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Hughes

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[54] **ATOMIZING NOZZLE ASSEMBLY**

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[52] **U.S. Cl.** **239/11,** 239/102, 239/428, 239/596, 239/600

[51] **Int. Cl.** **F23d 11/16**

[58] **Field of Search** 239/8, 9, 11, 102, 239/424.5, 427, 427.3, 428, 543, 544, 545, 600, 419, 596

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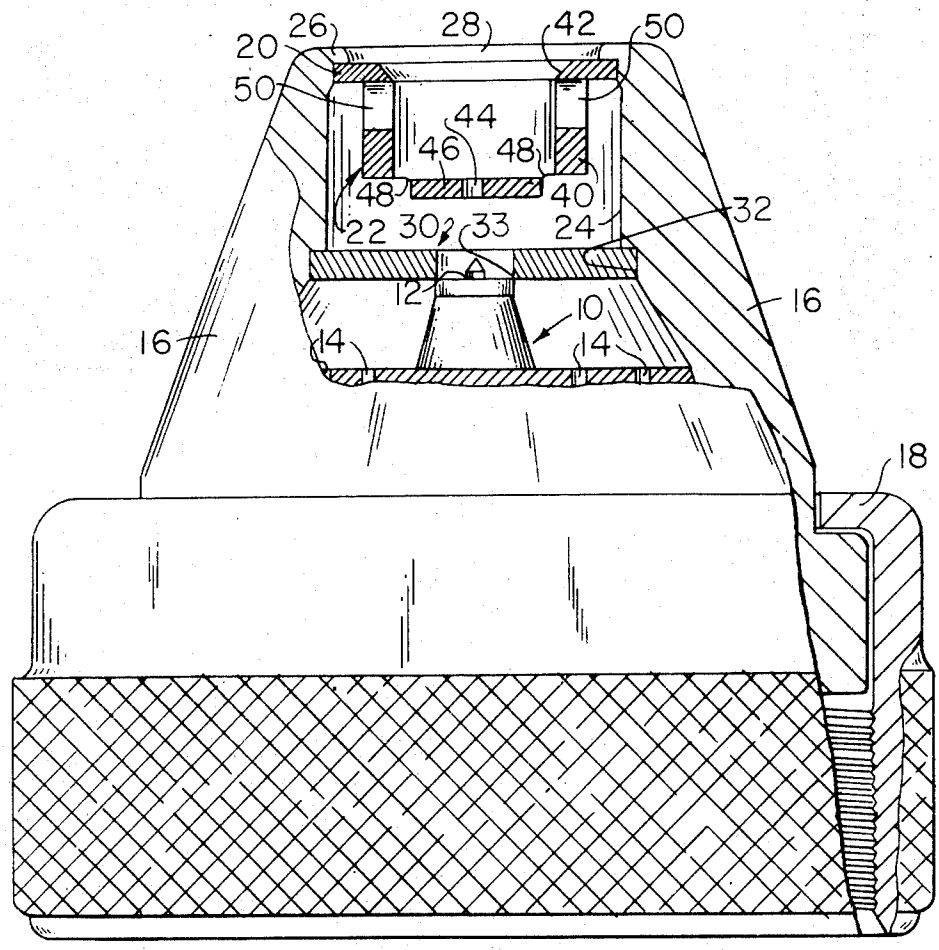
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[57] **ABSTRACT**

Liquid (e.g., paint) is sprayed with a nozzle having an axial flow passage and coaxial radial holes into the passage spaced 180° apart intermediate the nozzle inlet and outlet.

10 Claims, 2 Drawing Figures



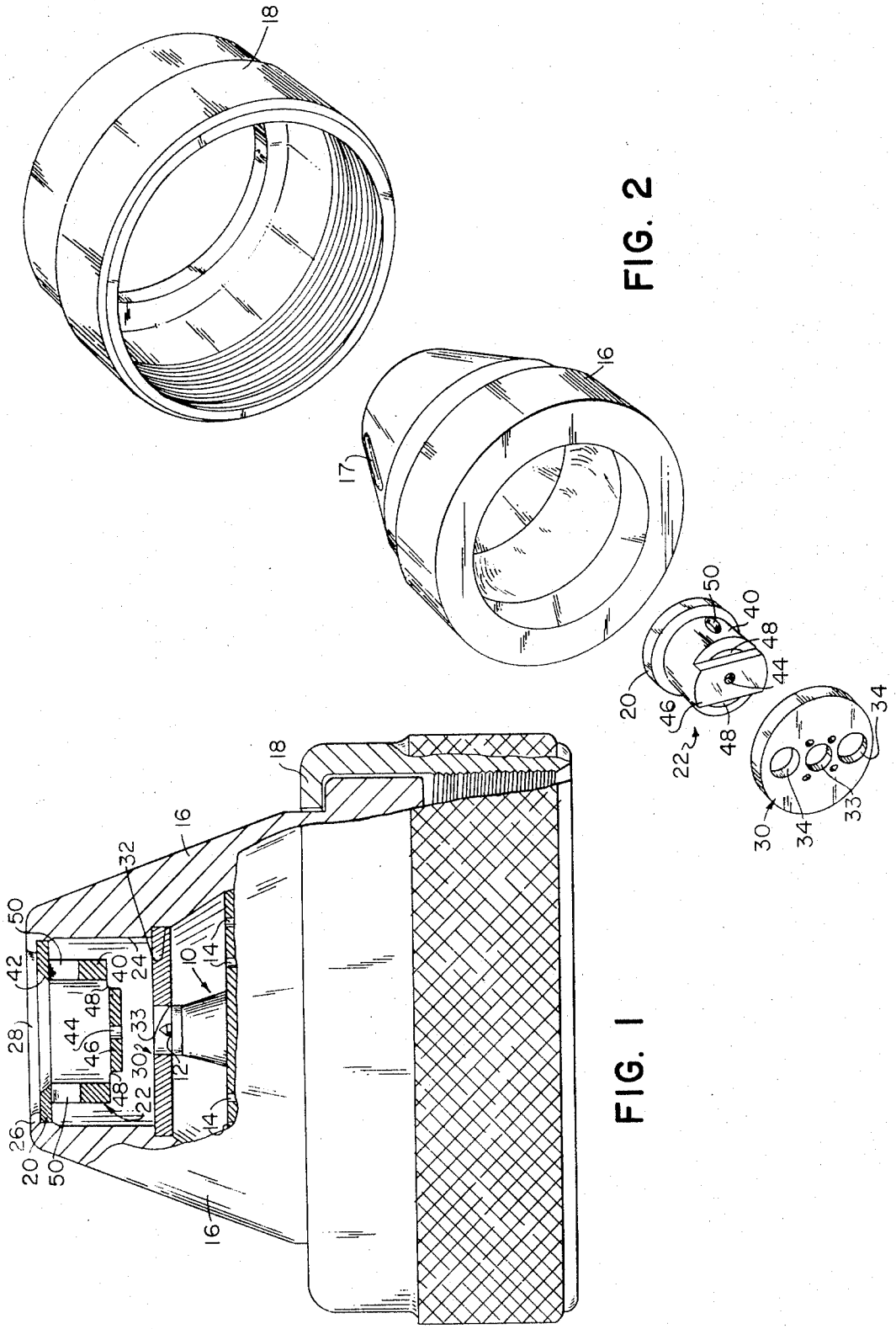

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FIG. 2

FIG. 1

ATOMIZING NOZZLE ASSEMBLY

This invention relates to spraying liquid, especially paint.

Objects of the invention are to provide an improved sprayer in which even very heavy liquid can be finely atomized and yet which can be operated at low liquid and air pressures and with low air consumption, and is simple, reliable, self-cleaning, and inexpensive to make and use. Other objects include provision of a wide, fan-shaped spray of uniform qualities, so that, e.g., paint can be applied to even a smooth, non-porous surface in a thin, smooth, fast drying, tightly adhered coat, all without requiring separate air outlets for shaping the spray; reduction of forward momentum and overspray characteristics of the paint, yet with increase in paint flow capability; provision for control of the fan dimensions and of solvent removal by adjustment of the air pressure; and provision of a nozzle that is insensitive to liquid viscosity or to its distance from the work surface, and in which there are no critical orifices to clog.

The invention in one aspect features spraying paint by providing an atomizing nozzle having a body with inlet and outlets ends and an axial flow passage therebetween, and at least a pair of coaxial radial holes into the passage spaced 180° apart intermediate the inlet and outlet ends; and supplying compressed air and paint to the nozzle at the inlet end and at the radial holes to produce a spray of atomized paint at the outlet end. In preferred embodiments air and paint are introduced through a single pair of radial holes to produce a fan-shaped spray the long dimension of which is perpendicular to the common axis of those radial holes; air and paint are also introduced into the axial passage through a pair of openings arranged at the inlet end symmetrically at opposite sides of the nozzle axis and respectively angularly aligned with the two radial holes, each opening being shaped as a segment of a circle and having an area larger than that of a radial hole; air and paint are also introduced through an axial hole into the axial passage, the axial hole having an area less than that of either segment-shaped opening and of either radial hole; all air and paint is supplied through a reflector located upstream of the nozzle and having an axial opening and two additional openings arranged symmetrically at opposite sides of the axial opening, the three openings having their centers in a single plane perpendicular to the common axis of the radial holes, there also being small openings in the reflector closely adjacent the axial opening to partially relieve the hydraulic pressure drop thereacross; and the nozzle has a single outlet through a countersink to the axial passage.

In another aspect the invention features producing a fan-shaped spray of atomized liquid by introducing a compressible fluid into a nozzle with an axial flow passage through a pair of radial holes downstream of the nozzle inlet, the holes having a common axis perpendicular to the long dimension of the fan.

Other objects, features, and advantages of the invention will be apparent from the following description of a preferred embodiment thereof, taken together with the drawings thereof, in which:

FIG. 1 is a view of a conventional paint sprayer modified to embody the invention, with the aircap partly broken away, some of the elements inside the aircap being shown in section; and

FIG. 2 is an exploded perspective view of some of the elements of FIG. 1.

Conventional paint sprayer head **10**, with needle valve paint outlet **12** surrounded by air outlets **14**, is mounted inside aircap **16**, which is adapted to be secured to a conventional compressed air operated spray gun (not shown) by threaded retainer ring **18**. Cap **16** has an indicating groove **17** (FIG. 2).

Annular flange **20** of nozzle **22** is press-fitted in the downstream end of axial bore **24** of cap **16**, against flange **26** surrounding cap outlet **28** (outlet diameter 0.370 inch).

Disc-shaped reflector **30** (outside diameter 0.496 inch) is press-fitted in counterbore **32** of cap **16**, between nozzle **22** and head **10**. Reflector **30** has a central hole **33** (diameter 0.111 inch) midway between two holes **34** (each 0.144 inch in diameter) having axes spaced 0.290 inch and coplanar with the axis of hole **32**. Central hole **33** is concentric with an imaginary circle (diameter 0.136 inch) containing the centers of four equally spaced holes **36** (diameter 0.0135 inch) arranged symmetrically about the line of centers of holes **33** and **34**.

Nozzle **22** has a cylindrical wall **40** (outside diameter 0.346 inch, inside diameter 0.260 inch), open at its outlet end across 45° countersink **42**, which is surrounded by flange **20**. Axial inlet **44** (diameter 0.025 inch) is provided in upstream end wall **46** which is relieved to provide two openings **48** into the nozzle, each opening **48** having the shape of a segment of a circle. The centers of openings **48** are respectively spaced angularly 90° from the centers of holes **34**. Two opposing coaxial radial holes **50** (each of diameter 0.073 inch) through wall **40** are 180° apart and tangent to countersink **42**. The centers of inlet **44**, openings **48**, and holes **50** all lie in a single plane which is horizontal when the sprayer is oriented with groove **17** facing up (FIG. 2).

Additional nozzle dimensions are:

Length between downstream face of wall **46** and upstream end of countersink **42**. . . . 0.148 inch

Overall length of nozzle. . . . 0.209 inch

Depth of countersink **42**. . . . 0.029 inch

Width of wall **46** between openings **48**. . . . 0.190 inch

Diameter of bore **24** upstream of flange **20**. . . . 0.442 inch

In operation, paint, and air at greater than atmospheric pressure are supplied to head **10** (held so that groove **17** faces up) in conventional manner and respectively enter cap **16** through outlets **12** and **14**. The paint passes through hole **33** and most of the air passes through holes **34**. Holes **36** relieve by about **20%** the hydraulic pressure drop across hole **33**, thus reducing the required paint pressure. Mixing takes place in bore **24**, with paint and air in varying proportion passing into the nozzle through inlet **44**, openings **48**, and holes **50**. Nozzle **22** atomizes the paint, which emerges from outlet **28** in a vertical, fan-shaped spray of very small droplets, due to the arrangement of holes **50** in a single opposing pair (although the spray would still be fan-shaped if there were, e.g., a pair of additional radial holes respectively spaced 90° from and smaller than holes **50**). Reflector **30** minimizes back spraying of paint against head **10**, improves atomization, and, by the arrangement of holes **34** spaced 90° respectively from holes **50** and openings **48**, increases the width of the fan.

In a typical operation, paint flow is 23 oz./minute, and air flow is 15 CFM at 60 p.s.i.g. Air consumption decreases as paint flow is increased.

The subject matter disclosed herein relating to the aircap and provisions therein for mounting the nozzle and the reflector was the joint invention of Nathaniel Hughes and Edson B. Gould III.

Other embodiments will occur to those skilled in the art and are within the following claims.

What is claimed is:

1. The method of spraying paint, comprising

providing an atomizing nozzle having

a body with inlet and outlet ends and an axial flow passage extending therebetween, and

at least one pair of coaxial radial holes into said passage spaced 180° apart intermediate said ends, and

supplying compressed air and paint to said nozzle at said inlet end and said radial holes to produce a spray of atomized paint at said oulet end, wherein said air and paint are introduced through one pair of said radial holes at a rate greater than through any other pair of said radial holes, whereby said spray is fan-shaped, the long dimension of the fan being perpendicular to the common axis of said radial holes of said one pair.

2. The method of claim **1** wherein air and paint are introduced through a single coaxial pair only of said radial holes.

3. The method of claim **1** wherein air and paint are introduced through a pair of openings into said axial passage at said inlet end arranged symmetrically at opposite sides of the nozzle axis and respectively angularly aligned with said one pair of radial holes.

4. The method of claim **3** wherein said inlet end openings each have an area larger than that of a said radial hole of said pair.

5. The method of claim **3** wherein air and paint are additionally introduced through an axial inlet hole to said axial passage of area less than that of either said inlet end opening and either said radial hole of said one pair.

6. The method of claim **1** further comprising the steps of providing openings in said reflector adjacent said axial opening to partially relieve the hydraulic pressure drop thereacross.

7. The method of claim **3** wherein each said inlet end opening has the shape of a segment of a circle.

8. The method of producing a fan-shaped spray of atomized liquid, comprising,

providing a nozzle having a body defining

an axial flow passage having inlet and outlet ends, and

at least one pair of coaxial radial holes into said passage spaced 180° apart intermediate said ends,

supplying said liquid to said passage, and

supplying a compressible fluid to said radial holes at a rate through one pair of said holes greater than any corresponding rate for any other pair of radial holes,

whereby said spray is produced at said outlet end with the long dimension of said fan being perpendicular to the common axis of said one pair of holes.

9. The method of spraying paint, comprising

providing an atomizing nozzle having

a body with inlet and outlet ends and an axial flow passage extending therebetween, and

at least one pair of coaxial radial holes into said passage spaced 180° apart intermediate said ends,

supplying compressed air and paint to said nozzle at said inlet end and said radial holes to produce a spray of atomized paint at said outlet end,

providing upstream of said nozzle a perforated reflector,

supplying said air and paint to said nozzle through said reflector, and

arranging said reflector so that at least the major volume of said air is supplied through zones out of angular alignment with said radial holes of said one pair.

10. The method of spraying paint, comprising

providing an atomizing nozzle having

a body with inlet and outlet ends and an axial flow passage extending therebetween, and

at least one pair of coaxial radial holes into said passage spaced 180° apart intermediate said ends,

supplying compressed air and paint to said nozzle at said inlet end and said radial holes to produce a spray of atomized paint at said outlet end,

providing upstream of said nozzle a reflector having an axial opening and two additional openings arranged symmetrically at opposite sides of said axial opening, the centers of said three openings being in a single plane,

arranging said reflector so that said single plane is perpendicular to said common axis of said radial holes, and

supplying said paint to said nozzle through said axial opening and air to said nozzle through each of said additional openings.

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