

May 8, 1934.

J. E. FERGUSON

1,957,705

SPRAY GUN

Filed Jan. 25, 1929

2 Sheets-Sheet 1

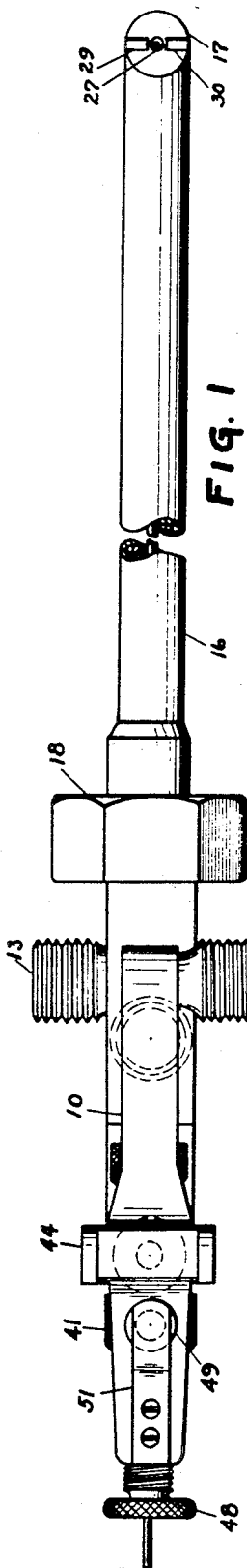


FIG. 1

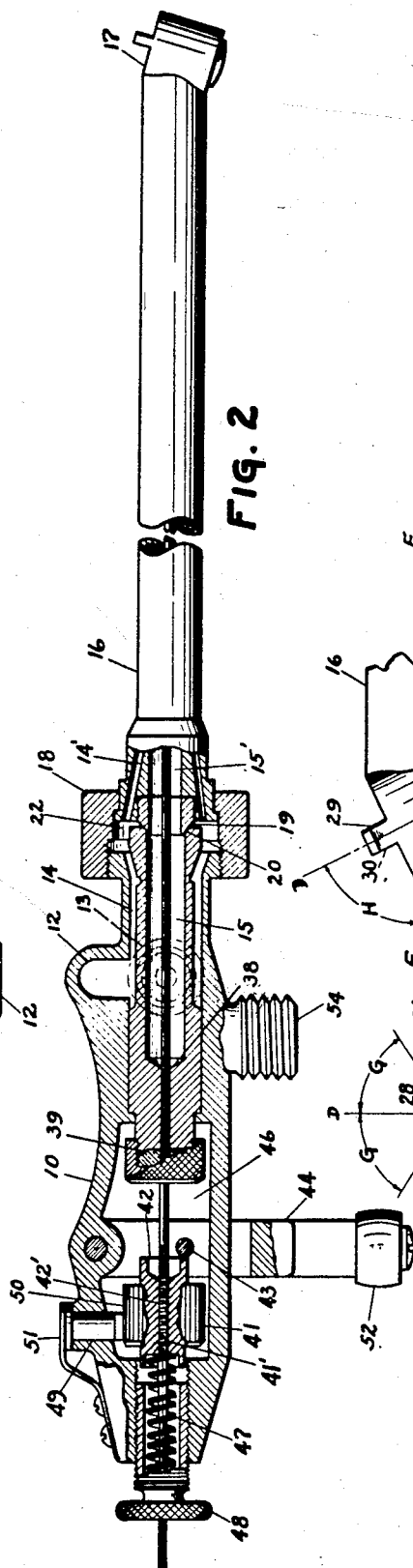


FIG. 2

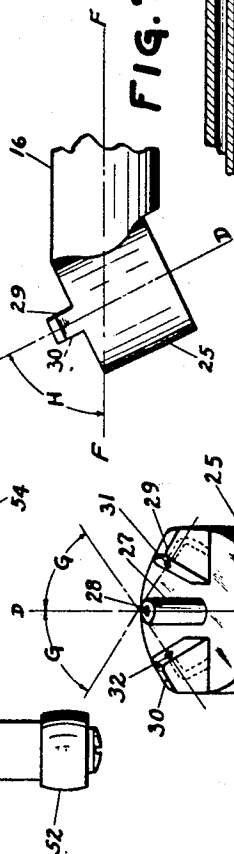


FIG. 3

FIG. 7

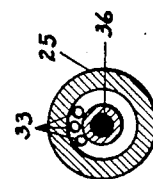


FIG. 4

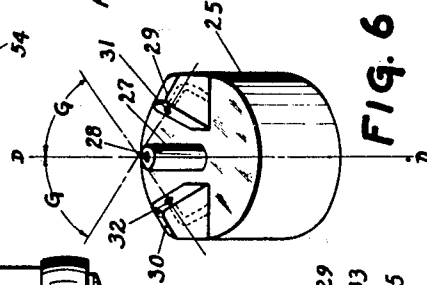


FIG. 5

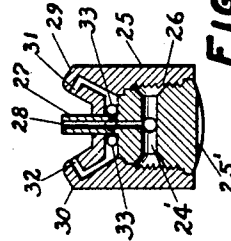


FIG. 6

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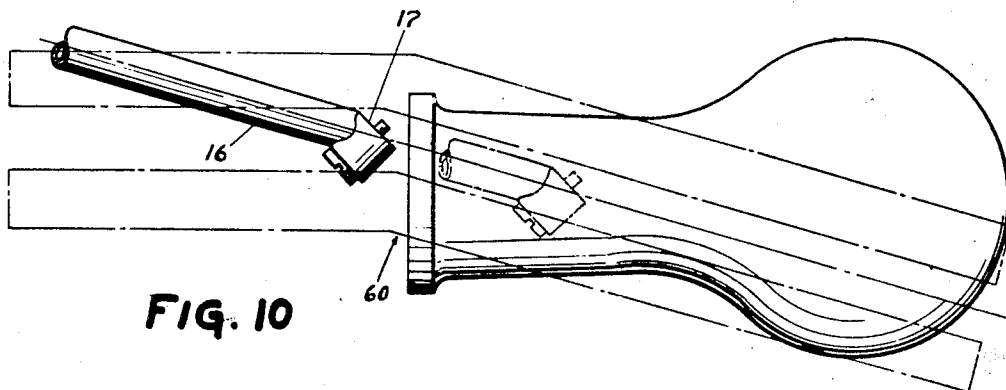
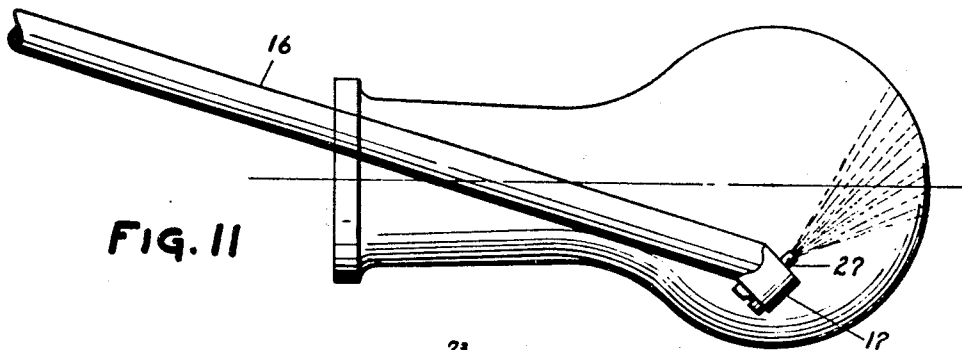
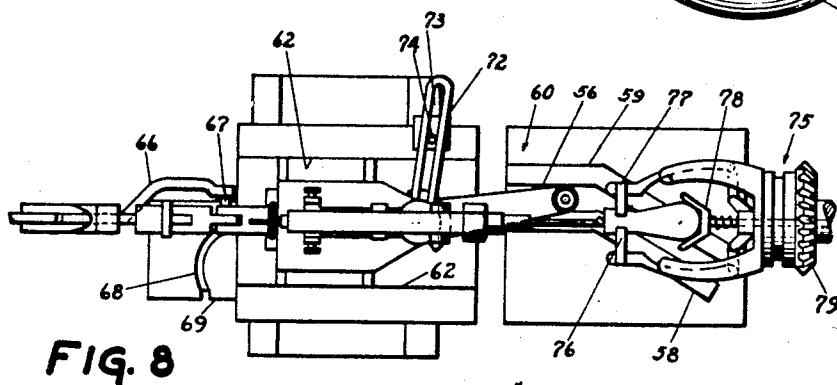
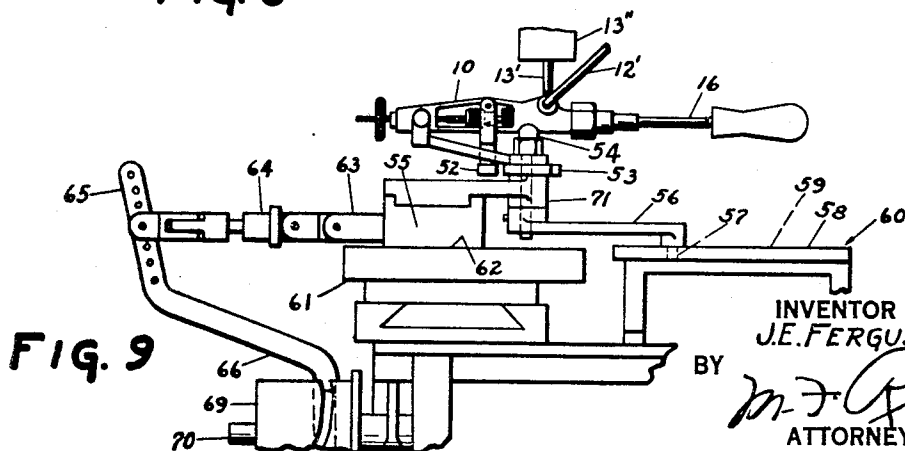
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2 Sheets-Sheet 2



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SPRAY GUN

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10 Claims. (Cl. 9—45)

This invention relates to spray guns or the like and relates more particularly to an automatically controlled spray device for depositing a layer of coating material upon curved surfaces such as incandescent lamp bulbs or other surfaces employed for light diffusion.

The present invention provides a spray discharge device or spray gun operable to deposit a layer of uniform thickness and density upon a surface and is particularly adapted for the spraying of the interior surfaces of lamp bulbs.

In the manufacture of incandescent electric lamps it is important to be able to provide a bulb having thereon a layer of light diffusing material. It has also been found advantageous to deposit this layer upon the interior surface of the bulb so that the light diffusing property of the material in conjunction with the smooth glazed outer surface of the bulb gives a pleasing so-called opalescent effect. When coating a lamp bulb or other article through which light is transmitted it is of extreme importance to have the coating free from blemishes or irregularities in thickness and of a uniform density so that diffused light will be transmitted with equal degree throughout all portions of the bulb.

The coating of the interior surface of a bulb, in the manner above set forth, involves certain difficulties with respect to the manipulation of the gun by reason of the physical formation of the bulb which is usually provided with a relatively small neck and a large bowl or bulbous portion in which the light source is disposed. It is necessary to provide a spray device which will enter the bulb through a predetermined path and which will have a given movement within the bulb during a rotation thereof.

In connection with the above operation it is necessary to provide means for automatically effecting and terminating a discharge of sprayed material. When coating a lamp bulb it is desirable to have the lower or neck portion of the bulb free from any deposit of sprayed material so that when the bulb is sealed or fused to the lamp mount the portion of the bulb which is heated will be free from coating material. If the coating material covers the interior surface of the bulb difficulty arises in that the melting point of the glass is raised to the end that it is impossible to accomplish a practical sealing-in operation. Furthermore, when spraying the interior surface of a bulb the spray nozzle is held in relatively close relation to the bulb wall, and it has been found that in order to obtain a uniform deposit the direction of discharge

should be substantially at right angles to the surface to be coated.

It is an object of the present invention, therefore to provide a spray gun which may be automatically operated for the discharge of sprayed material.

Another object of the invention is to provide a spray gun movable through a predetermined path and operable for the discharge of spray material after a given degree of movement thereof.

Another object of the invention is to provide a spray gun, having an extension carrying a nozzle for the discharge of sprayed material substantially at right angles to the interior surface of a hollow body.

Another object of the invention is to provide a spray gun having a spray nozzle movable into a glass bulb through a path substantially in the direction of the longitudinal axis of the bulb and for the discharge of spray material substantially at right angles to the said path of movement.

Other objects and advantages of the invention will be more fully understood from the following description together with the accompanying drawings in which:

Figure 1 is a plan view of a spray gun constructed in accordance with the present invention.

Figure 2 is a side elevational view partly in section showing the spray gun illustrated in Figure 1.

Figure 3 is a longitudinal section of a portion of the spray gun slightly enlarged.

Figure 4 is a transverse cross sectional view taken on line IV—IV in Figure 3.

Figure 5 is a view taken on line V—V in Figure 3.

Figure 6 is a perspective end view of the nozzle of the gun.

Figure 7 is a side view of the nozzle.

Figure 8 is a plan view of an apparatus for moving the spray gun into operative relation with the bulb.

Figure 9 is a side elevational view of the apparatus shown in Figure 8.

Figure 10 shows a bulb in position to receive the nozzle of a spray gun for a spraying operation, and

Figure 11 illustrates a bulb with the nozzle in its advanced position within the bulb.

A spray gun embodying the present invention made as above mentioned although useful for other purposes is particularly adapted to coat the inside surface of a lamp bulb and especially in

connection with an inside coating machine as shown and described in copending application Serial No. 238,734 filed December 9, 1927 and application Serial No. 308,562 filed September 26, 1928 both applications having been assigned to the assignee of the present application.

In the machine described in the above copending application mechanism is provided for manipulating a gun for the uniform deposit of a coating material. This operation includes a movement of the gun through a predetermined path so as to bring the nozzle of the gun in proper relation to the bulb wall while the nozzle moves relative to the wall or surface which is rotated during the spraying operation.

In providing a spray device for coating the interior surface of bulbs, certain problems exist which do not attend the usual coating operation. The construction of the bulb is such that only a limited movement of the spray gun is possible and the neck of the bulb through which the nozzle of the gun must enter is relatively small tending to hinder the practical operation of the usual form of spray device. Ordinarily a spray gun operates to discharge material in the direction of the longitudinal axis of the extension supporting the nozzle or straight ahead. In coating the inner surface of a bulb it was found desirable in order to produce a uniform layer to direct the spray laterally with respect to the extension or substantially at right angles to the surface of the bulb or at an angle to the nozzle extension.

In order to accomplish the above the present invention provides a gun having a casing or body portion from which a fluid and air conduit projects in the form of a tubular extension terminating in a nozzle. The nozzle being so arranged as to direct a discharge of atomized material laterally or substantially perpendicular to the bulb wall. The movement of the extension into and out from the bulb is such, however, that the nozzle must have a particular angular relation to the extension and the present invention contemplates the novel relative position of the nozzle with respect to the extension of gun proper.

Furthermore when spraying a bulb it is an advantage to be able to effect and terminate the discharge at a predetermined point during the movement of the gun and the present spray gun is so constructed as to make possible this control of the sprayed material.

As shown in the drawings a gun constructed in accordance with the present invention may comprise casing 10 having a fluid or air inlet 12 connected to a suitable air pressure line 12' and a liquid or spray material inlet 13 connected by a conductor 13' with an elevated container 13'' when the liquid is to be fed by gravity. If desirable a forced liquid feed may be provided by employing liquid under pressure.

The air inlet 12 communicates with a duct or passage 14 in casing 10 and the liquid inlet 13 communicates with a passage 15 in casing 10. The passages 14 and 15 connect with passages 14' and 15' respectively in a tubular extension 16 which terminates in a nozzle 17. The extension 16 is secured to the casing by a suitable coupling 18 and is provided with a tapered portion 19 to engage a seat 20 to provide an air tight connection between passages 15 and 15'. The passages 14 and 14' are connected by an annular chamber 22 in the coupling 18. The free or exposed end of the extension 16 may be provided with an internal thread 23 to receive a threaded shank 24 of the nozzle 17.

This nozzle is constructed as a unit comprising a housing 25 and may be removed and replaced at will and is so constructed that when in position the liquid passage 15' of the extension communicates with an annular chamber 24' formed in a screw plug 25' threadedly secured in a recess 26 in the nozzle housing. The plug 25' is provided with a tip 27 connected by a passage 28 with the chamber 24'. The tip 27 is in the form of an extended tube through which liquid is discharged. At opposite sides of the tip 27 are disposed lugs 29 and 30 having passages 31 and 32 disposed at an angle to the axial line of the path of discharge from the tip 27 which path is indicated by dotted line D—D.

The path of discharge D—D is disposed in angular relation to the direction of flow of the fluid and liquid in the extension 16; this direction of flow being indicated by line F—F. Fluid communication between the passages 31 and 32 is effected through a plurality of orifices 33 (see Fig. 4). The combined area of these orifices is so proportioned as to supply a sufficient amount of fluid as air for the atomization of the liquid or coating material issuing from the tip 27 the outlet area of which is of a given dimension so as to discharge an amount of material capable of being properly atomized.

It has been found that when making a spray gun for discharging a material for coating lamps, the sizes of the outlet orifices of the nozzle as well as the angle of the fluid discharge with relation to the material discharge is important. For example the present gun is particularly adapted for the uniform discharge of a coating mixture comprising sodium silicate, kaolin and a pigment.

The character of sodium silicate is such that with spray guns as heretofore constructed particles of the coating material would build up about the outlet orifice to such degree that the practical operation of the gun would be destroyed before a uniform layer could be applied. This resulted in a coating having thin spots or other irregularities and made a disagreeable appearing lamp since as above mentioned, when applying a coating for the diffusion of light the coating must possess uniformity of color and density and be free from spots.

The present spray gun has therefore been constructed to avoid the above disadvantages and satisfactory results have been obtained by providing a nozzle with the passage 31 and 32 of about .028 of an inch and disposed at an angle indicated by the letter G of 38 degrees (see Fig. 6) to the path of discharge D—D of the material issuing from tip 27, the said tip having an inside dimension of .026 of an inch.

As shown (see Fig. 7) the path D—D is at a preferred angle of 38 degrees indicated by the letter H to the path of flow F—F so that when the gun is moved into position for a coating operation the material may be discharged approximately perpendicular to the surface of the wall to be coated as, for example, the inside surface of a bulb.

The present device is so constructed as to operate to give an intermittent spray discharge and by reason of the angular position of the nozzle, a control valve 34 is in the present construction disposed intermediate the nozzle and the casing. This construction is provided so as to make possible the present offset nozzle which gives what may be termed an angular discharge.

The valve 34 may comprise a seat 35 to receive an end 36 of a stem 37. The stem controls the

discharge of the liquid or coating material and extends through the passages 15 and 15'. The end 38 of passage 15 is provided with a stuffing box 39 to provide a sealed support in which the stem 37 is slidable. For the purpose of reciprocating the stem the same is provided with a circular collar 41 having a threaded aperture 41' to engage with a threaded portion 42' of the stem. The collar 41 is provided with a contact surface 42 to be engaged by a pin 43 secured to a lever or rocker-member 44. The member 44 is bifurcated at its upper end and straddles the casing, the pin 43 extending through a compartment 46 through which the stem extends and in which the collar 41 is disposed. The valve stem 37 is normally held on its seat or closed by a spring 47 positioned about the stem and between collar 41 and an adjustable nut 48 operates to vary the tension of the spring 47.

By reason of the threaded relation of the collar 41 to the stem 37, the stem may be adjusted by rotating the collar which acts as a nut and thus the position of the valve or stem with respect to its seat may be varied to vary the amount of material ejected from the tip 27.

For the purpose of holding the valve stem in a given position the outer surface of collar 41 is provided with a plurality of longitudinal slots or notches 50 and a knife edged pin 49 is mounted in the casing so as to engage a notch and hold the valve stem in a given position. The pin 49 is tensionally retained in position by a leaf spring 51. When the valve stem has been adjusted to discharge the proper amount of material it is actuated by a movement of the member 44 the lower end of which is provided with a roller 52 arranged to engage actuating mechanism as for example a cam 53 constituting part of the mechanism shown and described in the above mentioned copending application and partially shown in Figures 8 and 9.

In spray guns as heretofore constructed the inlets for the fluid and liquid were located at opposite upper and lower sides of the casing. In the present construction the lower portion of the casing is provided with a threaded lug 54 whereby the gun may be attached to a movable carriage 55 having an arm 56 with a pin 57 to engage guides 58 and 59 forming track 60, so that a movement of the carriage will cause the nozzle 17 of the gun to enter the bulb and move through a predetermined path (indicated by dotted line 61 in Fig. 10). When the nozzle reaches a given position such as indicated in dotted lines in Fig. 10 in the bulb, the cam 53 is actuated causing an operation of the valve 34 and coating material is discharged from the tip 27 and atomized by the oppositely directed streams of fluid such as air under pressure giving a fine fan or coniferous discharge.

The inward and outward movement of the gun is accomplished by providing a support 61 for the carriage with gibs 62 to provide a slide path. Extending from the carriage is a bearing 63 having one end of a link 64 pivotally connected therewith. The opposite end of the link is connected with an end 65 of a lever arm 66. The opposite end of the arm is provided with a pin 67 disposed in a slot 68 of a barrel cam 69.

The said cam is mounted on a shaft 70 driven through any suitable source of power (not shown). The above described mechanism is shown more or less diagrammatically in the Figures 9 and 10 but is thought to be sufficient to give a comprehensive understanding of the operation of the gun. This

mechanism being more clearly set forth in the above mentioned copending applications.

When the carriage 55 is reciprocated by a rotation of the cam 69 the finger 56 traverses the guide 60 and the gun which is attached to the carriage by lug 54 swivels in bearing 71. Attached to the lug 54 and movable with the gun is the cam 53. This cam is provided with an arm 72 having a slot 73 in which a pin 74 is disposed. The pin is stationary so that a forward and backward movement of the gun will cause the arm to rock and bring the cam 53 into engagement with the roller 52 at the lower end of the arm 44.

The mechanism is so constructed and arranged that the cam 53 actuates the arm 44 to cause a discharge of spray material when the nozzle has reached a given position in the bulb such as the position shown in dotted lines (in Fig. 10), above mentioned. The gun then moves to position shown in Fig. 11, during this movement the bulb is rotated. A rotation of the bulb may be had by supporting the same in a head 75 having jaws 76 and 77 to grip the bulb neck and a seat 78 for centering the bulb. The head may be provided with a gear 79 adapted to mesh with a driving gear (not shown). The complete mechanism for operating the spray gun and for rotating the bulb is shown and described in the above mentioned copending application Serial No. 308,562.

When using a coating material including sodium silicate it has been found, as above mentioned that the particles of the coating accumulate at the outlet orifice of the liquid passage. The present nozzle is so constructed as to reduce the possibility of this deposit and as will be noted the liquid passage or tip 27 extends between the fluid outlet orifices and the perimeter of the passage is so disposed as to lie close to the point of intersection of the oppositely directed jets of fluid which as hereinbefore set forth intersect the longitudinal axis of the passage 27 at an angle.

A nozzle as above set forth has been found to give satisfactory results and to permit the discharge of spray material in an effective and practical manner.

By reason of the present invention a surface may be provided with a smooth uniform coating and in the case of a lamp bulb the interior surface thereof may be coated in such manner that a uniform diffusion of light is attained without weak or dark spots to mar the appearance of the bulb when used as part of an incandescent lamp.

Although a preferred embodiment of the invention is shown and described herein it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A spray gun comprising a casing, an extension on said casing, said extension having a liquid passage and a fluid passage, a nozzle mounted on the free end of said extension, said nozzle having a fluid outlet orifice and a liquid outlet orifice, a valve comprising a stem and valve seat intermediate said casing and said outlet orifices and a rocker member mounted on said casing and means on said rocker member for engaging said stem to actuate said valve.

2. A spray gun comprising a casing, an extension on said casing, said extension having a liquid passage and a fluid passage, a nozzle mounted on the free end of said extension, said nozzle having a fluid outlet orifice and a liquid outlet orifice a valve comprising a stem and valve seat in-

intermediate said casing and said outlet orifices and a rocker member pivoted on said casing for engaging said valve stem and means for actuating said rocker member to open said valve.

3. A spray gun comprising a casing, an extension on said casing, said extension having a liquid passage and a fluid passage, a nozzle mounted on the free end of said extension, said nozzle having a fluid outlet orifice and a liquid outlet orifice a valve comprising a stem and valve seat in intermediate said casing and said outlet orifices, a rocker member pivoted on said casing for engaging said valve stem, means for actuating said rocker member to open said valve and means for automatically closing said valve.

4. A nozzle for a spray gun or the like comprising a tubular member having a liquid passage and a fluid passage, a nozzle at one end of said member, said nozzle having a chamber in communication with said liquid passage, an outlet pipe extending from said chamber at an angle to the longitudinal axis of said member, and fluid outlets disposed to direct fluid jets across the path of liquid discharged from said outlet pipe.

5. A nozzle for a spray gun or the like comprising a tubular member having a liquid passage and a fluid passage, a nozzle at one end of said member, said nozzle having a chamber in communication with said liquid passage, an outlet pipe extending from said chamber at an angle to the longitudinal axis of said member, and fluid outlets disposed to direct fluid jets across the path of liquid discharged from said outlet pipe and means for controlling the discharge of liquid.

6. A machine of the class described comprising a casing, a nozzle extending from said casing, said nozzle having a liquid outlet and a fluid outlet, a valve stem controlling said liquid outlet, means for moving said casing bodily through a given path, means for moving said casing relative to said path and means for operating said valve stem upon a predetermined movement of said casing.

7. A spray gun comprising a casing, a nozzle extending from said casing, said nozzle having a fluid outlet and a liquid outlet, means for sup-

plying liquid to said liquid outlet, a valve stem controlling said liquid outlet, means for moving said casing through a given path, means for moving said casing relative to said path during movement therethrough and means for actuating said valve stem upon a predetermined movement of said casing.

8. A spray gun comprising a casing, a tubular extension extending from said casing, a nozzle at the free end of said extension, a liquid passage and a fluid passage in said extension, outlets in said nozzle communicating with said passages, said outlets being disposed for the discharge of fluid in a direction substantially transverse to the longitudinal axes of said extension, means for moving said casing through a given path, means for moving said casing relative to said path and means for causing a discharge of fluid upon a predetermined movement of said casing.

9. A spray nozzle comprising a tubular housing having a wall closing one end thereof, a screw plug threadedly engaged with and occupying said housing, a hollow stem integral with said plug, said wall having an aperture to receive said stem, said stem closely fitting and projecting through said aperture, an annular recess about said plug to provide a chamber, means for holding said plug spaced from said wall to provide another chamber, a communicating passage between said stem and said first named chamber, and an outlet passage from said second named chamber.

10. A spray nozzle comprising a tubular housing having a wall closing one end thereof, a screw plug threadedly engaged with and occupying said housing, a hollow stem on said plug, said wall having an aperture to receive said stem, an annular recess about said plug to provide a chamber, means for holding said plug spaced from said wall to provide another chamber, a communicating passage between said stem and said first named chamber and outlet passages from said second named chamber arranged to discharge fluid across the path of fluid discharged from said stem.

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