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SPRAY NOZZLE

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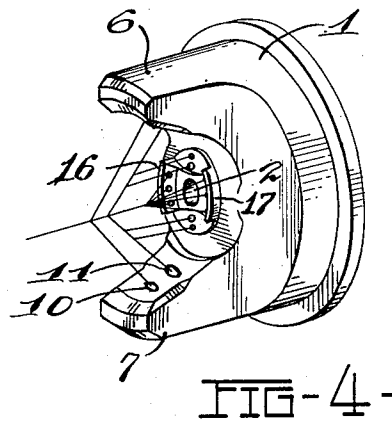
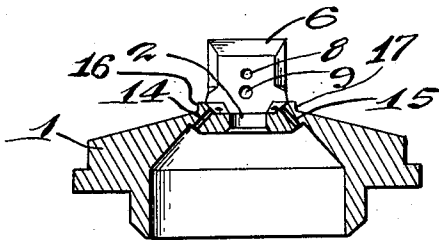
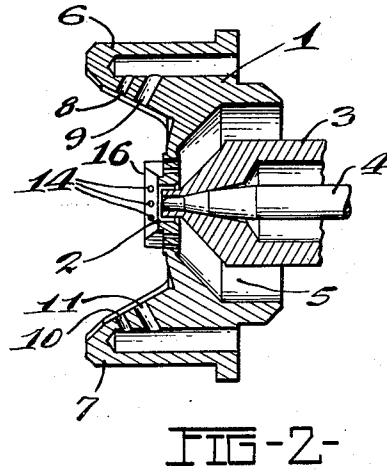
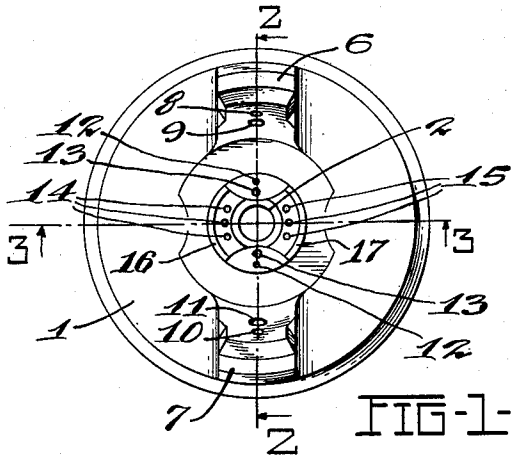


FIG-3-

FIG-4-

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SPRAY NOZZLE

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7 Claims. (Cl. 299—140.1)

1

This invention relates to spray nozzles utilizing compressed air for atomization and particularly to such nozzles in which a plurality of supplemental air jets are directed toward the discharged stream of spray material to further atomize it and to form it into a desired pattern.

In the conventional spray nozzle of this type, as used for spray coating furniture, refrigerator housings, automobile bodies and the like, there is an annular air outlet opening around a circular spray material outlet. The purpose of the air from this annular opening is the primary atomization of the material. It also provides a protective sheath around the material stream which tends to prevent an uncontrolled dispersion of the atomized material by the impingement of supplemental air jets. Prior to being subjected to the action of the supplemental air jets the atomized material stream has a forwardly flaring conical form.

It has long been customary to shape the spray discharge stream into a more serviceable fan pattern by projecting against opposite sides of the stream forwardly converging air jets. Various other auxiliary air jets of smaller size, and from ports closer to the center orifice than those of the main flattening jets, are used quite generally for improving the atomization, modifying the spray discharge pattern, and assisting in keeping the spray nozzle clean. The arrangement of these supplemental jets in spray nozzles commercially available have until recently given satisfactory service with coating materials commonly employed.

However, the ever increasing rate of consumer demands has made improved manufacturing procedures mandatory. To meet the urgent need for greater production and lower costs in finishing operations manufacturers are now adopting higher viscosity, heavier bodied materials. These reduce the number of coats required to obtain the film thickness desired. It is more difficult to atomize these more viscous materials and, if the material is not well broken up, the resulting film surface is rough and more time is consumed in sanding and polishing. This additional labor may reduce or nullify the savings attained from the application of a fewer number of coats.

The spray nozzle of this invention meets the challenge of these advanced requirements by providing extremely high atomization with both lacquers and synthetic enamels in a viscosity range of 17 to 32 seconds on a No. 4 Ford cup. At the same time the spray pattern delivered by this spray nozzle is a fan of exceptional spread, being

2

approximately $15\frac{1}{2}$ inches wide at $6\frac{3}{4}$ inches from the surface, and is accordingly well adapted for coating large surfaces at a high speed. A minimum of lapping of the spray strokes is necessary as the fan pattern is straight sided except for well formed tapers at the ends, and as the spray material is evenly distributed throughout the fan pattern.

This outstanding improvement in performance is derived principally from the novel disposition of supplemental air jet ports on the sides of the center orifice, 90° about the axis from the location of the main flattening jet ports, and supplementarily from an exact positioning of the spray material tip in relation to the spray nozzle, as hereafter more fully described and as illustrated in the accompanying drawings in which:

Figure 1 is a front view of a spray nozzle embodying my invention;

Figure 2 is a central vertical section taken on line 2—2 of Figure 1;

Figure 3 is a central horizontal section taken on line 3—3 of Figure 1; and

Figure 4 is a perspective view of the front and side of the embodiment.

Referring to the drawing, my invention is shown as applied to a spray nozzle 1 with a central orifice 2. Into this orifice extends a spray material tip 3 as shown in Figure 2. A needle valve 4 is the conventional member for controlling the discharge of spray material from tip 3.

This invention incorporates the discovery that, with spray nozzles of high capacities and fine atomization, cleanliness of the spray nozzle may be better assured by spacing the end of the spray material tip rearwardly of the spray nozzle frontal face approximately .003 inch. The general practice has been to have the end of the material tip flush with the spray nozzle surface. A variation from this practice has been to have the material tip extend beyond the surrounding spray nozzle surface to increase the aspirating effect of the air flow upon the material.

The primary atomizing air travels through space 5 surrounding tip 3 and issues from the spray nozzle through the annular opening formed between the forward end of tip 3 and the periphery of orifice 2. This air provides the initial atomization of the discharged spray material and in conjunction therewith travels forwardly in a gradually expanding conical stream.

From horns 6 and 7, pairs of converging flattening jets are emitted from ports 8, 9, 10 and 11 against the atomized material stream to shape it into its final fan pattern.

3

Between each horn and the center orifice are two ports 12 and 13. These emit clean up air jets in paths parallel or slightly inclined toward the axis of the center orifice. These jets aid in keeping the face of the spray nozzle clean and tend to shield the spray material stream from a piercing impingement by the main flattening jets from the horns. Experience has shown that a single jet of this type in front of each horn may give as satisfactory results as the double jets of this specific embodiment.

On the sides of the center orifice, 90° about its axis from the location of the horns and the clean up jet ports, are oppositely placed sets of three ports 14 and 15. These ports are disposed in a well-forming inverted frustro-conical surface flaring outwardly from the face portion of the spray nozzle surrounding the center orifice. The axes of the ports are perpendicular to the conical surface, or, as possibly more correctly defined, are perpendicular to planes tangent to the conical surface at points of intersection of the axes with the conical surface. The frustro-conical surface is on the inner side of a ridge which is non-continuous on the sides adjacent the horns 6 and 7. The two segments 16 and 17 of the ridge form horns of miniature size compared to the horns 6 and 7, but which are proportionately wider circumferentially of the nozzle. In regard to both pairs of horns the inwardly facing surfaces in which the horn air ports are located are conical in contour and the port axes are perpendicular to the conical surfaces.

Due to the raised location of the ports 14 and 15 they are brought into closer proximity to the axis of the central orifice. This feature in association with the symmetrical encircling relation of the port surface area to said axis results in a special concentration of the power of the jets emitted from these ports upon the central stream of material and air.

Each set of three ports is positioned to project three air jets along converging axes meeting at a common point on the axis of the center orifice. The power and action of these merging jets so agitate and form the primarily atomized stream of spray material that, with the subsequent impingement of the main flattening jets from the horn ports, 8, 9, 10 and 11, the stream of material becomes thoroughly atomized and evenly distributed throughout an exceptionally wide fan pattern.

My copending application Ser. No. 184,538, filed September 13, 1950, similarly entitled Spray Nozzle, relates to a specific form of the basic feature of striking the central stream near its source on opposite sides with a plurality of non-merging jets. Instead of having the jets directed along converging paths as in this application the jets of this copending application are directed along parallel paths.

In one form of my invention with which typically excellent results may be obtained, the more forward port (8 and 10) in each horn is .052 of an inch in diameter and is directed at an angle of 65° toward the axis of the center stream; and the more rearward port (9 and 11) of each horn has a diameter of .070 of an inch and is directed at an angle of 53° toward the center stream axis.

The inner clean up jets in this preferred form issue from ports 13 which are .024 of an inch in diameter and direct air jets toward the center axis at an angle of 5°, while the outer clean up jet ports 12 are .0225 of an inch in diameter and

4

their jet paths are angled at 10° to the stream axis.

The atomizing jets emitted from the sets 14 and 15 of three ports on each side, 90° about the axis from the horns, strike the center axis at an angle of 45°. The centers of the ports lie in an arc with a radius of .125 of an inch from the axis of the center orifice. The individual ports on each side are .054 inch apart from center to center, and each is .025 of an inch in diameter.

In another form of my invention with which very good results may be secured the more forward horn port is .070 of an inch in diameter and directed in a path angled toward the center axis at 65°, while the more rearward horn port is .0685 of an inch in diameter and is angled at 60°. This is at variance with the horn port arrangement of the first form described in that the more forward port is larger instead of smaller than the more rearward port and the angles to the center axis of the emitted jets differ. It may be noted that the smaller of the more rearward jets meets the central stream at a slightly more direct angle. This is inclined to compensate for the reduction in size.

The three sets of atomizing ports (14 and 15) at opposite sides of the center orifice in the second form all direct air jets along paths angled at 30° to the axis of the center orifice, the two outer ports of each set being .026 of an inch in diameter and the inner one .038 of an inch. They are all .107 of an inch from the center orifice, center to center, and are .082 of an inch apart.

My copending application Serial No. 184,538, filed September 13, 1950, similarly entitled "Spray Nozzle," relates to a specific embodiment of this invention in which the side atomizing jets are directed along parallel paths.

As is apparent from the above examples my invention is not restricted to a particular specific embodiment but may be utilized with various sizes, positions, and angularity of supplemental air jets.

Accordingly it is not desired to be limited to the exact disclosures herein set forth, but rather to the scope of the appended claims.

What I claim is:

1. A spray nozzle of the type having a center orifice for the discharge of an expanding conical stream of material and air, primary port means for impinging atomizing air jets against opposite sides of the stream and secondary port means in a plane diametric of the axis of the center orifice and ninety degrees about the axis from the primary port means for impinging air jets against opposite sides of the stream, subsequent to the impingement of the atomizing air jets, to form the stream into its final fan shape, said spray nozzle characterized by having said primary port means include a separate distinct set of closely adjacent circumferentially spaced ports on each of opposite sides of the center orifice with said ports formed and positioned to discharge air jets against opposite sides of the stream along paths angled relative to each other with each jet impinging the stream at an angle to the axis thereof of at least thirty degrees and at a point circumferentially spaced from the point of impingement of an adjacent jet, whereby the stream is indented at a plurality of points on each side and is flattened and spread laterally in the diametric plane in which the secondary port means are positioned and on opposite

5

sides of which the sets of primary port means are positioned.

2. A spray nozzle according to claim 1 in which the port means for the atomizing jets on each side of the center orifice lie within a quadrant of a circle centered on the axis of the center orifice.

3. A spray nozzle according to claim 1 in which all the atomizing jets are directed toward the same point on the axis of the center orifice.

4. A spray nozzle according to claim 1 in which the ports for the atomizing air jets are equidistant from the center orifice.

5. In a spray nozzle of the type having a center orifice for the discharge of an expanding conical stream of material and air, a pair of conventional horns on diametrically opposite sides of the center orifice projecting forwardly thereof from the peripheral area of the spray nozzle and port means in the horns for discharging air jets against the stream to shape it into its final fan form, the combination with said conventional horns of a second pair of horns on diametrically opposite sides of the center orifice 90° about the center orifice from the position of the conventional horns, the second pair of horns projecting

6

forwardly a lesser distance and being closer to the center orifice than the conventional horns, and port means in the second pair of horns directing a plurality of atomizing jets of air against opposite sides of the stream prior to the discharge there against of the air jets from the conventional horns.

6. A spray nozzle according to claim 5 in which the surfaces of each pair of horns in which the ports are located follow the outer contour of a forwardly expanding cone concentric with the central orifice.

7. A spray nozzle according to claim 6 in which the axis of each horn port is perpendicular to the conical surface in which it is located.

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