March 19, 1929. W. B. THOMPSON 1,706,006

APPARATUS OR TOOL FOR APPLYING COATING MATERIAL

Filed Sept. 16, 1925 3 Sheets-Sheet 1

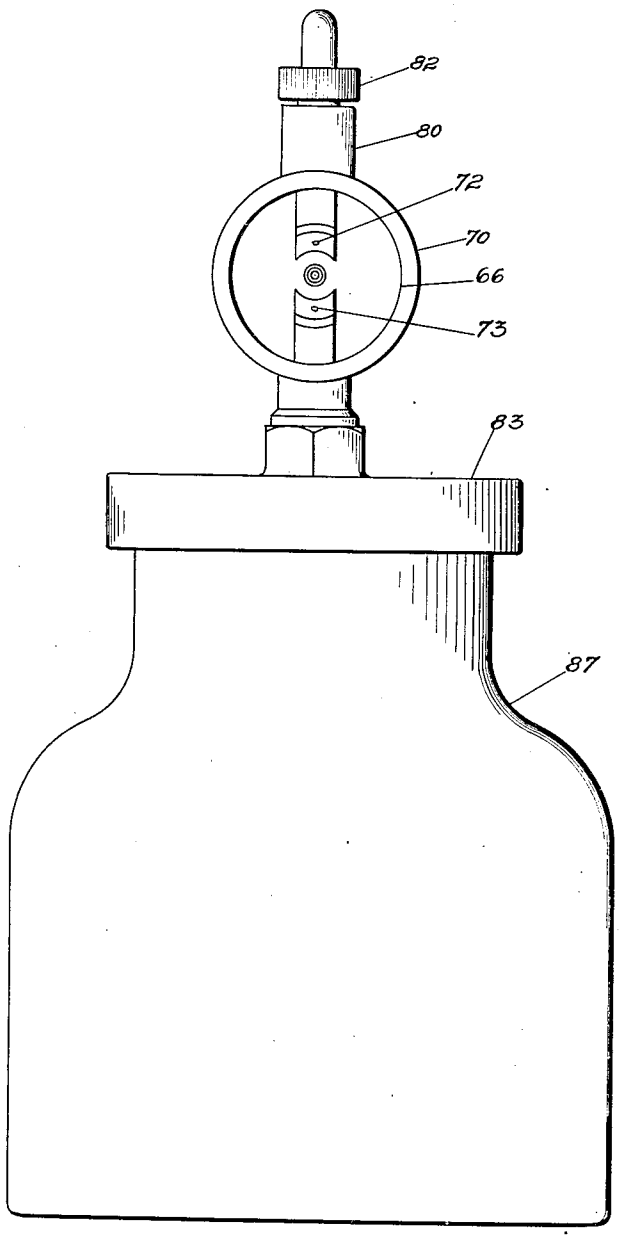


Fig. 1

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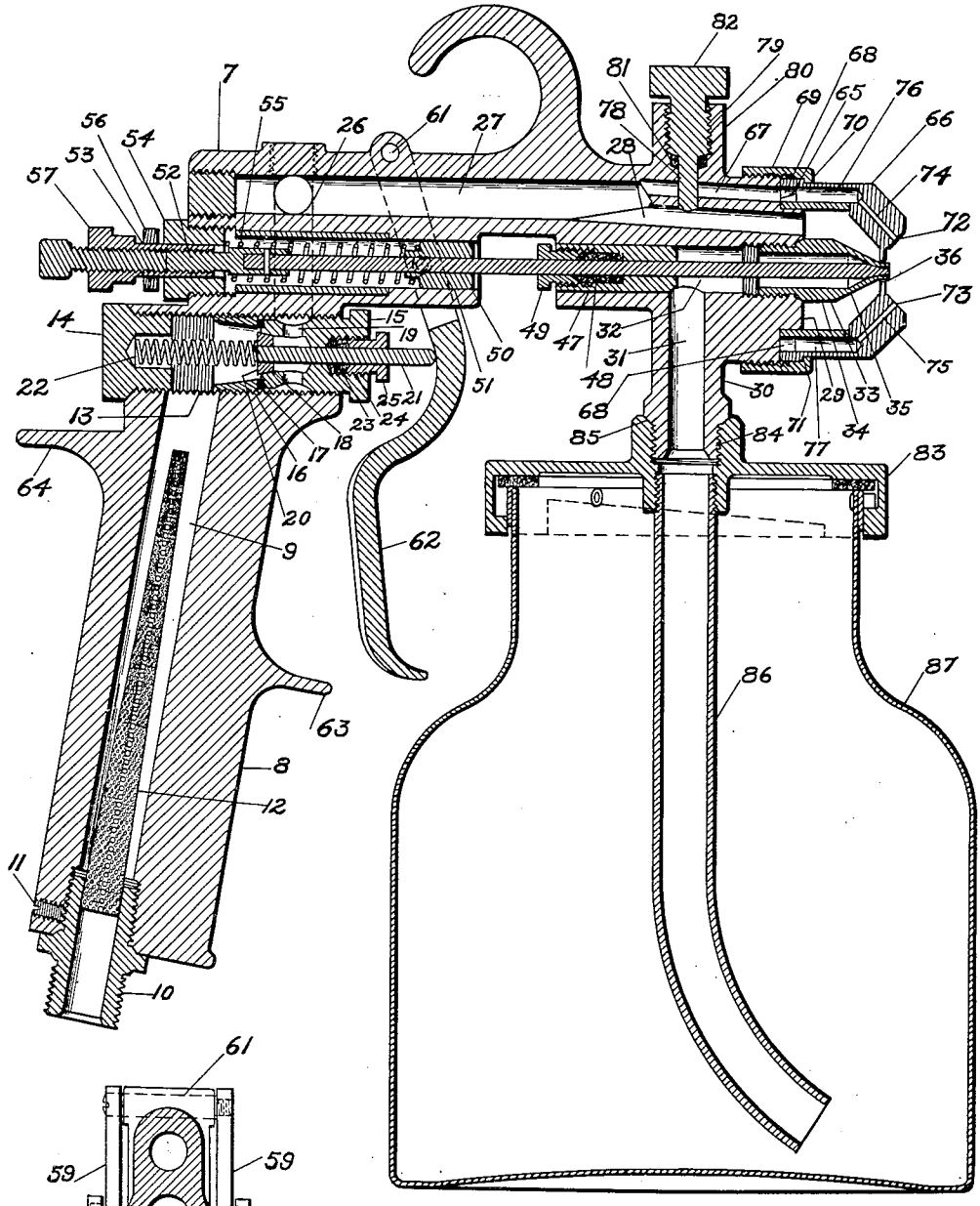


Fig. 2

Fig. 3

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Filed Sept. 16, 1925 3 Sheets-Sheet 3

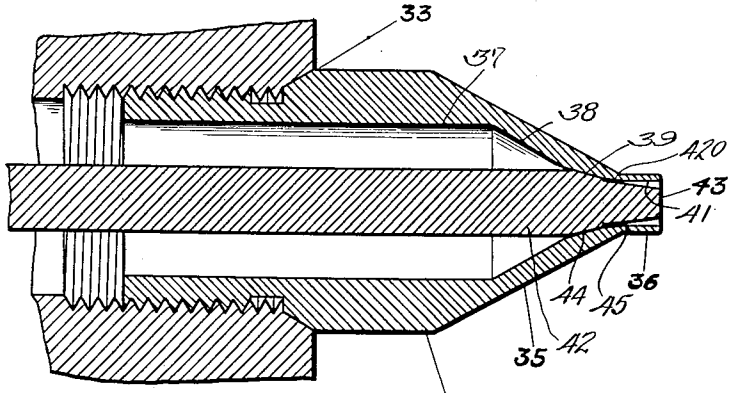


Fig. 4

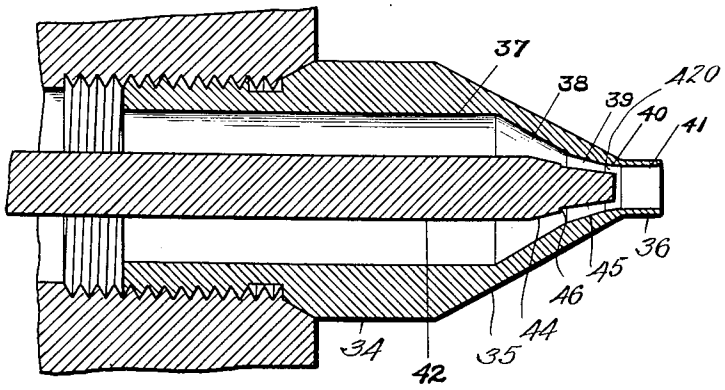


Fig. 5

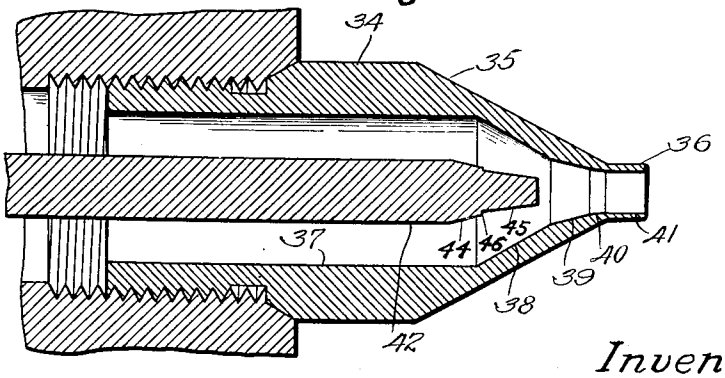


Fig. 6

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Patented Mar. 19, 1929. 1,706,006

UNITED STATES PATENT OFFICE.

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APPARATUS OR TOOL FOR APPLYING COATING MATERIAL.

Application filed September 16, 1925. Serial No. 56,666.

The present invention relates to apparatus or tools for applying coating material such as paint, lacquer, varnish, etc., to various surfaces, and more particularly to spray guns which are portable hand tools constructed to receive the coating material and a motive agent under pressure for discharge therefrom in the form of spray.

Spray guns are of the pressure, gravity or suction type depending on whether the coating material is forced into the gun by air pressure, or introduced into the gun under the influence of gravity, or drawn into the gun from a container on the gun by the suction of the motive agent. Usually the container on the gun is removably mounted upon the hose connections to either the pressure or gravity tank, containing the coating material, in order that the gun may operate as a pressure, gravity or suction gun at the will of the operative.

When operating the gun as a suction gun it is highly desirable that the valve in the coating material discharge nozzle be quickly opened and thus instantly subject the entire surface of the coating material in the attached container to the influence of the vacuum created by the motive agent. But this quick opening of the valve in a suction gun is a disadvantage when operating the gun as a pressure gun because the pressure back of the coating material shoots it through the quick-opening valve too fast for satisfactory atomization initially. Consequently it has been necessary in constructing spray guns for universal use to modify the valve construction by either improving the efficiency of the gun as a pressure gun thus reducing its efficiency as a suction gun, or by obtaining the maximum efficiency of the gun as a suction gun and/or a pressure gun and a minimum efficiency of the gun as a pressure and/or suction gun.

The object of the present invention is to produce an apparatus or tool for applying coating material, such as a spray gun, by which a maximum efficiency may be obtained when operating the gun either with suction or under pressure.

To the accomplishment of this object, a feature of the present invention contemplates the provision in a spray gun having an external nozzle for the motive agent under pressure and an internal nozzle for the coating material having a discharge orifice of a valve spaced therefrom embodying quick-opening means to provide a maximum initial flow of the coating material under the suction and the motive agent, of means for neutralizing the effect of the quick opening means on the flow of the coating material introduced into the gun under pressure. With this construction the gun may be operated as a suction gun with a maximum efficiency without affecting its operation as a pressure gun.

Broadly considered the effect of the quick-opening valve on the flow of the coating material introduced into the gun under pressure may be neutralized in any manner found desirable or convenient. It is preferred, however, to throttle the flow of the material progressively after its passage through the valve seat. This may be done conveniently by providing the nozzle in the space between the valve seat and the discharge orifice with a reduced portion or throttle passage or by providing the nozzle beyond the valve seat with a needle having a small clearance between it and the nozzle, or by providing the nozzle both with a throttle passage and said needle.

It is highly desirable in spray guns that a minimum discharge velocity of the coating material be maintained as the higher the velocity of the discharged motive agent compared with the velocity of the discharged coating material the finer the atomization. But in throttling the flow of the coating material after it flows through the valve seat its velocity is naturally increased.

Accordingly, a further object of the present invention is to produce a spray gun in which a minimum discharge velocity for the coating material is maintained notwithstanding the increase in velocity due to throttling.

To this end a further feature of the invention contemplates the provision in a spray gun having a nozzle provided with a discharge orifice and a valve seat spaced therefrom of a valve embodying quick-opening

means for throttling the coating material progressively after it flows through the valve seat and means for thereafter reducing the velocity of the flow of the coating material.

In the broader aspects of this further invention the means for reducing the velocity of the flow of the coating material after its velocity has been increased by the throttling means may take any elected form. It is preferred to provide means which will not only reduce the velocity of the flow of the coating material but which will equalize the velocity of the material entirely around the discharge orifice thus insuring uniformity of discharge.

Other features of the invention consist in certain combinations and arrangements of parts fully set forth hereinafter, the advantages of which will be readily understood by those skilled in the art.

The various features of the invention will be readily understood from an inspection of the accompanying drawings illustrating the best form of the invention at present known to the inventor, in which,

Figure 1 is a front elevation of a spray gun;

Fig. 2 is a longitudinal sectional elevation;

Fig. 3 is a detail, partly in section, showing the yoke connection to the trigger arm;

Fig. 4 is a detail, in longitudinal sectional elevation, of the nozzle for the coating material with the valve closed;

Fig. 5 is a view similar to Fig. 4 with the valve half opened, and

Fig. 6 is a view similar to Figs. 4 and 5 with the valve fully opened.

Referring to the drawings, the apparatus or tool for applying coating material is preferably provided with a metallic body 7 (Fig. 2) which has integral therewith or suitably attached thereto a handle or extension 8. The motive agent, which may be air under pressure, is preferably introduced into the body portion 7 through the handle 8 and for that purpose I have herein shown an air passage 9 which is connected to an air hose (not shown) through an air-hose coupling 10 fitted to the lower end of the passage 9 and held in place on the handle 8 by a set screw 11. To remove particles of dirt or other foreign matter from the inflowing motive agent and prevent their entrance into the body of the tool, the coupling 10 carries a perforated conical screen 12, which extends into the passage 9.

At its upper or leading end the air passage 9 communicates with a horizontal passage 13 extending completely through the upper portion of the handle 8. The passage 13 is interiorly threaded to receive three parts, namely, a plug 14 which closes one end of the passage, a valve casing 15 which closes the other end of the passage, and a central hollow stop 16 which determines the operative position of the valve casing 15 within the passage. The interior of the stop 16 is frusto-conical in shape in order to permit the insertion into the stop of an expanding tool which expands the stop to wedge its exterior threads into the threads in the passage 13 and thus lock the stop in a fixed position. Interposed between the valve casing 15 and stop 16 is a lead washer 17 which prevents the air leaking out between the casing and the stop into the threads between the casing 15 and passage 13. The valve casing 15 is provided with a valve seat 18 and with transverse air passages 19. The valve seat 18 is adapted to receive and seat a suitable air valve 20 having a spindle 21. The valve 20 is normally held upon the seat 18 by a coiled spring 22 interposed between the valve 20 and the plug 14. Near its outer end the spindle 21 passes through suitable packing shown as a gland packing 23, mounted in a cavity 24, formed in the valve casing 15, and held in place therein by a gland or plug 25 threaded into the cavity 24. The motive agent, such as air under pressure entering through the passages 9 and 13, passes through the air valve 20 when open, and enters a passage 26 which conducts the air to a longitudinal chamber 27 having a passage 28 which opens on the front face 29 of the body portion.

The coating material, such as paint, lacquer, and the like, may be introduced into the body 7, under pressure or gravity, by threading a hose coupling (not shown) to a pipe 30 depending from the body portion. The pipe 30 is provided with a passage 31 which conducts the coating material into a chamber 32 opening upon the face 29 of the body portion. With this construction the air chamber 27 and the paint chamber 32 are always out of communication with each other within the body of the gun.

The forward or discharge end of the chamber 32 is internally threaded to receive a threaded nozzle 33 (Figs. 4, 5 and 6) through which the coating material is discharged from the gun. On its exterior the nozzle 33 is provided with a substantially hexagonal surface 34, a tapered portion 35, and a cylindrical discharge tip or orifice 36.

On its interior the nozzle is provided with a cylindrical passage 37, a frusto-conical passage 38, a second frusto-conical passage 39, a third frusto-conical passage 40, and a cylindrical discharge passage 41 terminating at the orifice 36.

The walls of the frusto-conical passages 38, 39 and 40 have an inclination of 60°, 30° and 15° included angle, respectively. Extending longitudinally through the chamber 32 and substantially axially thereof is a needle or spindle 42 having a tip 43 formed on its forward end. The spindle 42 is provided with a frusto-conical surface 44 shaped to engage the wall of the passage 39 and thus act as a valve to control the discharge of

coating material. As the wall of the passage 39 is formed as a valve seat the passage 39 is hereinafter referred to as a valve passage.

In order to throttle the coating material after it has flowed through the valve seat the spindle 42, intermediate the surface 44 and the tip 43, is shaped to co-operate with the passage 40 to restrict the flow of coating material therethrough. Broadly considered, the relationship between the spindle and the wall of the throttle passage may be such as to throttle the coating material in a uniform manner at any point in the length of the throttle passage or along its entire length. In order, however, both to throttle the coating material during its flow through the throttle passage and to do so in a variable manner, the spindle 42 is also provided with a frusto-conical surface 45 which is separated from the surface 44 by an offset portion or abrupt shoulder 46. The surface 45 is formed with the same degree of angularity as the wall of the passage 40 in order that it may extend parallel thereto and be spaced therefrom to provide a small annular passage 420 frusto-conical in formation between the surface 45 and the wall of the passage 40. With this construction the diameters of the concentric walls of the passage 420 are greater at the entrance thereto than at the exit therefrom. As the area of the annular entrance to the passage 420 is less than the area of the initial annular opening of the valve passage, it follows that the flow of coating material is restricted or throttled progressively during its flow through the passage 420. By varying the relative longitudinal position of the surface 45 and the wall of the passage 40, it is possible to vary the throttling action on the coating material. When the valve is initially opened the coating material is subjected to the maximum throttling action of the passage 420 (see Fig. 4). As the opening of the valve passage 39 is increased in size, due to the continued withdrawal of the surface 44 away from the valve seat, the size of the passage 420 is also increased, thus decreasing the throttling action of the passage 420 (see Fig. 5). Owing to the difference in angularity between the surface 45 and the wall of the passage 41 an annular passage gradually increasing in width is provided between the surface 45 and the wall of the passage 41 towards the orifice 36.

From an inspection of Figs. 4, 5 and 6 it will be apparent that the narrower bases of the passages 38 and 39 are directed toward the orifice 36, and that the narrower base of the valve passage 39 has the same diameter as the broader base of the passage 40. The coating material may thus be throttled as it passes through the restricted passage 40 independent of the throttling action of the annular passage between the needle and the wall of the passage 40. The passage 40 is hereinafter designated as the throttle passage.

The spindle 42 passes out of the rear end of the chamber 32 through a plug 47 (Fig. 2) the open end of which is closed by packing 48 which is held in place by a packing or gland plug 49 threaded into the plug 47. The spindle 42 may be withdrawn from or inserted into the chamber 32 while the packing 48 is in place as the reduced end of the spindle passes through the packing without picking up strands thereof. Outside the chamber 32 the spindle 42 is secured to a guide 50 arranged to move in a longitudinal bore or spring chamber 51 formed in the body 7. The rear end of the spindle 42 is pinned to a stem 52 threaded at its free end to engage threads on an adjusting sleeve 53 rotatably mounted in a plug 54 threaded into the body 7. The spindle 42 is actuated in a direction to maintain the valve passage 39 normally closed by a spring 55, coiled about the stem 52 and the rear end of the spindle 42, interposed between the inside faces of the plug 54 and guide 50.

In order to move the spindle 42 in a direction to open the valve passage against the tension of the spring 55 the central portion of a strap yoke 56 is loosely interposed between an adjusting nut 57, on the sleeve 53, and the plug 54. The free ends of the yoke extend along the opposite sides of the body portion and are connected by pivot pins 58 (Fig. 3) to the arms 59 of a yoke or lever arm 60 embracing the body 7 and pivoting on a horizontal pin 61 carried by the body 7.

The inner face of the lever arm 60 engages the spindle 21 of the air valve 20. The yoke arm 60 thus operates to open both the air and coating material valves when the arm 60 is actuated against the tensions of the springs 22 and 55 which close the valves when the yoke-arm 60 is released. As sufficient play is provided for the yoke 56 before it engages the nut 57 the air valve will be opened before the coating material valve opens and the air valve will be closed after the coating material valve is closed.

In order to actuate the yoke arm 60 its lower end is curved to form a grip 62 for a plurality of the fingers of the hand of the operative grasping the tool handle, which is provided with a conveniently located finger rest and positioning member 63. The tool handle is also provided with a smooth under face 64 which is adapted to seat upon the hand of the operative grasping the handle to assist him in supporting the tool. From an inspection of Fig. 2 it will be apparent that the handle 8 below the finger rest 63 is wider than the portion of the handle above the rest by substantially the width of the grip 62. This construction is provided so that when the grip 62 is drawn towards the handle 8 in actuating the air and coating material valves the com-

bined handle and grip engaged by the index and second finger will have substantially the same width or girth as the portion of the handle engaged by the little and adjacent fingers.

In order to provide a discharge nozzle for the air the front face 29 of the body 7 is provided with a vertical seat 65 of reduced diameter upon which a main air discharge nozzle 66 is seated concentric with the inner nozzle 33. The nozzle 66 has an internal surface spaced from the external surface of the nozzle 33 throughout its length so that air can pass out of the passage 27 and be discharged from the gun.

The spray gun embodying my present invention preferably includes means for supplementally discharging air under pressure upon the discharged mist or cloud of material and main discharged air to effect the flattening, spreading or fan-shaping thereof when desired and accordingly there is formed in the body 7 a supplemental air passage 67 leading from the chamber 28 and terminating at the seat 65. In the rear face of the nozzle 66 is a continuous annular groove constituting, with the adjacent portion of the body, a circular air passage 68, the construction being such that some portion of the latter always lies opposite the forward end of the supplemental air passage 67 irrespective of the angular positions of the nozzle 66 with relation to the axis of the tool body.

The nozzle 66 is adjustably held in place flatwise against the forward end of the tool body by a suitable locking means shown as an internally threaded collar or nut 69 having an inturned flange 70 to engage a circular seat 71 formed in the outer face of the nozzle 66. The outer face of the nozzle 66 is provided with a pair of diametrically opposed jet members 72 and 73 having the inwardly directed air passages 74 and 75 in communication with the air passage 68 through the passages 76 and 77 in any position of angular adjustment of the nozzle 66. The nozzle 66 is assembled with the body merely by placing it flatwise against the seat 65 and screwing on the nozzle lock. When it is desired to adjust the plane of the sprayed material this may be readily effected merely by backing off the nozzle lock slightly, turning the nozzle 66 to bring the supplemental jets 72 and 73 to the desired position, and again tightening the nozzle lock.

The supplemental air discharge is desirably readily controllable and for this purpose I have provided a valve spindle 78 arranged to completely close the supplemental air passage 67. The valve spindle 78 projects from a body portion 79 which is threaded to engage internal threads formed in a boss 80 on the body 7. Surrounding the valve spindle 78 and interposed between the body portion 79 and boss 80 is a packing 81. The body portion is provided with a knurled cap 82 by which the valve spindle 78 may be manipulated to control the volume of supplemental air discharged through the supplemental air passages.

When it is desired to admit coating material not under pressure or gravity to the spray gun the material hose (not shown) is disconnected and a vented closure 83 is threaded on the lower end of the pipe 30. To this end the closure 83 is provided with a central hollow boss 84 threaded interiorly on opposite sides of the closure. The lower end of the pipe 30 is shaped to fit a seat 85 formed on the boss 84 to insure a tight joint. The lower threads on the boss 84 are engaged by outer threads on a pipe 86 extending down towards the bottom of a container 87 which contains the coating material. The container is attached to the closure by the same means disclosed in the patent to J. J. Preble, October 4, 1927, No. 1,644,081.

Referring now to Figs. 4, 5 and 6, when operating the gun with the attached container and consequently as a suction gun the needle is drawn back from the position of Fig. 4 to that of Fig. 6. Owing to the difference in angularity between the wall of the passage 38 and the surface 44 on the needle engaged with the valve seat on the wall of the passage 39 the instant the surface 44 leaves its seat the coating material in the pipe 86 is subjected to the suction produced by the air discharged from the external nozzle. This unbalances the coating material in the container so that it is free to flow under the influence of the atmospheric air pressure on the surface of the container into the coating material nozzle.

When operating the gun as a pressure gun the quick-opening valve is cracked just enough to allow the coating material to be blown through the valve passage. At this time the surface 45 extends within the throttle and discharge passages 40 and 41. The effect of the quick-opening valve upon the coating material blown therethrough is neutralized during its passage through the restricted passage 420 owing to its throttling action on the material. Because it is throttled during its passage through the throttle passage the velocity of the flow of the coating material is increased. But as the clearance between the surface 45 and the wall of the discharge passage gradually increases towards the orifice 36 the velocity of the coating material is gradually reduced until when it emerges from the orifice 36 it flows with that minimum discharge velocity relative to the high discharge velocity of the motive agent calculated to produce the finest atomization. In addition to reducing the velocity of the flowing material the gradually increasing clearance between the surface 45 and the wall of the discharge passage 41 permits the coating material to flow evenly around the needle. This operates

to equalize the velocity of the flow of the material during its flow through the discharge passage thus providing for a uniform discharge at the orifice 36.

It will be apparent to those skilled in the art taking into consideration the many kinds of coating materials handled with spray guns, their different degrees of fluidity, and the different kinds of surfaces coated, that the needle may occupy any position throughout its limit of movement off the valve seat. In some positions of the needle it will cooperate with the walls of the passages 40 and 41 both to throttle the flow of the coating material and thereafter reduce and equalize its velocity. In other positions the needle will cooperate only with the wall of the throttle passage 40 to throttle the coating material. In this case the increase in area in the discharge passage owing to the withdrawal of the needle provides for the reduction and equalization in the velocity of flow of the coating material. In other positions of the needle it will be withdrawn from both the throttle and valve passages as shown in Fig. 6. It must be borne in mind, however, that even in reaching the position of Fig. 6 with the coating material under pressure the needle must have performed its function of cooperating with the walls of the passages 40 and 41 to throttle the coating material flowing through the throttle passage and to reduce and equalize the velocity of the coating material flowing through the discharge passage thus providing for an initial neutralization of the effect of the quick-opening valve on the coating material under pressure.

It will also be apparent that because the walls 39 and 40 are formed on different degrees of angularity relative to the longitudinal axis of the nozzle and because the surfaces 44 and 45 on the spindle are separated by the shoulder 46 that this shoulder performs an important function in distributing the coating material uniformly around the spindle before it enters the passage 420. When the surface 44 is withdrawn from the valve seat, the shoulder 46 enters the valve passage 39. Immediately the coating material drops off the surface 44 upon the shoulder 46 and accumulates therein before entering the restricted entrance into the passage 420. This accumulation of coating material in the pocket affords the coating material an opportunity to distribute itself uniformly around the needle before entering the passage 420.

Nothing herein explained is to be interpreted as limiting the invention in the scope of its application to use in connection with the particular apparatus or the particular mode of operation or both selected for purposes of illustration and explanation. While the particulars of construction herein set forth are well suited to one mechanical form of the invention, it is not limited to these details of construction, nor to the conjoint use of all its features, nor is it to be understood that these particulars are essential since they may be variously modified within the skill of the artisan without departing from the true scope of the actual invention, characterizing features of which are set forth in the following claims by the intentional use of generic terms and expressions inclusive of various modifications.

What is claimed as new, is:

1. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having a discharge orifice and a valve embodying quick opening means to provide a maximum initial flow of the coating material under the suction of the motive agent and means for neutralizing the effect of the quick opening means on the flow of the coating material introduced into the gun under pressure.

2. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having a discharge orifice and a valve seat spaced therefrom, and a valve constructed to engage the seat embodying means in the space beyond the valve seat for throttling the material progressively as it flows therethrough.

3. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having a discharge orifice and a valve seat spaced therefrom, means in the space beyond the valve seat for throttling the material progressively as it flows therethrough and means for maintaining a minimum discharge velocity of the material at the orifice notwithstanding the increase in the velocity of the flow of the material by the throttling means.

4. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having at least three distinct successive passages, namely, a cylindrical discharge passage, a frusto-conical valve passage, and a frusto-conical throttle passage interposed between the discharge and valve passages, and a needle constructed and arranged to seat only on the wall of the valve passage.

5. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having at least three distinct successive passages, namely, a cylindrical discharge passage, a frusto-conical valve pas-

sage, and a frusto-conical throttle passage interposed between the discharge and valve passages, the broader base of the throttle passage having the same diameter as the narrower base of the valve passage, and a needle constructed and arranged to seat only on the wall of the valve passage.

6. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having at least three distinct successive passages, namely, a cylindrical discharge passage, a frusto-conical valve passage, and a frusto-conical throttle passage interposed between the discharge and valve passages, the broader base of the throttle passage having the same diameter as the narrower base of the valve passage and the narrower base of the throttle passage having the same diameter as the discharge passage, and a needle constructed and arranged to seat only on the wall of the valve passage.

7. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having at least three distinct successive passages, namely, a discharge passage, a valve passage, and a throttle passage interposed between the discharge and valve passages, and a needle having at least two distinct surfaces thereon, one of said surfaces being constructed and arranged to seat on the wall of the valve passage and the other one of said surfaces being constructed to extend parallel to and be spaced from the wall of the throttle passage.

8. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having at least three distinct successive passages, namely, a cylindrical discharge passage, a frusto-conical valve passage, and a frusto-conical throttle passage interposed between the discharge and valve passages, and a needle having at least two distinct frusto-conical surfaces thereon, one of said surfaces being shaped to seat on the wall of the valve passage, and the other one of said surfaces being shaped to extend parallel to and be spaced from the wall of the throttle passage.

9. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having at least three distinct successive passages, namely, a cylindrical discharge passage, a frusto-conical valve passage, and a frusto-conical throttle passage interposed between the discharge and valve passages, and a needle constructed to seat on the wall of the valve passage, to provide a uniform clearance between the needle and the wall of the throttle passage throughout the length thereof, and to provide a gradually increasing clearance between the needle and the wall of the discharge passage from its juncture with the throttle passage to the other end thereof.

10. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having at least three distinct successive passages, namely, a cylindrical discharge passage, a frusto-conical valve passage, and a frusto-conical throttle passage interposed between the discharge and valve passages the walls of which have differential degrees of angularity with relation to the longitudinal axis of the nozzle, respectively, and a needle having at least two surfaces formed with the same degree of angularity as the walls of the valve and throttle passages, respectively, arranged to seat on the wall of the valve passage only.

11. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having three distinct successive passages, namely, a cylindrical discharge passage, a frusto-conical valve passage and a frusto-conical throttle passage interposed between the discharge and valve passages, said frusto-conical passages having their walls formed with different degrees of angularity with relation to the longitudinal axis of the nozzle, respectively, the narrower bases of both frusto-conical passages being directed toward the discharge passage, and a needle arranged to extend within all the passages and constructed to seat on the wall of the valve passage only.

12. In an apparatus or tool for applying coating material, a nozzle for the coating material having at least three distinct successive passages, namely, a cylindrical discharge passage, a frusto-conical valve passage the walls of which are formed on, substantially, a 30° included angle, and a frusto-conical throttle passage the walls of which are formed on, substantially, a 15° included angle, and a needle having two distinct frusto-conical surfaces separated by an offset portion, one of which seats upon the wall of the valve passage and the other one of which extends parallel to and is spaced from the wall of the throttle passage.

13. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having a discharge orifice, a valve passage, and a throttle passage between the valve passage and the orifice, and a spindle having at least two distinct surfaces thereon separated by a shoulder, one of said surfaces normally having engagement with the wall

of the valve passage and the other one of said surfaces normally occupying a position spaced from and concentric to the wall of the throttle passage.

14. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having a discharge orifice, a valve passage and a passage between the valve passage and the orifice, and a spindle having at least two distinct surfaces thereon separated by an abrupt shoulder, one of said surfaces normally having engagement with the wall of the valve passage and the other one of said surfaces normally occupying a position spaced from the wall of the other passage.

15. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having at least two distinct adjacent passages, namely, a valve passage and a throttle passage, the walls of which have differential degrees of angularity with relation to the longitudinal axis of the nozzle, respectively, and a spindle having at least two surfaces formed with the same degree of angularity as the valve and throttle passages, respectively, arranged to seat on the wall of the valve passage only, said spindle having an abrupt shoulder separating the two surfaces.

16. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having at least three distinct successive passages, namely, a discharge passage, a valve passage and a throttle passage interposed between the discharge and valve passages, and a needle having at least two distinct adjacent surfaces separated by a shoulder one of which seats on the wall of the valve passage and the other one of which provides a clearance between the needle and the walls of the throttle and discharge passages.

17. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having at least three distinct successive passages, namelly, a discharge passage, a valve passage and a throttle passage, between the discharge and valve passages, and a needle having at least two distinct adjacent surfaces separated by a shoulder one of which seats on the wall of the valve passage and the other one of which provides a uniform clearance between the needle and the wall of the throttle passage throughout the length thereof and a gradually increasing clearance between the needle and the wall of the discharge passage from its juncture with the throttle passage to the other end thereof.

18. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having a discharge orifice and at least three successive communicating frusto-conical passages, the narrow base of one passage constituting the broad base of the next succeeding passage in the direction of the flow of the coating material towards the discharge orifice, and a needle having a cylindrical surface, normally occupying a position spaced from the walls of the passage having the broadest base, a frusto-conical surface, normally engaged with the wall of the passage having the next to the broadest base, and a frusto-conical surface normally occupying a position spaced from the wall of the passage having the narrowest base.

19. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having a discharge orifice and at least three successive passages constructed to throttle progressively the coating material during its flow towards the discharge orifice, and a needle having at least three distinct adjacent surfaces, the intermediate surface normally having engagement with the wall of the second one of the three successive passages and the two other surfaces normally occupying positions spaced from the first and the third successive passages, respectively.

20. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having a discharge orifice, a frusto-conical valve passage and a frusto-conical passage between the valve passage and the discharge orifice, and a needle having at least two distinct frusto-conical surfaces thereon, one of said surfaces normally having engagement with the wall of the valve passage and the other one of said surfaces normally extending into the frusto-conical passage to form a conduit the diameters of the concentric walls of which are greater at the entrance than at the exit therefrom.

21. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having a discharge orifice, a valve passage and a separate passage between the valve passage and the discharge orifice, and a needle having at least two distinct surfaces thereon, one of said surfaces normally having engagement with the wall of the valve passage and the other one of said surfaces normally extending into the separate passage to form a conduit for throttling the coating material progressively during its flow therethrough.

22. An apparatus or tool for applying coating material having, in combination, an external nozzle for the motive agent under pressure, an internal nozzle for the coating material having a discharge orifice and four distinct successive communicating passages, three of which throttle the coating material progressively in the direction of its flow toward the orifice and the fourth one of which is a cylindrical passage adjacent the orifice, and a needle normally extending into all of the passages constructed to seat on the wall of one only of said passages.

In testimony whereof I have signed my name to this specification.

WAYNE B. THOMPSON.