Aug. 15, 1950 R. G. PULVER 2,519,283

SPRAY NOZZLE WITH VALVED WHIRL PLUNGER

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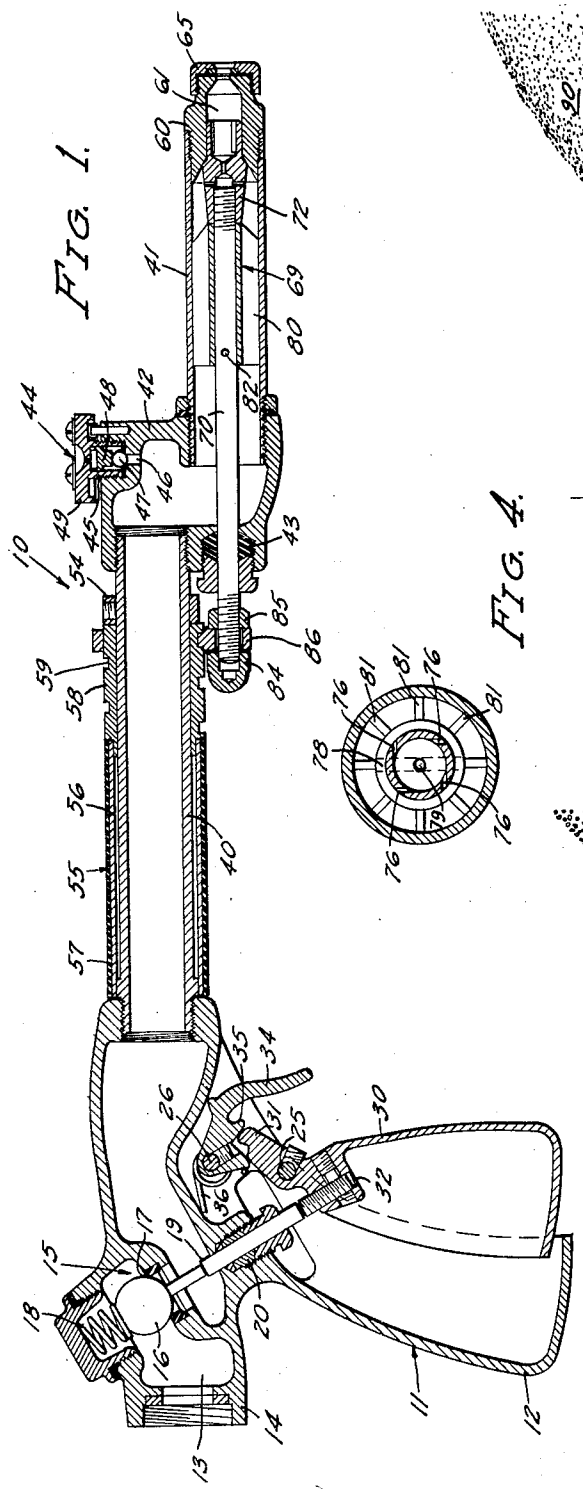


FIG. 1.

FIG. 4.

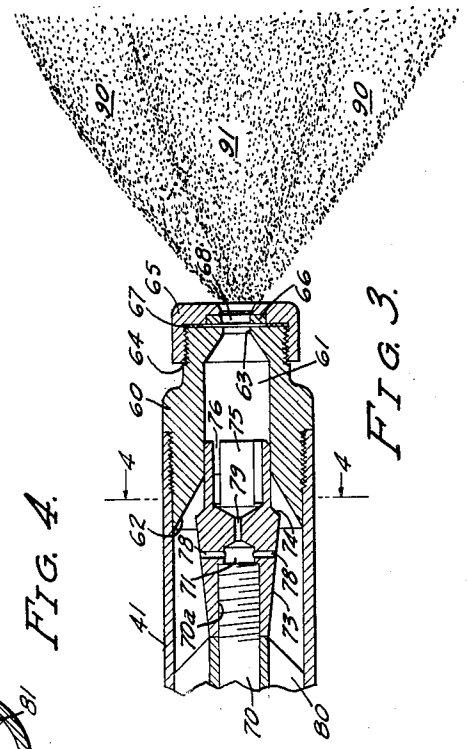


FIG. 3.

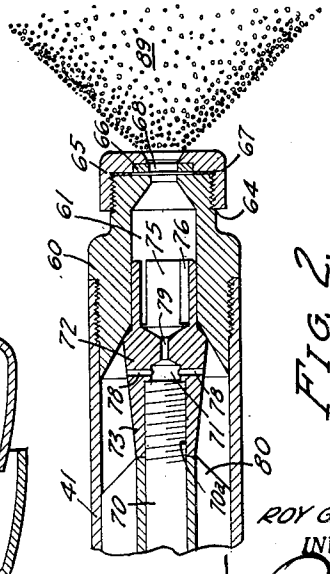


FIG. 2.

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SPRAY NOZZLE WITH VALVED WHIRL PLUNGER

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1 Claim. (Cl. 299—118)

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This invention relates to spray guns operating under relatively high pressure, and is particularly useful in improving the spray gun disclosed in U. S. Letters Patent to H. C. Stockdale, No. 2,362,946, issued November 14, 1944.

The Stockdale gun is widely used in fighting fires by the fog method. This gun handles liquid at pressures in excess of 600 pounds per square inch. It projects this liquid 60 to 100 feet in the form of a fine fog which is very effective in blanketing and putting out fires.

The nozzle of the Stockdale gun has a liquid whirl chamber in which the liquid is whirled and thus broken up before it is discharged through a spray orifice. The character of the spray is controlled manually by axially shifting a so-called whirl plunger, located inside the barrel, to extend this varying distances into the whirl chamber. The nozzle and whirl plunger have mating seats so that when the whirl plunger is extended as far as it will go into the whirl chamber, the plunger will plug the mouth of this chamber and shut off a flow of liquid into this.

The Stockdale gun has a separate shut-off valve for controlling the admission of liquid to the barrel, and two grips on which the right and left hands are applied in holding the gun. One of these grips is adapted to be held and manipulated by one hand to actuate the spray control. The other grip is adapted to be held and manipulated by the other hand to control the shut-off valve.

It has been found that sometimes, in the effort to get a fine spray with the Stockdale gun, the whirl plunger is extended forward to the point where it plugs the mouth of the whirl plunger. The tremendous pressure of the liquid filling the barrel then makes it difficult for the operator to withdraw the whirl plunger from the whirl chamber so as to resume the formation of a spray.

It might be noted that this locking of the whirl plunger by the presence of liquid under high pressure in the barrel is not relieved by operating the shut-off valve to shut off the supply of liquid under high pressure coming from the pump. The body of liquid trapped in the barrel when the shut-off valve is closed still operates to lock the whirl plunger in plugging relation with the whirl chamber.

It is an object of this invention to provide a spray gun of the general type of the Stockdale gun in which the whirl plunger may not be liquid locked in plugging relation with the whirl chamber.

As firefighting must be carried on in all kinds of weather, it has been found necessary to fight

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fires with the Stockdale gun at temperatures far below freezing. There are always pauses in such fire-fighting operations when it is desired to save the limited supply of water available, and this is normally done by actuating the cut-off on the gun to stop the supply of water thereto. In such intervals, however, the water in the gun barrel frequently freezes, thereby rendering the gun inoperative until it has been thawed out.

It is a further object of this invention to provide a spray gun of the general type of the Stockdale gun, the flow of water through which, except for a negligible discharge, can be shut off during intervals in fire-fighting operations in extremely cold weather without the gun icing up.

After a fire has been brought under control by the fog method, there are numerous smoldering embers which must be extinguished individually. The main object of the fog method being to completely extinguish the fire with a relatively small amount of water and thereby prevent any more damage than necessary to the property involved, some means has been sought to extinguish these smoldering embers without having to use as much water as would be discharged by the Stockdale gun, even when the whirl plunger is adjusted to produce a spray of minimum volume.

It is a still further object of this invention to provide a spray gun of the general type of the Stockdale gun from which a spray may be delivered which is suitable for extinguishing smoldering embers remaining after a fire has been brought under control, which spray will use only a small fraction of the amount of water discharged in the smallest spray which could be produced by a partial withdrawal of the whirl plunger from the nozzle of the gun.

When the spray control on the Stockdale gun is adjusted to produce a relatively wide-angled, fine cone of spray, the particles in an axial portion of this cone are less dense than in the balance of the cone.

It is an object of my invention to provide a spray gun of the general type of the Stockdale gun which will produce a wide-angled cone of spray of substantially uniform density.

The manner of accomplishing the foregoing objects, as well as further objects and advantages, will be made manifest in the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of a preferred embodiment of the spray gun of my invention, with the whirl plunger thereof shown in its forwardmost position in plugging relation with

the nozzle of the gun, and with the cut-off valve closed.

Fig. 2 is an enlarged view of the nozzle end of said gun with the whirl plunger positioned as shown in Fig. 1, and indicating the discharge from the gun nozzle of a coarse spray such as is produced by said gun with the whirl plunger so positioned and the cut-off of the gun opened.

Fig. 3 is a view similar to Fig. 2, showing the whirl plunger withdrawn rearwardly at a slight distance from the whirl chamber to cause the discharge from the nozzle of the gun of a uniformly dense wide-angled cone of spray.

Fig. 4 is a cross-sectional view taken on the line 4—4 of Fig. 3.

Referring specifically to the drawings, the invention is there shown as preferably embodied in a spray gun 10 which includes a butt member 11 having a pistol grip 12 to assist in supporting and controlling the gun. Formed in the butt member 11 is a liquid passage 13, there being a hose connection 14 at the outer end of this for connecting a hose to the gun. Also provided in the butt member 11 to control the passage 13 is a shut-off valve 15 including a ball 16 which is urged against a seat 17 by a pressure spring 18, and is adapted to be lifted from this seat by a valve stem 19 which enters the passage 13 through a stuffing box 20.

The pistol grip 12 is hollow and has pins 25 and 26. Mounted pivotally on the pin 25 within the grip 12 is a trigger 30, from which a latch arm 31 extends upward. The trigger 30 also has an adjustable screw tappet 32 for contacting the valve stem 19.

Pivotally mounted on the pin 26 is a latch 34 having a hook 35 which is adapted to be manually hooked over the arm 31 when the trigger 30 is compressed by the fingers of the hand holding the pistol grip 12, so as to hold the valve 15 open when the trigger is released.

The latch 34 is urged into the position in which it is shown in full lines in Fig. 1 by a coil spring 36. Thus after trigger 30 is compressed to open the valve 15, and while it is held in that position, if the latch 34 then be manually rocked to extend the hook 35 downwardly behind the arm 31, and the trigger 30 released, the latch 34 will hold the trigger in compressed position with the valve 15 open.

In order to release trigger 30 from the latch 34, it is only necessary to squeeze the trigger 30 slightly to release the hook 35 from the arm 31, whereupon the spring 36 returns the latch 34 to its full line position with respect to the trigger 30. When pressure of the fingers on the trigger 30 is now released, the spring 18 closes the valve 15 and returns the trigger 30 to its full line position.

The spray gun 10 also includes a primary barrel 40 and a secondary barrel 41, adjacent ends of which are connected in offset relation by an adapter 42.

The adapter 42 has a stuffing box 43 which is concentric with the barrel 41. It also provides a safety sprinkler 44, including a threaded valve socket 45 which is connected by a hole 46 with the interior of the adapter. A ball 47 is held against a seat formed about the outer end of hole 46, by a whirl plunger 48 confined by a sprinkler head 49 screwed downwardly into the socket 45.

The safety sprinkler 44 is adapted to be operated by rotation of the sprinkler head 49 to emit a spray which protects the face and shoulders of the fireman operating the spray gun 10. It is the subject of a separate application, filed October 1, 1946, Ser. No. 700,361, co-pending herewith, and reference is had to said application for a full disclosure of the structure and operation of this sprinkler.

The primary barrel 40 is secured to the butt member 11 so as to communicate with the fluid passage 13. Provided on the barrel 40 is a stop ring 54, there being a manual control sleeve 55 rotatably mounted on the barrel 40 between the ring 54 and the butt member 11. The sleeve 55 includes a cylindrical tube 56, which is covered by a rubber grip 57. The sleeve 55 also includes a cylindrical cam 58, in which a cam groove 59 is formed, and which is united with the tube 56 so that the cam may be rotated by manually rotating the tube.

The secondary barrel 41 has a nozzle 60 screwed into its front end. This nozzle has a liquid whirl chamber 61 which is of smaller diameter than the interior of the barrel 41, and a beveled seat 62, provided on the inner end of the nozzle 60, extends from the chamber 61 to the bore of the barrel 41. The chamber 61 has a tapered forward end which terminates in a narrow opening 63. The nozzle 60 has a threaded nipple 64 onto which a bonnet 65 is screwed to retain an orifice disc 66 and a packing washer 67 pressed tightly against the extremity of the nozzle 60. The disc 66 has a spray discharge orifice 68 through which liquid passing through the gun 10 is discharged.

Longitudinally slidable within the secondary barrel 41, and centered by the interior surface of said barrel, is a liquid control device 69. This device includes a shaft 70 which extends slidably through the stuffing box 43. The front end of this shaft screws into the counter bore 70a of an axial hole 71 of a whirl plunger 72, having an expanding frusto-conical outer surface 73 which joins a counter-frusto-conical surface 74, the inner edge of which terminates at a tubular whirl sleeve 75 extending forwardly from the plunger 72. This sleeve has formed therein a series of slots 76, the latter lying in planes which are parallel with the axis of the barrel 41, and spaced equi-distant from said axis so that said slots 76 have a spiral relation to the axis of the barrel.

The sleeve 75 slidably fits into the whirl chamber 61 when the plunger 72 is shifted toward the nozzle 60. The mouth of this chamber is plugged by the plunger 72 when the latter has been thus advanced to the point where the surface 74 comes into contact with the beveled nozzle seat 62, as shown in Figs. 1 and 2.

Provided to pass diametrically inwardly into the axial hole 71 of the whirl plunger 72 are holes 78. Extending axially forwardly from the hole 71 is a hole 79 which opens into the interior of the tubular whirl sleeve 75, and is, of course, coaxial with this and with the spray orifice 68.

Also included in the liquid guide and control device 69 is a spider sleeve 80 having a series of guide fins 81 which extend radially outwardly to slidably engage the inner surface of the secondary barrel 41. The spider 80 is riveted fast on the shaft 71 by a pin 82.

Mounted between nuts 84 and 85 on the rearwardly extending end of the shaft 71 is a cam follower yoke 86 which threadedly extends into the cam groove 59 of the cylindrical cam 58 so that rotation of the manual control sleeve 55 shifts the control device 69 longitudinally in the barrel 41.

Operation

To prepare the gun 10 for operating the same, a hose leading from a high pressure liquid pump is first attached to the hose connection 14. Supposing the operator is right-handed, he carries the gun in his two hands by holding the pistol grip 12 in his right hand, and the manual control sleeve 55 in his left hand.

Without removing either of his hands from the gun, the operator is able to open or shut the shut-off valve 15 by clenching or relaxing the fingers of his right hand on the trigger 30, or he is able, by rotation of the sleeve 55 with his left hand, to shift the whirl plunger 72 so as to withdraw this entirely from the whirl chamber 61 or to extend it varying distances into the whirl chamber.

When the whirl plunger 72 is withdrawn entirely from the whirl chamber 61, a rod-like stream of highly condensed spray is discharged through the spray orifice 68 which travels a relatively long distance from the gun before it breaks up and scatters in the air. The present invention has no effect on the operation of the gun in discharging this type of stream.

The objects of the present invention relate to operation of the gun 10 when the whirl sleeve is partially or entirely extended into the whirl chamber, and these objects are accomplished by the holes 71, 78 and 79 which provide a liquid escape passage through the whirl plunger 72. For instance, when the valve 15 is held open and the sleeve 55 is rotated to shift the whirl plunger 72 forwardly into the position in which it plugs the mouth of the whirl chamber 61, as shown in Figs. 1 and 2, and the pressure of the liquid in barrel 41 against the frusto-conical surface 73 of the whirl plunger renders it difficult to withdraw this plunger from plugging relation with the whirl chamber 61, the operator needs merely to close the shut-off valve 15, whereupon the pressure of the liquid in the barrel 41 immediately decreases to atmospheric pressure by leakage of a small amount of water through the passage formed by holes 71, 78 and 79. Upon this relief of pressure taking place in the barrel 41, the plunger 72 may be easily withdrawn rearwardly by rotation of the sleeve 55, and the operation of the gun resumed by re-opening the valve 15.

When the whirl plunger 72 is run forward into plugging relation with the whirl chamber 61, and the valve 15 held open, the water escaping through the passage 71—78—79 is discharged outwardly through the orifice 68 in the form of a coarse spray 89, as shown in Fig. 2. This spray has been found very effective and adequate in the extinguishing of smoldering embers, which customarily remain to be put out individually after the main blaze of a fire is brought under control, as said spray, being discharged without velocity of consequence, does not blow said embers around.

When wide open, the gun 10 delivers water at a rate of approximately 30 gallons a minute. The coarse spray produced with the adjustment shown in Fig. 2 uses only two or three gallons of water a minute. When fighting fires in subfreezing temperatures, freezing of the gun 10 of my invention may be avoided by adjusting the whirl plunger 72 as shown in Figs. 1 and 2 and locking the valve 15 open whenever it is necessary to temporarily suspend operation of the gun 10 at its normal capacity.

The flow of water from the barrel 41 through the passage 71—78—79 during these intervals is sufficient to prevent the freezing of the water in the barrel 41, yet it constitutes a negligible amount to spend for the assurance that the gun will not freeze but will remain in readiness, to be instantly adjusted and go into action at any desired capacity.

When the whirl plunger 72 is positioned with the whirl sleeve 75 extending partially into the whirl chamber 61, as shown in Fig. 3, a more or less wide-angled cone of spray 90 is delivered from the nozzle of the gun. In former guns of this type, preceding the present invention, a similar cone of spray could be formed, but the spray particles in a central axial space 91 of the cone would be relatively sparse.

In the gun 10 of my invention the cone of spray 90 produced by the adjustment shown in Fig. 3 is relatively uniform in density as the water passing through the passage 71—78—79 of the whirl plunger 72 is broken up into fine particles by contact with the water delivered tangentially inwardly through the slots 76, and results in a substantial increase in the density of the water particles in the axial space 91 of the cone of spray 90.

I claim:

In a spray gun the combination of: a barrel adapted to be connected to a source of liquid under high pressure; a nozzle provided on the discharge end of said barrel, said nozzle having a whirl chamber and a discharge orifice opening axially therefrom; and a whirl plunger manually shiftable axially in said barrel and including a sleeve having spirally disposed liquid guiding surfaces and optionally extensible into said chamber to close the space between said plunger and said nozzle or to produce the emission from said orifice of a hollow cone of whirling spray varying in volume and force, said whirl plunger having a passage opening axially into said chamber and communicating with the inside of said barrel to receive liquid from the latter and discharge the same axially into said chamber and through said discharge orifice to form a solid cone of spray within said hollow cone, said solid cone of spray continuing to be discharged as aforesaid when said whirl plunger is in closed position and said hollow cone of spray is thus shut off.

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