

[54] **LIQUID SPRAY APPARATUS**

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Related U.S. Application Data

[63] Continuation of Ser. No. 788,678, Dec. 14, 1968, abandoned.

[52] U.S. Cl.**239/337, 239/373, 239/351, 239/369, 239/530, 239/579, 239/588**

[51] Int. Cl.**B05b 7/32, F23d 13/04**

[58] Field of Search.....**239/337, 579, 408-414, 239/365, 373, 303, 304**

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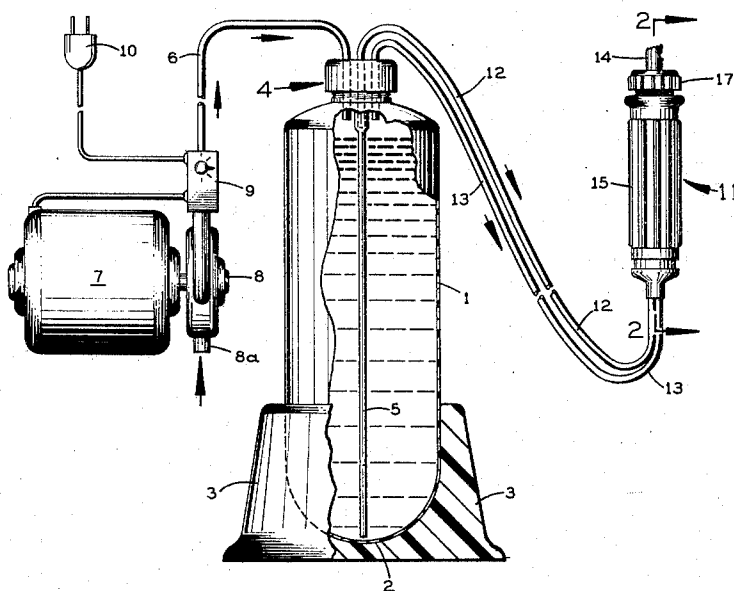
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[57] **ABSTRACT**

A liquid spray apparatus including a hermetically sealed container for retaining liquid connected to a source of pressurized air or other gas for propelling the liquid from an outlet in the container and a hand operated spray gun having a normally closed finger operated valve terminating in a spray nozzle. A flexible tube connecting the liquid outlet of the container to the liquid inlet of the valve. An auxiliary tube connecting the source of air or other gas to the liquid channel in the valve through a metering orifice for atomizing the liquid into spray from the nozzle when the valve is operated.

11 Claims, 9 Drawing Figures



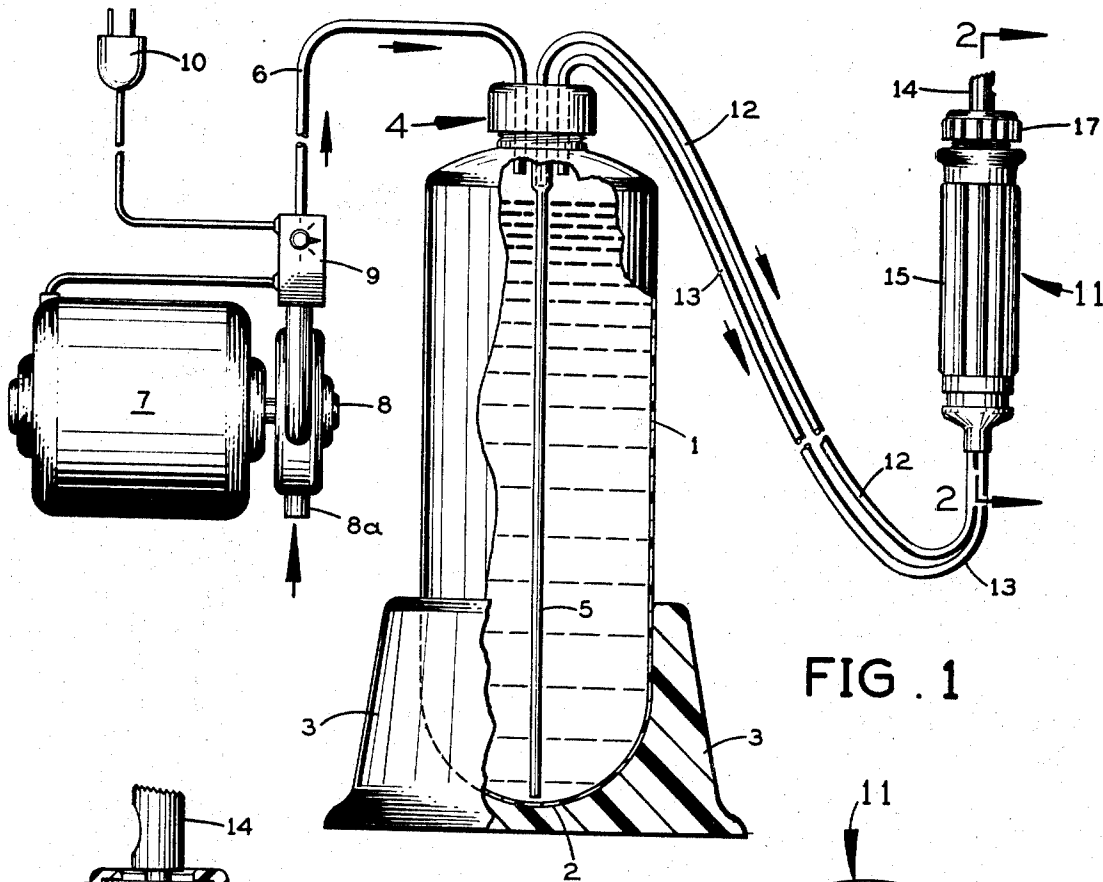


FIG. 1

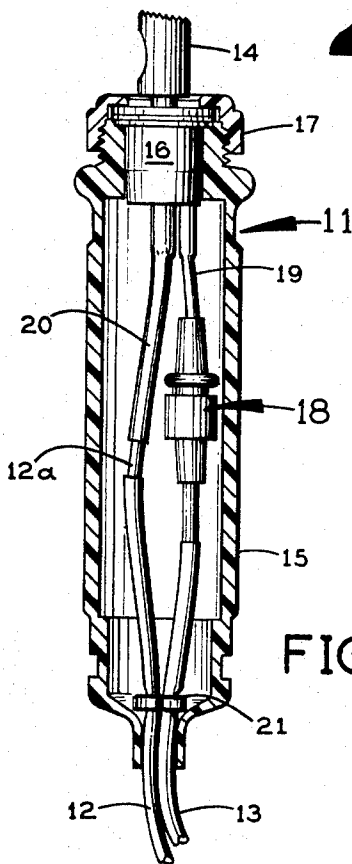


FIG. 2

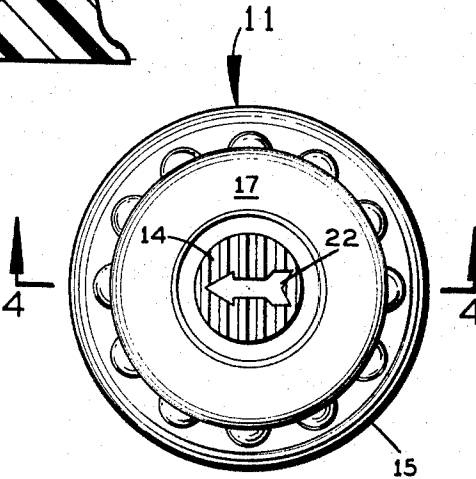


FIG. 3

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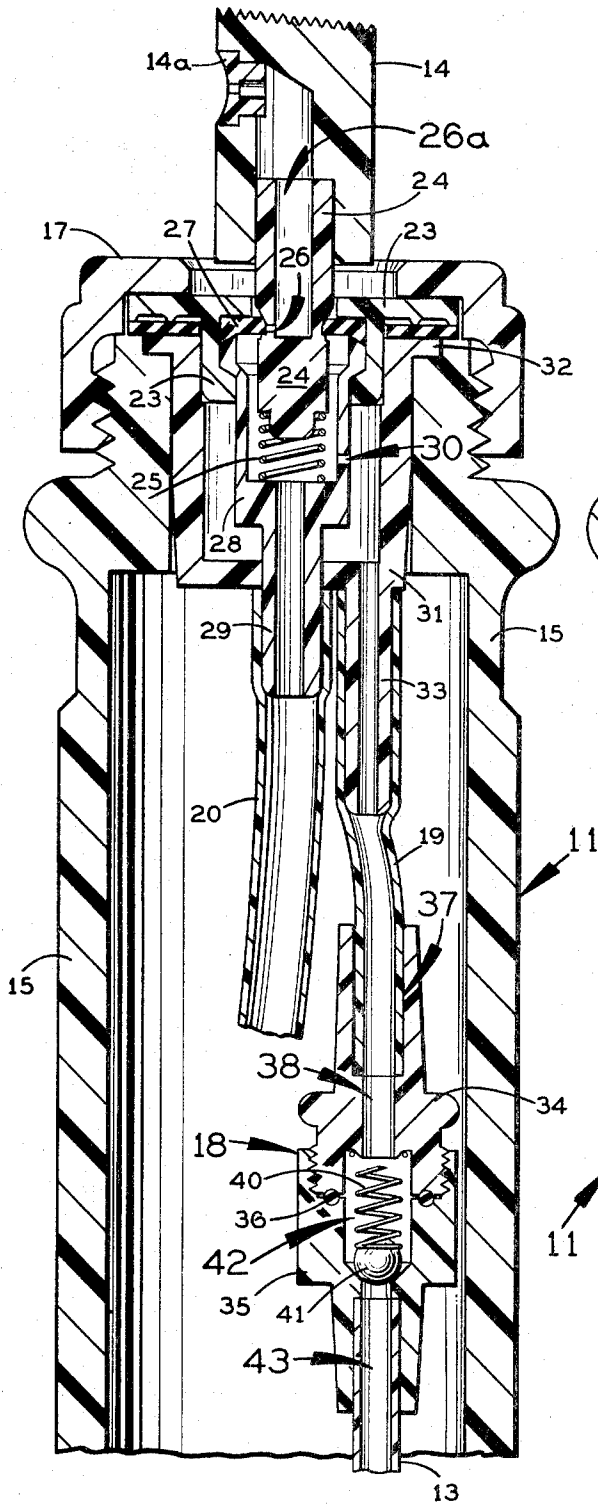


FIG. 4

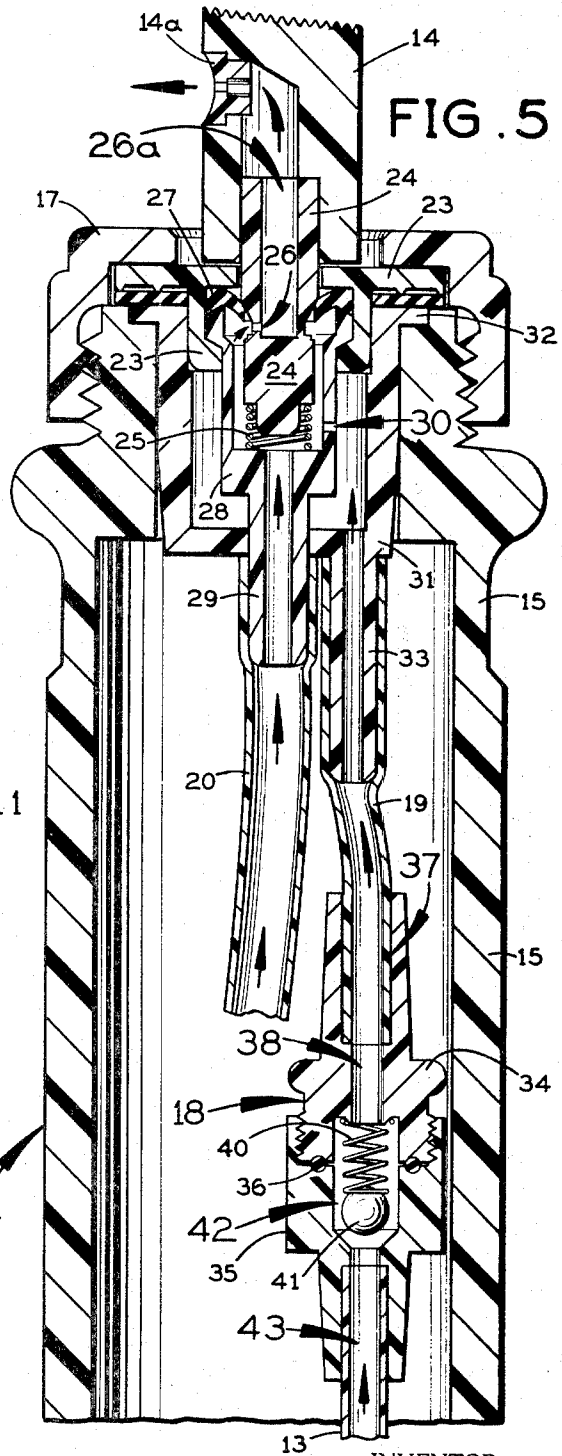


FIG. 5

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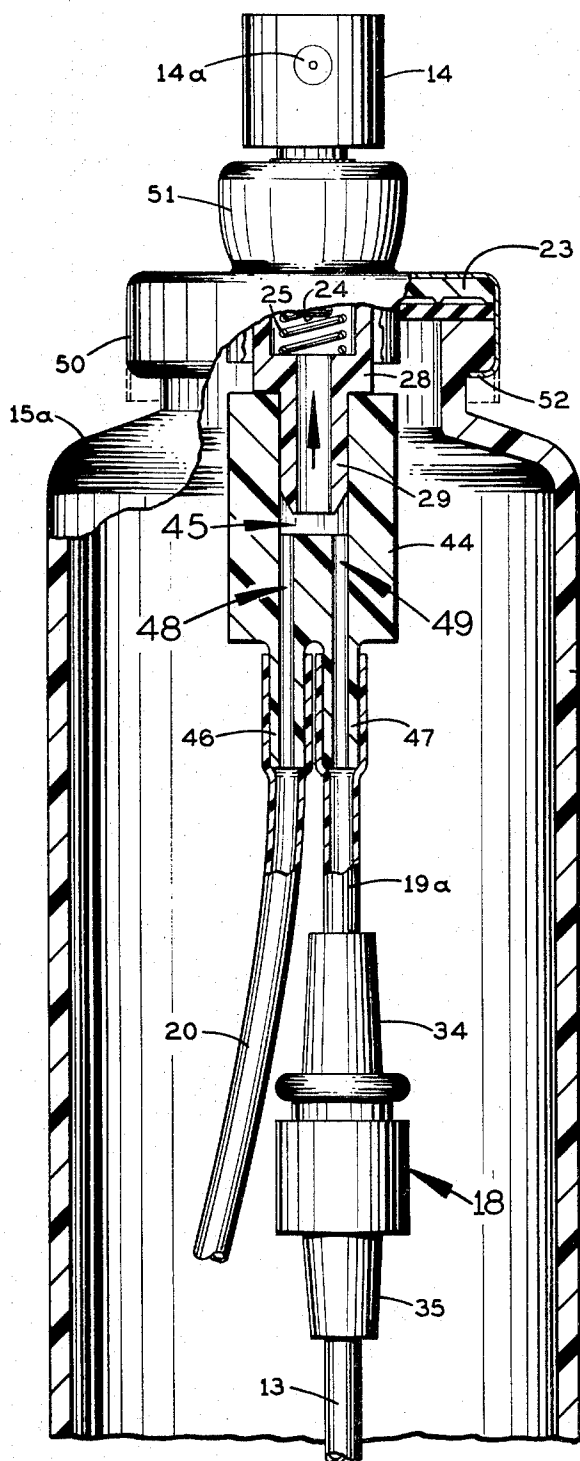


FIG. 7

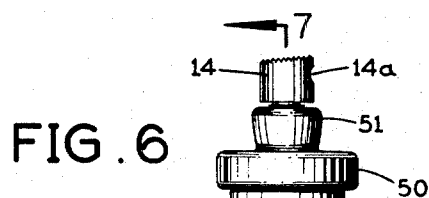


FIG. 6

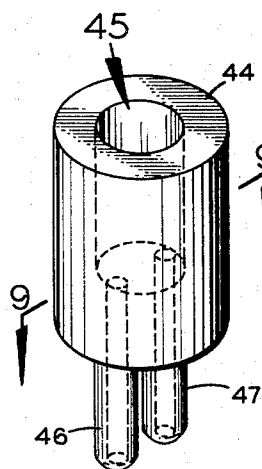


FIG. 8

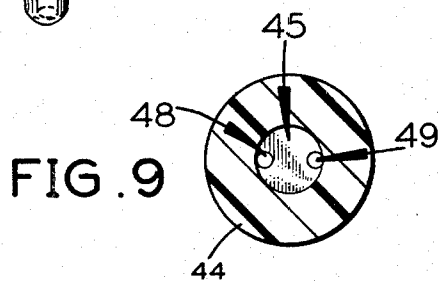


FIG. 9

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LIQUID SPRAY APPARATUS

This application is a continuation of application Ser. No. 788,678, filed Dec. 14, 1968, now abandoned.

This invention relates in general to liquid spray apparatus and more particularly to a hand spray gun remotely connected to a pressurized source of liquid.

Prior spray guns of this general character, such as those used for spraying cosmetic products, utilize a spray gun in which the spray was controlled by lever compressing and releasing air and liquid conducting tubes from an "off" to an "on" position. Other types of spray guns depended upon the use of well known retractable needle valves which often become inoperative through clogging and mis-alignment, and on occasion project an undesirable stream of liquid without being atomized.

The present invention overcomes the above objections and disadvantages by the provision of a hand spray gun remotely connected to a pressurized source of liquid and independently connected to a pressurized source of compressed propellant, such as air, whereby the finger or thumb pressure on a spray nozzle opens a metering port feeding the nozzle by displacing an elastomer member from a sealed position over an outlet port and release an atomized amount of liquid and propellant for producing from predetermined spray from the nozzle.

Another object of the invention is the provision of a spray gun having independent remote tubular connections to a source of liquid and compressed air or gas, including a check valve means in the air tube positioned within the gun for preventing liquid blow back into the source of air.

A further object of the invention is the provision of a liquid spray gun activated by a finger valve means for mixing and releasing pressurized liquid and a gas propellant from a chamber adjacent said valve means for the atomized projection of a spray from the nozzle of the spray gun including a check valve means in close proximity to the chamber for preventing the liquid from entering the propellant supply to the valve.

These and other objects and advantages in two embodiments of the invention are described and shown in the following specification and drawings, in which:

FIG. 1 is a diagram of an air pump, liquid container, and spray gun of the apparatus connected for operation.

FIG. 2 is an enlarged cross sectional view of the spray gun taken through section line 2—2, FIG. 1.

FIG. 3 is an enlarged top plan view of the spray gun shown in FIG. 1.

FIG. 4 is an enlarged fragmentary view of the spray gun shown in FIG. 1 taken through section line 4—4, FIG. 3.

FIG. 5 is the same as FIG. 4 in changed position.

FIG. 6 is a side elevation of a spray gun alternate to that shown in FIG. 1.

FIG. 7 is a fragmentary cross sectional view taken through section line 7—7, FIG. 6.

FIG. 8 is a perspective view of the mixing chamber shown in FIG. 7.

FIG. 9 is a cross sectional plan view taken through section line 9—9, FIG. 8.

Referring to FIG. 1, a container 1, having a spherical lower end 2, preferably made of plastic material, is normally retained in a socket stand 3, as shown. The top is

provided with a closure means 4 which has an orifice to which a dip tube 5 is connected and extends close to the bottom of the container, as shown. A second orifice through the closure means is connected by a flexible tube 6 to an air compressor system comprising a motor 7, an electric air rotary pressure pump 8, having an air inlet 8a, and an adjustable pressure regulator 9, connected to the outlet thereof, and a terminus plug 10 of a power cord from the motor 7 for connection to a source of electric power.

It is to be understood that a cylinder of compressed air or other suitable selected compressed gas propellant, preferably with a well known automatic pressure regulator, may be substituted for the motor driven air pump 7, shown, with satisfactory results.

A spray gun 11 is connected to the central orifice of the container, which is connected to the dip tube by a flexible tube 12 for conducting liquid to the gun. A second tube 13 from the spray gun is connected to a third orifice of the closure means 4, as shown, for conducting air propellant to the gun. The gun assembly 11 is operated by depressing the spray nozzle 14 by the finger or thumb when held in the hand.

Referring to FIG. 2, the hollow gun handle 15 is preferably molded from plastic material and contains a spray valve assembly 16 retained in the upper end of the handle 15 by a cap 17 threaded thereon, to be hereinafter described.

A check valve assembly 18 in the handle is connected between the air supply tube 13 and valve inlet tube 19, as shown.

A liquid conducting tube 12 is connected to a liquid inlet tube 20 by a frictional coupling 12a, as shown. A strain relief clip 21 is secured around both tubes 12 and 13 to prevent disengagement of the valve connections when the tubes 12 and 13 are subjected to strain.

FIG. 3 shows the top view of handle 15, cap 17, and the nozzle 14, which bears an arrow 22 indicating the direction of the spray when operated.

Referring to FIG. 4, the spray valve mechanism, which is operated by depressing nozzle 14, comprises a body member 23, which has a coaxial control member 24 in the bore thereof, which is normally urged in its upper "off" position by a spring 25 which positions a metering bore 26 sealed against the inner periphery of a resilient elastomer washer 27, which washer is retained in body member 23 by the upper edge of a coaxial cup-shaped member 28 and an inward formed flange of the member 23, as shown. The lower end of the cup-shaped member 28, also retained in the body member, terminates in a tubular nipple 29 over which is secured a flexible tube 20 connected through coupling 12a to the liquid supply container by tube 12.

A lateral bore 30 through the wall of the member 28 is for the inlet of atomizing air, to be hereinafter described. A closure cup 31 is frictionally secured in the neck of the casing 15 with a flange 32 extending around the upper periphery thereof. The cup 31 has an integral downward extending nipple 33 on which is frictionally secured the air tube 19. It is now apparent that the cup 31 forms a chamber around member 28 to provide an air passage into the bore 30.

The check valve assembly 18, which is connected to tube 13, comprises an upper member 34 and a lower member 35 threaded together and sealed by an "O"

ring 36, as shown in FIG. 4. The upper member has a coaxial small bore 37 therethrough for receiving and sealing the lower end of tube 19 and a smaller bore 37 open into a cylindrical chamber 42 mating in both upper and lower members. The lower surface of the chamber 42 forms a conical seat for a ball 41, which is normally urged against the seat by a spring 40. The lower member has a bore 43 for receiving and sealing the air supply tube 13.

It is to be noted that the nozzle 14 may have an insert 14a having a bore for metering the particular spray projected therefrom. It is also to be noted that when the gun is in idle position, as shown in FIG. 4, the bore 26 is sealed closed by the contact of the inner periphery of washer 27, and the air check valve assembly 18 is in a closed position by virtue of spring 40, as shown.

Referring to FIG. 5, when the nozzle 14 is depressed, as shown, or laterally displaced, the bore 26 in member 24 is moved and the washer 27, is deformed and as shown in FIG. 5, will permit pressurized liquid to flow from the cup-shaped member 28 into bore 26a and from nozzle 14. Simultaneously, the pressurized air from tube 13 will raise the ball 41 of the check valve and permit air to flow into cup 31, as shown by arrow, and through bore 30 for mixture with the incoming flow of liquid to project a finely divided atomized spray from the orifice in nozzle insert 14a.

FIGS. 6 through 9 show an alternate construction for the handle 15a of different shape, which includes certain modifications in the fluid and air junction for atomizing the spray from the valve. The cup 31, shown in FIGS. 4 and 5, which forms the channel around member 28 for conducting air into fluid in the valve for atomizing the latter is eliminated by the use of an alternate fitting 44 which has a coaxial upper bore 45 in press fitted engagement over nipple 29, as shown. The lower end of the fitting 44 terminates in a pair of liquid and propellant gas nipples 46 and 47, respectively, which nipples have small bores 48 and 49 therethrough. A space between the upper end of the bores 48 and 49 and the lower end of the nipple 29 provides for the propellant to atomize the liquid for pressure movement upward through the bore in nipple 29, as shown by arrow, into and from the valve shown in FIG. 4 in finely divided spray form.

Referring to FIG. 7, the screw cap 17, shown in FIG. 2, is replaced by a formed metal cap 50 having a coaxial upper portion 51 for retaining the valve operator with a lower cylindrical margin 52 of the cap 50 formed under the underside of the closure flange at the upper end of the handle 15a, as illustrated by broken lines.

As previously described, the tube 20 is provided to carry pressurized liquid and the tube 19a carries the air or other propellant for atomizing the liquid in the bore 45 and conducting same through and from the valve and nozzle as previously described.

In both of the embodiments previously described, the check valve assembly 18 is important to the proper operation of the device, which is apparent in that the sudden closure of the spray valve will not instantly arrest the inertia of the flowing liquid, which would result in the liquid traveling from the bore 45 into the air line. This and other conditions would permit a small amount of liquid to escape through the valve nozzle without being atomized or otherwise clog the system if left in-

operative. However, the check valve assembly 18 prevents the entry of any liquid into the air supply circuit.

In operation, the cap 17 is tightly threaded on handle 15 to compress the washer 27 between the under surface of body member 23 and the upper surface of cup 31, which retains the valve means in the handle. Then it is apparent that the compression of nozzle 14 will project an atomized spray when pressure is applied to container 1, retaining a predetermined liquid. It is also apparent that the same retention of the valve means results when the metal cap 50, shown in FIGS. 6 and 7, is formed under the container flange, as illustrated in full lines.

It is apparent that with the exception of the springs and clip 21, all of the elements of the spray gun may be made from inexpensive well known molded plastic materials, thus making it possible to produce an efficient, relatively long life spray gun at low manufacturing cost.

This invention comprehends certain modifications in construction which come within the scope and teachings described.

Having described my invention, I claim:

1. In a liquid spray apparatus, a spray gun comprising a hollow handle, a mixing chamber secured in the handle, the chamber having a first inlet for pressurized gas and a second inlet for liquid under pressure simultaneously supplied thereto, a nozzle member mounted on the handle having an inlet connected to receive the mixture of pressurized gas and liquid from the chamber and an outlet for projecting an atomized spray therefrom, and manually controlled valve means normally forming a barrier to the flow of gas and liquid between the chamber and the inlet to the nozzle member and operable to establish communication between them for flow of such pressurized gas and liquid.
2. In a liquid spray apparatus in accordance with claim 1 wherein the nozzle member is operatively connected to the valve means for manually operating it to establish said communication.
3. In a liquid spray apparatus according to claim 2 wherein the valve means is normally biased to provide a closed passageway between the inlet in the nozzle member and the chamber.
4. In a liquid spray apparatus according to claim 3 further including a check valve in the first inlet to prevent flow of liquid from the chamber thereto but allow flow of pressurized gas into the chamber.
5. In a liquid spray apparatus according to claim 3 in which the valve means comprises a hollow tubular member open at one end and supported for movement through a wall of the mixing chamber, said tubular member having a closed end within the chamber, and a lateral opening through the wall thereof intermediate its ends, the tubular member being normally biased to locate the opening outwardly of the chamber and movable against said bias to locate the opening within the chamber upon operation of the nozzle means for flow of gas and liquid into the inlet of the nozzle member.
6. In a liquid spray apparatus according to claim 5 wherein the wall of the chamber through which the tu-

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bular member is movable is comprised of an elastomer having an opening tightly accommodating the tubular member, and stop means cooperating with the tubular member when biased to prevent flow, to stop it with the lateral opening therein against the wall of the opening in the elastomer. 5

7. In a liquid spray apparatus according to claim 6 in which the lateral opening in the tubular member is in a portion thereof of reduced cross-sectional dimension and sealed by the wall of the opening in the elastomer when the tubular member is stopped by the stop means. 10

8. In a liquid spray apparatus according to claim 7 further including a check valve in the first inlet to prevent flow of liquid from the chamber thereto but allow flow of pressurized gas into the chamber.

9. In a liquid spray apparatus according to claim 3 including a container for the liquid having a sealed liquid outlet means in the upper end thereof and a dip tube extending from said outlet means into the container 20

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to the proximity of its bottom, and a sealed gas inlet means in the upper end thereof, means connecting the container inlet means to a source of pressured gas, means connecting the container outlet means to the second inlet of the chamber, and means connecting the first inlet of the chamber with the source of pressurized gas.

10. In a liquid spray apparatus according to claim 9 wherein the means connecting the first inlet of the chamber with the source of pressurized gas comprises a second sealed outlet means from the upper end of the container connected to the first inlet of the chamber.

11. In a liquid spray apparatus according to claim 9 further including a check valve in the first inlet of the chamber to prevent flow of liquid from the chamber thereto but to allow flow of pressurized gas into the container.

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