March 18, 1941. A. F. JENKINS 2,235,708

SPRAYING DEVICE

Filed Jan. 10, 1938 2 Sheets-Sheet 1

FIG. 1.

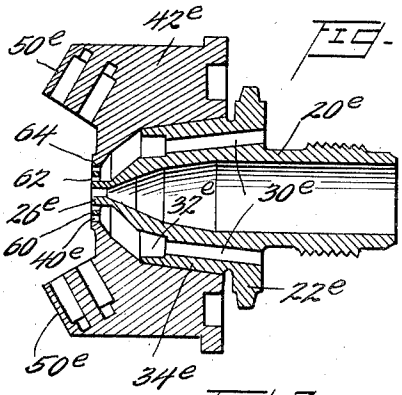


FIG. 2.

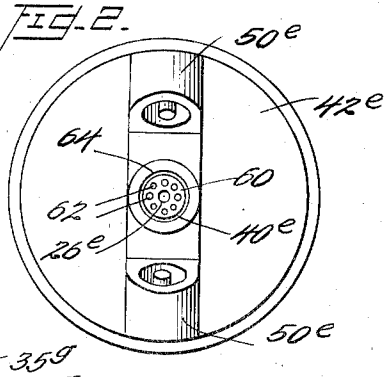


FIG. 5

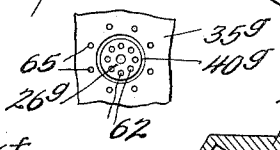


FIG. 3.

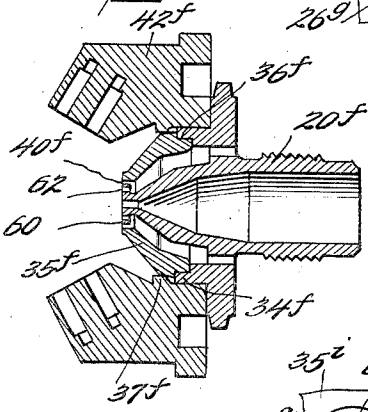


FIG. 4

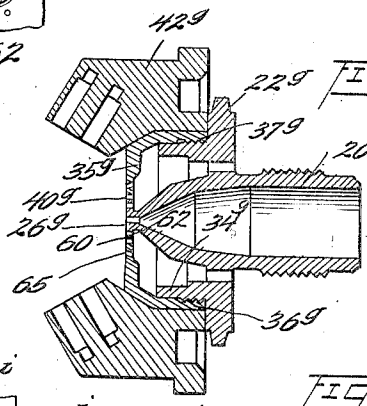


FIG. 8

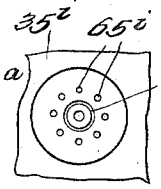


FIG. 6.

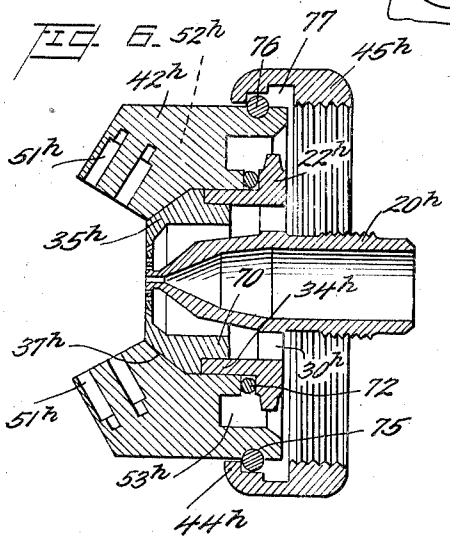
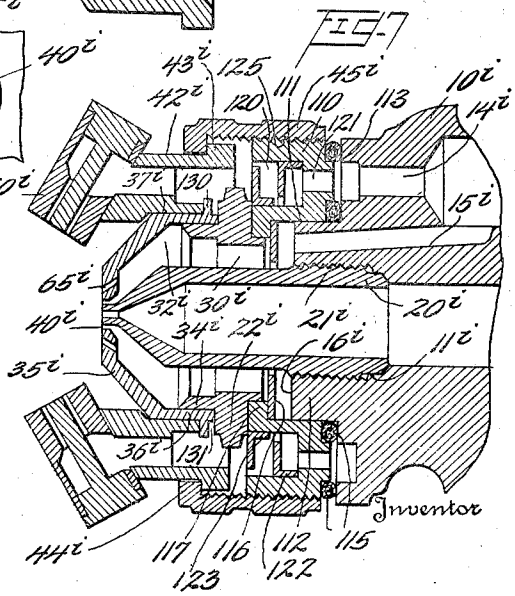


FIG. 7



Alexander F. Jenkins

By Watson, Cole Morse & Grindle Attorneys

March 18, 1941. A. F. JENKINS 2,235,708

SPRAYING DEVICE

Filed Jan. 10, 1938 2 Sheets-Sheet 2

FIG. 9

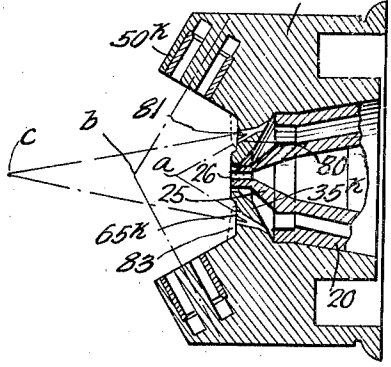


FIG. 10

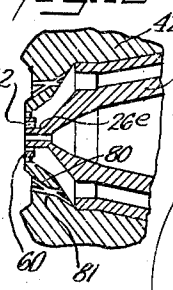


FIG. 11

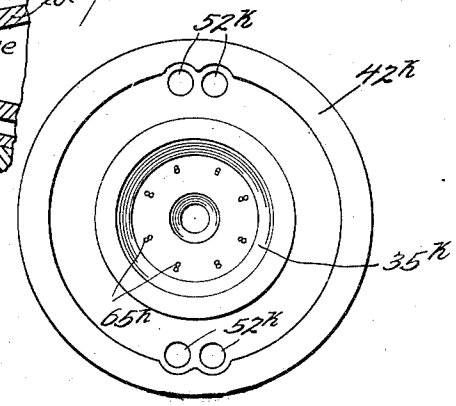
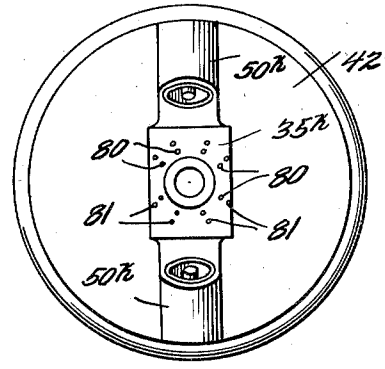


FIG. 12



Inventor

Alexander F. Jenkins,

By Watson, Cole, Grosvenor & Grindle Attorneys

Patented Mar. 18, 1941

2,235,708

UNITED STATES PATENT OFFICE

2,235,708

SPRAYING DEVICE

Alexander F. Jenkins, Baltimore, Md.

Application January 10, 1938, Serial No. 184,301

16 Claims. (Cl. 299—140.1)

This invention relates to spraying devices or the like, and more particularly to the nozzle assemblies of spray guns of the type which are employed in atomizing and spraying liquids, such as coating materials or the like.

The general object of the invention is the provision of novel and improved nozzle constructions of the class described, which are easy and economical to manufacture and at the same time are capable of being readily assembled so as to produce a spray jet of great accuracy and fineness of atomization; and one which is susceptible of a wide range of adjustability.

It is a more specific object of the invention to provide in a nozzle of this type, means for ensuring the accuracy and uniformity of width or diameter of the central orifice for the atomizing and aspirating jet of air which surrounds the liquid jet. Heretofore, in the manufacture and use of spray guns, much difficulty has been experienced in obtaining an accurate alignment or centering of the air and liquid jets, and this has been due principally to the fact that the annular aspirating air orifice has been formed between cooperating surfaces of the inner liquid conducting nozzle portion and of the outer separable air cap or atomizer head. Numerous expedients have been proposed for ensuring the maintenance of the proper concentric positions of these nozzle parts, including the provision of conical or spherical bearing surfaces between them, but these proposals have not been entirely satisfactory, due to both the increase in the difficulty and expense of manufacture and to the failure to entirely eliminate the distortions or inaccuracies of fit even in the most careful processes of machining and assembly.

The present invention attains this object by providing means embodied in the construction of the inner liquid nozzle portion itself for defining the aspirating and atomizing air jet orifice, and thus removes the greatest source of error in manufacture. Furthermore, in the preferred embodiments of the present nozzle construction, the portion which confines this air jet is joined or sealed to the liquid nozzle proper at a point so immediately adjacent to the forward effective end of the fluid nozzle that there is little chance of error or variation in the cooperation or interfitting of the parts. Several optional arrangements of assembly details of such a nozzle are shown herein, but obviously the invention in its broadest aspect is not limited to these disclosures.

Another closely allied object of the present invention, and one the attainment of which is facilitated by the above described improvement, is the provision in fluid spraying nozzles of this general type, of aspirating and atomizing air jets of various configurations and combinations, such as, for example, those formed of one or more annular series of openings, which are preferably used in addition to and in cooperation with the annular orifice to which reference has already been made. A similar arrangement is disclosed in the applicant's copending application, Serial No. 58,399, filed January 9, 1936, which is a continuation-in-part of application Serial No. 714,766, filed March 9, 1934, issued June 1, 1937 as U. S. Patent No. 2,082,060.

The provision of such multiple orifices attains several advantageous objects. First of all, the provision of these supplemental air jets adjacent the fluid jet, aids in the atomization of the fluid, providing a smoother, easy flowing wall of air surrounding and mingling with the jet of liquid which effects a softer central conical spray which can be very easily flattened and widened in the zone where the auxiliary jets from the side wings of the nozzle impinge upon it. The provision of these multiple orifices has been found to be particularly effective when employed in connection with the hollow or annular type of side wing jets of the general type disclosed in my copending applications, Serial No. 81,952, filed May 26, 1936, and Serial No. 128,507, filed March 1, 1937; an extremely wide, wet, and highly atomized spray of liquid material being produced, even in the case of the widely used synthetic enamels with the spraying of which considerable difficulty has been encountered in the past. Another important function which the multiple central orifices perform is that of preventing the building up of coating material upon the face of the nozzle around the central orifices. A much cleaner operation of the spraying device is attained both during the actual spraying process and immediately after the fluid supply has been cut off. Most of the spray guns of this general type are provided with adjustments which enable the maintenance of the air flow for a short period of time after the liquid flow has ceased. This affords a cleaning or "wiping" action by means of the flow of air through the multiple central jets after the flow of liquid has ceased, and which serves to effectively prevent the building up of the coating material on the face of the nozzle.

The provision of these additional openings is rendered easy by the construction of the nozzle in accordance with the previously described ob-

ject of the invention involving the employment of the air jet forming members which are applied to the inner liquid nozzle organization of the spray gun, as will be developed further in connection with the detailed description of the several embodiments of the invention.

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

In the drawings:

Figure 1 is a vertical longitudinal sectional view of one embodiment of the invention in which there is employed an inner annular series of air openings disposed around the central liquid orifice;

Figure 2 is a front elevation of the same;

Figure 3 is a vertical longitudinal sectional view of a variant form of this type of nozzle;

Figure 4 is a similar view of a nozzle having two series of air openings;

Figure 5 is a fragmentary view in front elevation of the central portion of the nozzle shown in Figure 4;

Figure 6 is a similar view of a modified form of this nozzle showing one means of connecting the air cap to the body of the gun;

Figure 7 is a view in vertical longitudinal section of a nozzle and front end construction applicable especially to a spray gun body made of a die casting;

Figure 8 is a fragmentary front elevation of the same;

Figure 9 is a vertical longitudinal sectional view of a nozzle comprising another embodiment of the invention;

Figure 10 is a similar view of another adaptation of the air cap of Figure 9;

Figure 11 is a view in rear elevation of the air cap of Figures 9 and 10; and

Figure 12 is a front elevational view of the air cap.

Referring to the drawings, and preliminarily especially to Figure 7 thereof, it will be seen that a portion of the forward end of the body of a spray gun is indicated at **10***i* and is provided with a liquid chamber or passageway **11***i* and a main air passageway which is provided with a valve seat dividing the air passageway to provide a forwardly directed passageway **14***i* leading to the supplemental flattening jets of the air cap and the diverging passageway **15***i* leading to the central aspirating air orifices. The forward face of the body portion of the gun may be formed in a single plane, although within the scope of the invention the construction of the body portion of the gun may vary widely.

The inner liquid nozzle portions in the several embodiments are indicated generally by the reference numerals **20** with certain exponents to indicate varient forms and comprises the central rearwardly projecting nipple which is threaded as at **21***i* (Figure 7) into the recess **11***i* formed in the head **10***i*. The central portion of the liquid nozzle **20***e*, for example as in Figure 1 is provided with the flange **22***e*, the periphery of which may be squared for the application of a wrench or suitable tool for removing and applying this portion of the nozzle to the spray gun. The forward end of the liquid nozzle proper is of a general conical configuration and is provided centrally at the tip thereof with a liquid orifice **26***e*, etc.; the flow of liquid through this orifice being controlled by means of the usual needle valve which projects rearwardly and is operatively connected with the trigger of the gun which is not shown herein, but may be of any usual or conventional construction, or may be arranged as shown in my Patent No. 2,082,060 or 2,082,061. The intermediate flange **22***i* is provided with an annular series of passageways **30***i* which provide communication between the rear annular chamber into which the air passageway **15** leads, and the forward air chamber **32***i* formed between the conical top of the liquid nozzle and the air cap.

The air cap may be formed integrally as in Figure 1 or it may include a separately formed insert or tip **35***i* provided for rigid and substantially permanent application to the liquid nozzle **20***i* to provide the annular aspirating air orifice **41***i*, as illustrated in Figure 7. This insertable tip is adapted to be applied to the wall or flange **34** and the rearwardly extending portion **36***i* of the tip or insert may be seated against the flange **22***i*. The tip **35***i* converges forwardly to the plane of the face of the liquid nozzle and the inner margin of the opening therein is spaced from the liquid nozzle tip at a predetermined distance to provide the annular aspirating air orifice **40***i*. It will thus be seen that there is thereby formed a relatively permanent arrangement for defining the orifice **40***i* which is adapted to be carried by the inner liquid nozzle portion of the nozzle assembly; which is of a relatively small diameter as compared with the air cap of the usual arrangement; and which is secured to the rigidly supported liquid nozzle at a point well forwardly thereon and adjacent the front face of the nozzle assembly. Thus no reliance need be placed upon the accuracy of fit of the usual air cap with relation to the inner liquid nozzle to provide the aspirating jet of air.

The air cap of this type of nozzle assembly is indicated generally by the reference numeral **42***i* and is provided with an inner circular opening which fits around the cylindrical outer surface of the cap or insert **35***i* and abuts the forward face of the flange **130** formed thereon. The rearward portion of the air cap is provided with an outwardly extending annular flange **43***i* which forms a shoulder about which the inwardly directed flange **44***i* of the clamping ring **45** may engage. The clamping ring **45***i* is connected to the forward end of the body of the gun as will be later described and when applied serves to effect the necessary sealing of the air supplies within the nozzle. Air cap **42***i* is provided with the usual diametrically oppositely disposed wings **50***i* which in this instance are provided with annular openings for the projection of the hollow annular flattening jets as in the case of the construction shown in my copending application, Serial No. 218,507. Leading to the base of these annular openings there are provided channels which open rearwardly into the rear annular recess formed in the air cap. These annular openings and recesses are designated respectively **51***h* and **53***h* in Figure 6. This rear recess lies opposite corresponding recesses and passageways in the nozzle assembly of the gun into which the air passageway **14***i* opens as will be later described in more detail. There is thus provided communication between the main air supply and the auxiliary flattening jets provided by the wings **50***i*.

It is understood that any form of side wing or flattening jet may be employed in this connection whether they are adapted to produce hollow annular jets or solid conical jets of flattening air.

In Figures 3 to 12, inclusive, various arrange-

ments of supplemental central air orifices are disclosed and it will be seen that the provision of the separately formed air tips which have just been described greatly facilitates the arrangement of these supplemental orifices although within the broader aspect of the invention the orifices may be provided in nozzles of more or less conventional construction.

In Figure 1 of the drawings, as has already been generally explained, the inner liquid nozzle portion of the nozzle assembly is indicated by the reference numeral **20***e* and is provided forwardly of the intermediate flange **22***e* with a frusto-conical portion **34***e* having the annular series of passageways **30***e* formed therein and opening into the forward annular recess **32***e*. Upon the forward tip **26***e* of the liquid nozzle there is provided an outwardly extending annular flange **60** which may be formed integrally with the tip **26***e* or permanently secured thereto as by welding, soldering, brazing or the like. This flange is provided with an annular series of minute openings or orifices **62**. The air cap **42***e* in this embodiment is provided with the somewhat enlarged circular central opening the annular wall of which is indicated by the numeral **64** which is spaced from the outer periphery of the flange **60** a sufficient distance to provide the annular opening **40***e* of sufficient width for the purpose desired. This arrangement of orifices is clearly shown in Figure 2 of the drawings and the function and effect of the added annular series of orifices will be at once apparent. The openings **62** will provide an initially interrupted annular wall of air and it will cooperate with the annular jet issuing from the orifice **40***e* to effect an increased atomization of the liquid and also provide means for preventing dripping and the building up of accumulations of liquid on the face of the nozzle. The provision of this means for effecting a more complete atomization of the central spray also provides a better formed basic jet for impingement by the flattening jets issuing from the side wings **50***e* of the nozzle.

In Figure 3 there is illustrated a very similar arrangement of central jets including the flange **60** and the series of orifices **62** but in which the separate air tip **35***f* is used, this tip being connected as at **36***f* with the wall **34***f* of the liquid nozzle portion **20***f* and inwardly directed annular flange **37***f* is formed on the air cap **42***f* and aids in preventing the removal of the tip **35***f*. This arrangement as already described, provides an accurate means for defining the annular orifice **40***f* which surrounds the flange **60** of the inner liquid nozzle.

Figures 4 and 5 illustrate an embodiment of the invention in which an air tip **35***g* is made of an enlarged diameter so as to provide the wide rearwardly extending flange **36***g* which encloses the annular wall **34***g* of the liquid nozzle **20***g* and is threaded thereto as at **37***g*. The air cap **42***g* fits around the exterior surface of the air tip **35***g* and abuts the flange **22***g* in the usual way. An important feature of the present embodiment is the provision in the tip **35***g* of the outer annular series of openings **65** which surround the annular air orifice **40***g* formed between the air tip **35***g* and the tip of the liquid nozzle **20***g*. In Figure 4 the tip **26***g* of the liquid nozzle is provided with the flange **60** having the inner annular series of openings **62** formed therein but obviously the outer series of orifices **65** in the tip **35***g* could be employed without the provision of the inner series **62**, as shown in Figure 7 of the drawings. The outer series of orifices **65** may be formed with their axes parallel to the axis of the nozzle assembly or they may converge toward a point on the latter axis as shown in the preferred embodiment. In any event, the outer series of orifices performs the dual function of providing a better atomization of the liquid and a softer preliminary spray jet which is acted upon more effectively by the side wing jets in providing a wide, wet, fan-shaped spray; and also in providing means for preventing dripping and building up of coating material on the face of the nozzle as already described. It is understood that any desired number and spacing of orifices may be provided in the inner circular series of openings **62** or in the outer circular series **65**.

In Figure 6 there is shown an air cap **35***h* which is fitted to the wall **34***h* of the liquid nozzle portion **20***h* in a manner very similar to that shown in Figure 3 of the drawings, except that the inwardly tapered surface **37***h* of the air cap **42***h* serves to enclose and aid in retaining the cap **35***h* in position. The central air and liquid jets are formed in a similar fashion to those shown in Figure 4 of the drawings. The threaded retaining ring is shown at **45***h*, the squared intermediate flange of the liquid nozzle **20***h* is shown at **22***h*, the inner annular series of passageways leading through this flange is shown at **30***h* and the dual passageways leading from the annular chamber **53***h* forwardly to the side wing openings **51***h* are indicated at **52***h*. (See also Fig. 11.)

Figure 6 also illustrates a novel fastening means for securing the air cap to the body portion of the gun by means of the clamping ring **45***h*. Rearwardly projecting flange **70** of the air cap surrounds the wall **34***h* of the liquid nozzle and is adapted to compress the gasket **72** against the flange **22***h* when the air cap **42***h* is clamped to the body portion of the gun. An outer annular groove **75**, preferably of semi-circular configuration is provided in the periphery of the rear portion of the air cap **42***h* and is adapted to receive the split annular wire ring **76** which is sprung into the groove so as to provide an abutment for the forward flange **44***h* of the clamping ring **45***h*. In applying the ring, it may be expanded into the annular recess **77** formed in the clamping sleeve or ring **45**, and both the clamping ring and the spring wire ring **76** applied to the outer surface of the air cap and moved longitudinally thereof until the ring **76** snaps into the groove **75**. It will be understood that this arrangement has particular applicability to air caps which are provided with outwardly projecting side wings which would prevent the application of the clamping rings **45***h* forwardly of the air cap.

In Figures 7 and 8 of the drawings, already referred to in a general way there is illustrated one very practical embodiment of the invention, the air cap portion **42***i* of which is provided with assembled wing constructions **50***i*. The liquid nozzle portion **20***i* is threaded as at **21***i* into the recess **11***i* formed in the forward portion **10***i* of the main body of the gun, which in this embodiment may be made of a forging or die casting of aluminum. The inner liquid nozzle **20***i* is provided with the intermediate radial flange **22***i* and the inner air passageway **30***i* as in the case of the previously described embodiments. However, instead of having the flange **22***i* directly abut the front face **16***i* of the body of the gun, as in the usual case, there is provided an intervening annular thread carrying element **110**, the inner an-

nular surface 111 of which fits around the central projecting portion 112 of the front end of the gun and is sealed against the rearward stepped face 113 of the body portion 10*i* as by means of the gaskets 115.

An inwardly disposed ring or washer 116 is held by the flange 117 of the member 110 so as to baffle and equalize the distribution of the central air supply passing through the passageway 15*i* before it enters the passageways 30*i*. The annular intermediate member 110 is also provided with the annular recess or forward annular chamber 120 which is placed in communication with the air supply passing through the passageway 14*i* in the body of the gun by means of the series of holes 121. An inwardly projecting flanged baffle ring 122 and an outwardly projecting ring 123 are fitted within the chamber 120 in order to equalize the distribution of the auxiliary jet air supply upon opposite sides of the air cap.

The intermediate annular member 110 is preferably made of brass or some other durable readily machinable metal and is provided around its outer periphery with the screw threads 125 upon which may be screwed the clamping ring 45*i* which is provided with the flange or shoulder 44*i* surrounding the shoulder 43*i* of the air cap. This arrangement not only provides a convenient disposition of the equalizing air baffles but also enables the placing of the screw threads for the attachment of the air cap on the member made of renewable bar stock and eliminating the alternative of providing threads upon the front end of the body portion which would be subject to wear and deterioration.

The very practical form of air tip illustrated in Figure 7 of the drawings as applied to the liquid nozzle 20*i* will now be described in more detail. This nozzle portion is provided with the forwardly projecting annular flange or wall 34*i* similar to the corresponding portion of certain of the other embodiments and around the exterior surface of this wall is fitted the rearwardly extending flange 36*i* of the air tip 35*i*. The outer air cap 42*i* is provided with a central annular surface 37*i* which fits around the flange 36*i* of the air tip 35*i*. The flange 36*i* extends rearwardly to abut the intermediate flange 22*i* of the liquid nozzle and is provided with a radially outwardly directed flange 130 which is spaced from the flange 22*i* so as to leave an annular space 131 into which a screw driver or other suitable tool may be inserted in order to remove the cap or tip 35*i* from the liquid nozzle. The flange 130 also provides an abutment element for the surrounding inner portion of the air cap 42*i*. Preferably the inner wall 34*i* of the liquid nozzle 20*i* is shaped as shown in Figure 7 and terminates short of the converging front walls of the cap 35*i* so as to provide as much of an enlargement within the air chamber 32*i* as possible.

The inner air tip 35*i* in this embodiment is provided with an annular series of openings 65*i* which surround the annular aspirating air orifice 40*i* of the nozzle. Any number of these openings 65*i* may be provided and they may be arranged as shown in Figure 8 of the drawings, with diagonally opposite pairs of openings on opposite sides of the central liquid orifice.

In Figures 9 to 12 inclusive of the drawings, there is illustrated a form of air cap which is applicable to many of the liquid nozzle arrangements illustrated in other figures of the drawings and which may obviously be applied to liquid tips having the perforated flanges 60, 62, as well as plain tips. This air cap, which may be designated 42*k*, is provided with side wing arrangements 50*k* similar to those already illustrated and forming one of the principal features of my application Serial No. 128,507. The inner portion 35*k* of the air cap is arranged to surround the liquid tip in the manner already explained and this portion is provided with an annular series of dual orifices 65*k*, these orifices being the forward opening ends of the intersecting passageways 80 and 81; the passageways 80 being so drilled as to converge at the point *a* which is nearer the face of the nozzle than the point *b* which represents the approximate center of the zone of impingement of the jets from the side wings 50*k*. The passageways 81 are of less convergence and are adapted to intersect substantially at the point *c* outwardly of the center *b*. By means of this disposition of supplemental air orifices all of the previously stated objects may be obtained and a more diffused spray produced. In making this air cap, it is preferred that portions of the metal of the interior of the cap adjacent the orifices and indicated at 83 be allowed to remain until after the passageways 80 and 81 are drilled, then the metal represented by the areas 83 may be removed.

It will be seen that by the various provisions of the present invention, a novel and improved spray gun nozzle has been attained which will ensure an accurately formed, finely atomized, and readily controllable spray.

It will be understood that various changes and modifications in the embodiments illustrated and described herein may be made 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 assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, said nozzle assembly being provided with a centrally disposed valve controlled liquid orifice, an annular series of spaced air orifices disposed radially outwardly thereof, concentric therewith, and immediately adjacent thereto, and an annular air orifice surrounding said series of spaced orifices and closely adjacent thereto.

2. In a spray gun for coating materials or the like, a nozzle assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, said nozzle assembly being provided with a centrally disposed valve controlled liquid orifice, an annular series of spaced air orifices disposed radially outwardly thereof and immediately adjacent thereto, and an annular air orifice surrounding said series of spaced orifices and closely adjacent thereto, and another annular series of air orifices surrounding said annular air orifice; the central liquid orifice, the annular air orifice, and both annular series of air orifices all being concentric.

3. In a spray gun for coating materials or the like, a nozzle assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, said nozzle assembly being provided with a centrally disposed valve controlled liquid orifice, an annular series of spaced air orifices disposed radially outwardly thereof, concentric therewith, an immediately adjacent thereto, an annular air orifice surrounding said

series of spaced orifices and closely adjacent thereto, and an annular series of air passageways opening through the face of the nozzle and surrounding said annular air orifice, means disposed radially outwardly of the central portion of the nozzle and on diametrically opposite sides thereof for projecting converging jets of air against the central jet of aspirated and atomized fluid to flatten the same, the axes of the several passageways of the outer series converging toward the axis of the central fluid jet.

4. In a spray gun for coating materials or the like, a nozzle assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, said nozzle assembly being provided with a centrally disposed valve controlled liquid orifice, an annular series of spaced air orifices disposed radially outwardly thereof, concentric therewith, and immediately adjacent thereto, an annular air orifice surrounding said series of spaced orifices and closely adjacent thereto, and an annular series of air passageways opening through the face of the nozzle and surrounding said annular air orifice, means disposed radially outwardly of the central portion of the nozzle and on diametrically opposite sides thereof for projecting converging jets of air against the central jet of aspirated and atomized fluid to flatten the same, the axes of the several passageways of the outer series converging toward the axis of the central fluid jet and adapted to intersect therewith at a point rearwardly of the point of impingement of said spray flattening jets.

5. In a spray gun for coating materials or the like, a nozzle assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, said nozzle assembly being provided with a centrally disposed valve controlled liquid orifice, an annular series of spaced air orifices disposed radially outwardly thereof, concentric therewith, and immediately adjacent thereto, an annular air orifice surrounding said series of spaced orifices and closely adjacent thereto, a series of radially aligned pairs of air orifices surrounding said annular orifice, passageways through the front wall of said nozzle leading to said pairs of orifices, means disposed radially outwardly of the central portion of the nozzle and on diametrically opposite sides thereof for projecting converging jets of air against the central jet of aspirated and atomized fluid to flatten the same, the axes of the several passageways of the outer series of pairs of orifices all converging toward the axis of the central fluid jet, the axes of some of said passageways adapted to intersect with said central fluid jet at a point rearwardly of the point of impingement of said spray flattening jets and the axes of the remaining passageways adapted to intersect with the axis of said central fluid jet at points forwardly of the point of impingement of said spray flattening jets.

6. In a spray gun for coating materials or the like, a nozzle assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, the forward wall of said nozzle enclosing an annular air chamber, a central liquid orifice in said nozzle, a plurality of pairs of radially aligned intersecting passageways through said wall providing air orifices in the face of said nozzle, said pairs of passageways being arranged in an annular series, the axes of all of said passageways converging forwardly toward the axis of the liquid orifice, but the axes of the passageways which provide the inner orifices of each pair having a greater angle of convergence than the axes of the other set of passageways.

7. In a spray gun for coating material or the like, a nozzle assembly comprising a central liquid nozzle member having a valve controlled liquid passageway axially thereof and terminating in a discharge orifice in the forward tip of said liquid nozzle member, a radially outwardly disposed air cap member having passageways and orifices therein for the projection of spray flattening jets of air, air passageways formed in said liquid nozzle member radially outwardly of said liquid passageway and communicating with a source of compressed air, an annular flange on said liquid nozzle member radially outwardly of said air passageways and a forwardly disposed cap fitting said flange and having a central opening surrounding the tip of the liquid nozzle member with sufficient clearance to provide an annular orifice for the aspirating and atomizing air, said air cap being provided with an annular series of air passageways opening forwardly therethrough to provide an annular series of air orifices immediately outwardly of said annular orifice.

8. In a spray gun for coating material or the like, a nozzle assembly comprising a central liquid nozzle member having a valve controlled liquid passageway axially thereof and terminating in a discharge orifice in the forward tip of said liquid nozzle member, a circular radial flange formed on said tip and having longitudinal air passageways therethrough opening forwardly in an annular series of orifices immediately adjacent the central liquid orifice, a radially outwardly disposed air cap member having passageways and orifices therein for the projection of spray flattening jets of air, air passageways formed in said liquid nozzle member radially outwardly of said liquid passageway and communicating with a source of compressed air, an annular flange on said liquid nozzle member radially outwardly of said air passageways and a forwardly disposed cap fitting said flange enclosing an air chamber into which said liquid nozzle air passageways lead, and having a central opening surrounding the flanged tip of the liquid nozzle member with sufficient clearance to provide an annular orifice for the aspirating and atomizing air.

9. In a spray gun for coating material or the like, a nozzle assembly comprising a central liquid nozzle member having a valve controlled liquid passageway axially thereof and terminating in a discharge orifice in the forward tip of said liquid nozzle member, a circular radial flange formed on said tip and having longitudinal air passageways therethrough opening forwardly in an annular series of orifices immediately adjacent the central liquid orifice, a radially outwardly disposed air cap member having passageways and orifices therein for the projection of spray flattening jets of air, air passageways formed in said liquid nozzle member radially outwardly of said liquid passageway and communicating with a source of compressed air, an annular flange on said liquid nozzle member radially outwardly of said air passageways and a forwardly disposed cap fitting said flange enclosing an air chamber into which said liquid nozzle air passageways lead and having a central opening surrounding the flanged tip of the liquid nozzle member with sufficient clearance to pro-

vide an annular orifice for the aspirating and atomizing air, said air cap being provided with an annular series of air passageways opening forwardly therethrough to provide an annular series of air orifices immediately outwardly of said annular orifices.

10. In a spray gun for coating materials or the like, a nozzle assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, said nozzle assembly comprising an inner axially disposed liquid nozzle member having a valve controlled liquid discharge orifice in the tip thereof, a radially projecting flange on said tip at its extreme end, means providing an air chamber rearwardly of said flange and surrounding said liquid nozzle member, and an annular series of fine passageways passing through said flange, for the projection of a plurality of air jets adjacent the liquid jet issuing from said liquid orifice.

11. In a spray gun for coating materials or the like, a nozzle assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, said nozzle assembly comprising an inner axially disposed liquid nozzle member having a valve controlled liquid discharge orifice in the tip thereof, a radially projecting flange on said tip at its extreme end, a cap applied to said liquid tip and enclosing an air chamber which surrounds said tip rearwardly of said flange, said cap having a central orifice of greater diameter than that of said flange and surrounding the latter so as to provide between these two members an annular air orifice, and an annular series of passageways passing through said flange which provide a plurality of air orifices between said annular orifice and said central liquid orifice.

12. In a spray gun for coating materials or the like, a nozzle assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, said nozzle assembly having a valve controlled liquid discharge orifice in the tip thereof, a radially projecting flange on said tip at its extreme end, a cap applied to said liquid tip and enclosing an air chamber which surrounds said tip rearwardly of said flange, said cap having a central orifice of greater diameter than that of said flange and surrounding the latter so as to provide between these two members an annular air orifice, and an annular series of passageways passing through said flange which provide a plurality of air orifices between said annular orifice and said central liquid orifice, said cap also being provided with an annular series of air passageways therethrough and providing orifices disposed outwardly of said annular orifice.

13. In a spray gun for coating materials or the like, a nozzle assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, said nozzle assembly comprising an inner axially disposed liquid nozzle member having a valve controlled liquid discharge orifice in the tip thereof, a radially projecting flange on said tip at its extreme end, a cap applied to said liquid tip and enclosing an air chamber which surrounds said tip and is disposed rearwardly of said flange, said cap having a central orifice of greater diameter than that of said flange and surrounding the latter so as to provide between these two members an annular air orifice, and an annular series of passageways passing through said flange which provide a plurality of air orifices between said annular orifice and said central liquid orifice, said cap also being provided with an annular series of air passageways therethrough and providing orifices disposed outwardly of said annular orifice, said last named passageways communicating with said air chamber and converging toward a point on the axis of said nozzle forwardly of the front face of the nozzle.

14. In a spray gun nozzle assembly of the class described, an inner liquid nozzle member which comprises a generally conical forward portion having a liquid orifice in its outer end and a circular radial enlargement of said member formed thereon at a point adjacent said end and rigid therewith, said enlargement being perforated to provide air orifices therethrough.

15. In a spray gun for coating materials or the like, a nozzle assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, said nozzle assembly being provided with a centrally disposed valve controlled liquid orifice, an annular series of spaced air orifices disposed radially outwardly thereof, concentric therewith, and immediately adjacent thereto, an annular air orifice surrounding said series of spaced orifices and closely adjacent thereto, means for placing said last named orifices in communication with a source of compressed air, and a pair of diametrically oppositely disposed orifices for projecting converging spray flattening jets of air upon the main central spray jet as modified by the jets from said annular series of orifices.

16. In a spray gun for coating materials or the like, a nozzle assembly at the forward end thereof for the atomization and projection of a spray of material therefrom, said nozzle assembly being provided with a centrally disposed valve controlled liquid orifice, an annular series of spaced air orifices disposed radially outwardly thereof, concentric therewith, and immediately adjacent thereto, an annular air orifice surrounding said series of spaced orifices and closely adjacent thereto, means for placing said last named orifices in communication with a source of compressed air, and a pair of diametrically oppositely disposed annular orifices for projecting converging substantially tubular spray flattening jets of air upon the main central spray jet as modified by the jets from said annular series of orifices.

ALEXANDER F. JENKINS.