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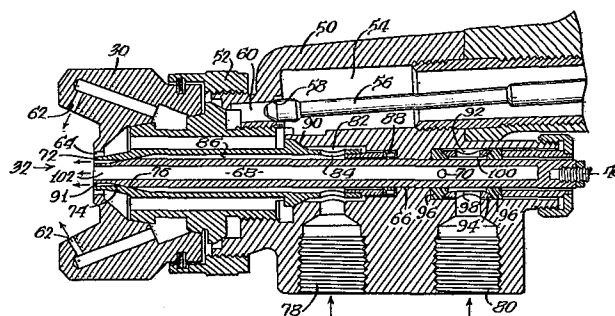
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⑤④ **Plural component spray gun.**

⑤⑦ A spray gun for dispensing plural component materials, such for example as polyurethane foam or plural component paint, mixes the components externally of the gun, not in the gun, so that flushing of the gun is not required when spraying is stopped. This is accomplished by providing a hollow and ported needle valve (66) in the gun, introducing one of the components into the gun and around the needle (82, 84, 86) and the other component through the port (70) to the interior of the needle (92, 98, 100). When the gun is off, the forward end of the needle seats against a fluid nozzle (32) to prevent spraying of the one component and the port (70) in the needle is sealed off from the supply of the other component. To spray the components, the gun is triggered to move the forward end of the needle (66) from its seat with the fluid nozzle (32) and to position to port (70) in communication with the supply (92, 98, 100) of the other component, whereby both components are emitted from the gun, the one through the space between the needle and nozzle (86) and the other through an opening at the forward end (102) of the needle. Air jets (62, 64) atomize the spray and form the same into a fan-shaped pattern.



Background of the Invention

The present invention relates to spray guns for mixing and dispensing plural component materials, such for example as polyurethane foam, and in particular to an improved plural component gun wherein mixing occurs externally of the gun so that flushing of the gun is not required when spraying is stopped.

Prior art plural component spray guns usually mix the components internally of the gun, and one problem which arises in their use is that, between operations, the residual material in a mixing chamber and/or outlet nozzle of the gun tends to harden and jam the outlet, thereby making further mixing and dispensing impossible until the chamber and nozzle are purged of the hardened residue. Purging may be accomplished, for example, by manually opening a valve to admit a flow of solvent and/or air through the chamber and nozzle to remove the residue.

This purging procedure has several disadvantages. First, the use of solvent adds an unnecessary expense to the process. Second, the solvent, because of being ejected under pressure, is dispensed into the surrounding air and creates a potential safety and health problem. Also, the blast of solvent and/or air, while forcefully ejecting the hardened components, scatters the residue haphazardly. Overall, such a cleaning arrangement is inefficient and unsatisfactory.

Other prior art arrangements, such for example as disclosed in Gusmer Patent No. 3,263,928 and Gusmer et al U.S. Patent No. 2,890,836, in an attempt to overcome the mentioned difficulties, utilize a rod to eject residual material between spraying operations. In these devices,

the rod purports to purge the mixing chamber and the outlet nozzle on a single stroke each time the gun is shut off. However, such rods were designed to scrape the walls of the chamber, were utilized as the valving mechanism to open and close the component infeed orifices and, for this reason, could be utilized for only one purging stroke for each dispensing operation. In practice, it was found that on the return stroke the rod tended to pull back some of the residue. If the gun was then left unused for a period of time, the residue hardened and bonded causing the gun to jam. For this reason, such guns also utilized a solvent flush, giving rise to the same problems mentioned heretofore relative to other prior art guns.

Object of the Invention

The primary object of the present invention is to provide an improved plural component air atomization spray gun, constructed to maintain the components separate from one another while within the gun and to mix the components only after they have been dispensed to exterior of the gun.

Brief Description of the Drawings

Fig. 1 is a side elevation view of a plural component spray gun embodying the teachings of the present invention, and

Fig. 2 is a fragmentary longitudinal section of the forward end of the spray gun shown in Fig. 1, illustrating the novel structure of the gun for maintaining the components separate therein.

Summary of the Invention

In accordance with the present invention, a plural component spray gun comprises a gun body having a passage therein opening upon a forward end of said body and a valve seat in said passage, and a needle valve reciprocable in said passage between a forward position against and a rearward position away from said valve seat, said needle valve having a passage longitudinally therein opening upon said forward end of said body. Also included are means for moving said needle valve between said forward and rearward positions; means for introducing a first fluidic component into said body passage and around said needle valve; and means, responsive upon said needle valve being in said rearward position, for introducing a second component into said needle valve passage. In this manner, the components are maintained separate in said spray gun, when said needle valve is in said forward position neither component is dispensed from said forward end of said gun body and when said needle valve is in said rearward position both components are dispensed, the first through said body passage and around said needle valve and the second through said needle valve passage.

Because the components are maintained separate within the spray gun body, when the same are reactive there is no danger of the components intermixing and hardening within the gun, and flushing or purging of the gun is not required when spraying is stopped.

The foregoing and other objects, advantages and features of the invention will become apparent upon a consideration of the following detailed description, when taken in conjunction with the accompanying drawings.

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- 4 -

Detailed Description

Referring to Fig. 1, there is shown a paint spray gun assembly, indicated generally at 20, including a spray gun 22 having a handle 24 connected at a lower end thereof with a source of compressed air (not shown) through a fitting 26 and an air supply line 28. The gun includes an air nozzle 30 and fluid nozzle means 32 centrally located in the air nozzle, through which first and second components, provided to the gun from supplies thereof (not shown) through respective component supply lines 34 and 36, are dispensed from the fluid nozzle for being atomized into a spray and formed into a fan-shaped pattern by jets of air emitted from the air nozzle. To control the spraying operation, the gun includes an air valve means 38 movable between open and closed positions to control a flow of pressurized air through the gun, a fluid valve stem 40 movable between open and closed positions to control a flow of components through the fluid nozzle and a manually manipulatable trigger 42 operably connected with the valve means 38 and stem 40. The trigger is pivotally mounted at an upper end by a pivot pin 44 and is manually movable between a gun off position away from the handle whereat the air valve means and fluid valve are closed, to a gun on position toward the handle whereat the air valve means and fluid valve are open and a spray of material is emitted from the gun. An air control knob 46 is adjustable to control the amount of atomizing air when the gun is on and a fluid control knob 48 is adjustable to control the rate of dispensing of material.

- 5 -

The spray gun assembly as thus far described is known in the art and, if conventional, would mix the components within a chamber in the gun prior to dispensing the same. Consequently, the gun would have to be purged of material each and every time use were discontinued to prevent hardening of residual material within the gun. This would disadvantageously create not only a need for a supply of solvent to purge the gun, but also for an additional flush pump and a solvent line running to the gun. In addition, it often happens that an operator is not in a position where solvent may conveniently be flushed through the gun, for example when he is working directly over material that has already been sprayed.

In improving upon conventional plural component spray guns, the particular structure of the gun of the invention enables two components to be maintained separate within and mixed only externally of the gun. This is accomplished by providing a ported and hollow needle valve in the gun, introducing one of the components into the gun and around the needle and the other component into the gun and through the port to the interior of the needle. When the gun is off, the forward end of the needle seats against the fluid nozzle means to prevent spraying of the one component and the port in the needle is sealed off from the supply of the other component. To spray the components, the gun is triggered to retract the needle and move the forward end of the needle from its seat with the fluid nozzle means and to position the port in communication with the supply of the other component, whereby both components are emitted from the gun for mixing, the one through the space between the

needle and nozzle and the other through an opening at the forward end of the needle. Consequently, the components are mixed only after they have been dispensed to exterior of the gun, so that cleaning of the gun is not required when spraying is stopped. Positive displacement pumps may be used to provide exact ratios of the components under pressure to the gun, and the air jets emitted by the air nozzle atomize the components into a spray and form the same into a fan-shaped pattern.

Referring to Fig. 2, which shows the novel structural features of the spray gun of the invention, the air nozzle 30 is mounted on a forward body portion 50 of the spray gun 22 by a nozzle retaining ring 52. The body portion has an air passage 54 which receives air under pressure upon opening of the air valve means 38, and an air valve stem 56 extends through the passage and against a seat 58 at a forward end thereof. The air valve stem is connected with the trigger 42 for being retracted when the gun is turned on, with the amount of retraction being determined by the setting of the air control knob 46, and when retracted establishes communication between the passage 54 and a passage 60 leading both to pattern forming air outlet orifices 62 in opposed ears or wings of the air nozzle 30 and to an annular atomizing air orifice 64 around the fluid nozzle means. Thus, triggering the gun causes air to be discharged for atomizing dispensed material into a spray and forming the spray into a fan-shaped pattern.

To maintain the components separate within the gun and control dispensing of the same for mixing exteriorly of the gun, in accordance with the invention the fluid nozzle means 32 includes a hollow and ported needle valve 66 in the forward body portion 50. A passage 68 extends longitudinally through the needle from a forward open end

thereof to a rearward closed end, and one or more circumferentially spaced ports 70 are formed through the needle in communication with the passage. The needle valve extends through and is reciprocable within a generally cylindrical fluid nozzle body 72 of the fluid nozzle means, and is provided with a taper 74 at its forward end for movement against a valve seat 76 interior of the body 72. The rearward end of the needle connects with the valve stem 40, such that operation of the trigger to turn on the gun retracts the needle from the seat.

To introduce the components into the gun for being dispensed, the supply line 34 communicates with an inlet 78 to the gun and the supply line 36 with an inlet 80. For convenience of reference, the component introduced at the inlet 78 shall be called the "A" component and that at the inlet 80 the "B" component. When the gun is used to dispense polyurethane foam, the "A" component could, by way of example, be isocyanate and the "B" component polyol, although it is understood that the gun could just as readily be used to dispense plural component paint or other plural component materials.

The inlet 78 communicates with a chamber 82 defined between the nozzle body 72 and the forward gun body 50, and a plurality of circumferentially spaced passages 84 through the nozzle body communicate between the chamber and the needle 66. Consequently, component "A" introduced at the inlet flows into the chamber and through the passages into a generally cylindrical space 86 between the inner surface of the nozzle body and the outer surface of the needle, and an annular seal or gland 88 at the rearward end of the chamber, along with a seal 90 defined by mating shoulders of the nozzle body and the gun body

at a forward end of the chamber, seal the sides of the chamber. The component is supplied to the gun under pressure, and when the gun is off and the needle seated against the valve seat 76, the component is confined within the space 86. However, when the gun is triggered on, the needle is retracted from the valve seat and the component is dispensed from the nozzle means through an annular orifice 91 defined between the needle and the nozzle body.

To provide for spraying of the component "B", the inlet 80 communicates with a chamber 92 between a cylindrical sleeve 94 and the gun body 50. The sleeve is positioned around the needle 66 and sealed at its side ends by a pair of annular seals or glands 96, and the needle is reciprocable within the sleeve and seals. A plurality of passages 98 are formed through the sleeve between the chamber 92 and an inner annular chamber 100 defined between the sleeve and the needle, and the ports 70 are located on the needle so that, when the gun is off and the needle is in its forward position, the ports are against and closed by the forward seal 96, the seal precluding any communication between the ports and the chamber 100.

Upon introduction of the component "B" through the inlet 80, the component enters the chamber 92 and flows through the passages 98 into the inner chamber 100 about the needle 66, the seals 96 precluding a lateral flow of the component from the side ends of the chambers. When the gun is off and the needle in its forward position, the component is confined within the chambers. However, when the gun is triggered on and the needle retracted, the ports 70 are moved rearwardly away from

- 9 -

the sealing surface of the forward seal 96 and into communication with the annular chamber 100, whereupon the component flows through the ports and into and through the needle passage 68 for being dispensed from the gun through a forward open end or orifice 102 of the needle passage. At the same time, upon retraction of the needle a path is established for a flow of the component "A" to the forward end of the gun for being dispensed through the orifice 91, which is then in communication with the space 86. Thus, the particular structure of the gun precludes any mixing of the "A" and "B" components within the gun, with mixing occurring only after the components are dispensed from the gun and atomized into a spray by the atomizing air.

As is apparent, when the gun is turned on the component "A" is dispensed immediately upon retraction of the tapered end 74 of the needle 66 from the valve seat 76. However, before the component "B" may be dispensed, at least a portion of the ports 70 must be drawn past the forward seal 96 and into the chamber 100. Thus, the time at which the "B" component begins to be dispensed with respect to the time at which dispensing of the "A" component commences may be determined by controlling the longitudinal position of the ports 70 along the needle 66 and/or the width of the forward seal 96 or its longitudinal placement with respect to the ports. The ports 70 may be exposed to the chamber 100 substantially immediately upon movement of the needle from the valve seat 76, whereby "A" and "B" components will be sprayed simultaneously. On the other hand, the ports may be exposed to the chamber only after the needle has been moved from the seat, whereby spraying of the "A" component will commence before and end after spraying

of the "B" component. The latter arrangement would be preferable, for example, if some dripping of the components occurs at the outlet from the gun when the gun is first turned off, since immediately prior to gun turn off only the "A" component would flow, thereby cleansing the forward end of the gun of any mixture of the components and precluding hardening of the components on the gun.

The invention thus provides an improved plural component spray gun assembly, wherein the components are never intermixed internally of the gun, but only externally, so that no hardening or setting of the components occurs in the gun and flushing of the gun is not required when spraying is stopped. Consequently, in use of the gun there is no need for a supply of solvent for the gun or for an additional flush pump and solvent line running to the gun.

While one embodiment of the invention has been described in detail, various modifications and other embodiments thereof may be devised by one skilled in the art without departing from the spirit and scope of the invention, as defined in the appended claims.

What Is Claimed Is:

1. A plural component spray gun, comprising a gun body having a passage opening upon a forward end of said body and a valve seat in said passage; a needle valve extending through and reciprocable in said body passage between a forward position against and a rearward position away from said valve seat, said needle valve having a longitudinally extending passage therein opening upon said forward end of said body; means for moving said needle valve between said forward and rearward positions; means for introducing a first fluidic component into said body passage and around said needle valve rearwardly of said valve seat; and means, responsive upon said needle valve being in said rearward position, for introducing a second fluidic component into said needle valve passage, whereby the components are maintained separate in said spray gun, neither component is dispensed from said forward end of said gun body when said needle valve is in said forward position, and both components are dispensed from said forward end of said gun body when said needle valve is in said rearward position, the first through said body passage and around said needle valve and the second through said needle valve passage.

2. A plural component spray gun as in claim 1, including air atomizing means at said forward end of said gun body for mixing the dispensed components in a spray.

3. A plural component spray gun as in claim 1, wherein said means for introducing the second component into said needle valve passage comprises a port through said needle valve communicating with said passage therein; seal means in said gun body for closing said port when said needle valve is in said forward position, said port being moved away from said seal means when said needle valve is moved to said rearward position; and means for introducing the second component through said port and into said needle valve passage when said port is moved away from said seal means.

4. A plural component spray gun as in claim 1, including a nozzle comprising a relatively elongate, generally cylindrical nozzle body in said gun body passage toward said forward end thereof, wherein said nozzle passage extends longitudinally through said nozzle body and said valve seat is formed therein toward a forward end thereof, said needle valve extends through said nozzle body passage and has a tapered portion toward its forward end for seating against said valve seat, and said means for introducing the first component comprises at least one port formed through said nozzle body in communication with said passage therethrough, and means for introducing the first component through said port, into said nozzle passage and around said needle valve.

5. A plural component spray gun as in claim 4, wherein said needle valve extends rearwardly of said nozzle in said gun body passage, and said means for introducing the second component comprises a chamber

in said gun body rearwardly of said nozzle in communication with said needle valve, a port through said needle valve in communication with said needle valve passage, said port being forward of said chamber and out of communication therewith when said needle valve is in said forward position and being moved into communication with said chamber when said needle valve is moved to said rearward position, and means for introducing the second component into said chamber.

6. A plural component spray gun as in claim 4, wherein said needle valve extends forwardly of said valve seat and said forward openings to said nozzle and needle valve passages are substantially aligned when said needle valve is in said forward position.

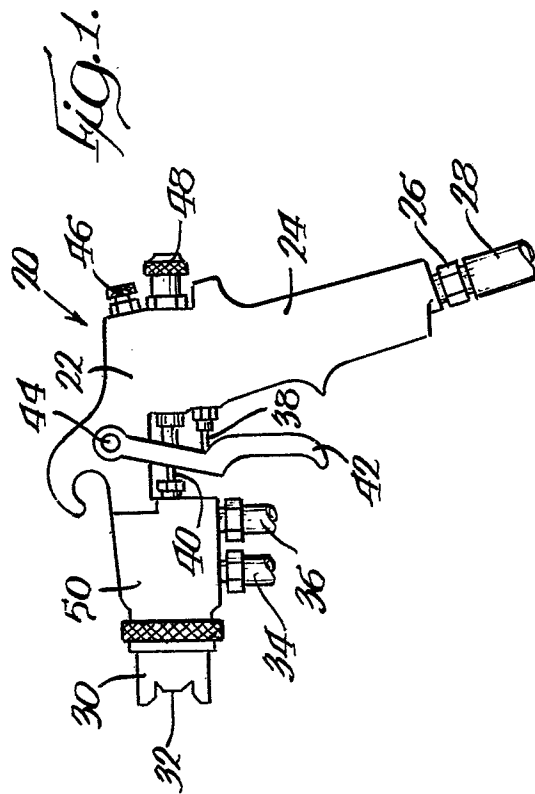
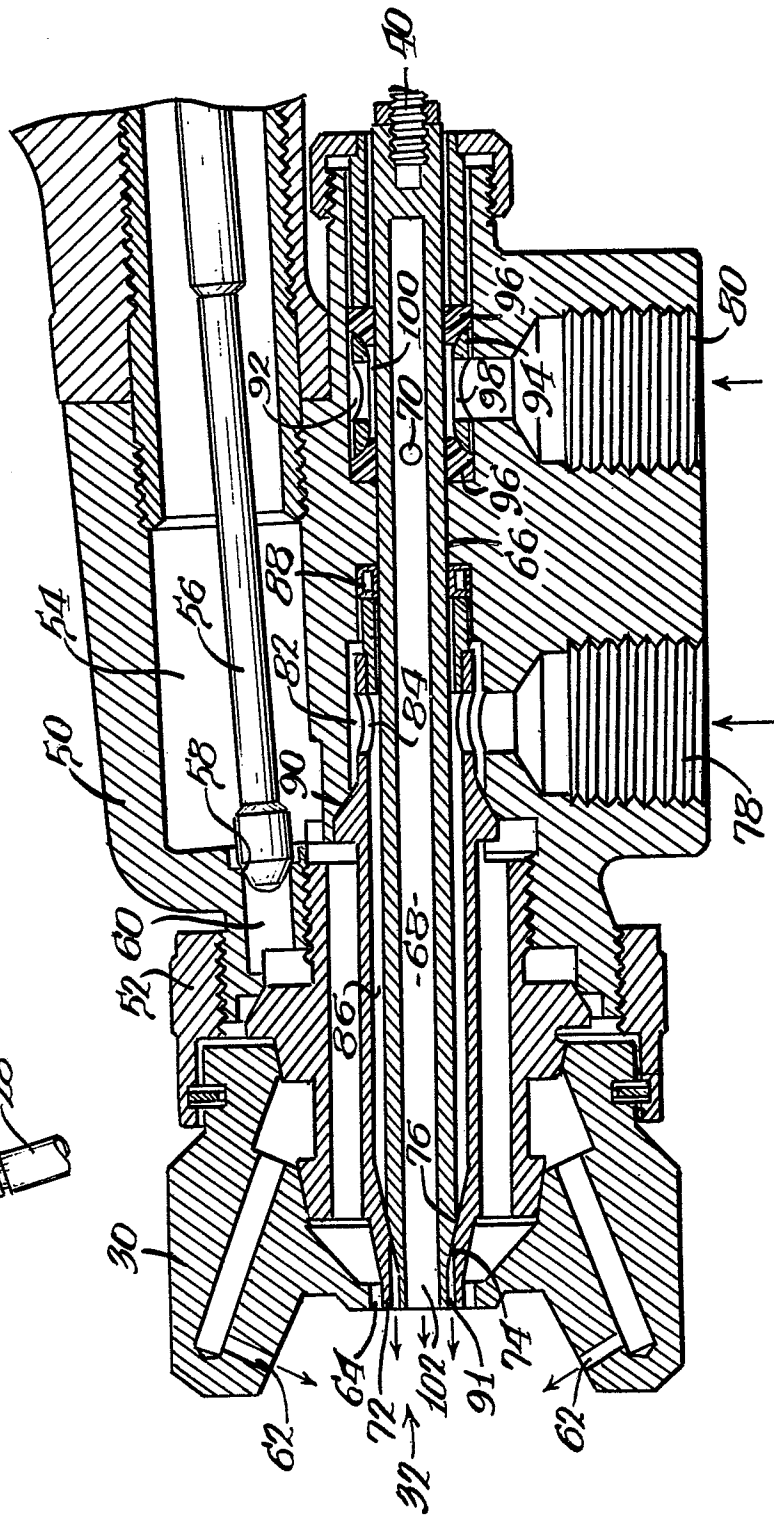


fig. 2.





DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	<u>US - A - 2 780 496</u> (H.J. ASBECK et al.) * Totality; particularly fig. 1,2,7 * --	1-6	B 05 B 7/10 B 05 B 7/06
X	<u>US - A - 3 232 540</u> (U. CASSAN-MAGNAGO) * Totality; particularly fig. 1,2 * --	1-6	TECHNICAL FIELDS SEARCHED (Int.Cl. ³)
X	<u>DE - B - 1 034 076</u> (R.C.WALTHER) * Totality; particularly fig. 1 * ----	1-6	B 05 B B 29 D
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons
			&: member of the same patent family, corresponding document
X	The present search report has been drawn up for all claims		
Place of search VIENNA		Date of completion of the search 09-07-1982	Examiner KAHOVEC