Aug. 16, 1938. A. F. JENKINS 2,126,889

SPRAY GUN

Filed March 1, 1937

FIG. 1.

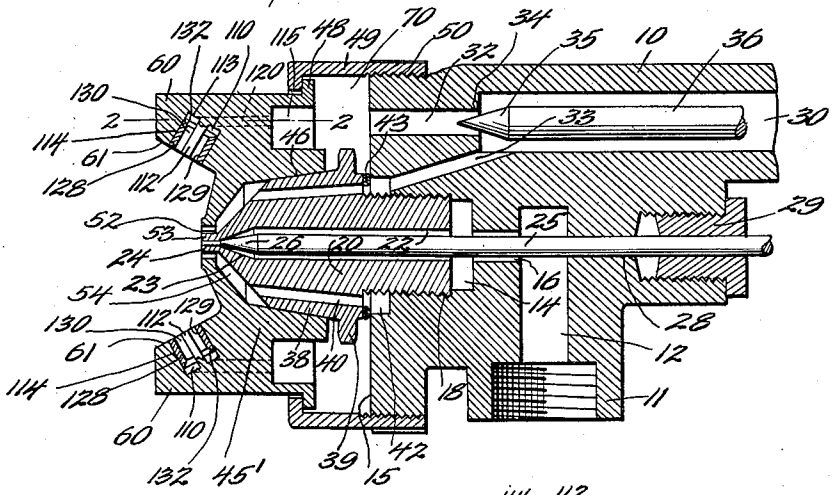



FIG. 3.

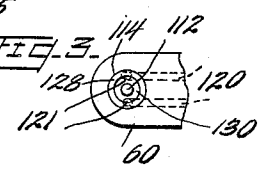



FIG. 2.

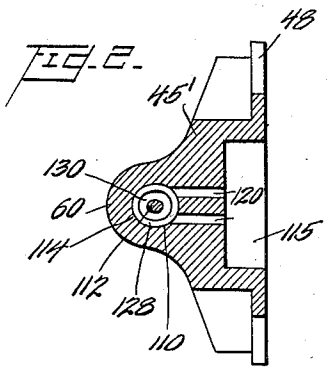



FIG. 4.

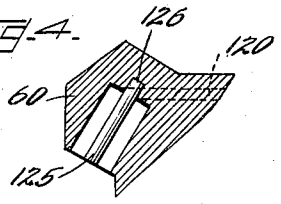
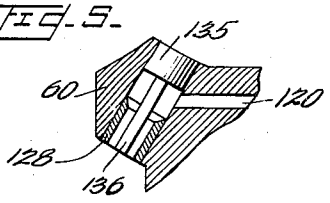



FIG. 5.




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# UNITED STATES PATENT OFFICE

2,126,889

## SPRAY GUN

Alexander F. Jenkins, Baltimore, Md.

Application March 1, 1937, Serial No. 128,507

11 Claims. (Cl. 299—140.1)

This invention relates to spraying devices and has for its general object the provision of improvements in the nozzles of such devices whereby better atomization and distribution of the liquid material employed may be attained; the subject matter of the present application being somewhat similar to that of my co-pending application, Serial No. 81,952, filed May 26, 1936.

In a spray gun of the type now generally employed for applying paint, enamel or other liquid coating material to surfaces for the purposes of protection, ornamentation, or the like, the liquid material is aspirated through a valve controlled orifice disposed centrally of the forward face of the nozzle of the gun, by means of an annular jet of air under pressure; and if a relatively flat or fan-shaped spray is required, convergent supplemental jets of compressed air are directed through laterally disposed orifices in the nozzle so as to impinge upon the central jet of aspirated liquid and convert this substantially cylindrical or conical jet into one having an oval or even an approximately rectangular cross sectional configuration.

Heretofore the spray modifying jets have been in the form of solid cones emitted from fine circular orifices formed very accurately in the side portion of the nozzle so that the jets will impinge exactly upon opposite sides of the axis of the liquid jet. The liquid coating material is frequently also supplied to the gun under some degree of pressure and valves for regulating the pressures and quantities of the liquid and of both the aspirating and spray modifying air supplies are generally provided on the guns. The degree of atomization required, the nature and viscosity of the liquid to be sprayed, and the desired shape of the spray,—all of these factors determine the degree of adjustment necessary for these regulating devices; and in most cases the relative pressures are quite critical and must be very accurately controlled.

In the use of spray guns of the usual type in which solid supplemental jets of spray modifying air are employed, there is a tendency to cause a "split" in the spray; that is, a narrowing of the cross section of the center of the spray and a lessening of the density of the spray at this point and an increase in density at the end portions thereof due to the unequal atomization of the sprayed liquid. To correct this condition, the usual practice, in constructions which permit it, is to reduce the supply of air to the supplemental jets. This adjustment, however, reduces the width of the spray and is apt to alter the character of the spray in other ways, especially when made in connection with the use of highly viscous and difficultly atomizable materials such as synthetic enamels and the like.

I have found that by the provision of tubular or hollow conical spray modifying jets of air, either alone or in conjunction with solid jets, a better atomization and distribution of the liquid material may be attained and the splitting eliminated, while at the same time there may be employed higher pressures or greater volumes of modifying air; and this comprises an important feature of the present invention. This improvement also affords wetter and more uniform coatings and wider spray patterns, and permits the more effective atomization of heavier coating materials, such as the synthetic enamels to which reference has been made, which are more difficult to break up or atomize than the ordinary paints or lacquers.

It has also been found that the pressures and volumes of air may be varied within rather wide limits, without necessitating the fine adjustment of the supplemental spray modifying air supply which has always been necessary in the case of the use of solid jets.

Another advantage accruing from the use of a hollow tubular or conical air jet resides in the fact that such extreme accuracy in machining the orifices to produce this type of jet is not necessary as in the case of the circular orifices employed for the projection of the solid jets.

Another readily appreciable effect of this novel feature is the uniform atomization of the material at the extreme ends of the generally elliptical spray patterns produced.

In the several embodiments of the invention shown in my co-pending application referred to above, the hollow or tubular supplemental air jets are produced by means of one or more annular orifices provided in the side portions of the spray gun nozzle, and the annular configuration of those orifices is attained by the employment of insertable plugs or pins which are uniformly spaced from the walls of a preferably cylindrical recess with which the source of compressed air is placed in communication.

However, it is one of the objects of the invention as comprised herein to provide a nozzle having annular orifices for the spray modifying jet formed directly therein by machining or otherwise, whereby the central pin or projection is integral with the material of which the cap is formed.

Other objects of the present invention include

the provision of a plurality of ducts leading to the modifying jet recesses whereby a better distribution of air is obtained; and also the provision of means for adjusting the size of the annular orifices to conform with the requirements of the particular job as determined by the character of the coating desired and the nature and viscosity of the coating material.

A further object is to provide means for diminishing the outer diameter of the recess near the face of the nozzle in order to provide an enlarged chamber or pocket adjacent the base of the recess wherein may be established a small reservoir of air for cushioning or equalizing the flow to the supplemental orifices.

It is understood that the features described in the two immediately preceding paragraphs may be applied to any of the embodiments of the invention illustrated in the co-pending application to which reference has been made, as suggested in certain of the figures of drawing in the present case. However, these features have especial utility and function in connection with the integrally formed jet arrangement forming a part of the present invention, as will be more fully set forth as the description proceeds.

Other objects and features of novelty will be apparent from the following specification when taken in connection with the accompanying drawing in which several embodiments of my invention are illustrated by way of example:

In the drawing,

Figure 1 is a view in vertical longitudinal section through the forward body portion of a spray gun embodying the principles of my invention;

Figure 2 is a fragmentary horizontal sectional view taken substantially on line 2—2 of Figure 1;

Figure 3 is a fragmentary plan view of a face of one of the horns in which the supplemental jet orifices are formed;

Figure 4 is a fragmentary vertical sectional view of a horn in which the orifice is formed as shown in my above mentioned co-pending application, and which is to be taken as exemplary of all of those which include a separately formed and insertable plug; and

Figure 5 is a similar view illustrating the application of the insertable bushing or liner in connection with a separately formed and insertable plug or pin.

Referring more particularly to Figure 1 of the drawing the numeral 10 designates the forward body portion of the spray gun which may be of any desired construction so far as the actuating and controlling mechanism is concerned. For example, it may follow, except as indicated otherwise herein, the construction of the spray gun illustrated in my Patent No. 2,082,061, dated June 1, 1937, filed January 12, 1935. The forward body portion 10 is provided with an internally threaded boss 11 which is adapted to receive the usual flexible connections by which communication is established with a source of supply of liquid coating material, with which the passageway 12 communicates. A recess 14 is provided in the forward face 15 of the body portion 10 of the gun and is connected with the passageway 12 by means of the bore 16. Threaded as at 18 within the recess 14 is the liquid nozzle 20 which is provided with an axial bore 22 tapered as at 23 adjacent its forward end and narrowed at the extreme forward end to provide the relatively small central liquid port 24. A needle valve 25 is disposed within the bore 22 and is provided with a tapered and attenuated forward end 26 which serves to regulate the port 24. The needle valve 25 is extended rearwardly through the bore 20 formed in the body portion 10 of the gun and projects through the stuffing box arrangement 29 and is extended rearwardly to be connected to the regulating and actuating mechanism not shown.

In this illustrative embodiment a common air passageway 30 is provided in the body portion 10 of the gun which is provided rearwardly of the illustrated portion with suitable actuating and controlling mechanisms. At the forward end of the gun the passageway 30 diverges to provide two short passageways leading to the front face 15 of the gun. These passageways are designated by the numerals 32 and 33, the former providing means for supplying the air to the laterally disposed spray modifying jets and the latter supplying the air to the central aspirating jets of the nozzle. The mouth of the passageway 32 forms a valve seat 34 which is controlled by the needle valve 35 having the rearwardly extending stem 36 and adapted to be controlled by mechanism carried by the rearward body portion of the gun and not illustrated in the present disclosure.

The liquid nozzle member 20 is provided with an enlarged tapered frusto-conical portion 38 at the base of which there is formed a preferably hexagonal nut portion 39 by which this member may be threaded into the body portion of the gun. The outer peripheral portion of the conical liquid nozzle is provided with a circular series of small passageways 40 which communicate with the annular recess 42 formed between an outer enlargement of the recess 14 and the stem of the liquid nozzle. The air passageway 33 communicates with this annular chamber 42 and the connection is sealed by means of the small gasket 43 which is adapted to be compressed between the rear face of the enlarged portion 38 of the liquid nozzle and the face 15 of the spray gun.

An outer nozzle cap 45' is provided, which may be of one piece construction or may be made in two parts as illustrated and described in my co-pending application, Serial No. 81,952, referred to. This cap has an internally tapered portion 46 seating upon the conical outer surface of the enlarged portion 38 of the liquid nozzle. An annular flange or shoulder 48 is provided on the cap aroound which is fitted a clamping collar 49 which is threaded as at 50 around the forward body portion of the gun. Centrally of the forward portion of the nozzle cap 45' an opening is formed through which the narrowed projecting end 53 of the liquid nozzle extends. The end of the liquid nozzle fits the opening with ample clearance to form an annular orifice 52. Between the forward portion of the cap 45' and the liquid nozzle there is formed an air chamber 54 which provides communication between the circular series of passageways 40 and the annular aspirating air orifice 52. Certain novel features which involve the cooperation of the annular auxiliary air orifices and the shape of the annular central orifice 52 were described in the said co-pending application.

Upon diametrically opposite sides of the nozzle cap 45' there may be formed the projecting bosses or horns 60 having diverging faces 61 within which are formed the orifices through which are emitted the converging jets of spray modifying air which impinge upon the central spray projected axially of the gun in order to flatten and control the shape of the spray pattern.

In all of the illustrated embodiments of the

invention, each of the horns 60 is provided with a recess of a generally cylindrical configuration which is modified in certain respects to provide an annular orifice for the supplemental jet. In Figure 1 of the drawing, there is provided in each of the faces 61 of the horns 60 of the nozzle an annular recess 110 which is preferably formed by machining the material of which the nozzle is made so as to leave a central axial cylindrical pin or projection 112 extending from the bottom 113 of the recess 110 and preferably uniformly spaced from the outer walls 114 of the recess.

Although for certain purposes a single air passageway could be provided between the recess 110 and the air chamber 70 with which the passageway 32 communicates, in this form of the invention it has been found preferable to provide two parallel passageways 120 between the bottom 113 of the recess 110 and the annular chamber 115 formed in the rear surface of the air cap adjacent the air chamber 70. These passageways are very clearly shown in Figures 2 and 3 of the drawing, and from an inspection of these figures it will be seen that these passageways open respectively through the orifices 121 formed in the bottom 113 of the recesses. It will be noted that these openings 121 are disposed upon diametrically opposite sides of the projection 112 and this disposition of the passageways and openings accomplishes two important purposes. By this means the supply of air to the auxiliary jets is increased, and furthermore, a better distribution of the air is effected about the annular chamber.

Although the passageway construction just described probably finds its best adaptation in connection with the provision of an integral central projection such as illustrated in Figures 1, 2 and 3 of the drawing, the provision of the dual air supply to the auxiliary jet recess is applicable to arrangements in which the central projection takes the form of a separately formed and insertable pin such as is employed in the embodiments illustrated in my co-pending application, Serial No. 81,952. Therefore, in Figure 4 of the drawing there is illustrated a construction which is to be taken as exemplary of the application of this feature to nozzles of this general type. The separately formed and insertable pin is shown at 125 and is suitably seated as at 126 within the base of the recess. The passageways 120 lead to suitable openings in the recess as in the embodiments already described.

In order to suitably restrict the orifice of the recess 110 to provide an annular spray modifying jet of predetermined diameter, there is provided a bushing 128 which is adapted to be fitted snugly within the outer wall 114 of the recess and to have its inner surface 129 spaced a predetermined distance from the central pin or projection 112. Obviously, the bushings 128 of various sizes could be employed for selective insertion in the orifice to provide orifices 130 of varying dimensions, the diameter of the integral central projection being invariable in a given nozzle.

The inner end 132 of the bushing 128 is spaced from the bottom 113 of the recess so as to provide an air chamber or pocket of the original diameter of the recess at the bottom thereof. The end 132 of the bushing is preferably chamfered as shown in Figure 1 so as to provide a gradually outwardly decreasing diameter for this pocket or chamber. The provision of this inwardly disposed air chamber adjacent the base of the recess 110 serves to maintain a cushioning space or reservoir of air for the diminished orifice 130 and aids in maintaining an even flow through the orifice.

The provision of the restricting bushing is also effective in connection with an orifice having an axial insertable pin as in the embodiments described in the copending application, Serial No. 81,952. A typical arrangement of this sort is illustrated in Figure 5 of the present drawing in which the bushing is applied to a representative nozzle having such an insertable plug. The plug is indicated at 135 and the projecting pin at 136, the annular bushing being indicated by the same reference characters as those employed in the prior embodiments.

Various changes and modifications may be made in the embodiments of the invention illustrated and described herein without departing from the scope of the invention as defined by the subjoined claims. It is also obvious that the features of the present invention may be applied to various types of nozzles, including those having serrated central spray forming jets as illustrated in the co-pending application to which reference has been made.

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

1. In a spraying device of the class described, a nozzle having centrally disposed liquid and compressed air orifices for the discharge of a spray of atomized liquid material, a supplemental annular orifice formed in said nozzle laterally of said first named orifices for discharging hollow tubular jets of air against said spray to modify the cross-sectional configuration thereof, said orifice comprising an annular recess substantially cylindrical in outline formed in the face of said nozzle, there being a central axial projection extending from and integral with the bottom of said recess, and a passageway leading into said recess and communicating with a source of compressed air.

2. In a spraying device of the class described, a nozzle having centrally disposed liquid and compressed air orifices for the discharge of a spray of atomized liquid material, a supplemental annular orifice formed in said nozzle laterally of said first named orifices for discharging hollow tubular jets of air against said spray to modify the cross-sectional configuration thereof, said orifice comprising an annular recess substantially cylindrical in outline formed in the face of said nozzle, there being a central axial projection extending from and integral with the bottom of said recess and uniformly spaced from the outer walls of said recess, and a passageway leading through the bottom of said recess and communicating with a source of compressed air.

3. In a spraying device of the class described, a nozzle having centrally disposed liquid and compressed air orifices for the discharge of a spray of atomized liquid material, a supplemental annular orifice formed in said nozzle laterally of said first named orifices for discharging hollow tubular jets of air against said spray to modify the cross-sectional configuration thereof, said orifice comprising an annular recess substantially cylindrical in outline formed in the face of said nozzle, there being a central axial projection extending from and integral with the bottom of said recess, and a pair of passageways leading into said recess, one upon each side of said projection, and both communicating with a source of compressed air.

4. In a spraying device of the class described, a nozzle having centrally disposed liquid and compressed air orifices for the discharge of a spray of

atomized liquid material, a supplemental annular orifice formed in said nozzle laterally of said first named orifices for discharging hollow tubular jets of air against said spray to modify the cross-sectional configuration thereof, said orifice comprising an annular recess substantially cylindrical in outline formed in the face of said nozzle, there being a central axial projection extending from and integral with the bottom of said recess, and a pair of passageways leading through the bottom of said recess, one upon each side of the base of said projection, and both communicating with a source of compressed air.

5. In a spray gun nozzle of the class described, a supplemental spray modifying air jet orifice comprising an annular cylindrical recess formed in the face of the nozzle so as to provide a central, concentric, axial, cylindrical projection extending from the bottom of said recess, and a plurality of air admission openings in the annular bottom of said recess.

6. In a spray gun nozzle of the class described, a supplemental spray modifying air jet orifice comprising an annular cylindrical recess formed in the face of the nozzle so as to provide a central, concentric, axial, cylindrical projection extending from the bottom of said recess, air admission openings in the annular bottom of said recess, and an annular bushing fitted to the outer wall of said recess and spaced from said central projection for restricting the effective width of said orifice.

7. In a spray gun nozzle of the class described, a supplemental spray modifying air jet orifice comprising an annular cylindrical recess formed in the face of the nozzle so as to provide a central, concentric, axial, cylindrical projection extending from the bottom of said recess, air admission openings in the annular bottom of said recess, and an annular bushing fitted snugly within the outer portion of said recess and against the radially outward wall thereof to restrict the effective diameter of the orifice, the inner end of said bushing terminating short of the bottom of said recess in order to maintain the original diameter of the inner portion of the recess and provide an enlarged air chamber therein.

8. In a spray gun nozzle of the class described, a supplemental spray modifying air jet orifice comprising an annular cylindrical recess formed in the face of the nozzle so as to provide a central, concentric, axial, cylindrical projection extending from the bottom of said recess, air admission openings in the annular bottom of said recess, and an annular bushing fitted snugly within the outer portion of said recess and against the radially outward wall thereof to restrict the effective diameter of the orifice, the inner end of said bushing terminating short of the bottom of said recess in order to maintain the original diameter of the inner portion of the recess and provide an air chamber therein, said inner end of the bushing being chamfered to gradually vary the diameter of said recess.

9. In a spray gun nozzle of the class described, a supplemental spray modifying air jet orifice comprising an annular cylindrical recess formed in the face of the nozzle so as to provide a central, concentric, axial, cylindrical projection extending from the bottom of said recess, a pair of air admission openings in the annular bottom surface of said recess, each upon diametrically opposite sides of said projection, and an annular bushing fitted snugly within the outer portion of said recess and against the radially outward wall thereof to restrict the effective diameter of the orifice, the inner end of said bushing terminating short of the bottom of said recess in order to maintain the original diameter of the inner portion of the recess and provide an enlarged air chamber therein, said inner end of the bushing being chamfered to gradually vary the diameter of said recess.

10. In a spray gun nozzle of the class described, a laterally disposed spray modifying air jet orifice comprising an annular, substantially cylindrical recess formed in the face of the nozzle and provided with a pair of air admission openings in its annular bottom surface, each opening being disposed upon diametrically opposite sides of said bottom surface.

11. In a spray gun nozzle of the class described, a laterally disposed spray modifying air jet orifice comprising a straight walled, annular, substantially cylindrical recess formed in the face of the nozzle, and air admission passageways leading thereto, an annular bushing fitted to the radially outer wall of said recess, extending partially into said recess, and serving to restrict the effective diameter of the orifice.

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