

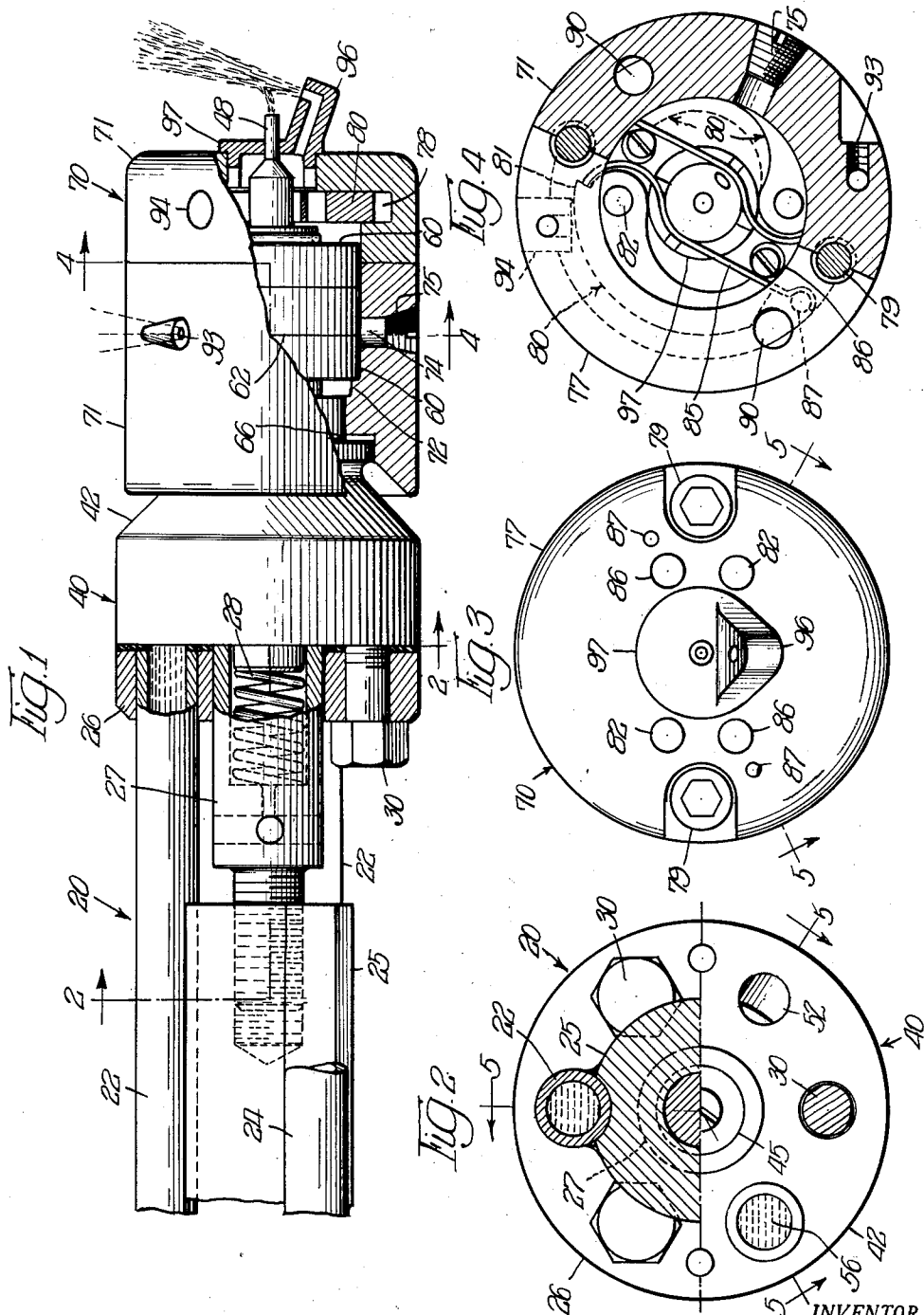
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ROTARY SPRAY GUN

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2 Sheets-Sheet 1



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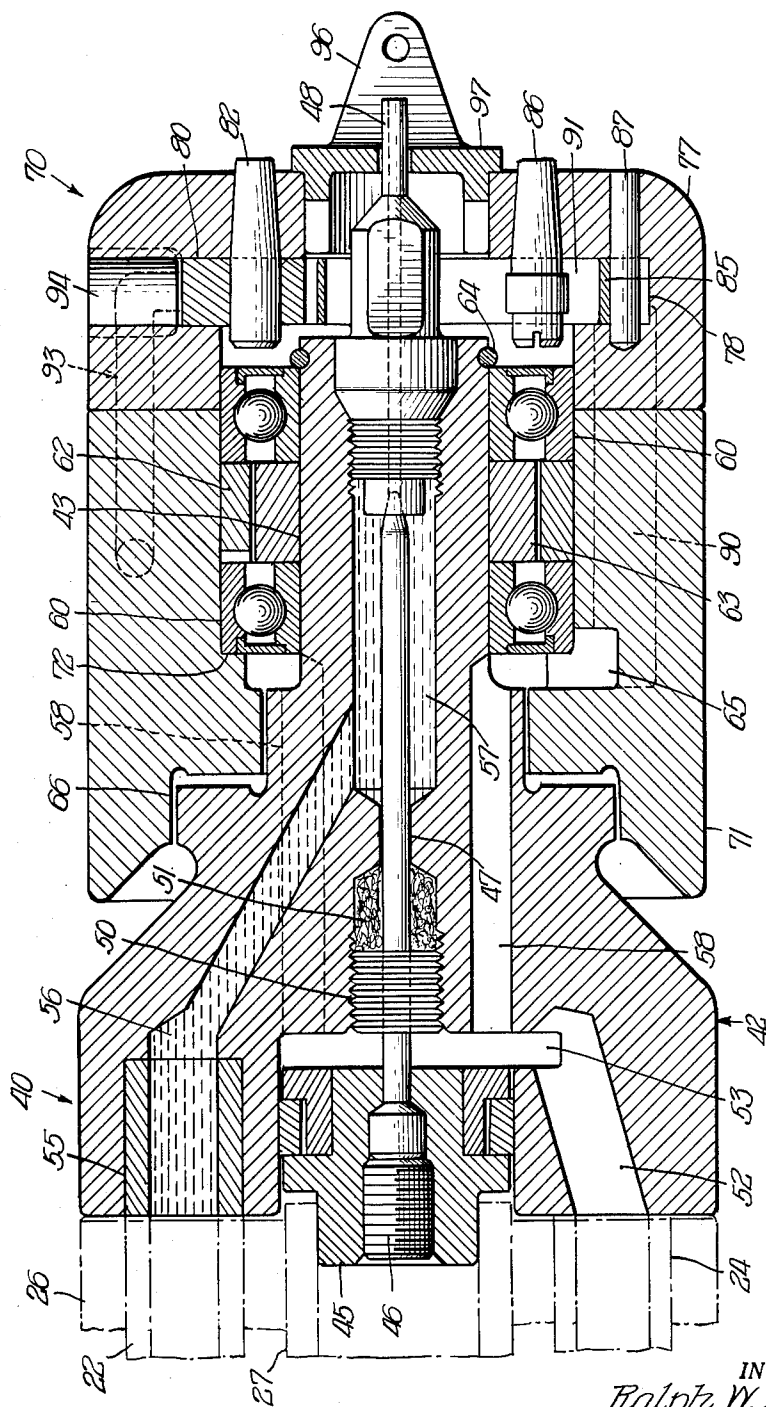
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Fig. 5.



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ROTARY SPRAY GUN

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6 Claims. (Cl. 299—140.1)

This invention relates to air operated devices for applying coating materials to the interior of tubes.

Tubes have heretofore been coated with liquids sprayed in a corona-shaped pattern by a device moved in and out of the tube. The production of a radially uniform corona of spray is difficult, however, and too difficult to be relied upon for many purposes.

Alternatively, tubes have been rotated and coated by passing a fan-shaped spray therethrough. If the spray is advanced a sufficiently short distance per revolution of the tube, a very uniform coating can be produced. Taking the tube into and out of a rotating state is time consuming, however, and not always convenient.

Revealed herein is a spraying device, i. e., a spray gun, which employs a rotated air nozzle to distribute the coating material. Rotational thrust is applied by air jets and controlled by a governor. Using this spray gun, tubes are coated in a precise, convenient and rapid manner, as will become evident as the description proceeds.

In the drawings:

Figure 1 is a side elevational view, partly sectional, of a spray gun embodying this invention.

Figure 2 is a transverse view of the projector and arbor taken on the line 2—2 of Figure 1.

Figure 3 is an end view of the rotor oriented as in Figure 1.

Figure 4 is a transverse view of the rotor taken on the line 4—4 of Figure 1.

Figure 5 is an enlarged axial view of the arbor and rotor taken, respectively, on the line 5—5 of Figure 2 and on the line 5—5 of Figure 3.

Broadly considered, the spray gun comprises a projector 20, an arbor 40, and a rotor 70. The projector and arbor cooperate in forming an air-operated valve. Coating material, discharged from the valve axially outwardly, is radially distributed in the form of a spray by air passed to the rotor via ports provided in the valve.

The projector 20 (incompletely shown) is a canted member in length somewhat greater than the tube to be coated. As shown in Figures 1 and 3, the projector comprises parallel pipes 22, 22, 24 mounted in circumferentially spaced relationship on a shaft 25. A flange 26, supported by the pipes, is disposed in axially spaced relationship with the shaft. A stop 27, threaded into the shaft, extends centrally through the flange; and a coiled spring 28 is disposed coaxially in the outer end of the stop.

The arbor 40 is disposed in packed tandem relationship with flange 26 and secured thereto by cap screws 30. As shown in Figures 1 and 5, the arbor includes a manifold 42 carrying a piston 45 in axially spaced and abutting relationship, respectively, with stop 27 and spring 28. Axially outwardly, a slender nozzle 48 is seated in a hollow journal 43 of the manifold. A needle 47, extending into the mouth of the nozzle, is secured to the piston by a screw 46. A gland 50 and a packing 51 cooperate in sealing a chamber 53 (defined by the needle, the piston and the manifold) from a chamber 57 (defined

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by the needle, the nozzle and the manifold). The hollow plug 55 is a fabrication detail employed weldingly in producing ports 56 connecting pipes 22 with chamber 57.

5 Disposed in radially abutting relationship with the journal 43, are ball bearings 60, 60. As best shown in Figure 5, a spacer 62 is disposed intermediate the outer races of the bearings; a spacer 63, intermediate the inner races. A snap ring 64 prevents the ball bearings and spacers from being stripped from the journal by the pressure of the air applied.

The rotor 70 comprises a collar 71 carried by the bearings 60 in radially spaced relationship with the manifold 42, which is formed to co-operate with a radially contiguous portion of the collar in providing a labyrinth seal 66. Axially outwardly from seal 66, a shoulder 72 of collar 71 abuts the outer race of the inner bearing 60. A duct 74, sealed outwardly by a threaded plug 75, extends radially through the wall of the collar and communicates with a slot (not shown) provided in spacer 62 for conducting lubricant to the bearings.

20 Disposed in axially abutting relationship with the outer end of the collar and secured thereto by screws 79, is a cap 77 provided with an annular groove 78. The cap carries spaced posts 82, 82 disposed radially inwardly from the groove 78. Depending from each post 82 and extending into the groove 78, is a curved arm 80 provided with a shoulder 81. Biasing the outward and limiting the inward movement of the arms, considered separately, is a bowed spring 85 which extends from the shoulder 81 and hooks around an eccentric post 86 onto a pin 87.

30 Disposed in eccentrically spaced relationship with arm 80, is a mouthpiece 94 comprised by an air jet 93 which extends axially through the wall of the cap into the wall of the collar and thence eccentrically outwardly to the atmosphere. Disposed in radially spaced relationship with nozzle 48 and directed radially inwardly, is an auxiliary nozzle 96 comprising a circular base 97 which extends axially inwardly through the wall of the cap. As will be further discussed, the incorporation of arms 80 biased by springs 85, provides means, i. e., a governor, for automatically limiting the rotational speed of nozzle 96.

40 Coating material is forced, by circulating means, through pipe 22 and port 56 to the chamber 57; thence, through a second port 56 and a second pipe 22 back to the circulating means. It will be noted that nozzle 48 envelopes a very small portion of the length of needle 47, a portion preferably less than one-quarter of an inch. Chamber 57 is accordingly small and well flushed by coating material passing in and out. Such coating material as remains in the nozzle is readily discharged if the standby interval is not prolonged. Like other spray guns, this species should be rinsed out with a cleaning fluid at the end of an operating period.

55 Air is forced, by compressing means, through pipe 24 and a manifold port 52 to the chamber 53; thence, through manifold ports 58 to a chamber 65 (defined by manifold 42, inner bearing 60, and collar 71); thence, through rotor ports 90 to a chamber 91 (defined by journal 43, nozzle 48, outer bearing 60, cap 77, base 97, and mouthpiece 94). The compressed air then passes partly through nozzle 96 and partly through jets 93 to the atmosphere.

60 As indicated in Figures 1 and 4, the rotor is thrust eccentrically and thus rotatively by an air pressure higher within than without the outlet of jet 93. At an air pressure less than enough to move piston 45 against the resistance of spring 28, the rotor is slowly rotated. As the pressure is increased, the rotational speed of the rotor is increased until one, or both, of the arms 80 swings centrifugally outwardly and restricts the passage intermediate the arm and mouthpiece 94 of jet 93. The

air pressure in jet 93 is accordingly reduced; the acceleration, halted; the air pressure in chambers 91, 65, 53, increased.

Under increased pressure, piston 45 slides, an amount controlled by stop 27, and draws needle 47 from nozzle 48. Coating material is then passed through the nozzle 48 axially outwardly and struck by air forcefully ejected from nozzle 96. Helping to disseminate the discharged coating material, a hollow stream of air flows axially outwardly through the radial gap formed by contiguous portions of the nozzles 48, 96.

Actually, the sequence of events, following a suddenly increased air pressure, occurs within a second's time. It will be noted that air jets 93 loom large in flow capacity compared with air nozzle 96. When the rotor is slowly rotated, a relatively large part of the air supplied is expended propellantly; when rapidly rotated, a small part. Mounted as described, the rotor requires little air, propellantly, except when being accelerated.

The rotational speed is adjusted by turning the eccentric post 86; predicted, by measuring the load required to move the arm 80. As the rotational speed is decreased the coating material is blown proportionately farther from an axial course. Using air supplied to the spray gun at a pressure of ninety pounds per square inch and an air nozzle opening, i. e., a passage extending inwardly through nozzle 96, of fifteen hundredths inches in diameter, the radial range is about four inches at three thousand revolutions per minute and about twenty inches at six hundred revolutions per minute.

The spray gun is prepared for washing by bringing the stop 27 tightly against the piston 45, sealing nozzle 96 with a clamp (not shown) and sealing jets 94 with screws (not shown). Compressed air is then applied, as when coating, to prevent the washing fluid from passing into the radial gaps provided for free movement of the piston and the rotor.

A spray gun constructed as here described, has successfully met a very trying demand, namely, the rapid and precise coating of tubular molds for use in centrifugating molten iron. Molds in length eighteen feet with an internal diameter seven inches to fifteen inches, have been undertaken to date.

In this service the spray gun is carried in spaced relationship with a parallel pouring trough, by a table mounted on ways perpendicular to the ways of the flask (a water box). The mold is centrifugally filled as it is retracted from the pouring trough; coated, as it is retracted from the spray gun. The spray gun is enveloped by the mold as the red-hot casting is withdrawn. The casting is caught on swinging skids and cleared from the ways of the flask in about three seconds. Coating is started immediately thereafter and completed in the next nine seconds.

Realized, is a covering capacity of some two hundred fifty square feet per minute, in an ambient temperature of five hundred degrees Fahrenheit. Lubricated with silicon oil, the bearings are known to have a useful life exceeding two thousand hours, in the duty cited.

Most significantly, the spray gun construction here described, calls for no power other than compressed air for distributing the coating material in a uniform radial manner. When spraying, the rotor is thrust rotatively by an air pressure regulated by the governor, which is to say, the rotational speed of nozzle 96 is not influenced

by small variations in the ambient temperature, the friction of the bearings, and the pressure of the air supplied to the rotor.

In the drawings and specification, there have been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation. Changes in form and in the proportion of parts, as well as the substitution of equivalents are contemplated, as circumstances may suggest or render expedient, without departing from the spirit or scope of this invention as further defined in the following claims.

I claim:

1. A spray gun comprising a manifold, a rotor, a slender nozzle mounted on said manifold for discharging a stream of coating material, an auxiliary nozzle for issuing a cross stream of air into said stream of coating material, said rotor supporting said auxiliary nozzle for rotation about the axis of said slender nozzle, a jet carried by said rotor for thrusting rotatively thereon when air is forced outwardly through said jet, means for supplying coating material under pressure to said slender nozzle, means for supplying air under pressure to said auxiliary nozzle and to said jet, and a governor mounted on said rotor for limiting the rotational speed imparted by said jet.

2. The construction described in claim 1 further characterized by having a piston mounted in said manifold for thrusting a needle into the mouth of said slender nozzle, means for supplying air under pressure to the end of said piston facing said slender nozzle, a threaded stop disposed in axially spaced relationship with the opposite end of said piston, and a coiled spring disposed intermediate said threaded stop and said piston.

3. The construction described in claim 2 further characterized by said slender nozzle enveloping less than one-quarter inch of the length of said needle.

4. The construction described in claim 1 further characterized by said governor comprising a curved arm tending to swing radially outwardly toward the mouth of said jet when said rotor is rotated, a bowed spring tending to swing said arm radially inwardly, and an eccentric post for varying the tension of said bowed spring.

5. The construction described in claim 1 further characterized by said governor comprising an arm member tending to swing radially outwardly and to restrict the mouth of said jet when said rotor is rotated, and a spring member tending to swing said arm member radially inwardly.

6. The construction described in claim 1 further characterized by said governor comprising an arm member tending to swing radially outwardly and to restrict the mouth of said jet when said rotor is rotated.

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