

June 27, 1967

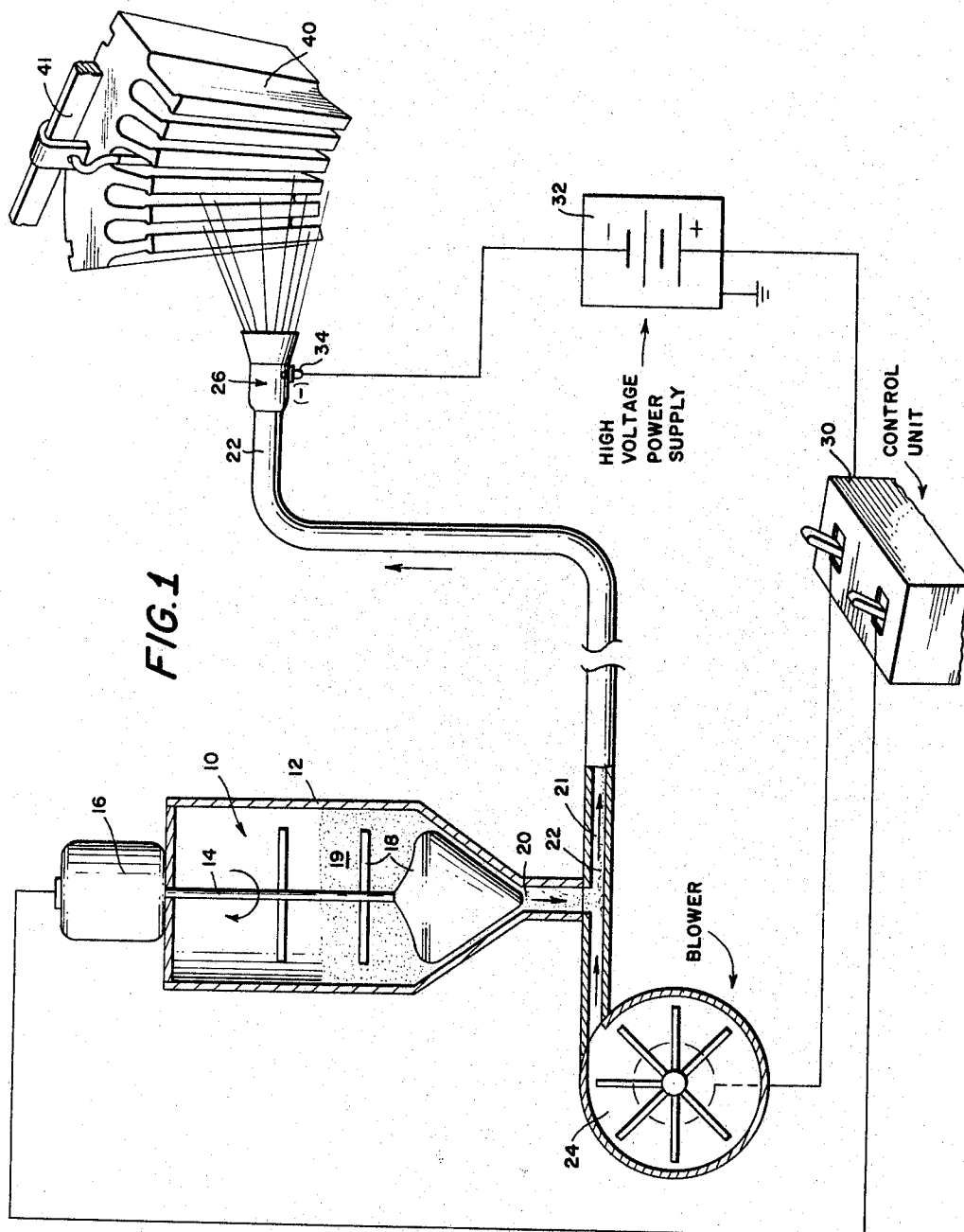
D. GIGNOUX

3,327,948

METHOD OF ELECTROSTATIC COATING INCLUDING VELOCITY REDUCTION

Filed July 7, 1964

2 Sheets-Sheet 1



INVENTOR

DOMINIQUE GIGNOUX

BY *Semmes and Semmes*
ATTORNEYS

June 27, 1967

D. GIGNOUX

3,327,948

METHOD OF ELECTROSTATIC COATING INCLUDING VELOCITY REDUCTION

Filed July 7, 1964

2 Sheets-Sheet 2

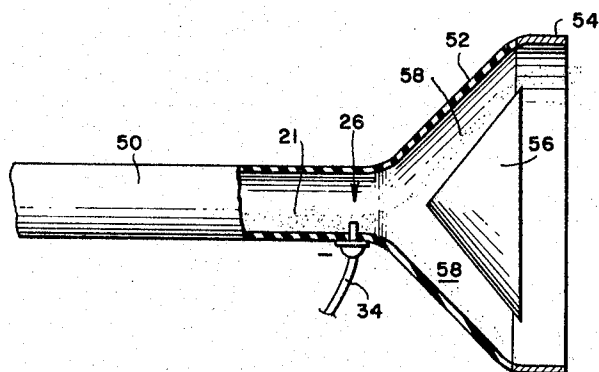


FIG. 2

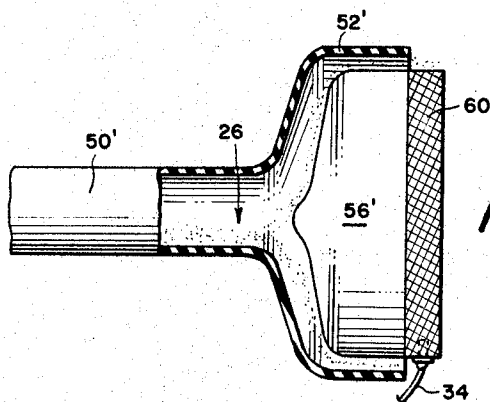


FIG. 3

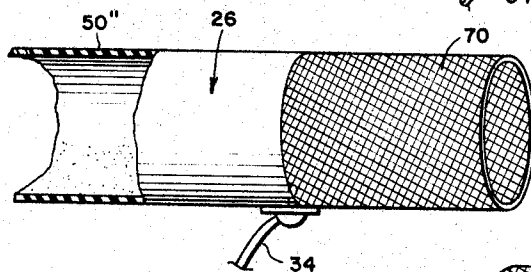


FIG. 4

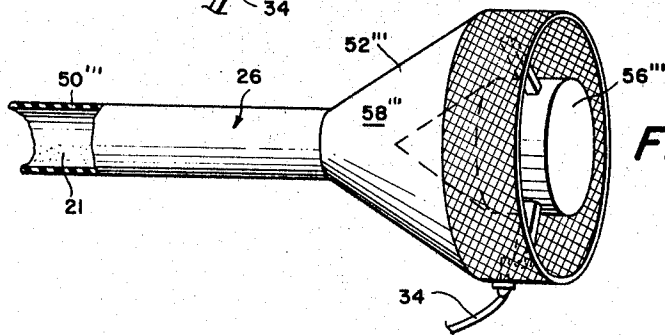


FIG. 5

INVENTOR

DOMINIQUE GIGNOUX

BY *Semmes and Semmes*

ATTORNEYS

1

3,327,948

METHOD OF ELECTROSTATIC COATING INCLUDING VELOCITY REDUCTION

Dominique Gignoux, Washington, D.C., assignor to Cosmic, Inc., Washington, D.C., a corporation of Delaware
Filed July 7, 1964, Ser. No. 380,802
4 Claims. (Cl. 239—3)

The present application relates to electrostatic coating and particularly to a method and apparatus for ionization within a fluid flow containing a dispersed phase of finely divided matter.

The invention disclosed herein relates to processes wherein a material in a dispersed phase is ionized within a dispersed fluid medium. An example of such a material is powder in a thinly divided state dispersed and carried by an air stream. As the air stream passes through the ionization zone, the powder carried thereby is bombarded by electrons and assumes a negative charge. Thereafter, the charged particles of matter, being subjected to the electric field, move along the lines of force thereof toward the object to be coated on which the lines of force terminate. If the particles of matter are liquid, they will adhere to the object by virtue of the forces of surface tension. If the particles are solid, they adhere to the object by virtue of the electrostatic image effect. The three above-mentioned processes of charging the particles, movement of the particles in the electric field, and adherence to the surface of the object to be coated are described, for example, in "Industrial Electrostatic Precipitation" by Harry J. White.

In the past, conventional fluidized bed techniques have been employed to coat pre-heated objects with powder. These require the use of two ovens, one for pre-heating and one for curing. Further, surface oxidation occurs on the hot metal and has a tendency to prevent the powder from adhering properly to the pre-heated objects.

The method and apparatus disclosed herein is considered to be a material advancement over the electrostatic sprays described in U.S. Patent Nos. 2,659,841; 3,049,301; 3,075,706; and 3,086,711 wherein control over the direction of charged powder is relatively inflexible and unsuitable for irregularly shaped objects containing interior portions.

Accordingly, it is an object of invention to provide means and apparatus for causing ionization within a fluid flow containing finely divided matter in dispersed phase to be used in coating an object.

Another object of invention is to provide means and apparatus for producing ionization of finely divided matter in dispersed phase within a fluid flow by the use of an electrode positioned in close relation to the air flow and to the object to be coated.

Still another object of invention is to provide a method and apparatus for controlling the velocity of the fluid flow containing the finely divided matter and the degree of ionization present therein within a wide range.

A further object of invention is to provide a method and apparatus for ionizing finely divided matter in dispersed phase within a fluid flow wherein the quantity of matter carried by said flow may be regulated instantaneously.

Still a further object of invention is to provide a method and apparatus for ionizing finely divided matter in dispersed phase within a fluid flow and controlling the direction of such flow to enable coating of internal openings of the object to be coated.

Yet, additional objects of invention will become apparent from the ensuing specification and attached drawings wherein:

2

FIGURE 1 is a schematic diagram of a complete installation utilizing the method and apparatus disclosed herein;

FIGURE 2 is a first embodiment of a nozzle employed in the method and apparatus disclosed herein;

FIGURE 3 is a second embodiment of the nozzle disclosed herein;

FIGURE 4 is a third embodiment of the nozzle disclosed herein; and

FIGURE 5 is a fourth embodiment of the nozzle disclosed herein.

As seen in FIGURE 1, the complete installation disclosed herein comprises a powder feed system 10 consisting of a hopper 12 containing a central shaft 14 which is rotated at a relatively low velocity in the order of 1 to 50 r.p.m. by synchronous motor 16. Shaft 14 terminates near the lower end thereof in several blades 18 which are used to prevent the powder 19 within hopper 12 from "caking" and promoting a continuous, even flow there-through when motor 16 is running. At the bottom portion of hopper 12 is located a funnel-like outlet 20 which introduces the powder 19 into a conduit 22 through which air is caused to flow by a blower 24 located upstream thereof. Although blower 24 has a relatively great inertia, the synchronous motor 16 which drives the blade bearing shaft 14 may be stopped instantaneously. Thus, the flow of powder 19 from hopper 12 may be interrupted and restarted instantaneously.

As also seen in FIGURE 1, conduit 22 terminates near the end thereof in a nozzle 26 which transmits the dispersed phase of finely divided powder 21 to object 40 which is spaced at a predetermined distance therefrom. It is, of course, advantageous to reduce the velocity of the air stream as it approaches nozzle 26 since the particles 21 carried by the air stream tend to take a higher charge when the effect of the air velocity is less pronounced. Thus, the diameter of nozzle 26 is enlarged beyond the diameter of conduit 22 at their juncture to reduce the velocity of fluid flow passing therethrough. Nozzle 26 is connected to a high voltage power supply 32 by means of an electrode 34 which preferably is negatively charged. The object 40 to be coated is generally connected to ground.

If the object 40 to be coated is large in dimension, the nozzle 26 may be moved manually or automatically (not shown) with respect to object 40. Also, in an effort to prevent "overspray," a plurality of nozzles 26 (not shown) may be used on both sides of object 40. That is, the use of such a plurality of nozzles 26 prevents "overspray" in the sense that the particles which pass by object 40 are repelled by a field on the other side thereof and are eventually deposited on object 40.

Since each object to be coated requires a different value of the air flow and electrostatic charge per drop, the high voltage power supply and the air flow from the blower are preferably continuously variable from central control unit 30.

In large industrial installations, it is obviously advantageous to have the object 40 hanging from a conveyor line 41, such as is shown in FIGURE 1. In such a case it is desirable to interrupt the flow of powder while there are no objects opposite nozzle 26. This can be accomplished by synchronizing the motor 16 with the movement of the objects on conveyor line 41.

FIGURE 2 illustrates a first embodiment of nozzle 26 wherein an insulating conduit 50 of substantially uniform cross-section terminates in a diverging end portion 52 containing ionizing edge 54. A deflector 56 is located within diverging portion 52 thus defining diverging passageways 58 having a total cross-sectional area exceeding that of insulating conduit 50. Electrode 34, leading from high

3

voltage power supply 32, provides a high voltage to the ionizing edge 54. The flow of powder passes near ionizing edge 54 and is bombarded so that the powder particles acquire a charge.

FIGURE 3 discloses a second embodiment of nozzle 26 wherein the ionizing zone is defined by a wire mesh 60, replacing the continuous metal surface ionizing edge 54 of that embodiment of nozzle 26 shown in FIGURE 1. Wire mesh 60, which is located adjacent diverging end portion 52' and deflector 56', tends, because of its foraminous character, to decrease the velocity of air flow near the ionization zone and it also permits some radial dispersion of the fluid and finely divided matter, thus establishing or locating the ionization zone on both sides of wire mesh 60.

FIGURE 4 discloses a third embodiment of nozzle 26 which is preferred for coating small objects and the interior portions of such objects. In this embodiment, insulating supply conduit 50'' terminates in a wire mesh tube 70 of approximately the same diameter. Thus, this embodiment of nozzle 26 emits a stream of air in the center thereof which has a relatively high velocity and powder having a relatively small charge and at the periphery thereof emits a stream of air having a relatively slow velocity and powder having a relatively high charge. This resulting relatively high velocity stream in the center of wire mesh tube 70 is particularly useful in coating the inside of holes or openings in the object 40 to be coated.

FIGURE 5 discloses a fourth embodiment of nozzle 26 wherein insulating supply conduit 50''' terminates in a diverging passageway 58''' defined by diverging end portion 52''' and insulating center deflector 56''' thus causing the air velocity to be reduced in the center and a wider spray of charged powder 21.

Manifestly, still further modifications of the novel method and apparatus for electrostatic coating may be employed without departing from the scope of invention, as defined by the sub-joined claims.

What is claimed is:

1. A method for coating an object with electrically charged, finely divided matter, comprising:

(A) propelling fluid along a first predetermined path;

(B) entraining a dispersed phase of finely divided matter within said fluid;

(C) bombarding the resulting fluid containing finely divided matter with electrons so as to cause said finely divided matter to assume a negative charge;

(D) decreasing the velocity of said fluid and finely divided matter by propelling in a latticed wire mesh defined path.

2. A method for coating an object with electrically charged, finely divided matter, as in claim 1, wherein the velocity is decreased by flowing of said fluid and finely divided matter around a supported latticed wire mesh simultaneously with bombarding.

3. A method for coating an object with electrically charged, finely divided matter, as in claim 1, wherein said first pre-determined path and said latticed wire mesh defined path are co-axial.

4. A method for coating an object with electrically charged, finely divided matter, as in claim 1, wherein the velocity is decreased by flowing said fluid and finely divided matter into a diverging passageway upstream from said latticed wire mesh simultaneously with bombarding.

References Cited

UNITED STATES PATENTS

2,893,893	7/1959	Crouse	239—15
2,955,565	10/1960	Schotland	239—15
3,017,114	1/1962	Marvin	239—3
3,111,266	11/1963	Axelson et al.	239—15
3,122,320	2/1964	Beck et al.	239—3
3,144,209	8/1964	Griffiths	239—15
3,178,114	4/1965	Point	239—15
3,263,127	7/1966	Point et al.	239—3
3,296,491	1/1967	Brown	239—3 X

FOREIGN PATENTS

1,302,415 7/1962 France.

M. HENSON WOOD, JR., *Primary Examiner*.

ROBERT B. REEVES, *Examiner*.

R. S. STROBEL, VAN C. WILKS, *Assistant Examiners*.