

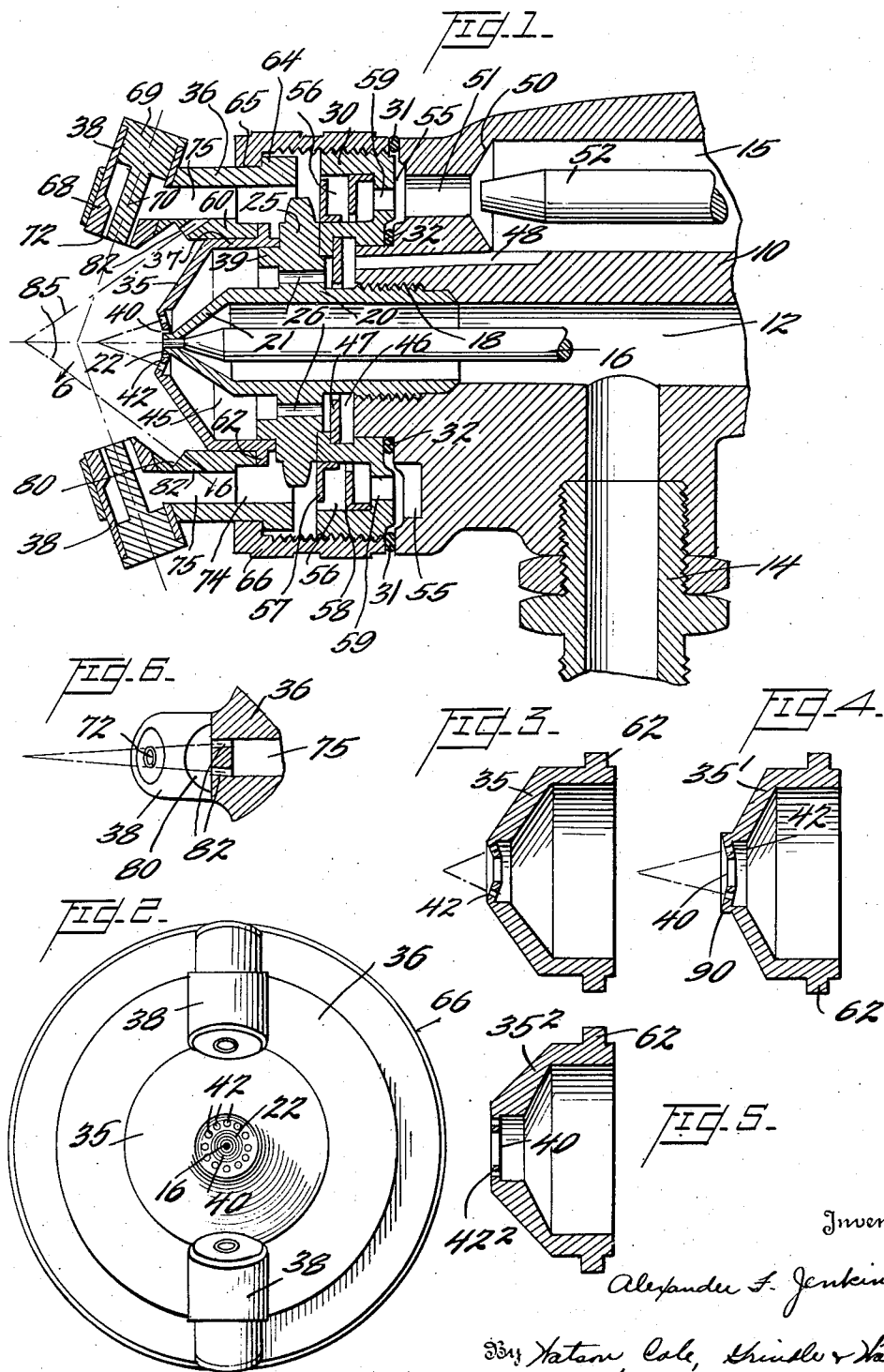
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A. F. JENKINS

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SPRAY GUN

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Inventor

Alexander F. Jenkins

By *Natam, Cole, Grindle & Natam*

Attorneys

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SPRAY GUN

Alexander F. Jenkins, Baltimore, Md.

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6 Claims. (Cl. 299—140.1)

This invention relates to spray guns and more particularly to improvements in the nozzles of such guns whereby the efficiency of the spray gun in the atomizing, diffusing and spreading of coating liquids or other fluent materials is greatly enhanced.

The general object of the invention is to provide novel and improved spray guns of the type described which include improved arrangements for projecting certain atomizing and spray pattern shaping jets of air under pressure upon the axial jet of liquid material issuing from the nozzle; the predetermined impingement of these air jets upon the liquid jet and upon each other resulting in a finely diffused, evenly distributed spray of improved covering properties.

In its preferred embodiments, the invention contemplates the provision of an air cap which may be made in two parts and adapted to be fitted to the centrally disposed liquid nozzle member and clamped firmly to the body of the gun. The inner element or portion of the air cap arrangement comprises a cup-shaped member, having a circular opening which fits around the liquid nozzle tip to form an annular orifice for the main tubular jet of aspirating air. Around this annular opening is arranged a circular series of fine openings the axes of which preferably converge toward the axis of the liquid jet. The central portion of the face of the cap through which these openings are formed is preferably formed with a conical depression, the angularity of which is complementary to that of the angle of convergence of the openings. One form of cap particularly adapted for use in the case of spray guns having a syphon feed, is preferably provided with openings having parallel or non-convergent axes.

Cooperating with these provisions, is a novel arrangement involving the auxiliary spray flattening jets which are usually projected from converging horn-like protuberances disposed upon diametrically opposite sides of the forward face of the air cap. This improvement comprises the provision of a pair of orifices adjacent the bases of each of these protuberances or horns, through which issue additional spray modifying jets of air which impinge upon the main modifying jets and together strike the aspirated and partially atomized axial stream of fluid to complete the atomization and flatten the jet to change its circular cross-section to a wide substantially oblong configuration.

Although capable of being used to advantage with any type of spray gun, the invention as

thus broadly outlined is especially effective when employed in connection with the main spray modifying side jets of hollow expanding tubular form such as are projected by means of the annular orifices which characterize the spray guns covered by my prior United States Patents Nos. 2,126,888 and 2,126,889; and this arrangement combined with the present additional modifying jets and the multiple central atomizing orifices affords a maximum of efficiency and convenience in the application of coating or treating materials. One application in which the invention has demonstrated its superiority is in the coating of airplane surfaces, on which an extremely smooth "satin finish" is provided.

Other objects and features of novelty will be apparent from the following specification when read in connection with the accompanying drawing in which certain embodiments of the invention are illustrated by way of example.

In the drawing:

Figure 1 is a view in vertical longitudinal section on an enlarged scale of the forward nozzle carrying end of a spray gun embodying the principles of the invention;

Figure 2 is a view in front elevation of the nozzle assembly;

Figures 3, 4 and 5 are longitudinal sectional views of three forms of aspirator caps or inserts which surround the liquid nozzle member and form parts of the air cap structure; and

Figure 6 is a fragmentary sectional view of a portion of the air cap taken substantially on line 6—6 of Figure 1, and illustrating the convergence of the auxiliary spray modifying jets.

The body of the spray gun, a portion of which is indicated in Figure 1 at 10, is of the same type as that shown in my copending application, Serial No. 184,301, filed January 10, 1938, now Patent No. 2,235,708, issued Mar. 18, 1941. This part of the gun is preferably made of aluminum and is provided with the usual centrally disposed liquid passageway 12 fed through the connections designated generally by the reference numeral 14, and the main air passageway 15 through which the aspirating, atomizing, and modifying jets of air are supplied. Suitable controls for the main air supply are provided in the rear portion of the gun where also certain operating means are disposed for moving the needle valve 16 longitudinally within the liquid passageway 12 in order to control the liquid orifice at the forward end of the nozzle. These controls are usually made adjustable and are

designed to be actuated by the trigger of the gun disposed adjacent the grip thereof.

Threaded into the enlarged forward end of the liquid passageway 12 as at 18, is the hollow liquid nozzle member 20, this member having a conical or convergent forward portion 21 terminating in a narrow cylindrical tip 22 provided with the liquid orifice controlled by the attenuated forward end of the needle valve 16. At a point intermediate its length, the liquid nozzle member 20 is provided with a circular radially extending flange 25 through which are drilled the annular series of openings or passageways 26.

Disposed between the flange 25 and the forward face of the body portion 10 of the spray gun is the annular insert element 30. This insert is adapted to be clamped against the forward face of the gun by means of the flange 25 when the liquid nozzle member 20 is threaded into place at 18. Suitable gaskets 31 and 32 are interposed between the annular insert 30 and the face of the body of the gun. This insert serves two purposes, namely the provision of a member comprised of a harder metal than the body of the gun to which the clamping ring for the air cap may be threaded, and also to provide a tortuous baffled passageway for the air supplies.

The air cap of the gun, in the illustrated embodiment, is made in two separable parts—the first section being an interiorly positioned cup-like cap portion 35 disposed adjacent the liquid nozzle member 20, and the second an outer annular cap section 36 which carries the horns or projections 38 through which the spray flattening air jet orifices are formed. The inner cap element 35 is somewhat frusto-conical in general outline and having rearwardly directed walls 37 the ends of which are adapted to abut the radial flange 25 of the liquid nozzle member and to fit around the forward annular flange 39 formed thereon. On the forward end of the element 35 there is formed a central opening which fits about the tip 22 of the liquid nozzle member with sufficient clearance to provide the annular aspirating air orifices 40 in the central portion of the face of the cap element 35. Around the orifice 40 there is disposed a circular series of fine orifices 42 the axes of which, in the embodiment illustrated in Figures 1 and 3 of the drawing converge toward the main axis of the spray gun. In the embodiment shown, this convergence includes approximately an angle of 30°, but it may be varied somewhat as circumstances may require. The forward face of the cap in which the openings are formed is rearwardly convergent to provide a re-entrant conical surface the included angle being, in the embodiment shown, about 150°, so that the openings 42 are substantially perpendicular to the surface of the cap.

The cap element 35 forms a forward air chamber 45 around the forward end of the liquid nozzle 20 and behind the openings 40 and 42. Air is supplied to this chamber through the passageways 26 which pass through the flange 25 from the annular rear chamber 46 containing the baffle ring 47, this chamber being formed between the front wall of the gun and the flange 25 and being supplied with air through the passageway or channel 48 leading from the main air supply passageway 15.

The air for the auxiliary spray modifying jets is supplied in the following way. The forward end of the passageway 15 is provided with a valve seat 50 from which a short bore 51 leads forwardly through the front face of the body of the gun, 75

this valve seat 50 being controlled by the needle valve 52 actuated from the rear of the gun. An annular groove 55 is formed in the forward face of the spray gun through which air supplied through the passageway 51 may pass around the entire circumferences. The insert 30 is provided with an annular chamber 56 containing angular baffle rings or washers 57 and 58, and this chamber is supplied with air through the peripherally spaced openings 59 leading from the groove 55. The outer air cap element 36 has an annular wall 60 fitted snugly around the walls 37 of inner cap member 35 and abutting rearwardly the annular flange 62 formed on the element 35. This flange 62 is spaced from the flange 25 sufficiently for the insertion of a screw driver or other tool whereby the element 35 may be disconnected from the inner liquid nozzle. The outer cap element 36 is also provided with a rearwardly disposed radial flange 64 around which is fitted the shoulder 65 of a clamping ring 66 which is threaded to the insert element 30 and serves to retain the outer cap member firmly in place.

The projection horns 38 formed on the outer air cap member 36 for the provision of the spray modifying jets may conveniently be constructed of separate elements including a hollow tubular element 68 into which a plug 69 may be inserted from the rear end and secured as by soldering. The plug 69 is provided with a projecting pin 70 which is spaced from the enlarged wall of the element 68 to provide the annular orifice 72 for the hollow tubular spray modifying jet. The air supply for these jets passes from the chamber 56 in the member 30 into the annular rearward chamber 74 with outer air cap member 36 and thence through the diametrically oppositely disposed forwardly directed passageways 75 to the orifices 72.

The spray modifying or flattening jets impinge from opposite sides of the device upon the axially directed partially atomized central spray, at a rather steep angle, as clearly shown in Figure 1. In order to aid in the effective atomization and spreading of the liquid, there is also provided additional orifices adjacent the side jets which have just been described. The protuberances or horns 38 of the air cap are undercut or notched upon their interior sides as at 80 and a pair of relatively fine converging passageways 82 are drilled through the wall of the projections and into the passageway 75 therein. The angularity of these pairs of passageways is indicated by the lines 85 in Figure 1 of the drawing and the included angle is approximately 70° in this particular embodiment. The openings 82 of each pair also converge toward each other by a slight angle as indicated in Figure 6 of the drawing this angularity being in the particular example illustrated approximately 8°.

By this means the spray modifying jets upon either side of the main spray are to some extent broken up and themselves modified at points just prior to or immediately upon impinging on the aspirated and partially atomized spray issuing from the central liquid orifice, which spray has been preliminarily broken up and diffused by means of the air jets issuing from the annular series of fine orifices 42 disposed adjacent the aspirating orifice 40.

As already indicated, the auxiliary atomizing and modifying jets 42 and 82 each have a beneficial effect when employed individually in a spray gun of conventional type, but their effects are notably increased when employed together and

are particularly effective when used in connection with the hollow tubular type of modifying jet such as issues from the annular orifices 72.

In Figure 3 there is shown as a separate article of manufacture the inner air cap element 35 described in connection with Figure 1 of the drawing. The embodiment designated 35' illustrated in Figure 4 of the drawing is quite similar in construction and function but is provided with a raised or protruding central portion 90 which has advantages in the spraying of certain types of material which have a tendency to build up upon the forward face of the nozzle. The inclination of the axes of the orifices 42 in this case is substantially the same as in Figure 3.

In Figure 5 there is illustrated an embodiment of the air cap which is designated 35² and in which the orifices 42² are parallel. The use of this type of cap is of advantage when the liquid material is syphoned from a container by the action of the spray gun rather than introduced by forced feed.

It is understood that various changes and modifications may be made in the embodiments illustrated and described herein without departing from the scope of the invention as defined by the following claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a spray gun for coating materials or the like, a nozzle at the forward end thereof for the atomization and projection of a spray of fluent material therefrom, said nozzle comprising, in combination, means centrally thereof for discharging an atomized spray of material of substantially circular cross-section, means for effecting further atomization and diffusion of said spray and for also altering its cross-sectional configuration, said last named means consisting solely of a pair of forwardly converging air discharge passageways disposed upon opposite sides of said nozzle, the axes of said passageways occupying a longitudinal plane which also includes a diameter of said nozzle, said passageways adapted to deliver spray flattening jets of air which intersect the axis of the axial spray of material, and a pair of co-planar air discharge passageways positioned adjacent each one of said first named passageways but upon opposite sides of said diameter and adapted to deliver jets of air toward said spray, the plane containing the axes of said second named jets adapted to intersect the axis of said first named jet at a point rearwardly of its point of intersection with the axis of the material spray.

2. In a spray gun for coating materials or the like, a nozzle at the forward end thereof for the atomization and projection of a spray of fluent material therefrom, said nozzle comprising in combination means centrally thereof for discharging an atomized spray of material of substantially circular cross-section, means for effecting further atomization and diffusion of said spray and for also altering its cross-sectional configuration, said last named means comprising a pair of forwardly converging annular air discharge passageways disposed upon opposite sides of said nozzle, the axes of said passageways occupying a longitudinal plane which also includes a diameter of said nozzle, said passageways adapted to deliver hollow tubular spray flattening jets of air which

intersect the axis of the axial spray of material, and a pair of air discharge passageways positioned adjacent each one of said first named passageways but upon opposite sides of said diameter and adapted to deliver jets of air toward the axes both of the material spray and of the flattening jet from the adjacent one of the first named passageways.

3. In a spraying device of the class described, a nozzle having a central orifice for discharging an axial jet of coating material or the like, means for enveloping said jet with an annular jet of atomizing and aspirating air, and means for further atomizing and shaping said spray by directing an annular series of fine converging jets of air upon the material spray from points radially outwardly of said annular jet, and means for projecting a group of air jets toward the axis of said material spray from diametrically opposite sides of said nozzle, each of said last named means comprising three orifices disposed at the apices of an isosceles triangle, one altitude of each of said triangles lying in a longitudinal plane passing through the axis of the material spray.

4. In a spraying device of the class described, a nozzle having a central orifice for discharging an axial jet of coating material or the like, means for enveloping said jet with an annular jet of atomizing and aspirating air, and means for further atomizing and shaping said spray by directing an annular series of fine converging jets of air upon the material spray from points radially outwardly of said annular jet, and means for projecting a group of air jets toward the axis of said material spray from diametrically opposite sides of said nozzle each of said last named means comprising three orifices disposed at the apices of an isosceles triangle, one altitude of each of said triangles lying in a longitudinal plane passing through the axis of the material spray, the outermost one of said orifices in each group being annular in form for the projection of a hollow tubular jet of air therefrom.

5. In a spray gun nozzle of the class described, in combination, an air cap member having an axially located opening for accommodating a central jet of sprayed material, and diametrically oppositely disposed forwardly projecting horns thereon, converging passageways in said horns for projecting jets of spray modifying air toward the axis of the jet of sprayed material, notches cut in the inwardly facing surfaces of said horns, and a pair of air discharge orifices formed in said notched sides one of each pair being disposed upon opposite sides of a diametrical plane containing the axes of said passageways and of said material spray.

6. In a spray gun nozzle of the class described, in combination, an air cap member having an axially located opening for accommodating a central jet of sprayed material, and diametrically oppositely disposed forwardly projecting horns thereon, converging annular passageways in said horns for projecting hollow tubular jets of spray modifying air toward the axis of the jet of sprayed material, notches cut in the inwardly facing surfaces of said horns, and a pair of air discharge orifices formed in said notched sides one of each pair being disposed upon opposite sides of a diametrical plane containing the axes of said passageways and of said material spray.

ALEXANDER F. JENKINS,