March 17, 1953 W. B. KOCHNER ET AL 2,631,891

PRESSURE SPRAYER

Filed April 20, 1948 2 SHEETS—SHEET 1

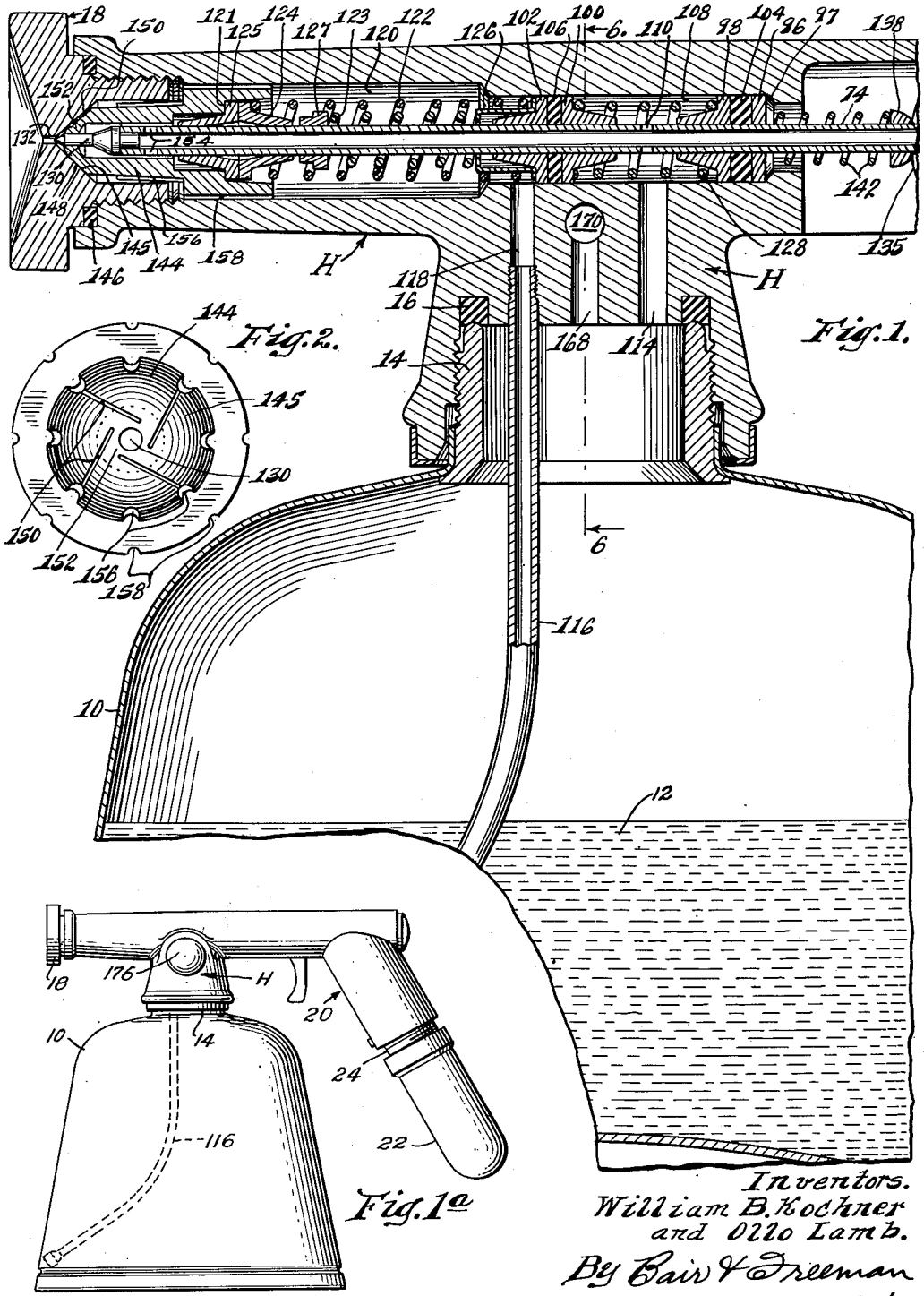

Fig. 1.

Fig. 2.

Fig. 1a

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Fig. 3.

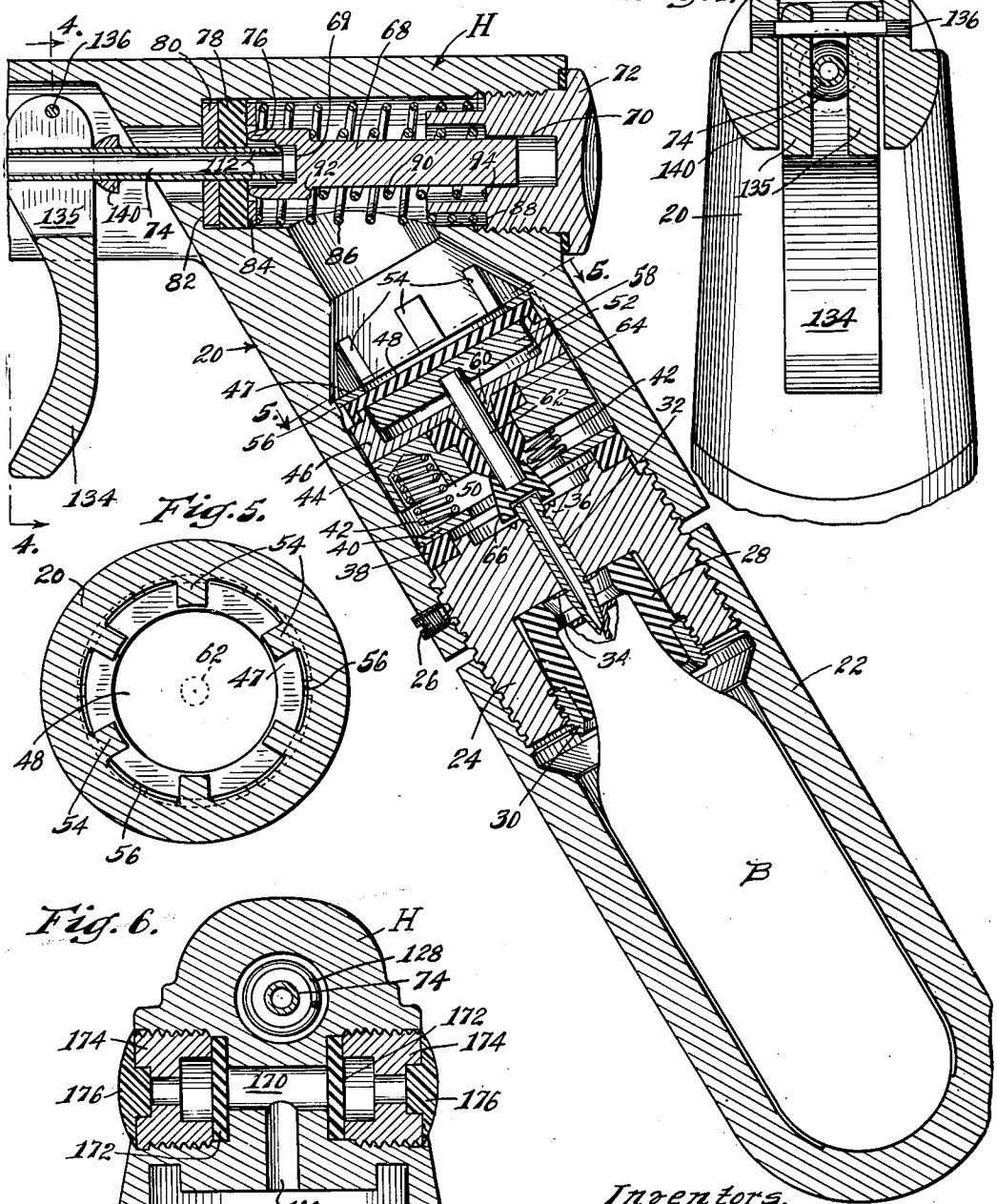

Fig. 4.

Fig. 5.

Fig. 6.

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PRESSURE SPRAYER

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6 Claims. (Cl. 299—89)

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Our present invention relates to a sprayer for insecticide and the like which is operated by pressure from a bulb of high pressure air or gas.

One object of the invention is to provide a sprayer including a container for the liquid to be sprayed and constituting a low pressure chamber, a regulating valve being interposed between a high pressure chamber and the low pressure chamber, and control of the spray being effected by admitting air or gas under pressure from the high pressure chamber to the low pressure chamber for displacing the liquid contents therefrom through a spray nozzle.

Another object is to eliminate the possibility of the liquid absorbing the air or gas and thereby reducing the pressure available for spraying as experienced with those types of sprayers wherein the pressure of the gas is continuously imposed on the liquid.

Still another object is to provide a container for liquid, and a control valve that admits gas to the container for displacing liquid, gas admission being permitted only when dispensation of the liquid is desired.

A further object is to provide a control valve arrangement which effects cut-off of the liquid at the discharge orifice to prevent dripping.

Still a further object is to provide a valve of the character just disclosed which is operated by a trigger or the like and includes a valve means for controlling the flow of gas from the high pressure chamber to the low pressure chamber under control of the same trigger.

An additional object is to provide means to permit discharge of high pressure gas with the liquid at the discharge orifice for more finely atomizing the liquid which is particularly desirable for indoor spraying to permit faster evaporation of the solvents and/or vehicle for the lethal ingredient in an insecticide liquid or the like.

With these and other objects in view, our invention consists in the construction, arrangement and combination of the various parts of our device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in our claims and illustrated in the accompanying drawings, wherein:

Figure 1 is an enlarged vertical sectional view through a sprayer embodying our invention from which the handle has been omitted.

Figure 1ª is a side elevation of the sprayer on a reduced scale.

Figure 2 is a front elevation of an insert in the spray nozzle showing spiral grooves to produce whirling action of the liquid as it is discharged.

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Figure 3 is a vertical sectional view through the handle of the sprayer and is a continuation of the upper right corner of Figure 1.

Figure 4 is a sectional view on the line 4—4 of Figure 3 showing a trigger mounting.

Figure 5 is a sectional view on the line 5—5 of Figure 3 showing constructional details, and

Figure 6 is a vertical sectional view on the line 6—6 of Figure 1 showing a safety relief valve arrangement.

On the accompanying drawings, we have used the reference number 10 to indicate a container for liquid 12 such as insecticide or the like. The container 10 has a threaded neck 14 on which a head H is threaded, with a gasket 16 interposed between the two for sealing purposes. The head H may be removed for filling the container 10.

The head H extends forwardly to an orifice member 18 and rearwardly to a handle member 20. The handle member 20 has an extension in the form of a bulb holder 22 threaded on a connecting member 24, which in turn is threaded in the handle 20. A set screw 26 is provided to normally hold the connecting member 24 in a predetermined position in relation to the handle 20.

The connecting member 24 has a sealing sleeve 28 held in position by a bushing 30. The sleeve 28 is adapted to seal against the neck of a gas bulb B which is forced into the sleeve 28 by the holder 22 when threaded on the member 24. The upper end of the bulb at that time is pierced by a combined piercing pin and valve seat element 32, the lower end of the element being sharpened for piercing purposes. The element 32 is retained in position by a split washer 34 soldered to the piercing pin and to the member 24 and by staking 36 at the upper end of the element.

A regulator valve is provided in the handle 20 consisting of a gasket 38, a washer 40, three springs 42, a disc 44, a diaphragm disc 46, a diaphragm 48 of flexible material such as Vinylite and a washer 47. The springs 42 are interposed between the washer 40 and the disc 44, being located in sockets 50 of the disc. They retain the gasket 38 compressed so there is no leakage from the chamber between the washer 40 and the disc 44 to atmosphere along the threads between the handle 20 and the connecting member 24.

The springs also compress the edge of the di-

aphragm 48 between the upper end of the diaphragm disc 46 and the washer 48 to seal a closed chamber 52 between the diaphragm 48 and the diaphragm disc 46 from the space in the handle 20 above the diaphragm 48. The washer 47 is seated against six projecting lugs 54 in the handle 20 and its edge is spaced from the bore of the handle by six circumferentially distributed ribs 56 between the lugs 54.

Within the chamber 52 a follower disc 58 is mounted against the diaphragm 48. The disc 46 has a hub 60 slidably receiving a valve pin 62 and fitting tightly into a packing 64. The valve pin extends slidably through the packing 64 and terminates at its lower end in a valve cap 66. The valve cap 66 is recessed to fit over the upper end of the valve seat element 32 and to seat thereagainst at times for sealing purposes. At atmospheric pressures the valve 66 would be unseated from the valve element 32 as shown in Figure 3. Upon piercing of the bulb B and discharge of gas therefrom through the element 32 and around the edges of the discs 44 and 46 and the washer 47 to the top of the diaphragm 48, there would result depression of the diaphragm and closure of the valve 66 against the element 32. Thus the valve serves to act as a regulator with the high pressure on top of the diaphragm 48 balancing against the pressure of trapped air in the chamber 52. Any time there is a reduction in pressure in the upper end of the handle 20 due to using gas for liquid dispensation purposes, the valve 66 will be opened automatically for admitting additional gas and will act as a pressure regulator therefor.

The pressure regulator just referred to is a sole invention of Ollo Lamb, one of the present co-inventors, and is claimed in his copending application, Serial No. 688,197, filed August 3, 1946. At the top of the handle 20 a gas valve is provided in the form of a slidable valve member 68 sliding in the bore 70 of a closure plug 72 and on a valve operating tube 74. The valve member 68 is provided with an annular valve lip 76 normally seated against a gasket 78 supported by a washer 80. The washer is positioned against a shoulder 82 of the head H. The gasket 78 and the washer 80 are retained against the shoulder by a washer 84 and a spring 86. The spring 86 is interposed between the washer 84 and a shoulder 88 of the closure plug 72. A second spring 90 is interposed between a shoulder 92 of the valve element 68 and a shoulder 94 of the closure plug 72 for the purpose of normally seating the valve lip 76 against the central portion of the gasket 78.

The valve operating tube 74 extends forwardly as in Figure 1 and is slidable through washers 96, 98, 100, 102, 124 and 125. Between the washers 98 and 96, a packing washer 104 is provided and between the washers 100 and 102 a packing washer 106 is provided. This provides a sealed-off space 108 in the head H into which gas may be discharged from an opening 110 of the tube 74. At the rear end of the tube an opening 112 is provided into which the gas may flow after passing between the valve seat 76 and the gasket 78.

Returning to Figure 1, the washers 96 and 125 are seated against stationary shoulders 97 and 121. The chamber 108 communicates with the container 10 by means of a passageway 114 in the head H so that gas pressure can be imposed on the liquid 12 in the container. Such gas pressure tends to displace the liquid through a syphon tube 116 and a passageway 118 into a chamber 120 of the head ahead of the washer 102.

A return spring 123 is located in the chamber 120 and interposed between a collar 127 secured to the tube 74 and a flanged cup-like sleeve 126 positioned against the washer 102. Heavy pressure springs 122 and 128 are located in the chambers 120 and 108, respectively and interposed between the washers 102 and 124 and the washers 98 and 100. The springs 122 and 128 serve as spacers and compress the packings 104 and 106 against the tube 74 to provide the chamber 108 sealed off from atmosphere and from the chamber 120.

The valve operating tube 74 may be manually retracted by means of a trigger 134 pivoted on a pin 136. The ends of the pin are located in the head H as shown in Figure 3, and stop collars 138 and 140 are mounted on the tube on opposite sides of a bifurcated upper end 135 of the trigger 134. The collar 138 is slidably mounted on the tube 74 and is retained lightly against the trigger 134 by a spring 142, whereas the collar 140 is secured to the tube by soldering or brazing so that when the trigger 134 is pulled toward the handle 20 it will engage the collar 140 and slide the tube 74 toward the right.

At the front end of the valve operating tube 74 a needle valve 130 in the form of a plug is attached so that it is an integral part of the tube. The needle valve normally closes a discharge orifice 132 in the fitting 18 by contacting its inner edge under bias of the spring 123. A liquid discharge fitting 144 is located in the forward end of the chamber 120 and retained therein by the orifice member 18 which has a cone shaped opening 148. The front end 145 of the fitting 144 is similarly cone shaped and is provided with grooves 150 arranged tangentially to a gas discharge opening 152 of the fitting 144. Gas is admitted from the tube 74 to the interior of the fitting 144 through openings 154 in the wall of the tube just back of the needle valve 130. The fitting 144 has longitudinal grooves 156 and 158 to permit passage of liquid past the outside of the fitting to the outer ends of its tangential grooves 150. A gasket 146 seals the fitting 18 in the head H.

Referring to Figure 6 the head H is provided with a passageway 168 connected with a cross passageway 170. The ends of the passageway 170 are closed in relation to atmosphere by puncturable diaphragms 172 of Vinylite or the like which are held in position by screw plugs 174. The plugs 174 in turn are plugged by plugs 176 of plastic or the like frictionally held in position.

Practical operation

In the operation of our pressure sprayer, when the bulb B is connected to the handle 20 in the manner disclosed in Figure 3, gas from the bulb will flow through the piercing pin 32 and into the handle 20 above the diaphragm 48. The diaphragm will then effect closure of the valve 66 when a predetermined pressure in the handle is produced. This pressure may be varied by adjusting the connecting member 24 in relation to the handle 20 after loosening the set screw 26. The set screw is then retightened to retain the adjustment.

When it is desired to dispense liquid 12 in spray form from the orifice 132, the trigger 134

may be depressed which first withdraws the needle valve 130 from the orifice and then effects engagement of the rear end of the valve operating tube 74 with a shoulder 69 of the valve member 68. Thereupon the valve lip 76 is unseated from the gasket 78 permitting gas flow from the handle 20 through the openings 112 to the interior of the tube 74.

The gas flows forwardly in the tube and discharges through the openings 110 and the passageway 114 to impose pressure on the liquid 12 in the container 10. Liquid displaced from the container 10 by the gas entering it through the passageway 114 flows upwardly through the syphon tube 116 and the passageway 118 into the chamber 120 and then through the grooves 156, 158 and 150 to the orifice 132 from which it is sprayed. The needle valve 130 can be adjusted by the trigger 134 to remain in the opening 152 or to open it if desired so that gas is then also discharged through the orifice 132 wherein it mixes with the liquid.

The liquid being discharged under pressure and the gas mixing with it effect spraying and fine atomization of the liquid. This is particularly desirable for inside spraying to prevent covering house furnishings and the like with a film of insecticide as happens when the spray is coarse. To aid in the atomization, the grooves 150 are arranged tangentially in relation to the opening 152 to give to the liquid a whirling action as it enters the orifice 132.

When the desired amount of spray has been dispensed, the trigger 134 is released, whereupon the gas valve 68 first closes and then the needle valve 130 closes against the edge of the orifice 132 for cutting off all further liquid and preventing drip.

In the event that coarse spraying is desired, the discharge of gas can be dispensed with. In other words, the dispensation of liquid may be entirely by displacement but this produces a coarse spray, although it does economize on the use of gas under high pressure. A coarse spray is suitable for outdoor spraying, whereas for indoor spraying a finer spray, as already mentioned, is desired and can be produced by using gas discharge in addition to liquid discharge.

In the dispensation of liquids by the use of gas under pressure to displace them, the liquids rapidly absorb certain gases and particularly CO_2, this being the most commonly used gas for this purpose. Due to such absorption the available gas pressure rapidly drops and the pressure drop is accelerated when the dispenser is shaken or otherwise disturbed. Also the higher the pressure used, the greater absorption and the more rapid proportional decrease in pressure.

We have therefore provided a dispenser or sprayer which admits high pressure gas to the liquid containing chamber only when dispensation is desired. After the spraying operation, the gas is shut off in the handle 20 and the bulb B, instead of being admitted to the chamber 10 where it can be absorbed by the liquid therein. By then providing for the discharge of gas only at the time liquid dispensation is desired, the usual continuous absorption during intermediate periods of use is eliminated.

We have provided a means to divert a portion of the gas directly into the nozzle orifice so that a finely divided atomization, particularly desirable for indoors spraying, can be had. At the same time the valve is so constructed that drippage after use is eliminated due to shut-off being accomplished at the nozzle itself.

The puncturable discs 172 of Figure 6 provide a safety feature in that they relieve pressure from the container 10 when, due to valve leakage or other causes, the pressure exceeds a predetermined safe value. This value is determined by the size and thickness of the discs 172 and when the safe pressure is exceeded it punctures one or the other of the discs and the excess pressure leaks through the plug 174, blowing the plug 176 out to permit final discharge to atmosphere. Ordinarily the discs 172 are never called upon to be punctured during normal operation of the dispenser but in the event that trouble develops and the pressure becomes dangerously high a disc 172 will be punctured before the container 10 will be damaged. After the trouble is remedied, the disc can be readily renewed.

Some changes may be made in the construction and arrangement of the parts of our device without departing from the real spirit and purpose of our invention, and it is our intention to cover by our claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

We claim as our invention:

1. A device of the character disclosed comprising a container for liquid, a head mounted on said liquid container, a spray nozzle at the forward end of said head and having a discharge orifice, a handle at the rearward end thereof, a high pressure gas chamber in said handle, a gas valve in the rearward portion of said head communicating with said gas chamber, a valve operating tube extending fore-and-aft within said head, a trigger ahead of said handle for effecting longitudinal movement of said valve operating tube, the rear end of said tube being adaptable for opening said gas valve, the outlet of said gas valve communicating with the interior of said tube, said tube intermediate its ends communicating with said container for supplying gas thereto to displace liquid from said container, the forward end of said tube communicating with said discharge nozzle for discharging gas with the liquid to atomize the same, a needle carried by the front end of said tube and coactible with said discharge orifice for sealing the same, said needle being separable from said orifice by operation of said trigger prior to the opening of said gas valve by said valve operating tube.

2. In a high pressure, gas operated spraying device, a container for liquid, a discharge nozzle communicating with said container below the level of liquid therein, and means to introduce fluid pressure into said container above the liquid to displace the same therefrom comprising a handle member for said sprayer, a high pressure chamber within said handle member, a high pressure gas bulb, connecting and piercing means associated with said handle, a manually controlled valve mounted between said handle and said container to introduce gas to said container to thereby displace liquid therefrom and through said discharge nozzle, and a second manually controlled valve to deliver gas directly to said discharge nozzle to discharge therefrom with the liquid issuing therefrom and to control the same.

3. In a sprayer apparatus, a container for liquid, a discharge nozzle for the liquid, a high pressure gas chamber, a gas control valve, and means of communicating between said gas control valve and said container comprising a valve operating tube communicating with the outlet

side of said gas control valve when the valve is open, said tube being movable for effecting opening of the valve, a pair of packings surrounding said tube, said tube between said packings communicating with said container for supplying gas thereto, and means carried by said valve operating tube for opening the orifice of said discharge nozzle.

4. In a device of the character disclosed, a container for liquid, a head mounted thereon, a spray nozzle at the forward end of said head, a handle at the rearward end thereof, a high pressure gas chamber in said handle, a gas valve in the rearward portion of said head and communicating with said gas chamber, a valve operating tube extending fore-and-aft within said head, the rear end thereof being adaptable for opening said gas valve, the outlet of said gas valve communicating with the interior of said tube, said tube also communicating with said container for introducing gas thereto which discharges liquid therefrom and with said discharge nozzle for discharging gas with the discharging liquid to atomize the same, and a needle carried by the forward end of said tube and coactible with said discharge orifice for sealing the same, said needle being separable from said orifice by sliding of said tube prior to the opening of said gas valve.

5. In a spraying apparatus, a container for liquid, a discharge nozzle for the liquid, passageway means of communication between said discharge nozzle and said container below the level of liquid therein, a high pressure gas chamber, a gas control valve, and means of communicating between said gas control valve and said container comprising a valve operating tube communicating with the outlet side of said gas control valve when the valve is open, said tube being movable for effecting opening of the valve, a pair of packings surrounding said tube, said tube between said packings communicating with said container above the level of liquid therein and discharging gas thereinto to displace liquid therefrom through said passageway means and said discharge nozzle.

6. In a liquid discharge apparatus, a container for liquid, a discharge orifice communicating therewith below the level of liquid therein, passageway means communicating with said container above the level of liquid, a supply chamber adapted to contain gas under high but variable pressure, a second chamber adapted to contain gas under a pressure that is regulated to remain at a lower value than the pressure in said supply chamber until the pressure therein recedes to the regulated pressure in said second chamber, a gas pressure regulating valve between said high pressure supply chamber and said second chamber to effect such regulation and a liquid dispensing control valve between said second chamber and said passageway means operable to admit gas at constant pressure from said second chamber to said container for displacing liquid therefrom.

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OLLO LAMB.

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