

Jan. 29, 1952

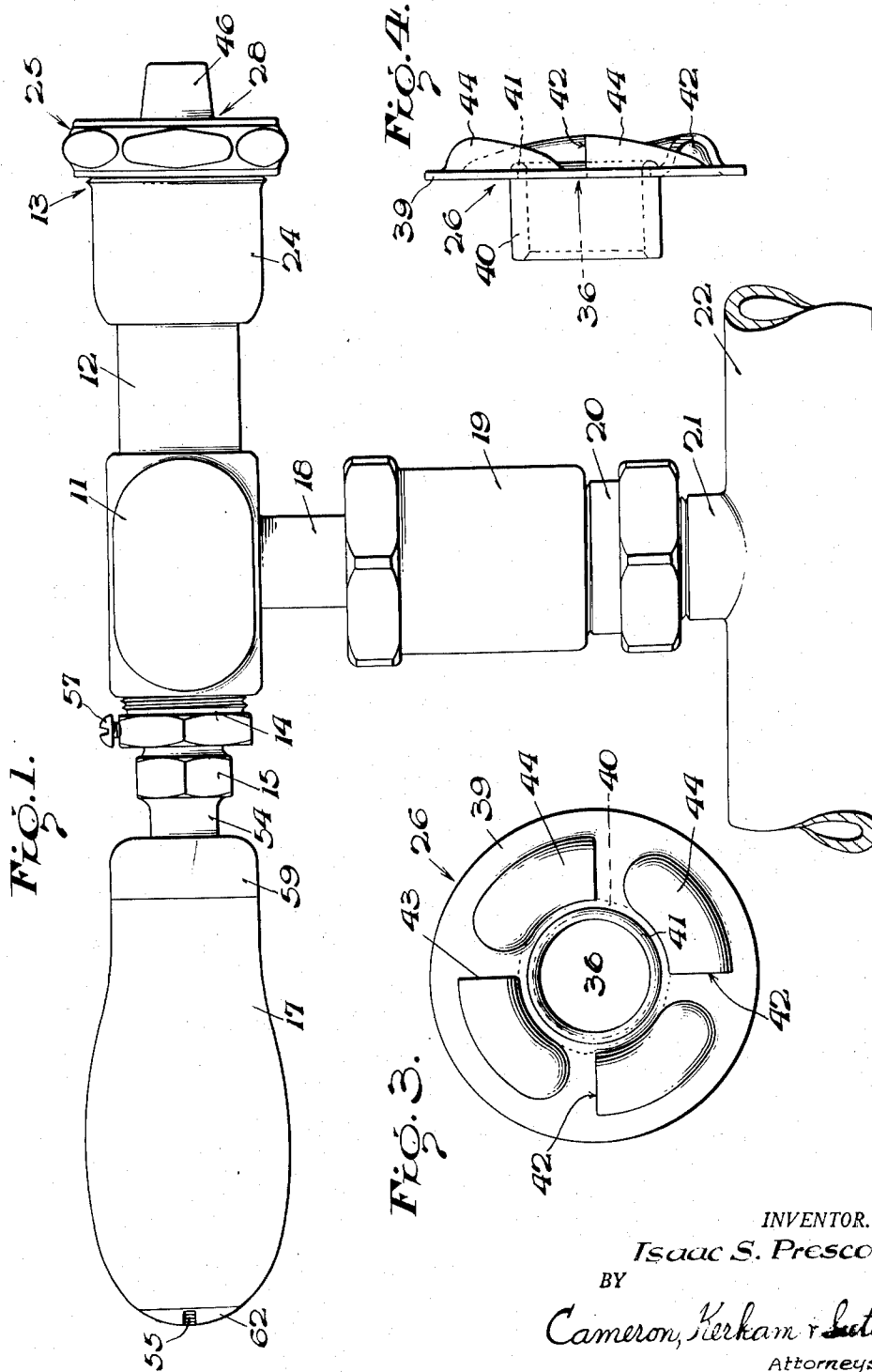
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SPRAY GUN NOZZLE ASSEMBLY

Original Filed Jan. 5, 1948

2 SHEETS—SHEET 1



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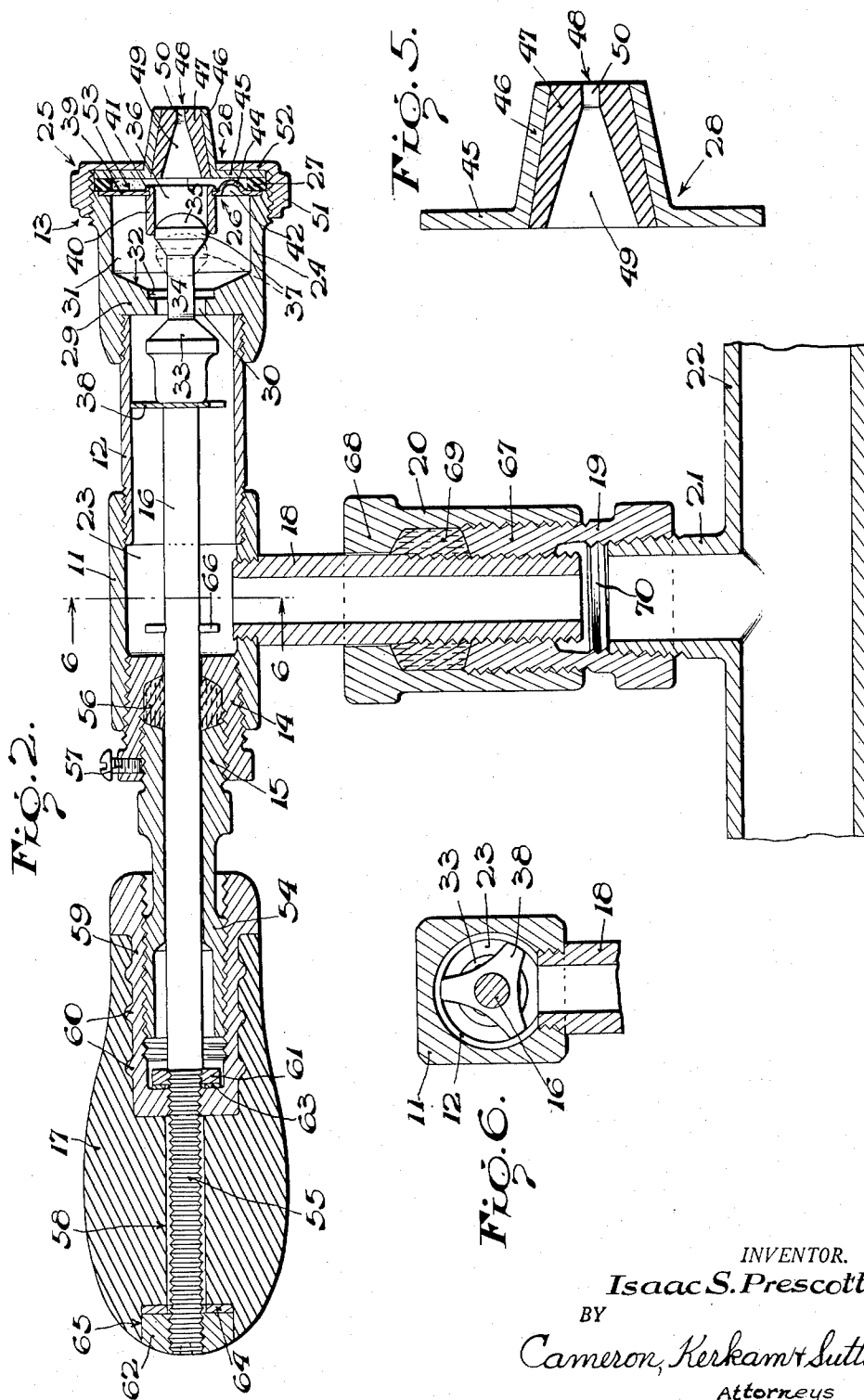
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2 SHEETS—SHEET 2



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2,583,706

SPRAY GUN NOZZLE ASSEMBLY

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6 Claims. (Cl. 299-114)

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This invention relates to devices for spraying liquids, and more particularly to devices of the character commonly known as spray guns and used for spraying fruit and vegetable trees and plants with insecticide, fungicide and other solutions.

The principal object of the invention is to provide a new and improved form of nozzle assembly for spray guns which is more versatile and efficient than nozzles of known design.

Another object is to provide a novel spray nozzle construction which is capable of producing, at the will of the operator, either a heavy fog-like spray of relatively short carrying distance or a more concentrated long range spray without any interchange of parts, and which results in a greater spray coverage than is attainable by devices of the prior art.

A further object is to provide an improved spray nozzle assembly of the character described which is of relatively simple construction, and the various elements of which may be readily replaced when worn or interchanged when a spray of different size is desired.

These and other objects, including that of facilitating and minimizing the expense of manufacture, assembly and repair of spray guns, will appear more fully upon consideration of the detailed description of the embodiment of the invention which follows. In this connection, although only one specific form of spray gun is described and illustrated in the accompanying drawing, it is to be expressly understood that this drawing is illustrative only and is not to be construed as defining the limits of the invention, for which latter purpose reference should be had to the appended claims.

Referring now to the drawing, wherein like reference characters indicate like parts throughout the several views:

Fig. 1 is a side elevation of a single nozzle spray gun embodying the present invention, including a showing of a fragment of a spray boom to illustrate the manner in which the gun is adapted to be mounted;

Fig. 2 is an axial cross section of the spray gun of Fig. 1 with certain parts shown in full;

Figs. 3 and 4 are enlarged end and side elevations, respectively, of the nozzle whirl plate embodied in the gun of Figs. 1 and 2;

Fig. 5 is an enlarged axial cross section of the spray nozzle disc or tip of the spray gun of Figs. 1 and 2; and

Fig. 6 is a transverse section of the gun body taken on line 6-6 in Fig. 2.

The single nozzle spray gun shown in the drawing comprises as its principal elements a body member 11, a gun tube 12 fixed at one end to the body member 11, a spray nozzle assembly

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indicated generally at 13 removably connected to the other end of the tube 12, a packing gland 14 and nut 15 forming a leak-proof closure for the end of body member 11 opposite that to which the tube 12 is connected, valve means for controlling the discharge of spray material from the nozzle assembly 13 including a valve operating rod 16 one end of which passes through the packing gland and nut assembly and projects outwardly from the body member 11, a valve operating handle 17 fixed to the outer end of the rod 16, and a structure for mounting the spray gun on a boom or other support comprising a body supporting tube 18 connected at one end to the body member 11, a mounting nut 19 into which the other end of the supporting tube 18 is adjustably threaded, and a packing nut 20 for preventing leakage of liquid through the threaded connection between the supporting tube 18 and mounting nut 19. As indicated in Figs. 1 and 2, the mounting nut 19 is adapted to be threaded onto a suitable nipple 21 forming part of a boom or other support 22, such, for example, as that disclosed in my Patent 2,444,367, dated June 29, 1948.

The body member 11 consists of a substantially rectangular block of metal, such as brass, having a cylindrical bore or passageway 23 extending therethrough, the body member being internally threaded at both ends of passageway 23 to receive the similarly threaded ends of gun tube 12 and packing gland 14, respectively. The tube 12 is coaxial with the passageway 23 in the body member and is externally threaded at its outer end to receive the spray nozzle assembly 13 consisting of a nozzle body 24, nozzle cap 25, whirl plate 26, gasket 27 and nozzle disc 28, the last three elements being interposed between, and held in properly assembled relationship by, the outer end of nozzle body 24 and nozzle cap 25.

The inner end of nozzle body 24 is internally threaded for engagement with the outer end of tube 12, and is provided with a transverse partition 29 having a central opening 30 of reduced diameter, said partition abutting the end of tube 12 when the gun is assembled. The outer end of nozzle body 24 beyond the partition 29 is cylindrically recessed to provide a chamber 31 of slightly larger diameter than the passageway 23 in body member 11, the inner end of the chamber 31 formed by the partition 29 having a beveled and countersunk configuration as indicated at 32 in Fig. 2.

The valve operating rod 16 extends axially through the passageway 23 and the bore of tube 12, and is provided with a main valve 33 adapted to control the flow of spray material through the central opening 30 in partition 29, the inner

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edge of the plane wall of said partition which abuts the end of tube 12 forming the seat for valve 33. The valve rod 16 is also provided with an extension 34 of reduced diameter which passes outwardly through the opening 30 and carries at its outer end another or secondary valve 35 adapted to control the flow of spray liquid through the central opening 36 in the whirl plate 26. The maximum diameter of the secondary valve 35, which is that of its substantially cylindrical seat engaging portion 37, is slightly smaller than the diameter of opening 30 in partition 29 so as to facilitate assembly and disassembly of the spray gun. The valve operating rod 16 also carries a centering guide member 38 fixed thereto adjacent the main valve 33, which member is generally triangular in shape as indicated in Fig. 6, the apices of said member being rounded and having sliding engagement with the bore of tube 12 so as to center the valve rod 16 in said bore, while the open spaces between said apices enable the spraying solution to flow freely past said member.

The whirl plate 26, the details of which are shown in Figs. 2, 3 and 4, consists of a relatively thin annular rim 39 of sheet metal lying in a plane perpendicular to the axis of the central opening 36, and a hollow cylindrical boss 40 which is fixed to the inner periphery of the rim 39, as by the clinched connection indicated at 41, and projects axially inwardly from the rim into the chamber 31 of nozzle body 24. The axial length of the boss 40 and its inside diameter are such that the cylindrical portion 37 of secondary valve 35 slidably engages the bore of boss 40 so as to close the central opening 36 in the whirl plate both when the main valve 33 is closed and when it is within a predetermined distance of its seat in partition 29, at which times the spray material is discharged from the gun in the form of a relatively wide angle, fog-like spray of relatively short carrying distance, created by passage of the spray material through only the tangential openings 42 of the whirl plate (next to be described). The boss 40 is short enough, however, to permit withdrawal of the secondary valve 35 when the main valve 33 is withdrawn further from its seat than the position indicated in Fig. 2, at which time the secondary valve 35 will occupy a position such as that indicated in broken lines in Fig. 2, and the spray liquid will pass through both the central opening 36 and the tangential openings 42 of the whirl plate and will be discharged as a more concentrated conical spray capable of carrying to a greater distance.

In the form of whirl plate shown in Figs. 2, 3 and 4, the tangential openings 42 which impart the whirling movement to the spray material as it passes from the chamber 31 to the nozzle disc 28 are formed by cutting the rim 39 along radial lines, as at 43 in Fig. 3, and then pressing arcuate sections of said rim outwardly (to the right as viewed in Figs. 2 and 4) to form trough-like conduits 44 of varying depth with respect to the plane of rim 39, said conduits terminating in the substantially semicircular openings 42 which lie in planes perpendicular to the rim 39 passing through the radial lines 43. Any suitable number of tangential openings may be formed in the whirl plate, although the preferred arrangement comprises four such openings as illustrated in Fig. 3.

Cooperating with the whirl plate to form the spray discharge from the gun is the nozzle disc

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28 consisting of an annular rim portion 45 lying parallel to the rim 39 of the whirl plate and spaced therefrom by the gasket 27, an elongated nose portion 46 which projects outwardly from the rim portion 45 through a central opening in the nozzle cap 25, and a bushing 47 seated in the nose portion 46, the bore of which bushing forms the spray discharge orifice 48 of the nozzle assembly. The nose portion 46 is formed integrally with the rim portion 45 and is frustoconical in shape both outside and inside, the orifice-forming bushing 47 having a similar shape externally and being pressed into the nose portion with a friction fit so as to be readily replaceable. The bushing 47 is preferably made of hardened stainless steel in order to prolong its useful life, although the rim and nose portions 45 and 46 are usually made of a softer metal, such as brass.

In order to increase the effective distance of spray discharge from the gun, the bore of bushing 47 tapers or converges toward the discharge end throughout the major portion of its length, as indicated at 49, and terminates in a relatively short section 50 of uniform diameter. The straight section 50 may vary in diameter from $\frac{1}{8}$ " to $\frac{3}{8}$ "; and since the bushing 47 is replaceable, the desired size of spray discharge orifice may be readily obtained by simply selecting a bushing wherein the section 50 is of the proper diameter. It has been found that excellent results are obtained by limiting the length of the straight section 50 to approximately $\frac{1}{8}$ " in a disc wherein the nose portion 46 projects approximately .6" from the rear face of the rim portion 45, and by tapering the bore section 49 at an angle of approximately 10°.

The whirl plate 26, gasket 27 and nozzle disc 28 are held in properly assembled relation with respect to one another and to the nozzle body 24 by the nozzle cap 25 which has an internally threaded rim 51 adapted to thread onto the externally threaded outer end of nozzle body 24, and an annular wall 52 adapted to engage the rim portion 45 of the nozzle disc and having a central opening through which the nose portion 46 of said disc projects. When the elements of the nozzle are assembled, the annular space 53 between the whirl plate and nozzle disc constitutes a whirl chamber into which the spray material issuing from the tangential openings 42 discharges and in which it sets up the whirling motion that produces the fog-like characteristic of the spray.

Movement of the main and secondary valves 33 and 35 from and to their respective seats is controlled by rotation of the handle 17 which is fixed to the end of the valve operating rod 16 opposite that carrying the valves, rotation of the handle 17 being converted into longitudinal movement of the rod 16 and valves 33 and 35 by means of a threaded connection between the handle and an extension 54 of the packing nut 15.

As shown in Fig. 2, the valve rod 16 extends outwardly of the gun body member 11 through the packing gland 14 and packing nut 15, including the latter's extension 54, and terminates in a threaded portion 55 to which the handle 17 is fixed. A suitable packing 56 is provided around the rod 16 between the gland 14 and nut 15 so as to prevent leakage of the spray material from the body member 11 outwardly along the rod, and the packing gland 14 is provided with a locking screw 57 for preventing rotation of pack-

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ing nut 15 relatively to the gland once the packing 56 has been properly compressed. The outer portion of the handle 17 is provided with a smooth bore 58 of a diameter such as to receive the threaded portion 55 of the rod 16, while the inner portion of the handle is recessed to receive an internally threaded ferrule 59 which surrounds and has threaded engagement with the extension 54 of the packing nut 15. Although the ferrule 59 may be fixed to the handle 17 in any suitable manner, the embodiment disclosed comprises a handle of hard rubber or other plastic material molded around the shank of the ferrule 59 which is preferably provided with circumferential ridges 60 to prevent axial displacement of the two elements. It will be understood that the pitch of the cooperating threads of ferrule 59 and packing nut extension 54 is great enough to enable relatively rapid opening and closing of the valves, but also small enough to permit the proper degree of adjustment thereof for the different spraying conditions desired and to maintain the valves in any adjusted position notwithstanding the axial pressure exerted by the spray material.

The handle 17 is fixed to the valve operating rod 16 by a pair of nuts 61 and 62, the nut 61 being threaded all the way on the portion 55 of the rod and, with a suitable washer 63, serving as a stop for the base of ferrule 59 when the end of the rod is passed through the bore 58 of the handle, while the nut 62 and its washer 64 are housed in a recess 65 in the outer end of the handle and are screwed up tight against the base of said recess so as to clamp the portion of the handle surrounding the bore 58 between the two nuts. With this construction, rotation of the handle 16 and its resulting axial movement due to the threaded engagement between the ferrule 59 and packing nut extension 54 produces axial movement of the valve operating rod 16 and the valves 33 and 35 carried thereby. In order to positively limit movement of valve rod 16 in valve opening direction to a desired maximum, the central portion of the rod located in body member 11 may be provided with a transverse pin 66 which is adapted to come into engagement with the inner face of packing gland 14 when the valves are fully opened.

Referring now to the construction by which the spray gun of the present invention is adapted to be adjustably mounted on a spray boom or other support, the supporting tube 18 is threaded into the body member 11 intermediate its ends with the axis of the tube at right angles to that of the body passageway 23, the bore of the tube being in free communication with said passageway for supplying spray liquid to the latter under pressure. The other end of tube 18 is also externally threaded over a substantial distance for engagement with cooperating threads formed internally of the portion 67 (the upper portion as viewed in Figs. 1 and 2) of mounting nut 19. The exterior of portion 67 of the mounting nut is likewise threaded to receive the internally threaded end of the hollow cylindrical body of the packing nut 20, while the closed end portion 68 of the packing nut frictionally engages the smooth cylindrical portion of supporting tube 18 intermediate its threaded ends. A suitable leak-proof packing 69 fills the space between the closed end portion 68 of the packing nut and the adjacent end of the portion 67 of the mounting nut, and is tightly compressed in said space around the tube 18 so as to prevent leak-

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age of spray liquid through the gun adjusting threaded connection between the tube 18 and mounting nut 19. The frictional engagement with the tube 18 resulting from compression of the packing 69 in this manner also serves to maintain the gun in any position to which it may be adjusted by rotation of tube 18 relatively to mounting nut 19.

As shown best in Fig. 2, the body of mounting nut 19 is provided with a frusto-conical recess 70, having a minimum diameter greater than that of the threaded portion 67, into which the end of tube 18 projects as the latter is threaded downwardly as viewed in Fig. 2. The outer portion of recess 70 is threaded to receive the similarly tapered and threaded end of a nipple 21 or other suitable element forming part of the spray boom 22 or other support on which the gun is adapted to be mounted, the conical taper of the cooperating threaded elements facilitating a liquid-tight connection therebetween.

When the spray gun is assembled and mounted in the manner indicated in Figs. 1 and 2, the spraying solution is supplied under pressure to the interior of the boom or support 22 in any suitable manner, as, for example, in my previously mentioned Patent No. 2,444,367. The solution passes upwardly, as viewed in the figures, through the nipple 21, mounting nut 19 and tube 18 into the passageway 23 of the body member 11 and thence through the gun tube 12 to the nozzle assembly. If the handle 17 is so rotated with respect to the threaded extension 54 of the packing nut 15 that the valves occupy the positions illustrated in Fig. 2, wherein the main valve 33 is partially open but the secondary valve 35 is still closed, the spray liquid will flow through the opening 30 in the partition 29 into the chamber 31, then through the tangential openings 42 of the whirl plate 26 into the whirl chamber 53, and finally through the converging and straight portions 49 and 50 of the orifice-forming bushing 47 of the nozzle disc 28, issuing from the orifice 48 in the form of a wide angle, fog-like spray of relatively short carrying distance. If the handle 17 is further adjusted so as to withdraw the secondary valve 35 to the position indicated in broken lines in Fig. 2, the spray solution will then pass through the central opening 36 in the whirl plate as well as through the tangential openings 42, with the result that the spray issuing from the orifice 48 is more concentrated and carries to a greater distance than when only the main valve 33 is open. The characteristics of the spray may, of course, be varied over a relatively wide range by suitable adjustment of the positions of the valves between the limits permitted by the positions of the transverse pin 66 and the valve seats formed by the partition 29 and boss 40.

There is thus provided by the present invention a new form of spray gun which embodies a number of improvements over similar devices heretofore available. For example, by providing the packing nut of the body member with a threaded extension cooperating with a similarly threaded portion of the handle, the valve adjusting mechanism is located entirely outside of the body member and out of contact with the spraying solution, thereby preventing corrosion and "freezing" of the threaded members by which the valve operating rod is moved. The combination of the body supporting tube, mounting nut and associated packing nut is also an improvement over prior devices of the same general type in that it provides a leak-proof means for so mounting a spray

gun on a support that the direction of the spray can be readily adjusted, and once the adjustment has been made, the gun will remain in the desired position without the necessity for manual support or the use of locking means which have to be unlocked in order to make the adjustment. Another feature of the present invention is that the various elements of the gun are easily assembled and disassembled, so as to facilitate manufacture and repair, and the majority of the parts are individually replaceable. Further improvements reside in the novel form of nozzle disc which increases the effective distance of spray coverage with the same pressure on the spray material, and in the inclusion of the removable orifice-forming bushing which both prolongs the life of the nozzle assembly and also makes it possible to change the size of the orifice by simply replacing the bushing. The nozzle assembly also includes an improved form of whirl plate of simple, inexpensive construction which is so designed as to also form the valve seat for the secondary valve.

While only one specific form of spray gun embodying the invention has been described and illustrated in the accompanying drawing, it will be obvious that the invention is not limited to the exact structure shown, and is equally adaptable to multiple nozzle spray guns as it is to the single nozzle gun illustrated. Various changes which will now suggest themselves to those skilled in the art may be made in the form, details of construction and arrangement of the parts without departing from the inventive concept. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

This application is a division of abandoned application, Serial No. 549, filed January 5, 1948.

What is claimed is:

1. In a spraying device, a spray nozzle assembly comprising a whirl plate having a central opening and a plurality of tangentially directed openings circumferentially spaced about the central opening, a nozzle disc spaced from said whirl plate having an orifice through which the spray is discharged from the nozzle assembly, a gasket interposed between the peripheries of said whirl plate and nozzle disc, and means for holding said plate, disc and gasket in assembled relation with the orifice in said disc coaxial with the central opening in said plate, said disc having an annular rim portion lying in a plane perpendicular to the axis of the spray discharge orifice, an elongated hollow nose portion projecting outwardly from said rim portion coaxially with said orifice, and an orifice-forming bushing seated in said nose portion.

2. A spray nozzle assembly according to claim 1 wherein the orifice-forming bushing has a bore which decreases in diameter toward the discharge end thereof and terminates in a relatively short section of uniform diameter.

3. A spray nozzle assembly according to claim 1 wherein the orifice-forming bushing is made of a harder metal than the remainder of said nozzle disc and is pressed into place in the nose portion of said disc with a friction fit so as to be replaceable.

4. In a spraying device of the type embodying a body member having a passageway therein, a nozzle assembly connected to one end of said body member, means for supplying spray material to said passageway and valve means for controlling the flow of spray material from said passageway to said nozzle assembly, a spray

nozzle assembly comprising a whirl plate having a central opening and a plurality of tangentially directed openings circumferentially spaced about the central opening, a nozzle disc spaced from said whirl plate having an orifice through which the spray is discharged from the nozzle assembly, a gasket interposed between the peripheries of said whirl plate and nozzle disc, and means for holding said plate, disc and gasket in assembled relation with the orifice in said disc coaxial with the central opening in said plate, said whirl plate having an annular rim lying in a plane perpendicular to the axis of the central opening therein, the tangentially directed openings being formed in said rim by outwardly pressed portions thereof each of which is separated from the remainder of the rim along a radially extending line, and a hollow cylindrical boss fixed to the inner periphery of said rim and projecting inwardly therefrom away from the nozzle disc coaxially with the central opening, said boss forming a seat for the valve means controlling the flow of spray material to the central opening in the whirl plate.

5. A spraying device comprising a body member having a cylindrical passageway therethrough, a conduit connected to said body member for supplying thereto the liquid to be sprayed, a nozzle supporting element threaded at one end into said body member and having a passageway therethrough coaxial and connecting with the passageway of said body member, a nozzle body element threaded at one end to the other end of said nozzle supporting element, a centrally apertured transverse web formed integrally with said nozzle body element intermediate the ends thereof and forming a valve seat, a centrally apertured nozzle cap threaded to the other end of said body element, spray forming means interposed between said cap and the end of said body element including a centrally apertured member forming a second valve seat, valve means for controlling the flow of liquid through said nozzle including a valve operating rod passing through the passageways in said nozzle supporting element and body member and extending outwardly of the latter at the end thereof opposite that to which said nozzle supporting element is connected, said valve operating rod also extending into said nozzle body element and carrying a pair of valves adapted to cooperate with the valve seats in said transverse web and spray forming means, respectively, and means for adjusting the position of said valve operating rod.

6. A spraying device according to claim 5 wherein said spray forming means includes a plate extending transversely across the end of said nozzle body element having a central opening and a plurality of tangentially directed openings circumferentially spaced about the central opening, and a hollow cylindrical member fixed in the central opening in said plate and forming the valve seat for the outermost valve carried by said valve operating rod.

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