Jan. 31, 1961 D. J. PEEPS 2,969,926

AIRLESS SPRAY GUNS

Filed Oct. 30, 1956 2 Sheets-Sheet 1

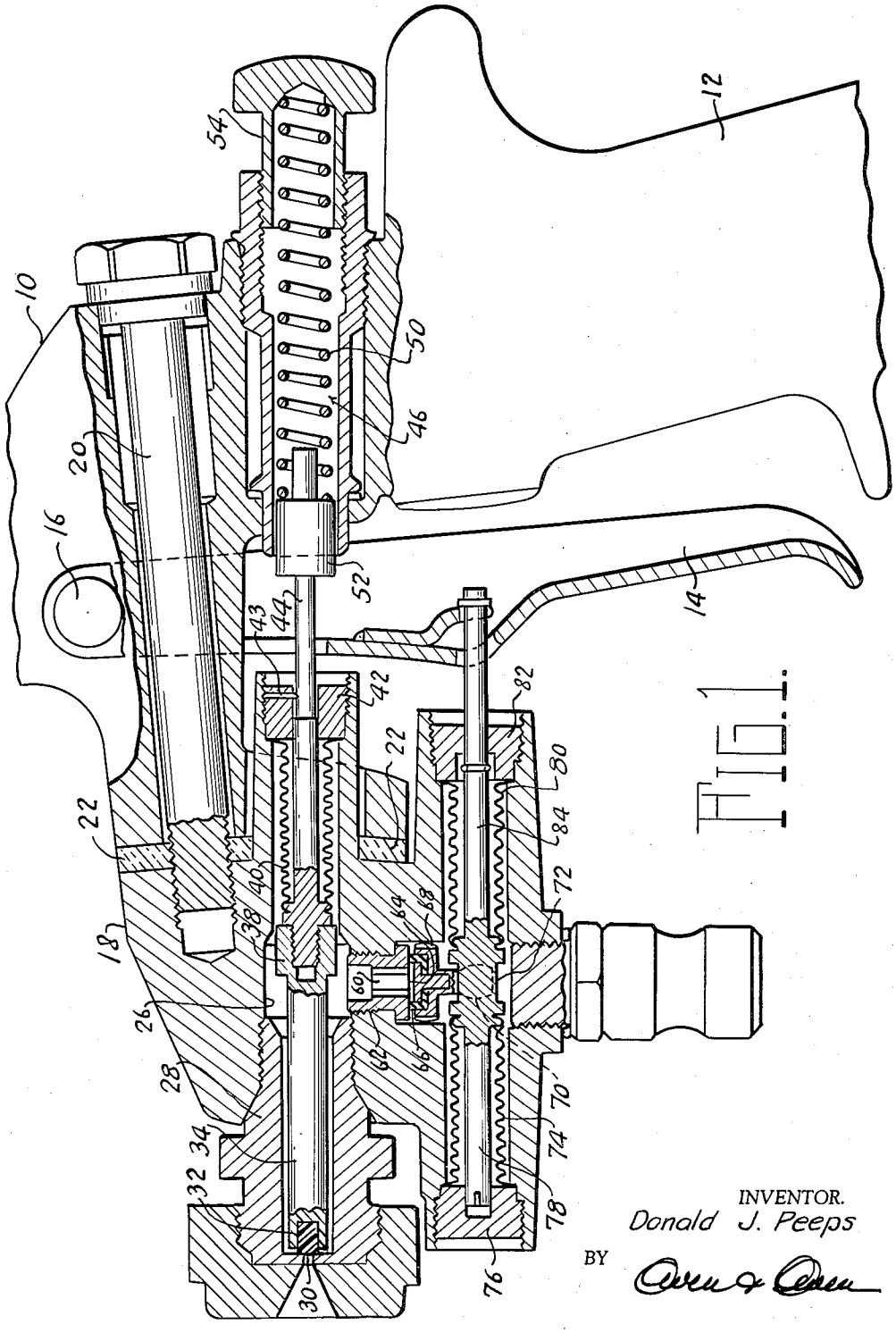


FIG. 1.

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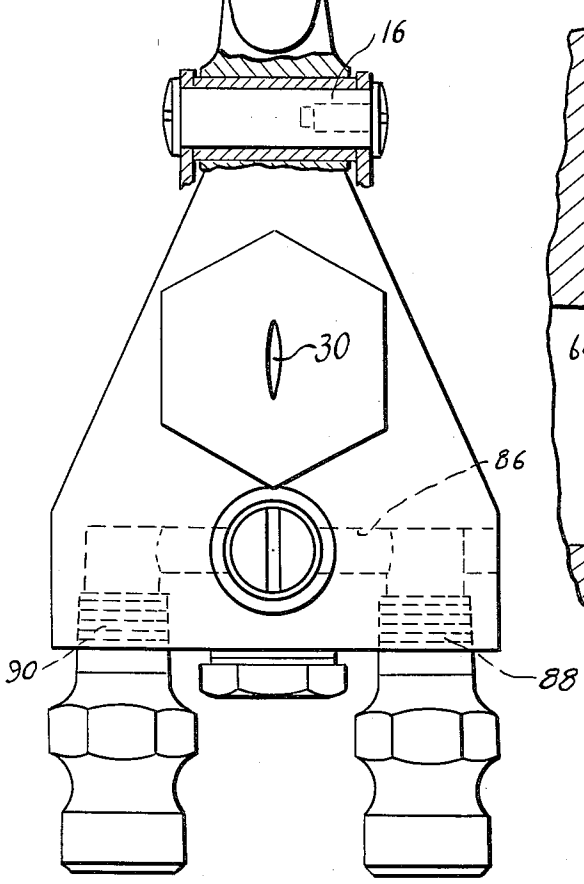
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FIG. 2.



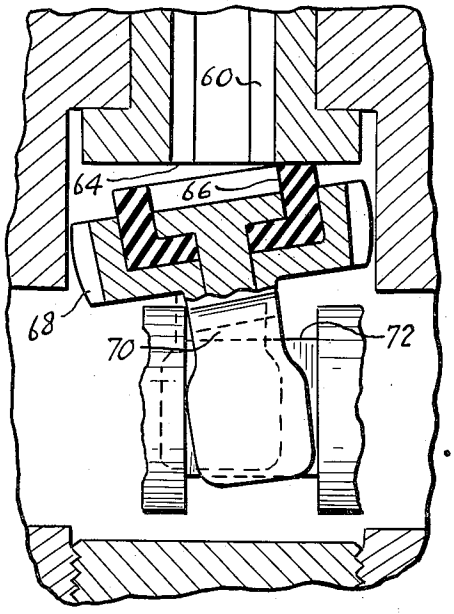


FIG. 3.

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AIRLESS SPRAY GUNS

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4 Claims. (Cl. 239—526)

This invention relates to spray guns for the airless application of viscous materials and is particularly directed to a control valve mechanism for such a spray gun.

It has heretofore been proposed to spray heated liquid materials without the use of an atomizing air stream, and theoretically atomization which takes place as a result of a sudden pressure release should give a more uniform coating than one deposited with the aid of entrained air. One of the difficulties with airless spray guns has been that the very high pressure on the liquid has made it difficult to operate the material control valve. In many instances the valve has opened and closed so slowly that a substantial portion of the stream failed to disperse immediately after opening and immediately prior to closing of the valve. This sluggish valve action has resulted in non-uniform and unacceptable coatings.

It has been proposed to provide an auxiliary, air operated piston to open the valve of an airless spray gun, and it has also been proposed to provide a complex series of toggle mechanisms for the purpose of imparting a snap action to the rearward or opening excursion of the material control valve. Such attempts have been unsatisfactory for various reasons and have not been widely adopted.

The present invention has for its primary object to provide a material valve control mechanism for an airless spray gun in which pressure differentials in the heated liquid itself are utilized to impart a rapid and positive motion to the valve parts.

Another object of the invention is to provide a material valve control mechanism in which undesired pressure differences are balanced out, leaving only those pressure differences which are required for the proper fast operation of the valve.

Other objects and advantages of the invention will become apparent from the following description of a preferred form thereof, reference being had to the accompanying drawings, in which—

Fig. 1 is a fragmentary central vertical sectional view of a spray gun embodying the present invention;

Fig. 2 is a front elevational view with parts in section; and

Fig. 3 is a fragmentary, somewhat enlarged and diagrammatic sectional view showing the control valve of the present invention in an open position.

Briefly stated, the present invention comprises a spray gun for the airless discharge of liquid materials comprising a gun body having two liquid chambers therein, together with means to supply liquid under pressure to the first of said chambers. A passage between the two chambers is selectively opened and closed by a control valve while a discharge valve normally closes the second of said chambers from the atmosphere. A trigger actuated mechanism is provided to open said control valve and the operation of said discharge valve is responsive to the pressure of liquid in the second chamber.

Referring to the drawings, the present invention is

shown in an embodiment including a gun body **10** having a handle **12** depending therefrom, a trigger **14** being pivotally attached to the body by a pintle **16** in the usual manner. A front body portion **18** is attached to the main body **10** by a bolt **20** extending longitudinally of the gun and the mating surfaces of the body portions are insulated from each other by a suitable heat resisting washer **22** which is preferably of a plastic material.

The front body portion **18** has a longitudinal discharge passage or chamber **26** which is threaded at its front end to receive a stationary valve seat member **28**. The stationary member **28** has an opening or spray nozzle **30** in its front wall through which heated liquid may flow under high pressure to expand and atomize during operation. This opening **30** is closed by a material control valve **32** which may be of any suitable form, a simple flat faced surface type valve being shown in the drawings. Such a valve is advantageous because it gives a maximum valve opening with a minimum longitudinal excursion. The valve itself is preferably formed of a heat resistant plastic material and is carried at the end of a valve operating rod **34**.

The rear end of the valve carrying rod **34** is attached as by a threaded connection to a head **38** to which is welded or otherwise fixed a longitudinally resilient sealing member such as a bellows seal **40**. The bellows **40** contains air at atmospheric pressure in its interior since its outermost end, remote from the head **38**, is fixed in position to seal the end of bore **26**. Since the head of the bellows **40** is exposed to whatever pressure exists in chamber **26**, a valve opening force is exerted on the annulus defined by the area of the bellows head minus the area of the valve **32**. This force is utilized as hereinafter described. A plug **42** may be threaded into the gun body and used to seat the bellows wall against an adjacent surface of the body in a fluid tight joint. The rearward movement of the rod **34** may be limited in any suitable manner as by a stop pin **43** inserted in the plug **42**.

An adjusting rod **44** extends rearwardly inside the bellows **40** from the head **38** and may, if desired, be made integral with the head. The adjusting rod passes freely through the plug **42** and extends into a spring retainer **46** carried in the main gun body **10**. The bellows **40** acts as a substantially frictionless fluid tight packing around rod **44**. An adjusting spring **50** is disposed within the retainer and is compressed between a head **52** on the rod **44** and a threaded cup **54** extending outwardly from the rear of the retainer into an exposed position where a nut-like head thereof can be readily grasped by the operator to turn the cup **54** in or out and thus increase or decrease the force of spring **50** against the adjusting rod **44**.

The present invention is particularly directed to a novel means to control the admission of fluid into chamber **26** in such a manner that an extremely rapid increase and decrease in pressure in that chamber is available for opening and closing valve **32**. To this end, the front gun body portion **18** is provided with a vertical fluid conduit **60** which may be conveniently formed in an insert **62**, threaded into the body. The insert **62** is ground flat on its lower face **64** to act as a valve seat for a resilient annular valve **66**. Valve **66** is carried by a holder **68** which has a spherically formed outer surface lying closely adjacent the walls of the bore of the body which form the fluid passage. The spherical portion of the valve holder is slotted at spaced points so that fluid can flow easily from below the holder to the valve **66**, yet the spherical surface can act as a rocking guide for the holder.

A stem **70** depends from the valve holder **68** and straddles an operating rod **72**. Rod **72** is connected on each side to a balancing bellows, the interiors of which

are at substantially atmospheric pressure. The front bellows, designated 74 in the drawings, has its open or outer end held in place by a threaded plug 76 and is guided for reciprocation by a center stem 78 the end of which is inserted into a bore or recess in the plug. The rear bellows, designated 80 in the drawing, is similarly held in place by a sealing plug 82 and encases a guiding and operating rod 84 which is either integral with, or attached to *a*, the rod 72. The operating rod extends through the rear plug 82 and is operatively connected with the trigger 14. It will thus be seen that the bellows 74 and 80 constitute a substantially frictionless sealing means for the valve operating rod 72 and that the seal is balanced because the effective area of the front or exposed portion of each bellows is the same and is exposed to the same fluid pressure.

Fluid enters the front gun body by a first chamber or lateral passage 86 in open communication with the vertical passage 60, intersecting the same at the bore which contains the sealing bellows. The passage 86 extends on each side of the center of the gun and is in turn intersected by vertical inlet and outlet passages 88 and 90 so that fluid may be circulated into and out of the gun in preparation for a spraying operation as hereinafter described. In some instances it is not necessary to circulate heated fluid through the gun, as where a fluid heating hose is used, and in these cases there will be required only a single vertical passage opening directly into the first chamber formed by passage 66 and the volume surrounding the bellows 74 and 80.

In operation, heated paint or other fluid material is circulated through the gun until such time as the front gun body portion 18 is sufficiently heated that operation can commence without danger of cooling the liquid to the point that sluggish or unsatisfactory operation will result. Liquid at a pressure of 250 to 900 pounds per square inch (depending on the material) is thus present in the bore 86 and exerts its pressure against the head of bellows 74 and 80. The operator first moves the trigger 14 rearwardly thus pulling rod 72 rearwardly. It will be seen that since both bellows 74 and 80 are attached to rod 72 the pressure of the liquid is balanced out and thus exerts no force, either forwardly or rearwardly, on rod 72.

Moving rod 72 rearwardly causes the depending valve stems 70 to rock the control valve 66 around a point on the rear of its circumference and causes the valve to move away from its seat first at the front edge. As soon as the valve 66 cracks away from its seat, liquid flows from the first chamber in which it has been circulating and enters the passage 60 and commences to build up a pressure therein, which pressure tends to open the control valve 66 more fully by increasing the pressure on the top thereof to a value nearly equal to the pressure on the lower face. The full pressure of the heated liquid thus appears quite rapidly in the second or discharge chamber 26 formed by the longitudinal bore of the gun and closed by the discharge valve 32. This pressure is exerted rearwardly in a direction tending to open the valve, on the annulus at the head of the bellows 40, above described. This pressure is resisted only by spring 50 so that valve 32 opens when the pressure times the area of annulus exceeds the force of the spring. As soon as valve 32 opens slightly, the full pressure in chamber 26 is exerted against the front face thereof and the rearward force tending to move the valve to a fully opened position and to hold it there is increased.

Spraying thus proceeds with the liquid atomized by the release of pressure beyond the orifice 30. By reason of the fact that liquid is flowing rapidly around the circumference of control valve 66 there is an area of reduced pressure above this valve due to the velocity of the liquid so that the operator must hold trigger 14 in valve opening position.

When it is desired to close the discharge valve 32 the operator releases the trigger 14. The aforementioned pressure difference on control valve 66 immediately causes the valve to move towards a closed position. Since valve 32 is still fully open the large pressure reduction caused by continued flow of even a very small quantity of fluid from chamber 26 is sufficient to seat valve 66 very firmly by reason of the pressure difference above and below it. Further, since there is now no continuous supply of liquid to chamber 26 the pressure therein drops to atmospheric pressure almost instantaneously and spring 50 can easily heat valve 32 against the plate or stationary valve member 28 and close off the discharge orifice 30.

It will thus be seen that the discharge valve 32 is operated by pressure in chamber 26 and that this pressure is controlled by fluid flowing past control valve 66 which, in turn, is opened mechanically and is closed by a difference in pressure on its upper and lower faces.

While the invention has been shown in conjunction with a specific form and disposition of the parts it should be expressly understood that it is capable of numerous modifications and changes without departing from the scope of the appended claims.

What I claim is:

1. A spray gun for the airless spraying of liquid coating materials, said spray gun comprising a gun body having first and second liquid chambers and a passage therebetween, means for supplying coating liquid under pressure to said first chamber, a control valve associated with said passage to close and to open said passage to the flow of coating liquid from said first chamber to said second chamber, said control valve having a stem projecting into and located wholly within said first chamber, a pressure-balanced, trigger-actuated mechanism carried by said body and operatively connected to said stem and movable in a direction laterally of said stem to move said stem laterally and to cause said valve to rock about a point on its periphery thereby to open said valve, trigger means located outside said first chamber and associated with said spray gun body for manually operating said mechanism, means forming a spray nozzle in communication with said second chamber, a discharge valve between said second chamber and said spray nozzle, means normally urging said discharge valve toward a closed position, and means operatively connected to said discharge valve and responsive to liquid pressure in said second chamber to open said discharge valve rapidly when pressure in said second chamber exceeds a predetermined value, whereby said coating liquid will be substantially instantaneously sprayed from said spray nozzle when liquid pressure in said second chamber builds up above said value when said control valve is opened to supply coating liquid under pressure from said first chamber through said passage to said second chamber.

2. A spray gun for the airless spraying of liquid coating materials, said spray gun comprising a gun body having first and second liquid chambers and a passage therebetween, means for supplying coating liquid under pressure to said first chamber, a control valve associated with said passage to close and to open said passage to the flow of coating liquid from said first chamber to said second chamber, said control valve having a stem projecting into and located within said first chamber, trigger-actuated mechanism carried by said body and operatively connected at an intermediate portion to said stem and movable in a direction laterally of said stem to move said stem laterally and to cause said valve to rock about a point on its periphery thereby to open said valve, a pair of balancing bellows, the interior of which is subjected to atmospheric pressure, said bellows encompassing said trigger-actuated mechanism within said first chamber on each side of said intermediate portion to balance out the effect of fluid pressure in said first chamber on said trigger-actuated mechanism, trigger means located outside said first chamber and associated with said spray gun

body for manually operating said mechanism, means forming a spray nozzle in communication with said second chamber, a discharge valve between said second chamber and said spray nozzle, means normally urging said discharge valve toward a closed position, and means operatively connected to said discharge valve and responsive to liquid pressure in said second chamber to open said discharge valve rapidly when pressure in said second chamber exceeds a predetermined value, whereby said coating liquid will be substantially instantaneously sprayed from said spray nozzle when liquid pressure in said second chamber builds up above said value when said control valve is opened to supply coating liquid under pressure from said first chamber through said passage to said second chamber.

3. A spray gun for the airless spraying of liquid coating materials, said spray gun comprising a gun body having first and second liquid chambers and a passage therebetween, means for supplying coating liquid under pressure to said first chamber, means forming an annular valve seat around an end of said passage communicating with said first chamber, an annular control valve adapted to seat on said valve seat to close and to open said passage to the flow of the coating liquid from said first chamber to said second chamber, said control valve having a stem projecting into and located wholly within said first chamber, a pressure-balanced, trigger-actuated mechanism carried by said body, having means operatively engaging opposite sides of said stem, and movable in a direction laterally of said stem to move said stem laterally to cause said valve to rock about a point on its periphery thereby to open said valve, trigger means located outside said first chamber and associated with said spray gun body for manually operating said mechanism, means forming a spray nozzle in communication with said second chamber, and a pressure-responsive discharge valve between said second chamber and said spray nozzle and adapted to open rapidly when pressure in said second chamber exceeds a predetermined value, whereby said coating liquid will be substantially instantaneuosly sprayed from said spray nozzle when said control valve is opened.

4. A spray gun for the airless spraying of liquid coating materials, said spray gun comprising a gun body having first and second liquid chambers and a passage therebetween, means for supplying coating liquid under pressure to said first chamber, a control valve associated with said passage to close and to open said passage to the flow of coating liquid from said first chamber to said second chamber, said control valve having a stem projecting into and located wholly within said first chamber, a pressure-balanced, trigger-actuated mechanism carried by said body and operatively connected to said stem and movable in a direction laterally of said stem to move said stem laterally and to cause said valve to rock about a point on its periphery thereby to open said valve, trigger means located outside said first chamber and associated with said spray gun body for manually operating said mechanism, means forming a spray nozzle in communication with said second chamber, a discharge valve located between said second chamber and said spray nozzle and normally closing said second chamber from said spray nozzle, an operating rod connected to said discharge valve, said rod having one end subjected to atomspheric pressure and the other end connected to said discharge valve, a portion of the valve end of said operating rod being subjected to liquid pressure in said second chamber to urge said discharge valve toward an open position, and means associated with said operating rod for urging said discharge valve to a closed position, whereby said discharge valve will be opened when pressure of coating liquid in said second chamber is built up to a point at which the force of the coating liquid on said operating rod exceeds the force of said urging means.

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