

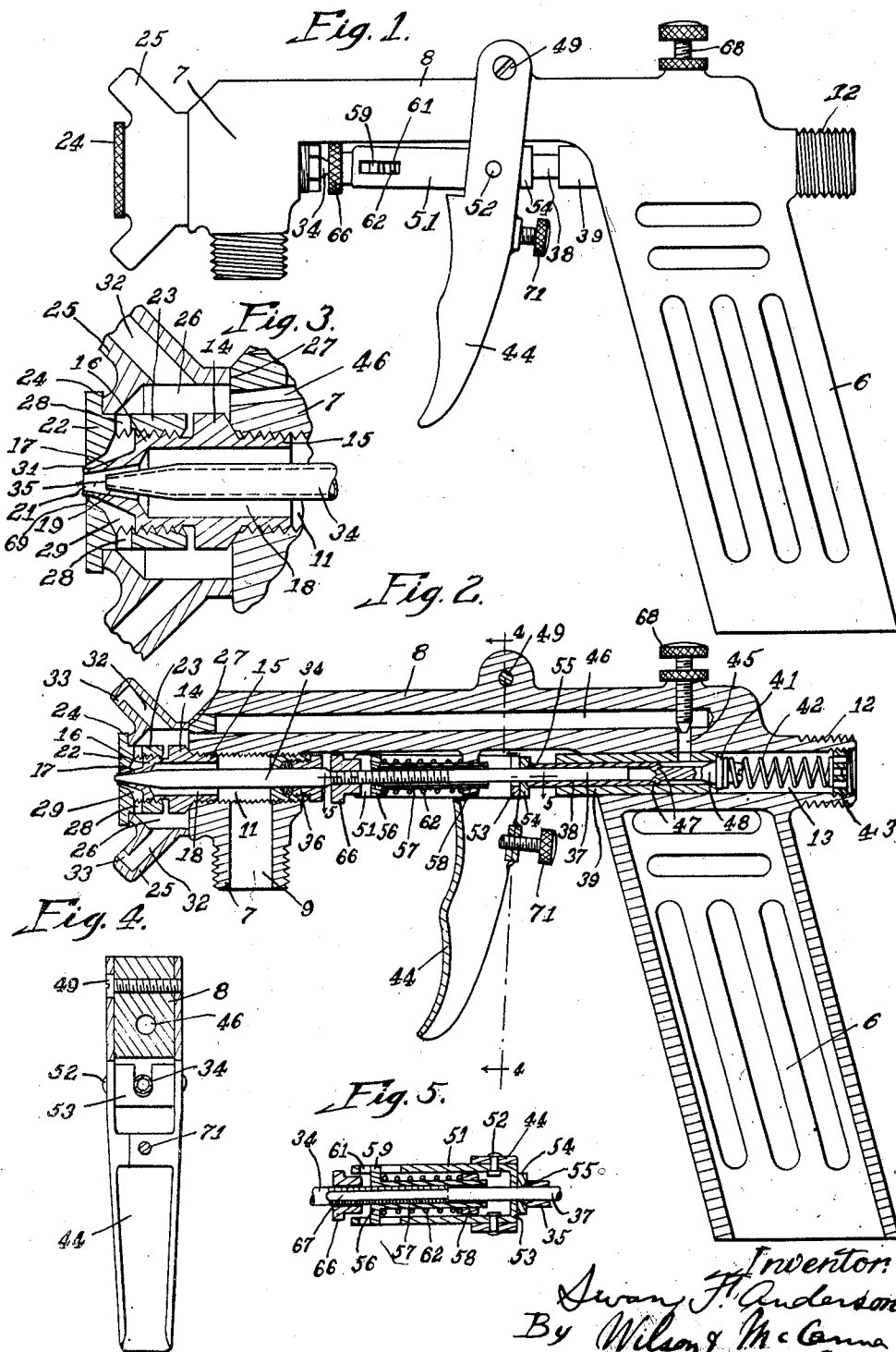
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SPRAY GUN

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TO PEERLESS PNEUMATIC SYSTEMS, INC., OF CHICAGO, ILLINOIS.

SPRAY GUN.

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This invention relates to air brushes or spray guns as they are commonly known, for atomizing and spraying by air pressure such materials as paints, fillers, enamels, varnishes, shellacs, dyes, stains, bronzes, aluminums and in fact all liquid or fluid material which it is desired to spread onto a surface for coating or any finishing purpose. The present invention is, more particularly, an improvement on that disclosed in my co-pending application Serial No. 600,241, filed November 11, 1922.

One of the objects of the present invention is to provide an improved spray gun for handling materials of heavier consistencies but adapted also for any of the lighter or finer materials. In other words my improvements enable the spraying of a greater variety of materials. This is accomplished primarily by the provision of a hollow needle valve for delivering a primary jet of air into an atomizing chamber in the discharge passage of a material-delivery nozzle and delivering a secondary stream of air peripherally about the material discharging from said passage through a central orifice, and finally delivering supplemental supporting jets of air onto the discharging spray from opposite sides thereof for the purpose of further atomizing the material and for flattening the spray into a line delivery in which the material is substantially uniformly distributed from end to end. I have also aimed to provide an adjustment for regulating the flow of secondary air independently of the primary air for purpose of obtaining uniformity in the distribution of materials of different consistencies.

Another object is to provide an improved nozzle, characterized by its few parts, its simple and practical construction, and the embodiment of a primary and a secondary delivery of air for the purpose described.

A further object is to provide improved means for controlling the delivery of the primary and the secondary air.

Still another object is to so construct the parts that they may be produced at a comparatively low cost and will serve in a practical and efficient manner the purposes intended.

Other objects and attendant advantages will be appreciated by those skilled in this art as the invention becomes better understood by reference to the following description when considered in connection with the accompanying drawing in which—

Figure 1, is a side elevation of a spray gun embodying my invention;

Fig. 2, is a longitudinal sectional view through the spray gun, showing its parts in the normal position;

Fig. 3, is an enlarged section through the nozzle end showing the needle valve retracted to the open position for spraying; and

Figs. 4 and 5, are sections taken substantially on the lines 4—4 and 5—5 respectively of Fig. 2.

Referring more particularly to the drawing, it will be observed that the body on which the several operating parts are mounted is in the form of a one-piece casting, shaped to provide a handle and a head portion 6 and 7 respectively, connected by an intermediate barrel-like portion 8. This one-piece body provides a rigid supporting structure for the several cooperating parts and is particularly well adapted for carrying them in the operative relation which will be presently described.

The material to be atomized will be delivered through a passage 9 into the inlet chamber 11 in the head 7 through a suitable hose connection and at a constant pressure. The air pressure will be admitted to the body through a hose connected to a suitable source of supply and attached preferably to a threaded nipple 12 on the handle portion 6, in which is formed an air supply inlet passage 13 coaxial with the material inlet chamber or passage 11.

According to my invention means is provided for delivering a primary jet of air into an atomizing chamber through a hollow needle valve receiving its supply of air in this instance from the passage 13, into which chamber material is delivered from the material supply passage 11 at a rate regulated by the position of the needle valve. The material will be atomized by such primary air and discharged through a central orifice and after leaving such orifice the ma-

terial will be further atomized by a secondary atomizing action produced by a secondary delivery of air peripherally about said central orifice, which secondary air is delivered from the air supply passage 13 through a passage or conduit separate from that of the primary air. The discharging material will be further atomized by the action of supplemental air jets delivered from opposite sides in such manner as to produce a flat spray as will be presently more fully described, the supplemental air jets being supplied in this instance from the same source as the secondary air. The parts employed in directly performing the function just described are embodied in a nozzle structure mounted on the head 7, which structure will now be more fully described.

A material-delivery nozzle which will be referred to as the color nozzle, designated generally by 14 is in the form of a hexagonal body having a reduced threaded end 15 screwed into the material inlet passage 11 and an opposite externally threaded end 16 terminating in a conical discharge nozzle 17. Said body 14 has a central bore or passage 18 which communicates at one end with the material inlet passage 11 and at the opposite end with a conical passage 19 in the nozzle portion 17 terminating in a discharge orifice 21. The body 14 is hexagonal merely to facilitate tightening it in the head 7. The conical passage 19 provides an atomizing chamber in which a jet of primary air is delivered into the material as will be presently described. Onto the threaded end 16 of the color nozzle is screwed a secondary air nozzle designated generally by 22 having a cylindrical periphery 23 and a flanged end 24 the periphery of which is knurled for convenience in tightening said nozzle in position. The secondary air nozzle serves to hold or clamp in position a flat spray nozzle the body of which is designated generally by 25. This body provides an annular air chamber 26 about the nozzles 14 and 22 and seats at 27 against the head 7 and is engaged at its opposite end by the flange 24 and clamped thereby so as to be held in position. The secondary air nozzle 22 has a plurality, four in the present instance, of equally spaced radial ports 28 connecting the air chamber 26 with an air chamber 29 surrounding the nozzle portion 17 and terminating in a secondary air discharge orifice 31 concentric with the discharge orifice 21. The flat spray nozzle 25 is shaped to provide a pair of diametrically opposite passages 32 leading from the air chamber 26 in diverging relation and terminating in converging discharge orifices 33 adapted for delivering supplemental jets of air onto the atomized material discharging from the central orifice 21 for the purpose of flattening the spray into a line-like delivery. By loosening the nozzle member 22

the flat spray nozzle 25 may be rotated or swivelled for the purpose of changing the plane of the flat spray about the axis of the nozzle structure, that is to produce a vertical or horizontal of any intermediate angular spray delivery.

The conical passage 19 in the color nozzle is normally closed by a needle valve 34 which has a tapered end complementary to and adapted to seat on the conical surface of said passage 19. This needle valve is hollow and has a discharge orifice 35 through which a jet of primary air is adapted to be delivered. The needle valve extends rearward from the passage 11 through a packing gland 36 and terminates at its rear end in a cylindrical portion 37 which slidably fits in a tubular valve stem 38 in turn axially slidable in a sleeve or bushing 39 fixed in the handle portion 6 of the body coaxial with the air-supply passage 13. The valve stem 38 has a valve 41 which seats against the rear end of the bushing 39 and is normally held seated by a compression spring 42 the outer end of which abuts against a perforated plug 43 threaded in the nipple 12. When the valve 41 is unseated by drawing back a trigger 44 as will be presently described the air supply will be admitted into the bushing and to a passage 45 leading therefrom which passage is connected by a passage 46 in the barrel-portion 8 to the annular chamber 26 above described, thereby providing air for the secondary nozzle and for the supplemental jets. The air thus admitted into the bushing 39 by unseating the valve 41 will also enter the rear end of the hollow needle valve through diametrically opposed ports 47 in the tubular valve stem 38 connecting the interior of said valve stem 38 with the interior of the bushing 39, it being noted that the valve stem is turned down intermediate the ports 47 and the valve seat 41 to provide for communication with the passage 45 and the ports 47 from the air supply passage 13 when said valve is unseated. It will also be observed that the valve stem is tapered at 48 so as to provide a graduated opening permitting only a small volume of air to enter the bushing 39 and passages communicating therewith when the valve 41 is initially opened and whereby the air supply will be increased with the opening movement of the valve. It will thus be manifest that upon unseating the valve 41 air will be delivered through the needle valve, the secondary air nozzle and the supplemental air jet orifices.

The trigger 44 not only unseats the valve 41 as above mentioned but also unseats the needle valve 34. The means by which this is accomplished will now be described. The trigger straddles the barrel-portion 8 of the gun body and is pivotally attached thereto at 49. A yoke 51 disposed between the arms of the trigger and pivotally attached thereto at 52 has a crosshead 53 against which the front end

of the valve stem 38 bears, a washer 54 being interposed and having a finished seat 55 engaged by the forward end of said valve stem for preventing leakage of air. It will be
 5 manifest that by drawing the trigger 44 rearwardly the valve stem 38 will be similarly moved so as to unseat the valve 41. The arms of the yoke 51 have a lost motion connection with the hollow needle valve so that the latter
 10 will be opened at a predetermined point subsequent to the opening of the valve 41, thereby producing a discharge of secondary air through the orifice 31 before the material to be atomized is discharged. This connection
 15 comprises a crosshead 56 fixed to a sleeve 57 threaded onto the hollow needle valve and having a bearing support in a lug 58 integral with the body barrel portion 8, the crosshead having diametrically opposed fingers 59 disposed in slots 61 in the arms of the yoke 51.
 20 A coiled compression spring 62 surrounding the sleeve 57 and acting between the lug 58 and the crosshead 56 urges the latter forward for seating the tapered end of the needle valve 34 against the conical wall of the passage 19. By turning the needle valve in the
 25 sleeve 57 the particular point at which the needle valve will unseat with respect to the unseating of the valve 41 may be varied. In the present instance the needle valve may be
 30 turned by means of a knurled disc 66 mounted on said needle valve between the yoke and the packing gland or stuffing box 36 so as to turn with the needle valve but slide lengthwise
 35 thereon, the needle valve being flattened at 67 for this purpose and the disc being shaped to engage the flat sides.

The operation of the spray gun is as follows: Parts are shown in the normal position in Fig. 2, in which the needle valve 34 is
 40 held seated by the spring 62 and the valve 41 is held seated by the spring 42. Assuming that the passage 9 is connected to a source of material supply, which is under a suitable
 45 pressure, and that the passage 13 is connected with a source of air supply at a suitable pressure, when the trigger 44 is drawn back the valve 41 will be unseated allowing air to be delivered through the needle valve orifice 35
 50 and through the secondary air discharge orifice 31 and the converging discharge orifices 33 as described above. The flow of air through the orifices 31 and 33 may be regulated with respect to the flow through the
 55 orifice 35 by adjustment of a valve stem 68 in the passage 45, this adjustment being particularly desirable when setting the spray gun for the use of materials of different consistency. As above mentioned the initial movement
 60 of the trigger does not, unless so set, open the needle valve. When the needle valve 34 does open after the lost motion movement between the yoke 51 and the crosshead 56, the material to be atomized will be delivered into
 65 the chamber formed by the conical passage 19.

In Fig. 3 I have shown the needle valve in an open position, showing its discharge orifice 35 withdrawn into the said chamber 19. As a result of this action and arrangement of
 70 parts the material will be atomized in said chamber 19 by the jet of primary air delivered through the hollow needle valve, this primary atomization taking place before the material reaches the discharge orifice 21. The discharge of primary air into the chamber 19
 75 will moreover produce an injector action which aids in the flow of material through the color nozzle and is especially advantageous in air brushes of this type when materials of comparatively heavy consistency are used.
 80 The partially atomized material discharging through the central orifice 21 will be subjected to the action of the secondary air which discharges peripherally thereabout through the orifice 31. It will be noted that the tip of the
 85 nozzle portion 17 indicated by 69 is cylindrical for a short distance so as to cause the flow of secondary air to intersect the spray discharging from the orifice 21 at a slight distance in front thereof at which point the discharging material issues in a diverging spray.
 90 By reason of this mixture of the secondary air with the primary mixture a very effective atomizing action is obtained. The discharging spray will be further atomized by the action of the supplemental jets of air delivered
 95 through the orifices 23 which cause the spray to be flattened into a line-like delivery, the major axis of which, with the present setting of the flat spray nozzle, will be horizontal. It
 100 will be noted that the valve opening movement of the trigger is limited by an adjustable set screw stop 71 which strikes against the forward edge of the handle.

The construction disclosed herein is especially desirable because practically all of
 105 the working parts are coaxial with the axis of the nozzle and the valves and because these parts are mounted on a one-piece body in such manner that they are maintained in
 110 alignment. This facilitates manufacture and assembly of the spray gun and enables the cost of production to be reduced to a minimum. It also insures the maintenance of well fitting valve seats and prevents such
 115 wear as will cause undue leakage of air. The extension of the hollow needle valve into the tubular valve stem is a feature of my invention which makes for simplicity in construction and operation. Another feature
 120 of importance is the nozzle construction by which atomization of the material is started before it leaves the color nozzle. In other words the material is also initially atomized in the chamber 19 by
 125 the action of the primary air. Still another feature is the use of a hollow needle in the manner disclosed causing an injector action and thereby leading the flow of the material into the nozzle and positively insur-
 130

ing against stoppage and variation in the flow which might occur in the absence of such construction. My improvements are therefore especially adapted for handling materials which do not flow easily. The construction is however equally well adapted for handling materials of thinner consistency.

It is believed that the foregoing conveys a clear understanding of the objects prefaced above and, while I have illustrated but a single working embodiment, it should be understood that changes might be made in details of construction without departing from the spirit and scope of the invention as expressed in the appended claims, in which—
I claim:

1. In a spray gun, in combination, a body having a material-supply passage and an air-supply passage, a color nozzle threaded into said material-supply passage and being peripherally threaded at its extended end and terminating in a nozzle portion having a conical interior passage and a conical exterior surface and a discharge orifice from said interior passage, a needle valve in said conical passage adapted to regulate the flow of material therethrough, a secondary air nozzle threadedly engaged on the said extended threaded end of the color nozzle and providing an air chamber about the conical end thereof converging to a central discharge orifice concentric with the discharge orifice of the color nozzle, and a flat spray nozzle body held in position by said secondary air nozzle and providing an annular air chamber about the latter communicating with said air supply passage in the body, said flat spray nozzle body having diametrically disposed air passages which diverge from said annular air chamber and terminate in converging orifices for delivering supplemental jets of air for flattening the spray discharging from said central orifice.

2. A spray gun comprising, in combination, a body having a handle at one end and a nozzle-supporting head at the opposite end, said head having a material-supply passage and said handle having an air-supply passage in coaxial relation, a material-delivery nozzle on said head connected with said passage therein and having a hollow needle valve passing axially through and rearwardly beyond said passage, an air-delivery nozzle concentric with the material-delivery nozzle and receiving air pressure from said air-supply passage in the handle, a tubular valve stem slidable axially in said air-supply passage and having a valve for closing the passage and adapted to open it by rearward movement therein, the rear end of the hollow needle valve extending into the tubular valve stem and adapted to receive air pressure when the valve stem is moved rearwardly to an open position, and a trigger connected to the

needle valve and valve stem for imparting opening movement thereto.

3. A spray gun as set forth in claim 2, including spring means for normally holding the tubular valve stem and the needle valve in a closed position, and means connecting the trigger with the tubular valve stem and the needle valve to move said tubular valve stem for opening the air supply passage prior to unseating the needle valve.

4. A spray gun as set forth in claim 2, including a bushing in the air-supply passage in which bushing the tubular valve stem is slidably mounted and against which the valve on said stem seats.

5. A spray gun as set forth in claim 2, including a thrust connection between the forward end of the tubular valve stem and the trigger through the intermediary of a part slidable on the needle valve.

6. A spray gun as set forth in claim 2, including means in the connection between the air-supply passage and the air-delivery nozzle for regulating the flow of air to the latter independently of the flow of air to the needle valve.

7. A spray gun comprising, in combination, a one-piece body having a handle and a nozzle-supporting head joined by a barrel portion, said head having a material-supply passage and said handle having an air-supply passage in coaxial relation below said barrel portion, a material-delivery nozzle on said head connected with said passage therein and having a hollow needle valve passing axially through and rearwardly beyond said passage, an air-delivery nozzle concentric with the material-delivery nozzle, the barrel portion having a passage connecting the air-supply passage in the handle with the air-delivery nozzle for supplying air thereto, a tubular valve stem slidable axially in the air-supply passage in the handle and having a valve normally closing said passage, the needle valve extending into the tubular valve stem and adapted to receive air pressure for the material-delivery nozzle when the air-supply valve is opened, and a trigger connected with said tubular valve stem and needle valve for imparting opening movement thereto.

8. In a spray gun, in combination, a head having a material-supply passage; a material-delivery nozzle comprising a body having a threaded end engaged in said passage and an opposite threaded end terminating in a conical nozzle portion having a conical passage terminating in a central discharge orifice, and a hollow needle valve having a conical end normally seated in said conical passage and adapted to be withdrawn so that the discharge orifice of the needle valve is positioned within said conical passage which latter constitutes a primary atomizing chamber; a secondary air nozzle comprising a cy-

lindrical body threaded onto the extended threaded end of the material-delivery nozzle and having a flanged outer end and shaped to provide a conical air chamber around the conical end of the material-delivery nozzle, said conical air chamber terminating in a discharge orifice concentric with that of the material-delivery nozzle and having ports communicating with the periphery of the cylindrical body of the secondary nozzle; a flat spray nozzle comprising a body embracing the secondary air nozzle and clamped in position by engagement with the flanged end of said secondary air nozzle, said flat spray nozzle body providing an annular air chamber communicating with said ports in the secondary air nozzle and having diametrically opposed air passages leading from the annular air chamber and terminating in converging discharge orifices adapted for delivering supplemental jets of air intersecting the spray discharge from the nozzle proper.

9. In a spray gun, in combination, a nozzle structure comprising a material delivery nozzle and a secondary air delivery nozzle, a trigger operated needle valve for regulating the flow of material through said material delivery nozzle, and means for supplying air to said secondary air nozzle including an air valve coaxial and telescoping with the end of the needle valve.

10. A spray gun as set forth in claim 9, including a gun body having a head and a handle portion, said nozzle structure being arranged on the head portion and said air valve in the handle portion, said body having a material inlet passage communicating with the material delivery nozzle, from which passage said needle valve extends rearwardly and into telescoping connection with said air valve in the handle portion, a packing for the needle valve at the point where it leaves the head portion of the body, and a trigger structure on the body operatively connected with the needle valve and said air valve member intermediate said head and handle portions.

11. In a spray gun, in combination, a gun body having a material inlet passage, a material delivery nozzle externally threaded at opposite ends one of which is engaged in said inlet passage, a nozzle portion on the other threaded end of said body terminating in a central material discharge orifice concentric with the adjacent threaded end, an air nozzle threaded on the outer end of said material nozzle and providing an air discharge orifice peripherally about and concentric with said material discharge orifice, and an air nozzle body embracing the material nozzle and said air nozzle and adapted to be clamped in position by tightening the latter on the material nozzle, said air nozzle body having diametrically opposed converging discharge orifices adapted for delivering supplemental jets of air into the atomized material discharging

from the central orifices, whereby said air orifices will be held in determined alignment with the material discharge orifice.

12. In a spray gun, in combination, a material delivery nozzle externally threaded in coaxial relation to its material discharge orifice, an air nozzle body threadingly engaged on the threaded portion of said material nozzle and having an air discharge orifice disposed coaxial with and peripherally about said material discharge orifice, and a supplemental air nozzle body embracing the first mentioned air nozzle body and adapted to be clamped in position by turning the latter on the threaded portion of the material nozzle, said supplemental air nozzle body having diametrically opposed converging air delivery orifices for producing a fan-shaped spray and being held in determined relation to said air and material delivery orifices by the clamping action of the first mentioned air nozzle body.

13. In a spray gun, in combination, a nozzle structure including an atomizing chamber having a central material discharge orifice and a secondary air chamber having an annular air discharge orifice concentric with and surrounding said material discharge orifice for delivering secondary air peripherally about and into the material discharging through said central orifice, a trigger-operated hollow needle valve for regulating the flow of material through said central orifice and adapted to discharge primary air into said material for effecting an initial atomization thereof, means for delivering air to said hollow needle valve and said secondary air chamber including a tubular valve stem telescoping with the end of the needle valve remote from its discharge end, means providing air communication between said valve stem and said secondary air chamber, said tubular valve stem having a valve communicating with a source of air supply and being movable axially independently of the needle valve for admitting air to the secondary air chamber and to the hollow needle valve, and means whereby said needle valve will be unseated subsequently to the opening of said air valve.

14. In a spray gun, in combination, a nozzle structure including an atomizing chamber having a central material discharge orifice and a secondary air chamber having an annular air discharge orifice concentric with and surrounding said material discharge orifice for delivering secondary air peripherally about and into the material discharging through said central orifice, a trigger-operated hollow needle valve for regulating the flow of material through said central orifice and adapted to discharge primary air into said material for effecting an initial atomization thereof, means for delivering air to said hollow needle valve and said secondary air chamber including a tubular valve stem telescoping with the end of the needle valve remote from its dis-

charged end, means providing air communication between said valve stem and said secondary air chamber, said tubular valve stem having a valve communicating with a source
5 of air supply and being movable axially independently of the needle valve for admitting air to the secondary air chamber and to the hollow needle valve, and trigger operable means bearing directly against said air valve stem for unseating it and having a lost-motion
10 connection with said needle valve for unseating it subsequently to said air valve stem.

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