Feb. 15, 1966 B. E. ENSSLE 3,235,185

SPRAY GUN HAVING VENT MEMBER FOR SPRAY MATERIAL AND AIR

Filed March 11, 1963 5 Sheets-Sheet 1

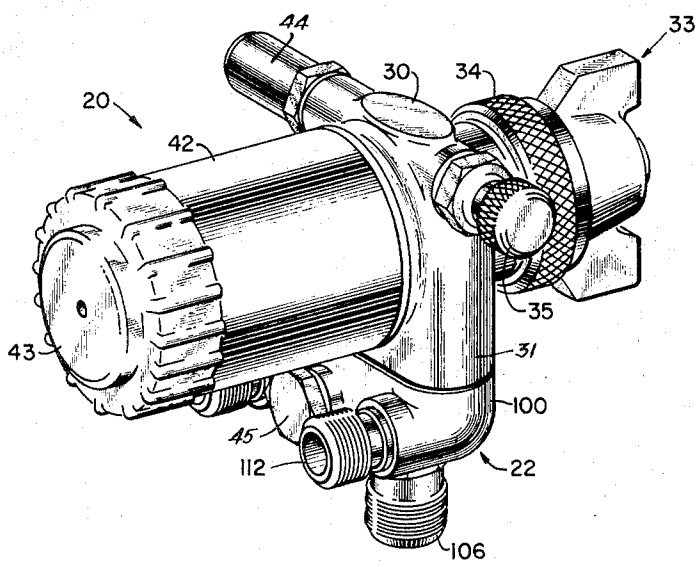


Fig. 1.

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SPRAY GUN HAVING VENT MEMBER FOR SPRAY MATERIAL AND AIR

Filed March 11, 1963 5 Sheets-Sheet 2

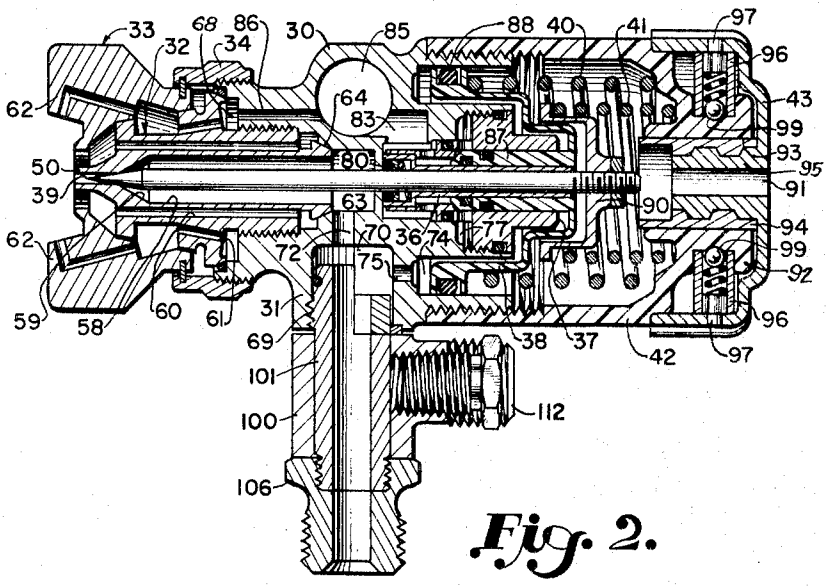


Fig. 2.

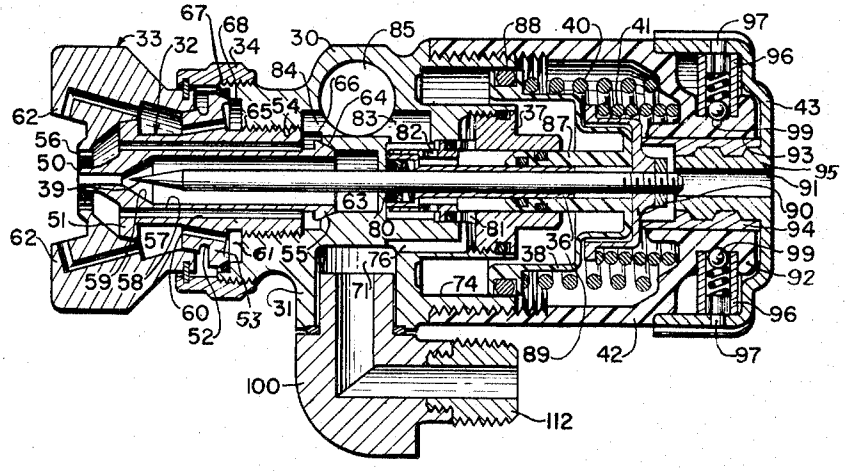


Fig. 3.

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SPRAY GUN HAVING VENT MEMBER FOR SPRAY MATERIAL AND AIR

Filed March 11, 1963 5 Sheets-Sheet 3

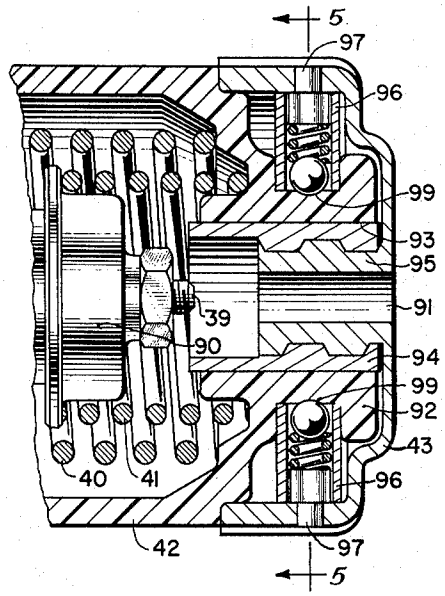


Fig. 4.

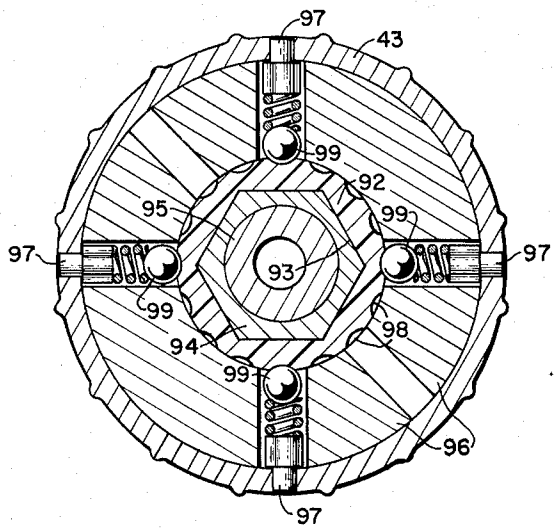


Fig. 5.

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SPRAY GUN HAVING VENT MEMBER FOR SPRAY MATERIAL AND AIR

Filed March 11, 1963 5 Sheets-Sheet 4

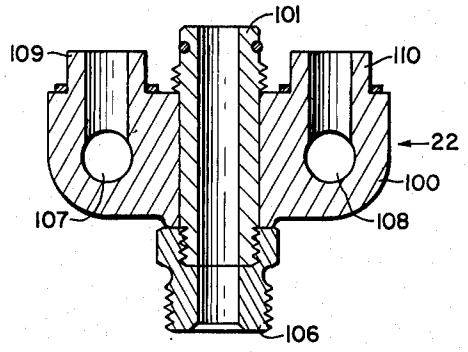


Fig. 6.

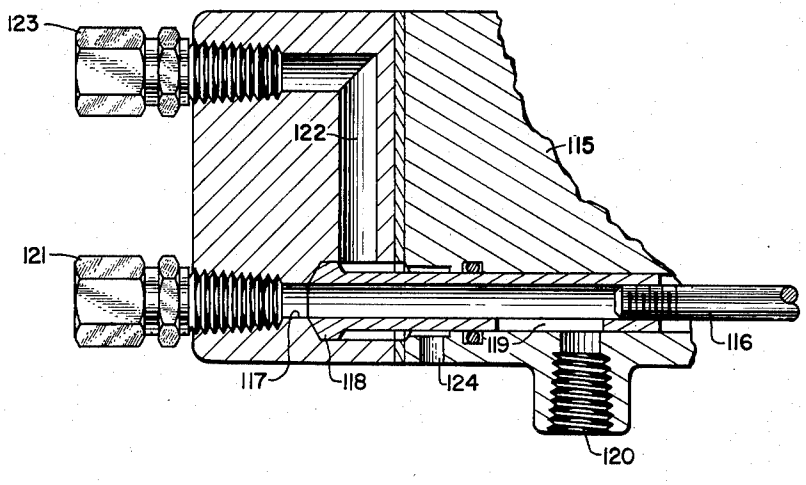


Fig. 7.

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SPRAY GUN HAVING VENT MEMBER FOR SPRAY MATERIAL AND AIR

Filed March 11, 1963 5 Sheets-Sheet 5

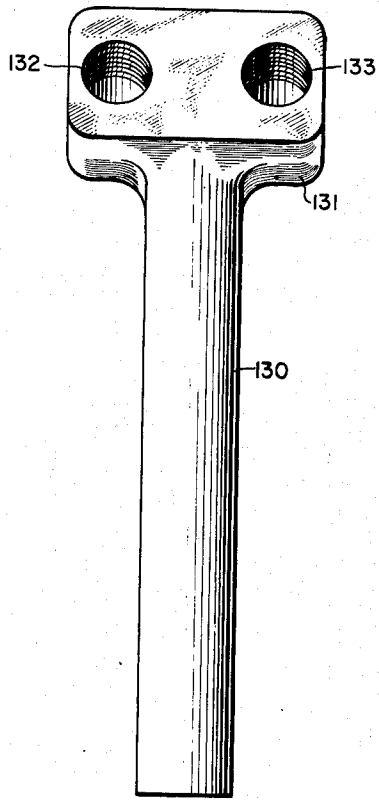


Fig. 8.

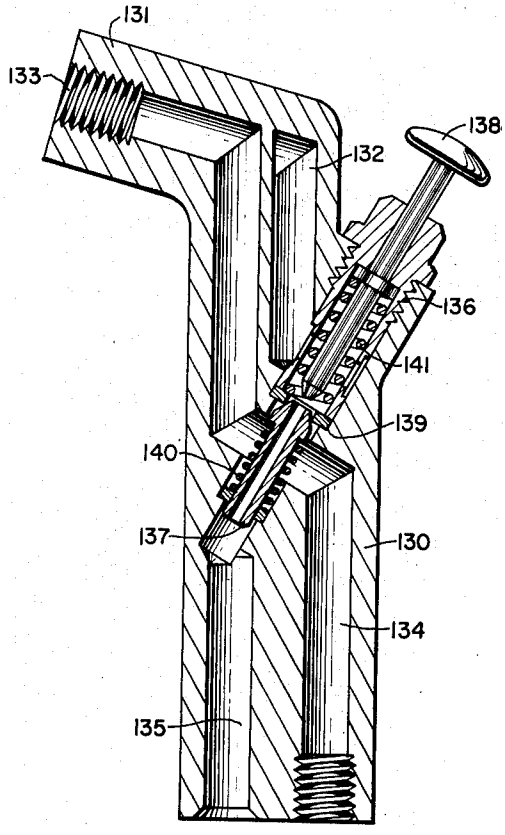


Fig. 9.

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United States Patent Office 3,235,185 Patented Feb. 15, 1966

3,235,185

SPRAY GUN HAVING VENT MEMBER FOR SPRAY MATERIAL AND AIR

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Filed Mar. 11, 1963, Ser. No. 264,199
17 Claims. (Cl. 239—411)

The present invention relates to devices, popularly known as spray guns, for spraying paint and other coating materials, and in particular, to improvements in spray guns wherein the coating material is atomized by compressed air or the like.

The art has developed a wide variety of spray guns for atomizing and applying coating materials by means of compressed air. Generally speaking, the gun comprises a body defining a materials supply duct and an atomizing air passage, and a nozzle secured to the front end or nose of the body for discharging the material in a relatively fine stream and for directing compressed air jets against the stream to atomize the material and project the resultant material spray forwardly from the gun. The materials supply duct is conventionally controlled by a needle valve which extends rearwardly from the nose for actuation, i.e., longitudinal reciprocation, by means located adjacent its rearward end. Usually, the stem projects through the atomizing air passage of the gun, particularly in guns having an on-off control valve for the atomizing air. With such guns, it was soon discovered that despite the efficiency of packing glands and seals, paint would leak along the stem of the needle valve into the air passage and cause the atomizing air passages and jets to be clogged or blocked, and/or air would leak along the stem into the materials supply duct and cause "spitting" at the nozzle, thereby disrupting the intended spray pattern and the uniformity of the applied coating. These disadvantages were particularly emphasized upon the advent of automatic spray guns wherein the materials control valve and the atomizing air control valve are disposed in longitudinally spaced coaxial relation and are actuated by a concentric piston operated from a high pressure air source.

To overcome the stated disadvantages, a spray gun construction has previously been devised which at present is the substantially universally accepted standard of the art. This gun construction is characterized by a body including a nose portion for reception of the nozzle and defining the materials supply duct, a rear portion (or a hand-grip portion in hand-manipulated guns) spaced rearwardly from the nose portion and including the air supply passage and air control valve, and a bridge portion bridging over the tops and interconnecting the nose and rear portions both physically and for the supply of atomizing air. By virtue of this construction, a space open to atmosphere is defined between the nose and the rear portions of the gun body through which space the materials control needle valve extends, whereby coating materials leaking from the nose portion along the needle and air leaking from the rear portion along the needle are independently or individually vented to atmosphere. The construction has proven eminently successful and has been in continuous use in the art for more than thirty years. Yet, even with modern materials and manufacturing skills, it results in a relatively large, heavy, bulky and expensive gun and imposes, because of the bridge portion, certain restrictions on flow of atomizing air.

The object of the present invention is to provide an improved spray gun construction facilitating economical manufacture of spray guns that are small, compact and

lightweight, and providing for increased operating efficiency in spray guns, especially increased efficiency of atomizing air flow.

It is in particular an object of this invention to provide an improved spray gun construction eliminating the need for the aforesaid intermediate atmospheric access area, and therefore the need for a gun body having spaced portions, without re-encountering the difficulties that led to the above described structure, i.e., the difficulties consequent upon leakage of coating materials into the air passages and vice versa.

Specifically, it is the primary object of this invention to provide an improved spray gun construction including a tubular portion intermediate the materials supply duct and the air passages having a fluid-tight relationship with the gun body, the tubular portion extending rearwardly through the air passages in encompassing relation to the needle valve and communicating at its rearward end to the exterior of the gun, whereby coating material leaking along the needle is vented to atmosphere through the interior of the tube and air leaking from the air passages is vented to atmosphere along the exterior of the tube, and whereby the air and coating materials are prevented from entering the material supply duct and the air passages respectively.

Another object of the invention is to embody this structural relationship into spray guns having a coaxial air valve, the assembly including the tubular portion and needle valve as aforesaid, an atomizing air chamber about the exterior of the tubular portion having a valve seat therein, and an annular air valve slidably mounted in the chamber on the exterior of the tubular portion for movement toward and away from the seat.

It is also an object of the invention to provide an improved automatic spray gun including the concentric arangement of the needle valve, tubular portion and air valve as defined in the preceding paragraph and further including, in concentric surrounding relation to the defined elements, a piston adapted to be actuated by a motive fluid such as compressed air, the piston having connection with the air valve and the needle valve for controlling the flow of both atomizing air and coating materials.

By virtue of the tubular portion or element of this invention, and the concentric relation thereto of the control elements, the need for spaced body portions is eliminated and the elements are disposed in surrounding relation to one another, rather than in axially spaced relation, thereby to facilitate exceptionally great decrease in the length and weight of the gun body, the amount of material required, and the cost of manufacture. This latter factor is especially emphasized by the fact that the gun body of this invention requires essentially concentric machining of one piece, as opposed to the separate machining of three body portions in the prior art gun construction. Moreover, because of the elimination of a bridging portion, much greater efficiency of atomizing air flow is readily attained.

An additional object of the present invention is the attainment of further economies and conveniences in manufacture and assembly of spray guns, especially integral fabrication of components that were previously made in a number of pieces, decrease in the size of components by virtue of integration, use of improved materials such as self-sealing plastics for movable parts, and so on.

A further object of the invention is the provision of an improved spray gun comprising a gun body and a mounting block therefor, the block including hose coupling means for supply thereto of coating materials and compressed air, the body and block including comple-

mentary mutually sealing nipples and sockets for supply of the materials and air from the block to the body, one of the nipples and the respective socket including quickly attached and detached locking means for detachably securing the body to the block in sealed relation thereto, whereby a worn or defective gun may be quickly replaced in service without necessity for uncoupling hoses and the like, and whereby the gun body may be adapted to a variety of uses by provision of different forms of mounting blocks therefor.

A still further object of the invention, in accord with the above stated object, is the provision of an automatic spray gun as previously defined, a mounting block therefor, and means selectively cooperable with the block to adapt the gun to different uses, said means including a first arrangement facilitating remote control of the motive fluid, a second means comprising a solenoid operated control valve for the motive fluid and a third means in the form of a pistol-grip embodying a manually actuated control valve for the motive fluid.

Other objects and advantages of the invention will become apparent in the following detailed description.

Now, in order to acquaint those skilled in the art with the manner of making and using my improved spray guns, I shall describe, in connection with the accompanying drawings, the construction, mode of operation and manner of use of a preferred embodiment of an automatic spray gun made in accordance with the present invention, a preferred mounting block therefor, and preferred embodiments of remote, electromagnetic and manual control means therefor.

In the drawings:

FIGURE 1 is a perspective view of my improved spraying apparatus illustrating preferred embodiments of my improved spray gun and gun mounting block;

FIGURE 2 is a longitudinal sectional view of the gun showing the valve thereof in closed position, the upper portions of the gun body and nozzles being sectioned to show the pattern controlling air passages and the lower portions of the gun body being sectioned to show the material inlet and the air inlet to the valve actuating piston;

FIGURE 3 is a view similar to FIGURE 2 showing the valves in open position and sectioned to show the atomizing air inlet to the gun;

FIGURE 4 is an enlarged fragmentary longitudinal section of the needle valve adjusting mechanism incorporated in the gun of the invention;

FIGURE 5 is a cross-sectional view of said mechanism taken substantially on line 5—5 of FIGURE 4;

FIGURE 6 is a transverse vertical section of the preferred embodiment of the gun mounting block provided according to the invention;

FIGURE 7 is a horizontal section of a solenoid operated control for the gun of the invention;

FIGURE 8 is a front elevation of a manipulating handle for my improved spray gun; and

FIGURE 9 is a vertical sectional view of said handle.

Referring to FIGURE 1, I have shown the preferred embodiments of the spray gun **20** and the gun mounting block **22** of my invention. The gun is particularly distinguished by minute size and elimination of the conventional intermediate gap for separately venting the material and air supply ducts of the gun to atmosphere. As will become apparent as the description proceeds, this gun has a wide variety of uses, but it is primarily an automatic, remotely controlled gun for use in automatic paint spraying apparatus embodied in producton facilities, such as automobile body spray painting lines, etc.

As shown particularly in FIGURES 1 to 3, the gun is comprised of a generally cylindrical main body **30** having a radially extending boss **31** on one side thereof, a conventional materials atomizing and spraying nozzle which in the embodiment shown includes a material nozzle **32**, an air nozzle **33** and a nozzle coupling ring **34**, a spray pattern control valve **35**, a vent member **36**, a porting member **37**, a combined piston and air valve **38**, a material control needle valve **39**, a piston biasing spring **40**, a needle biasing spring **41**, a generally cup-shaped body extension or piston enclosure **42**, and an adjustment cap **43**. To facilitate mounting of the gun in an automatic spraying machine, the body **30** is provided at one side with a radially tapped bore and the block **22** is provided with a centrally disposed rearwardly open tapped bore, the two bores being adapted for selective reception of a mounting post **44**. With the post mounted in one bore (the side bore in the body as shown in FIGURE 1), the other bore is preferably closed by a plug **45**.

The nozzle assembly employed with the gun of my invention may be any conventional assembly of standard size and manufacture. By way of example, I have shown a nozzle assembly comprised of a material nozzle **32**, an air or fanning nozzle **33**, and a coupling ring **34**. While these nozzle components are well-known in the art, it is to be noted that the material nozzle **32** comprises a unitary member including six concentric cylindrical portions, namely, a small diameter material discharge tip **50**, a slightly larger diameter atomizing air section **51** rearwardly of the tip, a still larger diameter spray pattern controlling air section **52** rearwardly of the section **51**, a radial flange **53** rearwardly of the section **52**, a threaded mounting portion **54** rearwardly of and smaller than said flange and a still smaller rearwardly facing conical seating portion **55**. Forwardly facing conical seats are provided adjacent the leading ends of each of the sections **50**, **51** and **52**, and the air nozzle **33** has complementary portions sealingly engageable with these seats. The first comprises a perforated annulus **56** surrounding the tip **50** and forming discharge ports for atomizing air, the second seals between the two air sections **51** and **52** to separate the same and the third seals on the section **52** and defines therewith a distributing chamber **57** for spray pattern controlling air.

The material nozzle **32** is bored axially thereof to define a material supply duct **58**, and the bore is stepped intermediate its ends to form a rearwardly facing seat **59** for the material controlling needle valve **39**. Holes **60** are drilled in the section **51** for passage of atomizing air, and holes **61** are drilled in the section **52** for passage of pattern controlling air. The duct **58**, the tip **50**, the holes **60** and the orifice in the annulus **56** are interrelated so that air under pressure is impinged upon material emanating from the tip to atomize and form a mist-like spray of the material. To control the pattern of the spray, and especially to form a fan-like spray pattern, the air nozzle **33** includes a pair of diametrically opposed ears or horns **62** having inwardly and forwardly directed ports therein communicating with the chamber **57** for impinging air on opposite sides of the spray to conform the same to the desired pattern.

The nozzle assembly depicted is of course only one of many that can be employed in conjunction with the novel features of my gun, but I have selected this nozzle for illustration herein as it involves the most complex of the porting problems encountered in spray guns, i.e., formation of three separate flow passages for the material, the atomizing air and the pattern controlling air.

To receive the nozzle assembly, the forward end portions of the body **30** are machined in a generally conventional manner in accordance with the nozzle construction. In the illustrated arrangement, the body is machined to define an axial or central bore or recess **63** comprising a material passage communicating with the nozzle duct **58**, a frusto-conical seat **64** forwardly of the recess for sealed engagement with the inner end **55** of the material nozzle **32**, a tapped bore **65** forwardly of and somewhat larger than the seat for screw-threaded reception of the mounting portion **54** of the nozzle, an annular chamber **66** between the seat and said tapped bore to communicate with the air passages **60**, and a concentric tubular exten-

sion 67 forwardly of the tapped bore within which the annular flange 53 on the nozzle seats, said flange and said extension defining an annular chamber 68 therebetween communicating with the pattern air passages 61.

The air nozzle 33 is rotatably engaged by a C-ring with the coupling ring 34, and the tubular extension 67 of the body is externally threaded for attachment thereto of the coupling ring, whereby the air nozzle 33 is secured to the gun in sealed coaxial relation to the material nozzle 32 to complete the assembly of the nozzle on the gun body.

The radial boss 31 on the body 30 has three laterally spaced parallel holes therein perpendicular to the axis of the body, namely, a central tapped bore 69 comprising a material inlet, a bore 70 comprising an inlet for valve operating air (see FIGURE 2 for both bores 69 and 70), and a bore 71 (FIGURE 3) comprising an inlet for atomizing and pattern controlling air. The body is drilled from the inner end of the bore 69 into the recess 63 to define a passage 72 for conducting material into the material supply duct 58–63.

The rearward end portion of the body is machined to define essentially a stepped axial bore (separated from the recess 63 by a thin centrally apertured wall) and a concentric, circumscribing annular chamber 74. A longitudinally disposed port 75 (FIGURE 2) establishes communication between the air inlet 70 and the chamber 74, and a hole 76 (FIGURE 3) establishes communication between the bore 71 and the rearward end portion of the annular wall separating the axial bore and the annular chamber 74. This latter hole leads into an annular air chamber 77 defined in the body by means of the porting member 37, which is threaded into said annular separating wall subsequent to machining of the body per se.

Inserted within the bottom of the stepped axial bore is a combined sealing washer and packing gland 80 over which the cup-shaped inner end of the vent member 36 is positioned, said member comprising a tubular stem extending rearwardly from the body. Disposed about the stem in radially spaced encircling relation thereto is the porting member 37, the inner end of which is sealed into the axial bore in the body and engages over the cup-shaped inner end of the vent member 36 thereby to secure the vent member, the seal 80 and the porting member in the body in sealed relation thereto.

The porting member 37 comprises a tubular element having a radially ported portion 81 communicating with the chamber 77 in the body, a radially ported reduced portion defining an annular chamber 82 in the forward end portion of the bore, and a rearwardly facing valve seat in the interior thereof intermediate the groove 81 and the chamber 82. To seal the member relative to the body and normally prevent air leakage from the groove 81, an O-ring seal is provided on the member intermediate the portions 81 and 82.

Within the body 30, a plurality of passages are defined which communicate with the chamber 82, namely, a passage 83 leading forwardly into a valve chamber 85 and a longitudinal passage 84 leading from the chamber 85 to the chamber 66, the passages 60 and the ports in the annulus 56 for delivery of atomizing air, and a valve port leading from the valve chamber 85 to a passage 86 (FIGURE 2) which communicates with the chamber 68, the passages 61, the chamber 57 and the ports in the horns 62 for delivery of pattern controlling air. The valve 35 is adjustably mounted in the body and includes a needle entering into the chamber 85 and cooperable with said valve port to vary the amount of air supplied to the horns 62, thereby to facilitate adjustment of the spray pattern, all as is well known in the art.

To control passage of air along the paths thus defined, a tubular air control valve 87 (comprising a part of the combined piston and valve 38) is slidably positioned within the annular chamber defined between the vent stem 36 and the porting member 37 for movement toward and away from the seat formed within the member 37. The valve has sealed engagement with both the vent stem and the porting member. O-ring seals being provided on the inside and outside of the valve for this purpose. Movement of the valve into and out of engagement with its seat will of course control flow of air from the inlet passages 71, 76, 77 and 81 to the atomizing air outlet passages 82, 83, 84, 66, 60, 56 and to the pattern controlling air outlet passages 85, 86, 68, 61, 62.

To effect actuation of the valve 87, there is coupled thereto, and preferably formed integrally therewith, a piston 88 which is reciprocably mounted in the annular chamber 74 in the body 30. In the preferred embodiment of the invention, the valve 87 and piston 88 comprise an integral element molded of a material having good sealing characteristics, a low coefficient of friction and dimensional stability, particularly plastic materials such as Delrin and Teflon. The primary power chamber is of course the chamber 74 which is selectively supplied with motivating fluid, preferably air under pressure, to cause opening of the valve 87. I additionally prefer to provide a secondary power chamber 89 (FIGURE 3) defined by a radial step between the porting chamber 37 and a complementary portion of the piston.

The purpose of the secondary cylinder and piston arrangement is to mitigate inadvertent actuation of the valve upon occurrence of minor variations in the pressure of the motivating fluid, and to insure that the valve will be actuated only in response to significant pressure variations intentionally caused by the operator or operating means of the spraying system.

Specifically, when air is initially admitted to the chamber 74, only the piston 88 is primarily exposed to the air (as shown in FIGURE 2) thereby necessitating a high unit pressure to effect movement of the piston against the bias of the springs 40 and 41 to move the valve to open position. When the valve approaches full open position, the portion of the piston complementary to the porting member 37 is moved rearwardly to define the chamber 89 (FIGURE 3) whereby a large area of the piston is exposed to the motivating fluid thereby firmly to hold the valve in open position. Because of the large area of exposure, the unit pressure of the motivating fluid will have to decrease substantially before the springs will be effective to move the piston and to return the valve to closed position. Consequently, fluttering or spasmodic operation of the valve is eliminated and positive control is maintained over the flow of atomizing and pattern controlling air.

To control the flow of material, the needle valve 39 is projected axially through the air valve 87, the venting tube 36, the seal 80 (which thus forms a packing gland about the needle), the aperture in the wall separating the air and material sections of the body, the recess 63 and the supply duct 58 to the seat 59 in said duct. At its rearward end, i.e., rearwardly of the piston and air valve member 38, the needle valve carries an abutment 90 to be contacted by the member 38 in its rearward or valve opening movement. The abutment 90 is preferably adjustable on the stem to vary the spacing between it and the member 38.

The needle biasing spring 41, which is of relatively great strength, is engaged with the rearward surface of the abutment 90 and the piston and air valve spring 40, which is of lesser strength, is engaged with the piston in encircling relation to the spring 40.

The body extension 42 is threadedly attached to the body by engagement with a threaded outer surface on the peripheral wall defining the chamber 74. This extension, being of generally cup-shape, thus encloses the piston 88, the rearward end of the needle and the springs 40 and 41, causing said springs to exert a biasing force on the respective valve members.

In the closed position of the valves as shown in FIGURE 2, the spring 41 causes the needle valve to engage its seat 59 and the spring 40 holds the air valve 87 on its seat in the porting member 37. In this position of

the valves, the abutment 90 is spaced rearwardly from the piston by a distance such that the air valve 87 would be moved to full open position or substantially so before the member 38 would contact the abutment 90. Thus, when motivating fluid under high unit pressure is supplied to the inlet 70 and chamber 74, the piston is first moved to open the air valve 87 thereby causing an initial discharge of air alone from the ports at 56 and 62. Then, as the piston continues to move, it engages the abutment 90 and moves the needle valve rearwardly to open position to permit flow of material through the nozzle tip 50, whereupon the material is immediately contacted and atomized by the pre-established jet streams of air under pressure. Thus, all material discharged is fully atomized for spray application and there can be no solid stream discharge or sputtering that would mar the finish to be applied by the spraying apparatus.

To the same purpose, when supply of motivating fluid to the piston 88 is discontinued, the more powerful spring 41 first drives the needle valve to its seat to stop material flow, and the weaker spring 40 thereafter closes the air valve whereby all material discharged is atomized before air flow ceases. This latter function also provides a final air cleaning of the air ports and the nozzle tip 50 to insure immediate operation of the gun upon the next actuation thereof.

Should the needle valve packing gland or seal 80 leak, as it usually does, materials leaking from the inlet 69 and the duct 58–63 will flow along the needle on the interior of the vent tube 36 to the rearward end thereof, which is spaced rearwardly from the air valve. From this point, the material will leak rearwardly and be vented to atmosphere through a center hole 91 in the adjustment cap 43. At the same time, air leaking past the air valve 87 will flow along the exterior of the vent tube 36 and be vented to atmosphere in the same manner as the material is vented to atmosphere. Also, air leaking past the piston 88 will be vented to atmosphere. Consequently, it is impossible for paint or other materials being sprayed to leak from the supply duct 58–63 into the air supply ducts of the gun, and it is also impossible for air to leak from the air supply ducts into the material supply duct; both the material and the air being independently vented to atmosphere via the interior and exterior, respectively, of the tube 36. The tube 36 therefore accomplishes the purposes of the air gap previously provided in spray guns of the general character. Because the tube is short and permits overlapping or concentric arrangement of the several air and material supply passages, guns incorporating such tube may be made considerably shorter, more compact and significantly lighter than prior art guns. While I have herein shown my new venting principles and apparatus as incorporated in an automatic gun, it will be readily appreciated by those skilled in the art that the same principles and the same apparatus may be applied to other forms of guns, such as hand operated guns, etc.

While the venting principle above described is a prime feature of the present invention, additional features of novelty have been incorporated in the gun illustrated herein, which features have general application in the spray gun field. Specifically, it is desirable and advantageous to afford means for controlling the degree of opening of the needle valve 39, thereby to control the amount of material sprayed in a given time interval and to control the character of the spray. For this purpose, I have incorporated in my gun a novel means for adjusting the degree of opening of the material control valve in small accurate increments.

Referring to FIGURES 4 and 5, I have provided a body extension 42 which is stepped progressively inwardly in a series of cylindrical portions adjacent its rearward end and which terminates in a coaxial annular boss 92. Within this boss, I form a non-circular axially extending passage, suitably a hexagonal passage 93. Within this passage a nut 94 is slidably mounted, the nut having an external configuration corresponding to that of the passage through the boss 92 so that the nut is slidably but non-rotatably mounted in the boss. The nut is provided axially thereof with an accurately formed screw thread of any desired standard formation. I have illustrated, by way of example, an acme thread having four threads to the inch.

For cooperation with the nut 94, a complementarily threaded stud 95 is formed integrally with or fixedly secured to the adjustment cap 43 and threaded into the nut. The cap 43 in turn engages rotatably over the stepped rearward end portions of the body extension 42 and is secured to the body extension against relative axial displacement by means of a pair of semi-circular split ring elements 96. Specifically, the terminal boss 92 of the body extension 42 is provided in its peripheral surface with a circumferential groove within which the two halves of the ring 96 rotatably engage. In assembly, the two-ring halves are first engaged in the circumferential groove in the boss 92, and the assembly of the cap 43, the stud 95 and nut 94 is then slipped onto the rearward end portion of the body extension 42.

Within the bottom of the circumferential groove within which the ring halves 96 are disposed, I provide a plurality of (preferably sixteen) evenly spaced depressions 98 within which four evenly spaced ball dentents 99 carried by the ring-halves 96 are adapted to be engaged. Preferably, the ring-halves 96 are bored for slidable reception of four evenly spaced spring pressed detent assemblies each including a ball 99 engaging in a respective depression 98 and a retainer 97 slidably engaged in the respective bore and an aligned hole in the side wall of the cap 43, whereby the retainers hold the cap and rings in assembled relation.

The spring-loaded detent balls 99 in cooperation with the depressions 98 thereby define sixteen physically sensible divisions to each revolution of the cap 43 relative to the gun body. With a stud 95 having four threads to the inch, the assembly results in a physically sensible adjustment of the nut 94 in increments of one sixty-fourth of an inch axial travel. As shown particularly in FIGURE 4, the nut 94 is disposed in alinement with and is adapted to be engaged by the abutment 90 on the rearward end of the needle valve. Consequently, axial adjustment of the nut 94 by the cap 43 will result in adjustment of the opening of the needle valve in precise increments of one sixty-fourth of an inch. Thus, the material spraying characteristics of the gun can quickly and accurately be adjusted at the will of the operator. This particular means for and mode of adjustment affords the particular advantage that internal gun adjustments may be effected externally of the gun without increasing the external length of the gun.

Another feature of the present invention is the provision of means whereby a defective or worn gun may quickly be replaced in service without need for uncoupling fluid supply conduits or hoses, mounting brackets, etc. Specifically, it is an object of this invention to provide a mounting block for the gun incorporating quick disconnect means whereby a gun may be removed and replaced by a new or repaired gun in a matter of seconds so that production lines need not be shut down when a gun requires replacement. As shown particularly in FIGURE 6 I provide a mounting block 22 comprised of a generally rectangular solid metal body 100 of a form generally complimental to the radial boss 31 on the gun body 30. The block body 100 is provided centrally thereof with a vertical bore alined with the material inlet 69 in the gun body. Within this bore, I journal a tubular stud 101, the ends of which project above and below the block body. The stud extends upwardly from the upper surface of the block body and is provided on its upwardly extending portions with a screw thread complementary to that in the material inlet 69. At the lower side of the block body 100, the stud 101 is provided with a

mounting sleeve or adapter **106** which retains the stud in the body against relative axial movement but accommodates rotary movement thereof, the adapter having a hex nut external part facilitating rotation of the stud to accommodate threading of the same into the inlet **69**.

To opposite sides of the central bore, the block body **100** is provided with L-shaped air passages **107** and **108** which are alined with the air passages **70** and **71**, respectively, in the extension **31** of the gun body **30**. Formed integrally at the upper face of the block body **100** in alinement with the passages **107** and **108** are a pair of tubular projections **109** and **110** which complement and are adapted for slidable reception in the air inlets **70** and **71**, respectively, in the valve body. Each of the projections **109** and **110** is provided adjacent its base with a seal for sealed engagement with extension **31** adjacent the respective inlet passage **70** and **71**. At the opposite ends thereof, i.e., on the rearwardly facing surface of the block, the passages **107** and **108** are provided with conventional nipples **112** for connection with the customary conduits or hoses for supplying air to the gun. Similarly, the adapter or nipple **106** is adapted for connection to the customary supply conduit for the material to be sprayed.

In use, the body **100** of the mounting block **22** is assembled to the gun by simply disposing the boss **31** over the three projections **101**, **109** and **110**. The three projections initially slide freely into the respective bores in the gun body until the threads on the tube **101** commence to engage the threads within the bore **69** in the gun body. The operator may then rotate the hand adapter or nipple **106** to effect rotation of the tube **101** thereby causing the gun body and the mounting block to be pulled together to effect a secure connection between the gun body and the block. The seals on the projections **109** and **110** effect a sealed connection with the bores **70** and **71**, respectively, and an O-ring is provided adjacent the upper end of the tube or projection **101** which is adapted to seal in the bore **69**, thereby to establish a sealed connection between the bore **69** and the tube.

Material to be sprayed is supplied under pressure to the nipple **106** and tube **101** to the material inlet **69** of the gun. A continuous supply of air under pressure communicates via the passage **108** and the projection **110** with the inlet **71** in the gun body for supply of atomizing and pattern controlling air to the gun. A source of air under pressure communicates via the pasage **107** and the projection **109** with the piston air inlet **70** in the gun body. This latter source of air is under the control of suitable value means exteriorly of the gun body and the block whereby air under pressure may intermittently be supplied to the actuating piston in the gun at the will of an operator or under remote automatic control, thereby to effect operation of the gun in the manner previously described.

Should the gun become defective for one reason or another, the gun may rapidly be replaced by a new or rebuilt gun by simply closing the air and material flow controlling valves and rotating the nipple **16** in an unthreading direction to uncouple the gun from the block.

As above stated, the supply of air to the gun actuating piston may be controlled by any suitable valve arrangement located adjacent or remotely of the gun and block. However, it is a particular object of the present invention to provide electrically controlled valve means directly associated with the gun and the block to facilitate remote control of gun operation. This suitably takes the form of a solenoid operated valve, the solenoid portion of which is conventional and is not shown herein, and the valve portion of which is illustrated in FIGURE 7.

With reference to FIGURE 7, the remotely operated solenoid valve includes a body **115** on which the solenoid operating mechanism (not shown) is fixedly mounted. The solenoid includes the usual operating or armature stem **116** which projects into the valve portion of the body **115**. This portion of the body includes a longitudinal bore **117** within which a tubular valve member **118** is reciprocably mounted. The body is suitably of two-part construction and each part is counterbored to provide oppositely facing seats for a double conical valve formed on the forward end portion of the tubular element **118**. Adjacent its opposite end, the valve member **118** is provided with an elongate slot **119** in its side wall which is disposed to communicate in all positions of the valve with a lateral bore **120** in the body **115**, which latter bore is threaded or provided with a nipple for reception of a hose or other conduit leading from a source supply of air under pressure. The bore **117** similarly terminates in an axially threaded portion or nipple within which a coupler **121** is secured for connecting the bore **117** to the inlet **112** on the body of the block **22** which communicates with the supply passage **108** and the atomizing air inlet **71** of the gun. Consequently, in all positions of the valve **118**, atomizing and pattern controlling air is continuously supplied to the gun.

To facilitate control of the gun, a generally L-shaped passage **122** is provided in the body **115** of the solenoid operated valve, one leg of the L generally paralleling the bore **117** and the other leg thereof intersecting the bore **117** at a point between said oppositely facing valve seats. The passage **122** in turn communicates via a coupler **123** with the passage **107** in the mounting block **22**, and thus with the piston air inlet **70** and the piston chamber **74** in the gun body. Upon actuation of the solenoid in customary manner, the valve **118** is retracted within the valve body **115**, whereby the valve is moved off the forward one of its seats and establishes communication between the air inlet **120** and the passage **122** and coupler **123** to effect actuation of the piston in the gun thereby to initiate spraying.

When the solenoid is de-energized, the conventional return spring of the solenoid mechanism operates to reseat the valve **118** on the forward one of its seats, whereby the supply of air to the passage **122** is discontinued. In this latter position of the valve **118**, i.e., the position shown in FIGURE 7, a vent port **124** is in open communication with the passage **122**, whereby the air in the piston chambers **74** and **89** may quickly be vented to atmosphere to facilitate closing of the valves in the gun and thereby discontinue spraying. As will be appreciated from FIGURE 7, the vent port **124** is closed by the valve **118** when the valve **118** is moved to its rearwardmost position in engagement with the rearward one of its seats upon actuation of the solenoid.

By virtue of the couplers **121** and **123**, the entire solenoid valve assembly may be physically mounted directly on the mounting block **22**, thereby to afford a compact unitary assembly of the gun and its operating means. Specifically, with reference to FIGURE 1, the solenoid valve may be disposed immediately rearwardly of the mounting block **22** below the rearward portions of the gun itself.

In addition to the above described automatic installations and cooperation with remotely actuated control means, the gun and mounting block of the present invention are particularly adapted to manual operation and manipulation. For example, in FIGURES 8 and 9, I have shown a gun butt or handle grip **130** which may quickly be associated with the mounting block **22** to convert the gun to full manual operation. The manipulating handle **130** comprises a hand grip portion of suitable size and configuration to facilitate holding of the gun in the hand of the operator, and a relatively wide boss **131** at the upper end of the hand grip of dimensions complementing the block **22** and the boss **31** on the gun body **30**. The boss **131** is provided with two ports **132** and **133** adapted to communicate with the passages **107** and **108**, respectively, in the block **22**; communication being established suitably by couplers like those indicated at **121** and **123** in FIGURE 7. The passage **133** communicates directly with a through passage **134** in the hand grip **130**, whereby air under pressure for atomization and pattern control may continuously be supplied

via the handle to the passage 108. The passage 134 in turn is intersected by a valve receiving bore which in turn communicates with a vent passage 135 in the hand grip 130.

A three-part valve comprised of a valve body 136, a valve 137 and a push button actuator 138 is removably mounted in the valve bore. The body 136 is threadedly mounted in the upper end portions of the valve bore and at its lower end defines a valve seat 139 immediately to the upper side of the passage 134 in the hand grip. The port in the valve member 139 is normally closed by the valve 137, which is disposed below the seat and intersects the passage 134, the valve being urged to its seat by means of a spring 140. The valve member 137 is also bored internally thereof to define a vent passage, as will subsequently be described. The actuator 138 is provided at its outer free end with a thumb button, and the actuator is normally biased in an outwardly direction by means of a spring 141 confined between the seat 139 and a projection or flange provided on the actuator. At its lower end, the actuator comprises a stem or pin-type valve adapted to engage and close the vent passage provided in the valve member 137, and thereafter to move the valve member 137 off its seat 139.

As shown in FIGURE 9, the port or passage 132 for gun controlling air communicates with the valve body 136 to the side of the seat 139 opposite the passage 134. Thus, when the actuator 138 is depressed by the thumb of the user, the vent passage in the valve member is first closed and the valve is then moved away from its seat 139, whereby air under pressure will be supplied via the passage 132 to the piston chamber 74 in the gun, thereby to initiate spraying. When spraying is to be discontinued, the operator simply removes his thumb from the button 138, whereupon the spring 140 will return the valve 137 to its seat 139, and the spring 141 will return the actuator 138 to its outwardly extended position, whereupon the vent passage in the valve 137 will be in open communicaion with the passage 132 and the vent 135 thereby to vent the piston chamber to atmosphere and accommodate rapid closing of the valves in the gun to discontinue spraying.

From the foregoing, it will be appreciated that the present invention provides an exceptionally compact and economical gun construction particularly characterized by a venting principle that eliminates the necessity for a venting air space between the material and air sections of the gun, whereby the sections may be disposed in concentric encircling relation to each other to facilitate a particularly compact gun construction. The invention also provides the novel gun mounting block above described, which is particularly advantageous in terms of the quick disconnect features thereof whereby a worn or defective gun may be replaced in just a few moments. In addition, the mounting block facilitates adaptation of the gun to remote automatic operation, remote electrical operation, and hand manipulation. Accordingly, it is believed that all of the objects and advantages of the invention have been shown herein to be attained in a convenient, economical and practical manner.

While I have shown and described what I regard to be the preferred embodimet of my invention, it will be appreciated that various changes, rearangements and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

I claim:

1. In a spray gun having a body, a passage for atomizing air, a materials supply duct and a control valve for said duct including a stem extending through said body and said passage, the improvement comprising a member secured adjacent one end in fluid-tight relation to said body intermediate said air passage and said materials supply duct, said member encompassing said stem and extending through said air passage and communicating adjacent its other end with the atmosphere, whereby said said member vents to atmosphere both materials leaking from said duct along said stem and air leaking from said passage along said member.

2. In a spray gun having a body, a passage for atomizing air, a materials supply duct, a materials control valve in said duct including a stem extending through said body and said passage, and an atomizing air control valve in said body about said stem, the improvement comprising a member secured adjacent one end in fluid-tight relation to said body intermediate said passage and said duct, said member encompassing the stem of said materials control valve, extending through said passage and said air control valve and communicating adjacent its other end to the exterior of the gun, whereby said member vents both materials leaking from said duct along said stem and air leaking past said air control valve along said member to the exterior of the gun.

3. In a spray gun including a body, a spray nozzle on the body, a materials supply duct in the body communicating with said nozzle, an atomizing air passage in the body and a materials control valve having a stem extending from said duct through said passage, the improvement comprising a tubular portion in said body separating said materials supply duct from said air passage, said tubular portion encompassing said stem and extending through said air passage and communicating at the end thereof opopsite the spray nozzle to the exterior of said body.

4. In a spray gun including a body having a bore therethrough defining an atomizing air passage at one portion thereof and a materials supply duct at another portion thereof, and a spray nozzle communicating with said materials supply duct, the improvement comprising a hollow member secured in fluid-tight relation to said body intermediate the said portions of said bore, said member extending through said one portion of said bore and communicating at the end thereof opposite the spray nozzle with the exterior of said body, and a materials control valve having a stem extending slidably through said member in sealed relation thereto.

5. In a spray gun, a body having a bore therethrough defining an atomizing air passage at one portion thereof and a material supply duct at another portion thereof, a hollow member secured in fluid-tight relation to said body intermediate the said portions of said bore, said member extending through said one portion of said bore and communicating at its end to the exterior of said body, a materials control valve having a stem extending slidably through said member in sealed relation thereto, and an air control valve slidably mounted on the exterior of said member in sealed relation thereto, whereby said member vents both materials leaking from said duct along said stem and air leaking past said air control valve along said member to the exterior of the gun.

6. In a spray gun, a body having a materials supply duct in the forward end portion thereof and a coaxial atomizing air passage in the rearward end portion thereof, a materials control valve having a stem extending axially through said passage and said duct, a rearwardly facing seat in said duct for said materials control valve, an air control valve concentric to said stem, a rearwardly facing seat in said body for said air control valve, a tubular portion in said body separating said duct from said passage and extending through said passage, said stem extending slidably through said tubular portion in sealed relation thereto, said air control valve being slidably mounted on the exterior of said tubular portion in sealed relation thereto, said tubular portion communicating at its rearward end to the exterior of the gun, and an actuating member for said valves comprising an axially shiftable portion connected to said air control valve and having connection with the stem of said materials control valve.

7. In a spray gun, a body having a materials supply

duct in the forward end portion thereof and a coaxial atomizing air passage in the rearward end portion thereof, a tubular portion in said body separating said duct from said passage and extending rearwardly through said passage, a materials control valve having a stem extending slidably through said tubular portion in sealed relation thereto, a porting portion in the rearward end portion of said body concentric with said tubular portion, and a combined air valve and valve actuating piston including an air valve portion slidably mounted on said tubular portion within said porting portion in sealed relation to both and a piston portion slidably mounted on the exterior of said porting portion, said tubular portion communicating at its rearward end to the exterior of the gun, said combined air valve and piston having connection with the rearward end of the stem of said materials control valve.

8. In a spray gun, a body having a materials supply duct in the forward end portion thereof and a coaxial atomizing air passage in the rearward end portion thereof, a tubular portion in said body separating said duct from said passage and extending rearwardly through said passage, a materials control valve having a stem extending slidably through said tubular portion in sealed relation thereto, a porting portion in the rearward end portion of said body concentric with said tubular portion, a combined air valve and valve actuating piston including an air valve portion slidably mounted on said tubular portion within said porting portion in sealed relation to both and a piston portion slidably mounted on the exterior of said porting portion, said tubular portion communicating at its rearward end to the exterior of the gun, said combined air valve and piston having connection with the rearward end of the stem of said materials control valve, said body including a terminal portion having three exteriorly opening sockets therein communicating respectively with said materials supply duct, the interior of said porting portion and the exterior of said porting portion, and a mounting block for said body including three nipples complementary to and enterable respectively into said sockets, said nipples and sockets having complementary sealing means and one of said nipples and the respective socket having complementary detachable locking means for detachably securing said body to said block.

9. In a spray gun, a body having a materials supply duct in the forward end portion thereof and a coaxial atomizing air passage in the rearward end portion thereof, a tubular member secured in fluid-tight relation to said body intermediate said duct and said passage and extending rearwardly through said passage, a materials control valve having a stem extending slidably through said tubular member in sealed relation thereto, a tubular porting element secured in the rearward end portion of said body concentric with said tubular portion, and an integrally formed air valve and valve actuating piston including a tubular air valve portion slidably mounted on said tubular member within said porting element in sealed relation to both and a surrounding cup-shaped piston portion slidably mounted on the exterior of said porting element, said tubular member communicating at its rearward end to the exterior of the gun, said integral air valve and piston having a lost-motion connection with the rearward end of the stem of said materials control valve.

10. In a spray gun as set forth in claim 9, means adjustably mounted on said body for limiting the stroke of said piston and said materials control valve.

11. In a spray gun, a short generally cylindrical body having a forward end portion for detachable reception of a nozzle, a generally axial bore through said body defining a materials supply duct at the forward end of the body and an atomizing air passage at the rearward end of the body, a tubular member secured in fluid-tight relation to said body in said bore intermediate said duct and said passage, said tubular member extending rearwardly through said passage, a tubular porting element secured to said body in encircling relation to said tubular member and defining an annular chamber between said element and said member, said body and said element having ports therein defining an air inlet and a longitudinally spaced air outlet, said element defining a valve seat therein intermediate said inlet and said outlet, an integral air valve and piston element comprising an annular air valve portion slidably mounted in said chamber in sealed relationship with the exterior of said tubular member and with the interior of said porting element and a piston portion encircling said porting element, said body at its rearward end defining an annular chamber within which said piston portion slidably engages, and a materials control valve having a stem extending slidably through said tubular member and having connection with said air valve and piston element.

12. In a spray gun, a short generally cylindrical body having a forward end portion for detachable reception of a nozzle, a generally axial bore through said body defining a materials supply duct at the forward end of the body and an atomizing air passage at the rearward ward end of the body, a tubular member secured in fluid-tight relation to said body in said bore intermediate said duct and said passage, said tubular member extending rearwardly through said passage, a tubular porting element secured to said body in encircling relation to said tubular member and defining an annular chamber between said element and said member, said body and said element having ports therein defining an atomizing air inlet and a longitudinally spaced atomizing air outlet, said element defining a valve seat therein intermediate said inlet and said outlet, an integral air valve and piston element comprising an annular air valve portion slidably mounted in said chamber in sealed relationship with the exterior of said tubular member and with the interior of said porting element and a piston portion encircling said porting element, said body at its rearward end defining an annular chamber within which said piston portion slidably engages, a materials control valve having a stem extending slidably through said tubular member and having connection with said air valve and piston element, said body including a terminal portion having three spaced parallel sockets therein communicating respectively with said materials supply duct, said atomizing air inlet passages and said annular chamber within which said piston portion engages, and a mounting block for said body including three spaced parallel nipples complementary to and enterable respectively into said sockets, one of said nipples being rotatable in said block, said one nipple and the respective socket having complementary detachable locking means for securing said body to said block and all of said nipples and the respective sockets having complementary sealing means for sealing said nipples in said sockets.

13. In a spray gun, a short generally cylindrical body having a forward end portion for detachable reception of a nozzle having an axial valve seat, a generally axial bore through said body defining a materials supply duct at the forward end of the body and an atomizing air passage at the rearward end of the body, a tubular member secured in fluid-tight relation to said body and said bore intermediate said duct and said passage, said tubular member extending rearwardly through said passage, a tubular porting element secured to said body in encircling relation to said tubular member and defining an annular chamber between said element and said member, said body and said element having ports therein defining an air inlet and a longitudinally spaced air outlet, said element defining a valve seat therein intermediate said inlet and said outlet, an integral air valve and piston element comprising an annular air valve portion slidably mounted in said chamber in sealed relationship with the exterior of said tubular member and the interior of said porting element and a piston portion encircling

said porting element, said body at its rearward end defining an annular chamber within which said piston portion slidably engages, a materials control valve having a stem extending slidably through said tubular member and rearwardly of said air valve and piston element and an abutment on the rearward end of said stem engageable by said air valve and piston element, a relatively strong spring urging said materials control valve onto the seat in the nozzle, a relatively weak spring engaging said air valve and piston element urging said air valve portion onto the seat in said porting element, an axially adjustable member mounted on said body rearwardly of said abutment and adjustable to vary the stroke of said materials control valve, and port means opening to the exterior of the gun communicating with the rearward end of said tubular member.

14. In a spray gun, a gun body having separate passages therein for compressed air and coating materials, and a mounting block for said body, the block including separate hose coupling means for separate supply thereto of coating materials and compressed air, the body and block including complementary mutually sealing nipples and sockets communicating respectively with said hose coupling means for separate supply of materials and air from the block to the body, one of said nipples and the respective socket including cooperable detachable locking means for detachably securing the body to the block in sealed relationship thereto, and each additional nipple being slidable in its respective socket.

15. In a spray gun as set forth in claim **14**, said cooperable locking means comprising rotatably engageable and disengageable elements, said one nipple being rotatably mounted in said block and including means to the exterior of said block for rotating said nipple.

16. In a spray gun as set forth in claim **14**, a control valve associated with said block and a solenoid for actuating said valve.

17. In a spray gun as set forth in claim **14**, said block comprising a pistol-grip, and a manually actuated control valve in said pistol-grip.

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