

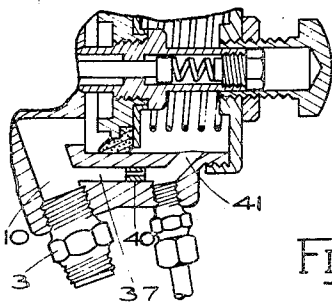
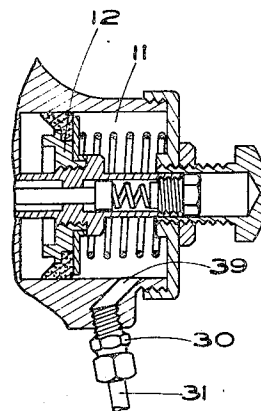
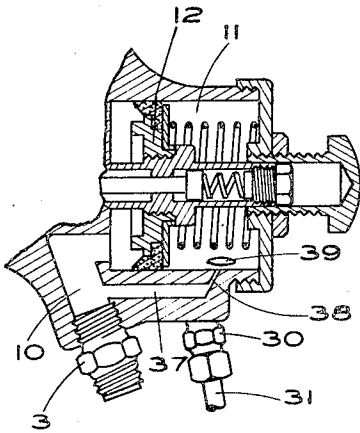
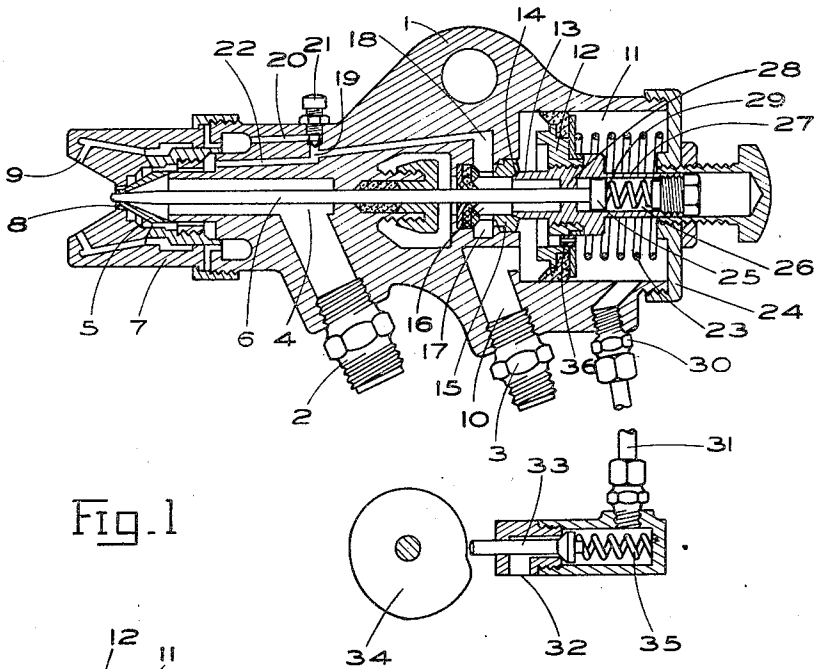
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SPRAY GUN

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SPRAY GUN

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This invention relates to spray guns of the type utilizing compressed air for atomization and also for actuation of a piston which motivates the spray material valve.

A spray gun of this general design is disclosed in U. S. A. Patent No. 2,059,706 issued November 3, 1936, to Jens A. Paasche. As in the device forming the subject of this application, this earlier spray gun has an atomizing air valve integral with the piston and a lost motion connection between the piston and the material needle valve. Such an arrangement is desirable in order that the air valve be opened with the first movement of the piston prior to the opening of the material valve. The atomizing air is then issuing from the nozzle and ready to atomize the material as the latter is discharged. Otherwise, should the material issue first it will be discharged as a substantially unatomized stream of no ordinary utility and likely to disfigure the surface being treated with a splatter of heavy drops.

The principal object of this invention is to provide a spray gun of this type which embodies improved means for controlling the piston movement.

In the Paasche device a single air source furnishes air for both the piston and atomization and the gun operation is started and stopped by the opening and closing of a valve in the sole air supply line. This control arrangement seems about as simplified as possible. However, a serious difficulty, which the subject invention is designed to overcome, is encountered with the Paasche device. To terminate the spraying action of the Paasche gun the valve in the air supply line is closed. The air between the valve and the gun continues to flow to the nozzle until the air pressure is lowered to a point where the piston spring moves the piston forwardly to the nonoperating position.

Until the piston reaches the latter location atomizing air at continuously lower pressure flows to the nozzle to atomize material still discharged from the nozzle at the regular rate. While the material needle reaches its seat before the air valve fixed to the piston arrives at its closed position, the reduced atomizing pressure at the final stage frequently is insufficient to properly atomize the material and the latter is then deposited in the form of a rough spray or spatter seriously impairing the quality of the coating. Should the piston be inclined to stick or move sluggishly, such an objectionable condition is intensified.

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With my invention air at suitable atomizing pressure is constantly maintained in front of the piston ready to pass past the atomizing air valve to the nozzle. As long as the piston is retracted from its forward position, air at full atomizing pressure will be flowing to the nozzle and properly atomizing any material discharged therefrom. This action is unaffected by erratic movement of the piston.

Such results are obtained by controlling the piston movement through alternate metered admission and drainage or venting of air to and from the air cylinder at the rear side of the piston. This variation in pressure in association with the piston spring tension and the constant pressure of compressed air on the forward side of the piston brings about the reciprocating movement of the piston as may be more clearly understood by reading the following description with reference to the accompanying drawings in which:

Fig. 1 is a vertical longitudinal section of a spray gun embodying my invention together with its associated control valve.

Fig. 2 is a vertical section of the rear end of a spray gun embodying a modified form of the invention.

Fig. 3 is a substantially vertical section of the rear end of the same gun shown in Fig. 2 taken in a plane turned about 25 degrees from that of Fig. 2; and

Fig. 4 is a vertical section of a portion of the rear end of a spray gun presenting a third form of the invention.

In the embodiment of the invention appearing in Fig. 1, the body 1 of the spray gun has a connection 2 for coating material and a connection 3 for atomizing and piston-actuating air. The material flows from connection 2 through passage 4 and out material tip 5 when material needle valve 6 is drawn rearwardly from its seat in the tip. Air cap 7 is substantially conventional, delivering air from an annular port 8 surrounding the outlet of the material tip and also from side ports 9 for flattening the central atomized stream into fan shape.

The air reaches the cap from connection 3 by passing through passage 10 into cylinder 11 on the forward side of piston 12. With the valve 13 drawn rearwardly with the piston away from its seat 14 on the insert 15, the air enters space 16 within the insert and laterally into an annular channel 17 which communicates with main air passage 18. This passage is divided at 19. The air going into the upper branch 20, after being

regulated by valve 21, reaches the side ports 9. The air taking the lower branch 22 is discharged through the annular port 8 surrounding the material tip 5.

On the rearward side of the piston 12 in the cylinder 11 is a spring 23. Supported upon cylinder cap 24 the spring is thrust against the piston 12 to move it forwardly until the air valve 12 prevents further movement upon reaching its seat 14.

Material valve 6 has a rearward extension with an enlarged head portion 25 slidably confined within a cylindrical chamber 26 in the tail piece 27 of the piston. When the piston is in its forward position the head 25 is spaced rearwardly from the front wall 28 of the chamber 26. A spring 29 within the chamber bears upon the head 25 to hold the needle 6 upon its seat until the piston has moved rearwardly to open the air valve and sufficient additional distance to bring the front wall 28 of the chamber against the head 25. The material needle 6 is then drawn to open position by continued movement of the piston.

The piston moves rearwardly and the spray operation is thus initiated when the compressed air on the rear side of the piston is drained out venting connection 30, through tubing 31 and out port 32, into the atmosphere by opening valve 33. A revolving cam 34 may be used to open the valve 33 at regular intervals.

The venting of air from the rear side of the piston leaves air under pressure only on the forward side. This atomizing air usually is over 50 pounds pressure per square inch and is ample to move the piston against the force of the piston spring.

When the segment of the cam 34 having the reduced diameter is turned toward the valve 33 the spring 35 returns the valve 33 to its seat and the venting operation is stopped.

In the piston 12 extending from the forward side to the rear side is a metering nipple 36 with a port therethrough of small diameter preferably between $\frac{3}{64}$ and $\frac{1}{8}$ of an inch. The size may be varied according to the speed of operation desired.

It is estimated that a port of this size will pass about 2 cubic feet of air per minute at 50 pounds pressure per square inch. As there would be only a few cubic inches of space in the air cylinder behind the piston and in the tubing 31 leading to the valve 33, the air flow through the metering port would bring the pressure on the rear side of the piston up equal to that on the forward side within a fraction of a second after the valve 33 is closed. As these two opposed pressures are equalized, the spring 23 becomes effective to move the piston to its forward position and thus to stop the spraying operation by successively bringing the material valve 6 and the air valve 13 to their seats.

The venting tube 31 and other venting passages leading to the port 32 should not have any restrictions which would hamper rapid release of the air. With a short length of tubing having a minimum diameter of $\frac{1}{8}$ inch the air should be evacuated at the rate of approximately 10 cubic feet per minute. This is enough greater capacity than that of the metering port 36 to cause the piston to move rearwardly within a small fraction of a second following the opening of valve 33 by cam 34.

In Figs. 2 and 3 is illustrated a modification of the invention, the operation of which is quite identical to that of the design of Fig. 1. The dif-

ference resides in the fact that the piston in the modified form does not have the metering nipple 36. Instead there is a branch passage 37 connected to the air supply passage 10 and communicating with the air cylinder 11 at the rear side of piston 12 through metering port 38. This port functions to deliver air to this space to replace that released by valve 33 in the same manner as does port 36.

While the venting connection 30, as shown in Figs. 2 and 3, communicates with the air cylinder 11 through port 39 circumferentially spaced from the metering port 38, a common passage into cylinder 11, as shown in Fig. 4, may be used.

In the embodiment of Fig. 4 a metering plug 40 is inserted in passage 37 and this latter passage together with venting nipple 30 jointly connect with passage 41 leading into the cylinder 11. The structure is somewhat simplified as compared to that of the previous figures, but functions as satisfactorily.

It may be seen that the various forms of my invention all provide a spray gun control as uncomplicated as that of Paasche and in addition one that avoids the possibility of a rough spray at the termination of the spraying action.

Another valuable advantage derived from the use of my invention is the freedom of choice in locating the control valve. Being entirely independent of the air supply source it may be placed wherever most convenient from an operating standpoint.

In earlier arrangements the control valve has always been associated with the air supply and has had to be located where the air lines could be conveniently placed.

Another advantage of the invention is that a simpler, less expensive control valve is satisfactory. This not only reduces the possibility of trouble but also permits the use of a lighter moving part of the conveyor or other mechanism, with which the spray gun may be associated, for tripping the control valve.

The spray guns as disclosed herein embody the invention in the forms now preferred, but it will be understood that changes may be made without departing from the invention as defined in the claims. It may be noted for instance that the invention may be adapted to a gun which does not have an air valve. While this would be wasteful of air as air would be continuously passing the nozzle, in some circumstances this condition might be compensated for by the benefits derived from the use of the invention.

I claim:

1. In an air operated spray gun, an air cylinder, a piston within said cylinder, said cylinder having an air inlet at its forward end portion for the continuous delivery of air, said cylinder also having an air outlet at the axial center of its forward end, a tubular air valve fixed to the piston and seating in said outlet, a needle type valve with a lost-motion connection with the piston and extending therefrom axially through the tubular air valve and the air outlet, a seat for said needle valve, a spring within the cylinder seating against the rear end thereof and thrust against the rear side of the piston, said piston having a restricted air passage therethrough from its forward side to its rearward side, said cylinder having connected to its rearward portion an air venting passage with a capacity considerably greater than that of the restricted air passage through the piston, and a

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valve controlled conduit extending exteriorly of the cylinder from the venting passage.

2. In an air operated spray gun, an air cylinder, a piston within said cylinder, said cylinder having an air inlet at its forward end portion for the continuous delivery of air, said cylinder also having an air outlet at the axial center of its forward end, a tubular air valve fixed to the piston and seating in said outlet, a needle type valve with a lost-motion connection with the piston and extending therefrom axially through the tubular air valve and the air outlet, a seat for said needle valve, a spring within the cylinder seating against the rear end thereof and thrust against the rear side of the piston, there being a restricted air passage from the forward side of the piston to the rearward side of the piston, said cylinder having connected to its rearward portion an air venting passage with a capacity considerably greater than that of the restricted air passage from the forward to the rearward side of the piston, and a valve controlled conduit extending exteriorly of the cylinder from the venting passage.

3. In an air operated spray gun, an air cylinder, a piston within said cylinder, said cylinder having an air inlet at its forward end portion, an air passage, a single supply source for the continuous delivery of compressed air to the air inlet of the cylinder and to the air passage, an air valve in said passage, an actuating connection between the piston and the air valve, a needle type material valve with a lost motion connection with the piston, a seat for said needle valve, a spring seating against the rear end of the cylinder and thrust against the rear side of the piston, there being a restricted air passage from the forward side of the piston to the rearward side of the

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piston, said cylinder having connected to its rearward portion an air venting passage with a capacity considerably greater than that of the restricted air passage from the forward to the rear side of the piston, and a valve controlled conduit extending exteriorly of the cylinder from the venting passage.

4. In a spray gun as set forth in claim 3 in which the restricted passage from the forward side to the rearward side of the piston is directly through the piston.

5. In a spray gun as set forth in claim 3 in which the restricted passage from the forward side to the rearward side of the piston is through the wall of the cylinder.

6. In a spray gun as set forth in claim 5 in which the forward end of the restricted passage communicates with the air inlet.

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