in constant communication with the interior of the container wherein the liquid is disposed, it is possible to utilize all of the pressure from the cartridge. Thus, the container may be charged under a relatively high pressure because with the cartridge being held open the actual pressure charge within the container is the pressure of the medium within the cartridge. The increased pressure is desirable because obviously, when the control valve A is opened the higher pressure will result in a greater spray of the liquid and will also project the spray a greater distance from the nozzle.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth together with other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having described the invention, I claim:

1. In a rechargeable spray device having a liquid container with an outlet in its upper end and a control valve communicating with the outlet for controlling the discharge of liquid from the container through said outlet, a sleeve mounted wholly within the interior of the container having its inner end communicating with the interior of the container and its outer end secured to the inner wall of the container, the bore of the sleeve being open to atmosphere through an opening in the bottom of the con-

tainer, whereby said container may be inverted and the liquid introduced through said sleeve, said sleeve having a lateral port in its wall intermediate its ends at a predetermined point for controlling the level to which the container may be filled, a recharging pressure medium cartridge insertable entirely within the sleeve, a closure for the open end of the sleeve for confining the cartridge therein, thread means connecting said closure to said sleeve to permit said closure to move inwardly toward said cartridge, and a puncturing element carried by the closure adapted to engage and puncture the end of the cartridge when the closure is threaded inwardly within the sleeve, said thread means holding said puncturing element within said cartridge after puncturing thereof, and said puncturing element having a vertical channel establishing communication from the interior of said cartridge to the exterior thereof whereby there is effected a release of the pressure medium from the cartridge into the interior of the container.

2. A sprayer device including, a container for receiving a liquid to be sprayed and having an outlet opening at one end thereof, a receptacle having communication with the interior of the liquid container and spaced from the outlet opening thereof, a cartridge having a pressurizing medium therein insertable within the receptacle, a closure for closing the end of the receptacle and for confining the cartridge therein, means on the closure for opening said cartridge to release the pressurizing medium into the interior of the container to pressurize the same, a liquid eduction tube extending from the lower portion of the container to the outlet opening in the end of the container, a control valve having communication with the outer end of said tube for controlling the discharge of the liquid therefrom, and a communication port in the upper portion of the tube below the outlet and above the liquid level in the container for permitting the pressure medium in the upper portion of the container to enter the tube and admix with the liquid therein, said control valve including a housing having a discharge opening, a slidable plunger in said housing, an annular shoulder on said plunger sealing with said housing; and a spring in said housing remote from said discharge opening and engaging said shoulder to urge said plunger to close said discharge opening.

3. The sprayer device set forth in claim 2, together with a discharge nozzle connected to the valve for discharging atomized liquid therefrom when said valve is opened, said nozzle having a resilient valve seat therein, and a ball valve on said plunger remote from said shoulder and engageable with said seat to close said nozzle, said outer end of said tube being disposed between said ball valve and said shoulder whereby said container can be pressurized by injecting a pressure medium into the nozzle to force said valve open.

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