ABSTRACT OF THE DISCLOSURE

A liquid-spray device that includes a gun having an upper connection to a liquid container from which liquid is fed by gravity to a chamber connected to and immediately adjacent a nozzle, while gas, which may be in compressed liquefied condition, is connected to the body of the gun through an upstream control valve, also adjacent the nozzle, actuated by a trigger to discharge the gas into the nozzle for subsequent mixture with the liquid. The gas valve is operated through a linkage connected to a trigger, while the trigger also moves a needle that controls the outlet opening of the liquid nozzle.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a liquid-spray apparatus.

The prior art

In conventional apparatus for spray painting or other liquid, compressed air is used in moving the liquid from its storage container to the nozzle of the spray gun, where it is discharged in a spray pattern. In one type of construction, the air passing through the gun aspirates the liquid from a pot suspended beneath the gun, drawing it upwardly to mix into the airstream. By another conventional approach, air is introduced into the liquid container, exerting pressure on top of the liquid to force it upwardly into the gun.

It has been proposed to utilize a compressed gas other than air as the medium for propelling the liquid to avoid the requirement for an air compressor. This compressed gas would be stored in a suitable pressurized container and allowed to escape to cause the spraying action to take place. This has not been satisfactory for liquid spraying, however, because of the limited capacity of normal portable gas storage containers and the substantial quantities of gas required to effect the spraying of the liquid. An excessive amount of the gas is dissipated if it is used to draw the liquid from a container by aspiration. If the gas is used to pressurize the liquid container to force the liquid from it, gas pressure is lost and a substantial volume of the gas is employed in filling up the liquid container so that it is then not available for discharge in the spray pattern. The use of large quantities of compressed gas not only decreases the amount of spraying that can take place, but also adds to the expense of the spraying operation.

It has been recognized that a gas may be liquefied as a means of retaining a greater quantity of the gas within a small container than is the case where the gas is pressurized to a lesser degree and remains in its gaseous form. When liquefied, it occupies considerably smaller volume so that there is the prospect of operating a spray device for a longer period before the gas supply is exhausted. However, even so, the supply of the gas is limited, and it is undesirable to have to expend portions of the gas in moving the liquid from the container. Even more serious has been the fact that, as the gas discharges from its container, its temperature becomes lowered substantially because of the expansion. Passing through the relatively long passageways of a conventional spray gun, the gas will cause the unit to freeze up as the moisture in the gun is frozen. This prevents the spray gun from operating.

SUMMARY OF THE PRESENT INVENTION

The present invention provides a spray apparatus which not only is suitable for use with liquefied gas but also is of simplified construction and is easily used and maintained. Rather than being located beneath the gun, the liquid reservoir is positioned above the body of the gun and caused to feed downwardly into the gun by gravity. It enters a chamber immediately adjacent the nozzle, so that the nozzle automatically is kept full of liquid as it runs down into the nozzle from the reservoir. The gas connection also is immediately adjacent the nozzle, positioned on the lower side of the gun opposite from where the liquid enters. A valve at the forward end of the gun controls the flow of the gas into the nozzle. There is no mixing of the gas and the liquid ahead of the nozzle, and the gas passageway thereby remains free of liquid at all times. By being discharged at the location of the nozzle, even liquefied gas will not cause freezing of the gun during operation of the device. Despite the fact that the gas is lowered in temperature as it expands to atmospheric pressure, it leaves the gun immediately, so that freezing does not take place as in the ordinary design where longer passageways are required.

The trigger actuates both the valve that controls the gas and the needle that extends to the liquid outlet at the nozzle. The gas control valve is positioned transversely of the gun body and moved to the open position by a linkage connected to the trigger. This linkage includes a rod pulled by the trigger to rotate a shaft, which, in turn, carries an arm that bears against the end of the valve member. This displaces the valve member and effects the opening of the valve when the trigger is moved. With the liquid flowing to the nozzle by gravity, all of the gas is used in creating the spray of liquid and gas, none being used to draw or push the liquid from a storage container. While ideally suited for use with liquefied gas, the spray gun is equally adapted for actuation by compressed air, in which event an air hose is connected to the gun in lieu of the liquefied gas bottle.

An object of this invention is to provide an apparatus capable of spraying liquid through the use of pressurized liquefied gas.

Another object of this invention is to provide a liquid-spraying arrangement having a gravity feed for the liquid so that the gas is not required to pump the liquid from a container.

A further object of this invention is to provide a spray apparatus which is adapted for use either by stored compressed gas or by air received from a compressor.

An additional object of this invention is to provide a liquid-spray apparatus that is readily used and maintained.

A still further object of this invention is to provide a spray apparatus of relatively simple and economical construction.

Yet another object of this invention is to provide an apparatus capable of spraying liquid through the use of pressurized liquefied gas.

These and other objects will become apparent from the following detailed description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view, partially broken away, of the spray apparatus of this invention;
FIG. 2 is a front elevational view of the spray gun, with the liquid and gas containers removed for clarity;
FIG. 3 is a top plan view of the spray gun;
FIG. 4 is an enlarged transverse sectional view taken along line 4—4 of FIG. 3, illustrating the control valve for the gas.

FIG. 5 is a enlarged sectional view taken along line 5—5 of FIG. 3, showing the push rod assembly of the gas valve-actuating linkage; and FIG. 6 is a longitudinal sectional view of the liquid and gas connections to the nozzle, taken along line 6—6 of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The liquid-spraying device of this invention includes a spray gun body 10 to the upper portion of which is connected the nozzle 32. The nozzle 32 is formed in an externally threaded fitting 12. This short rigid fitting supports the reservoir 11 above the forward end of the gun body. Opposite the reservoir 11, beneath the gun body 10, is a container 13 of compressed gas suspended from the body by a similar fitting 14. The container 13 may hold the gas in a liquefied form, and the gas may be of any of various types, Freon 12 being suitable.

The spray gun is adapted to be hand held and, for this reason, includes a hand grip portion 16 at its rearward end of the type conventional for spray guns. A trigger 17 is pivotally carried by the body 10 by means of a transverse pin 18. The intermediate portion of the trigger 17 bears against a sleeve 19, which is slidable in a cylindrical opening 20 in the body. The sleeve 19 receives an elongated needle 21 and bears against an enlarged portion 22 of the needle. Consequently, movement of the trigger to the right (counterclockwise), as the device is shown in FIG. 1, will move the needle 21 with it. The stroke of the needle 21 is terminated by engagement of the end of the needle with the wall of a socket 23 at the end of a recess 24 in a screw 25. The latter member is received in a fitting 26 which, in turn, is threaded into the right-hand end of the body 10. The screw 25 may be adjusted axially by rotation relative to the fitting 26 for thereby permitting variation of the stroke of the needle 21. One end of a compression spring 27 extends into the recess 24, while its other end bears against the enlargement 22 of the needle 21. This biases the needle to the left as the device is shown, thereby normally holding the trigger outwardly in the position of FIG. 1.

To the left of the trigger 17, the needle 21 extends through a packing screw 28 and a packing gland 29 and into a chamber 30 in the body 10 (see FIG. 6). A nozzle assembly 31 at the forward end of the body includes an inner liquid nozzle 32 that is threaded into the body 10 and provided with an axial opening 33 that connects to the nozzle chamber 30 of the conventional external mix type, although an internal mix nozzle also may be used. An outlet opening 34 is located at the end of the opening 33 in the nozzle 32, inwardly of which is a tapered throat 35. The pin 21 is larger in diameter than the outlet 34, so that, when the pin 21 is moved to the left under the impetus of the compression spring 27, the convergent end 36 of the nozzle is seated to close the exit of the nozzle 32. However, when the trigger 17 is pulled and the needle 21 is moved to the right, the end 36 of the needle moves away from the outlet 34, opening the nozzle 32. The size of the outlet aperture is determined by the stroke of the needle 21 to the right, which in turn, is established by the position of the screw 25.

The fitting 12 of the reservoir 11 is threaded into a relatively large vertical opening 38 in the body 10 that extends a short distance to the chamber 30. Therefore, the liquid from the reservoir 11 flows by gravity through the conduit formed by the fitting 12 to the chamber 30 and into the horizontal opening 33 of the liquid nozzle 32. In this way, the liquid to be sprayed enters the gun through a large passageway and immediately enters the nozzle. The liquid will be present in the nozzle 32 continuously during the use of the gun, flowing into it automatically by virtue of the gravity feed, requiring neither aspiration nor gas pressure to supply it to the gun.

An appropriate vent is provided at the upper end of the reservoir 11 so that there will be no vacuum lock to preclude flow into the nozzle 32. In the embodiment illustrated, there is a bolt 40 extending through a clearance opening 41 in the filler cap 42. The nut 43 is received in a recess 44, which has straight sides to prevent rotation of the nut. Therefore, in the event that is should become necessary to invert the reservoir 11, the bolt 40 may be tightened to close off the opening 41 to prevent leakage from that location. Otherwise, it will permit air to bleed into the reservoir 11 above the liquid within it.

The action of the trigger 17 also controls the flow of gas from the container 13. To this end, a rod assembly 45 is moved by the trigger 17 and, through an appropriate linkage, opens a valve to allow the gas to flow. The rod assembly 45 includes a member 46 having a recess that receives the ball end 47 of a short transverse pin 48 that projects laterally from the side of the trigger 17. The end 49 of the member 46 is threaded and received within one end of a sleeve 50. The sleeve 50 includes an axial recess 51 which receives a ball 52 that is held in place by a plug 53. A shank 54 projects laterally outwardly from the ball 52, having a threaded end passing through an opening in the upper end of a vertical shaft 55 to which it is held by means of a nut 56. The ball connections 47 and 52 to the rod assembly 45 allow the latter element to pivot as it imparts rotation to the shaft 55 when the trigger is pulled.

The shaft 55 includes a bottom portion 57 of reduced diameter that extends vertically through a bearing 58 carried by a bracket extension 59 integral with the body 10. A collar 60 circumscribes the lower end of the portion 57 of the shaft 55 beneath the bearing 58 and is connected to the shaft by means of a pin 61. Therefore, rotation of the shaft 55 also will rotate the collar 60. An arm 62 extends outwardly from the collar 60 toward the forward end of the gun, or to the left as the device is shown in FIGS. 1 and 3. The outer end of the arm 62 has a rounded pressure pad 63 that engages the end of a stem 64 that extends transversely of the body 10 of the gun. As may be seen in FIG. 4, the stem 64 extends into the body of a packing screw 66, a packing gland 67 and an elongated cylindrical opening 68. The stem enters a chamber 69 in the body 10 and, at that location, is provided with a valve member 70 of frustoconical configuration. The latter element is adapted to engage a complementary valve seat 71 in the chamber 69. It is biased to the position where the valve member 70 engages the valve seat 71 by means of a compression spring 72. One end of the spring 72 extends into a recess 73 in a screw 74, while the opposite end bears against the valve member 70, where it is centered by a projection 75 extending from the valve member. A gasket 76 seals the end of the chamber 69 at the location of the screw 74.

The fitting 14 of the gas container 13 threads into the body 10 at an opening 78 which, through a short vertical passageway 79, connects to the chamber 69 upstream of the valve member 70. Downstream of the valve member 70 is an outlet passageway 80, which extends to an annulus 81 within a collar 82 of the valve assembly 31, around the liquid nozzle 32. Gas from the annulus 81 than may pass through the longitudinal passageways 83 and 84 to the horns of the outer nozzle element 85. Additional gas may flow between the interior of the nozzle element 85 and the exterior of the liquid nozzle 32 if it has a hexagonal exterior, and through a series of additional openings 86 and the outlet apertures 87 around the liquid outlet opening 34.

As a result of this construction, when the trigger 17 is pulled, not only is the liquid outlet opened but also the gas valve is opened simultaneously so that the liquid is atomized and discharged in a spray pattern. The linkage connected to the trigger 17 moves the stem 64 transversely.
of the gun body 10, thereby opening the valve 70 so that a passageway exists from the gas inlet opening 78 to the outlet opening 80 that communicates with the nozzle.

By this design, the gas is caused to enter the gun immediately adjacent the nozzle from which it discharges, traveling only a short distance before it leaves the gun. Typically, for example, the passageway 80 from the valve to the nozzle is only around one-half inch long, while the upstream passageway 79 is even shorter. Consequently, even where a liquefied pressurized gas is used, it will expand into atmosphere prior to the time that the reduction in temperature of the gas can cause freezing. Thus, while spray guns of conventional design, with their elongated passageways for the gas through the gun, are not suitable for liquefied gas propulsion of the liquid because of the freezing that occurs as the gas expands, in the present design no such problem is encountered and freezing does not occur.

Moreover, all of the gas is utilized for its intended purpose in propelling the liquid from the nozzle. It is not necessary to draw the liquid from a container by suction, as in many spray guns, nor does gas have to be wasted in pressurizing a container to force the liquid upwardly to the gun. Furthermore, by connecting the gas container directly to the forward portion of the gun adjacent the nozzle, the pressure drop of the gas within the gun is minimized, and it is delivered to the nozzle at a relatively high pressure for effective spraying.

While the device has been described as employing a container of liquefied gas as the propelling medium, it is equally adapted for operation by compressed air delivered from a compressor. In that event, an air hose is connected to the threaded opening 78 in the gun body 10 to replace the connection of the gas bottle 13. Thus, the spray gun device is versatile in being adapted for different kinds of usage. Also, in lieu of the liquid reservoir 11, there may be a larger liquid container located on a separate elevated support, with a hose leading downwardly to the opening 38 to conduct the liquid by gravity to the gun. This, however, is at the sacrifice of convenience and mobility that the unit possesses when the container for the liquid is carried by the gun as in the embodiment described above.

The foregoing detailed description is to be clearly understood as given by way of illustration and example only, the spirit and scope of this invention being limited solely by the appended claims.

1. A spray device comprising
   a nozzle on said body,
   said nozzle having a central first passage for transmitting liquid, and
   a second passage for transmitting a gas said second passage being coaxial with said first passage, said body having a chamber adjacent said nozzle and in communication with said first passage,
   a liquid reservoir above said chamber, means connecting said reservoir to said chamber for allowing liquid to flow from said reservoir into said chamber and into said nozzle, means in said nozzle for controlling the flow of liquid through said first passage,
   said body having a third passage therein having an inlet adjacent said nozzle,
   said inlet being adapted to receive a compressed gas,
   said third passage having an outlet communicating with said second passage of said nozzle,
   said third passage including a portion extending transversely of said body,
   valve means in said portion of said third passage intermediate said inlet and said outlet thereof, and means for simultaneously operating said valve means and said means for controlling the flow of liquid through said first passage.

2. A device as recited in claim 1 in which said third passage is adapted to receive a gas stored in a liquefied condition, and said inlet is sufficiently close to said second passage of said nozzle to preclude freezing upon expansion of such a gas when said valve means is opened.

3. A device as recited in claim 1 in which said valve means includes an extension projecting outwardly of said third passage and said body, said operating means including a linkage engaging said extension for moving said valve means to an open position.

4. A spray device comprising
   a body having a forward end and a rearward end,
   a nozzle connected to said forward end of said body,
   said nozzle having a first passage for transmitting liquid, and
   a second passage for transmitting a gas, said body having a chamber in said forward end in juxtaposition with said nozzle and in communication with said first passage thereof,
   said passage means in said forward end including
   a portion extending transversely of said body, said valve being located in said transverse portion, and including an extension projecting outwardly of said passage means and said body,
   means for controlling the flow of liquid through said first passage, and
   said inlet means in said forward end adjacent said nozzle,
   said means for controlling the flow of liquid through said passage means in said forward end interconnecting said said inlet means and said second passage of said nozzle, a valve in said passage means in said forward end, said passage means in said forward end including
   a portion extending transversely of said body, said valve being located in said transverse portion, and including an extension projecting outwardly of said passage means and said body, and
   means interconnecting said trigger and said valve and said control means for simultaneously opening said valve and opening said first passage upon actuation of said trigger, said means interconnecting said trigger and said valve including a linkage engaging said extension for moving said valve to an open position upon actuation of said trigger.

5. A device as recited in claim 4 in which said liquid inlet means includes
   an upwardly extending conduit connected to said body, and
   a reservoir above said body and connected to said conduit.

6. A device as recited in claim 5 in which said conduit is a relatively short rigid element, said element supporting said reservoir.

7. A device as recited in claim 5 in which said said gas inlet means is connected to the lower portion of said forward end opposite said upwardly extending inlet means.

8. A device as recited in claim 7 in which said gas inlet means includes
   a relatively short conduit connected to said gas passage means, and
   a container of compressed liquefied gas connected to and carried by said conduit.

9. A device as recited in claim 4 including in addition resilient means normally biasing said valve to a closed position.

10. A device as recited in claim 9 in which said valve includes a member having a frustoconical surface, and
    including a frustoconical valve seat in said passage for engagement by said frustoconical surface in closing said valve.
11. A device as recited in claim 4 in which said linkage includes a rod connected to said trigger, a shaft, means pivotally mounting said shaft on said body, a first arm extending from said shaft to said rod whereby when said rod is moved by said trigger said first arm causes said shaft to rotate, and a second arm connected to said shaft and engaging said extension of said valve, whereby upon said rotation of said shaft said second arm moves said extension and said valve is moved to an open position.

12. A spray device comprising a body having a forward end, and a chamber in said forward end, a liquid reservoir, a conduit supporting said reservoir above said forward end, said conduit communicating with said chamber for conducting liquid thereto, a nozzle connected to said forward end, said nozzle having a central first passage communicating with said chamber for receiving liquid therefrom, control means in said nozzle for controlling the flow of liquid through said first passage, said body having a passage in said forward end, said nozzle having a second passage communicating with said passage in said body,

8 a valve in said passage in said body for controlling the flow therethrough, means for simultaneously actuating said valve and said control means, a container of liquefied gas, and means connecting said container to said passage in said body for discharging said gas through said passage in said body and said second passage, said passage in said body being sufficiently short to preclude freezing upon the expansion of said gas upon such discharge thereof.

13. A device as recited in claim 12 in which said means connecting said container to said passage in said body includes a short conduit connected to said body at said passage in said body, said conduit suspending said container beneath said forward end of said body.

References Cited
UNITED STATES PATENTS
2,401,504 6/1946 Pasche 239—414 X
3,043,524 7/1962 Boris 239—409 X

M. HENSON WOOD, Jr., Primary Examiner
M. Y. MAR, Assistant Examiner
U.S. Cl. X.R.
239—409, 414 527