Feb. 12, 1957 E. P. MILLER 2,781,280

METHOD AND APPARATUS FOR SPRAY COATING OF ARTICLES

Filed March 11, 1953

2 Sheets-Sheet 1

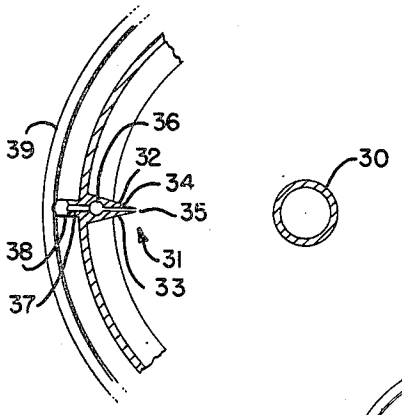


Fig. 2

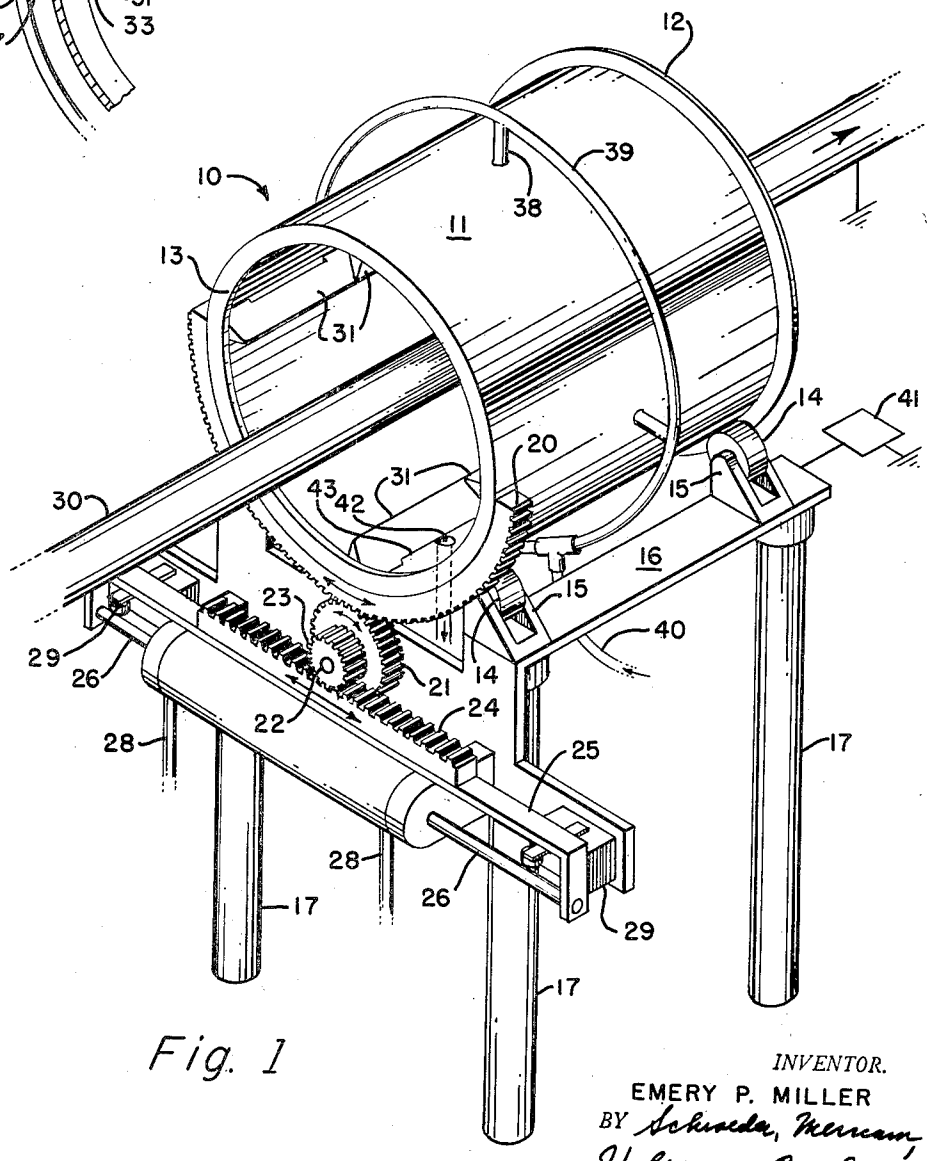


Fig. 1

INVENTOR.
EMERY P. MILLER
BY Schweda, Merriam, Hafgren & Brady
Attorneys

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2 Sheets-Sheet 2

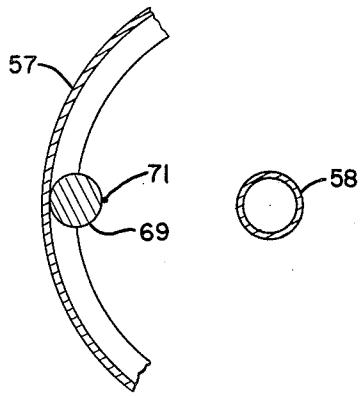


Fig. 4

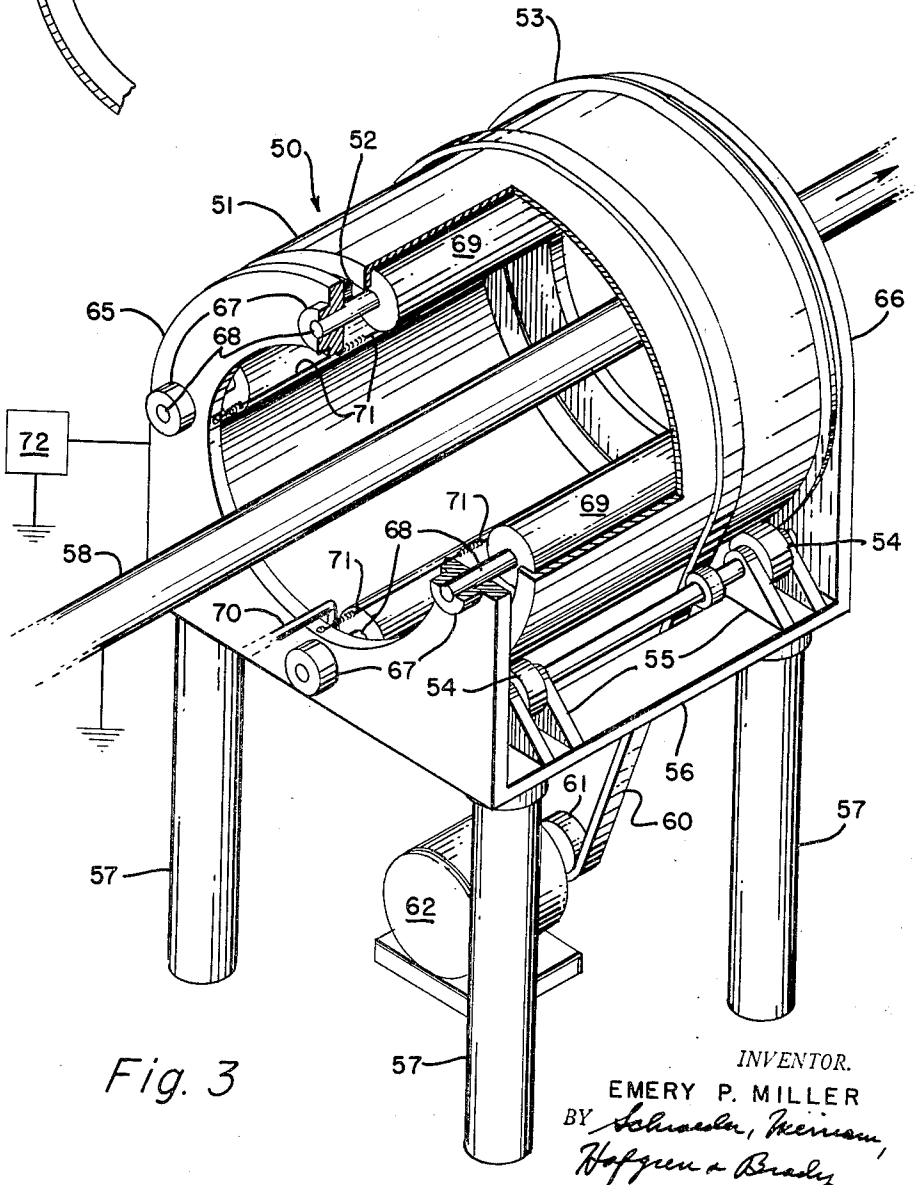


Fig. 3

INVENTOR.
EMERY P. MILLER
BY Schroeder, Brennan, Hoffgren & Brady
Attorneys

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METHOD AND APPARATUS FOR SPRAY COATING OF ARTICLES

Emery P. Miller, Williams Creek, Ind., assignor to Ransburg Electro-Coating Corp., a corporation of Indiana

Application March 11, 1953, Serial No. 341,752

4 Claims. (Cl. 117—93)

This application relates to the spray coating of articles and more particularly to the spray coating of articles by electrostatically depositing thereon atomized particles of the coating material.

In a majority of electrostatic coating systems an electrostatic field is created which includes the article being coated and atomized coating material particles so that the electrostatic forces assist in or cause the deposition of the particles on the article to be coated. In normal commercial practice it is desirable to mount the article on a grounded conveyor and thus to make the article itself (if it is of conducting material) or an electrode within or immediately behind the article at ground potential. Another electrode at high electrical potential with respect to ground is provided, with this latter electrode sometimes being the spraying device and sometimes being a separate electrode near or past which the spray passes in its movement toward the article.

When an article, particularly an elongated or extended article, is exposed to the spray issuing from a spraying device in an electrostatic coating system where deposition of coating material particles is primarily caused by electrostatic forces and where the particles are given an electrostatic charge at the time they leave the spraying device or shortly thereafter, difficulty has been experienced in applying a uniform coating around the entire exposed surface of the article. This difficulty is particularly marked when coating the external surfaces of such elongated or extended articles as pipe, chain and cable.

While the invention disclosed herein may be used with advantage for electrostatically coating articles of various shapes and types, it is particularly adaptable for coating pipe and for the purpose of exemplary disclosure will hereafter be described as employed for such purpose.

In many pipe manufacturing operations a thin, protective coating is applied to the external surface of the pipe after fabrication in order to protect the pipe from rust and corrosion during subsequent shipping and handling operations preceding the actual installation of the pipe. Previously this operation has been accomplished in many ways, for example by passing the pipe through a suitable housing wherein it is sprayed with coating material atomized mechanically or through the use of high pressure air or where the coating is applied by slushing the material on the pipe from suitable slushing nozzles.

According to the exemplified embodiment of the present invention the pipe or other article to be coated is carried on a suitably grounded conveyor through a coating zone wherein it receives a substantially uniform coating about its entire exterior surface. The coating is deposited on the exterior surface in the form of a spray of the coating material and by the action of electrostatic forces.

One of the principal advantages of the invention is that the waste and mess which necessarily accompany the former systems hereinabove described may be substantially completely eliminated while at the same time the employment of the methods and apparatus of this

invention insures a uniform coating of desired thickness over the entire exterior surface of the article.

According to the present invention the article to be coated is passed along a predetermined path and a multiplicity of atomizing sources are positioned spaced from the path but generally parallel to the direction of article movement therealong so as to provide a coating zone elongated in the direction of movement of the article. As the article passes through the zone it receives coating and a plurality of such zones may be provided spaced circumferentially around the article so as to apply coating to all sides thereof. The atomizing sources may be oscillated about an axis parallel to and generally centered along the path of movement of the article so as to effect a better distribution of coating material particles on the exterior surface of the article.

In the embodiment of the invention chosen for the purposes of illustration, the atomized coating material particles are moved toward and deposited on the article by electrostatic forces and the particles themselves are atomized without the employment of high pressure air. The absence of air atomization produces a more efficient operation in that no carrier air stream is present which might tend to carry the atomized particles beyond the article in the form of overspray. Methods and apparatus for coating in such manner are shown and described in the copending application of E. M. Ransburg and W. A. Starkey, Serial No. 556,390, filed September 29, 1944. Methods and apparatus for coating the exterior surface of a pipe by passing the same through a housing is shown in the copending applications of Merton Miller, Serial No. 258,213, filed November 26, 1951, and Emery P. Miller, Serial No. 258,439, filed November 27, 1951.

Other and further features and advantages of the invention will be readily apparent from the following description and drawings, in which:

Fig. 1 is a perspective view of an apparatus embodying the invention;

Fig. 2 is a partial vertical section taken through one portion of the apparatus and illustrating a portion of the housing and a sectional view of the atomizing means;

Fig. 3 is a view like Fig. 1 of a modified form of the invention; and

Fig. 4 is a view like Fig. 2, being a partial sectional view showing a portion of the housing and a sectional view of the atomizing means.

While this invention is suceptible of embodiments in many different forms, there are shown in the drawings and will herein be described in detail several embodiments, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiments illustrated. The scope of the invention will be pointed out in the appended claims.

Referring now to Figs. 1 and 2, there is provided a housing 10 in the form of a cylindrical drum 11 open at its ends 12 and 13. The drum is mounted for rotation about its longitudinal axis on a plurality of rollers 14 journaled in brackets 15 which are fixed to a frame 16. The frame is carried on a plurality of insulating supports 17 so that the entire assembly may be maintained at a high electrical potential relative to ground.

Means are provided for oscillating the housing about its axis of rotation and for this purpose there is secured adjacent the end 13 of the housing a gear segment 20 whose teeth mesh with the teeth on a spur gear 21 fixed to a shaft 22 rotatively carried by the frame. Also fixed to the shaft 22 is a second spur gear 23 whose teeth mesh with the teeth on a rack 24.

Means are provided for reciprocating the rack so as to produce an oscillatory movement of the housing 10 and the parts carried thereby. For this purpose the rack 24

is carried by a bracket 25 secured at each end to the opposite ends of a piston rod 26 secured to a reciprocating piston mounted within a pneumatic piston and cylinder device. Means in the form of air hoses 28 of non-conducting material are provided for introducing air under presure to one end of the cylinder while simultaneously venting air from the opposite end so as to produce reciprocation of the piston. Valves 29 are mounted on the frame and are located so as to be contacted by the bracket 25 near the end of each stroke of the piston. The valves may be connected to air operated master control valves (not shown) for reversing the direction of fluid flow through the hoses 28 so as to move the pistons on its return stroke.

As previously noted grounded conveyor means are provided for carrying an article through the coating zone with the article itself, if it be of conducting material, also being grounded through the conveyor. The article, shown as a pipe section 30, is passed through approximately the center of the housing 10 in a path which coincides generally with the axis of rotation or oscillation of the housing and during its passage through the housing is coated with coating material issued from atomizing means. Fixed to the inner wall of the housing is a plurality of atomizing means 31, four such means being shown in the embodiment illustrated, with each atomizing means being substantially linearly extended from end to end of the housing in positions spaced from the article but extending generally parallel to the path of article movement. The atomizing means are substantially equally spaced from each other within the housing and each comprises a pair of plates 32 and 33 separated slightly by shims so as to provide a passage 34 (Fig. 2) between the plates, which passage terminates in an extended atomizing edge 35. Communicating with the passage 34 is a channel 36 which, like the passage 34 and edge 35, extends substantially the entire length of the atomizing means. Coating material is supplied to the channel 36 for flow through the passage 34 to the edge 35 through an opening 37 in the atomizing means to which is connected a supply pipe 38 in turn connected to a supply manifold 39. Coating material is supplied to the manifold through a flexible supply hose 40 made of insulating material.

The assembly of the frame, housing and atomizers is maintained at high electrical potential with respect to ground by being connected to a high voltage source 41.

In operation fluid under pressure is supplied through the hose 40 and manifold 39 to the channels 36 for flow to the edges 35. With the edges 35 at high electrical potential coating material fed thereto is electrostatically atomized therefrom from a plurality or multiplicity of closely spaced points extending along the length of the atomizers and hence parallel to the path of movement to the article. As the article is maintained at ground potential, the charged coating material particles are deposited on it by the electrostatic forces in the field between the particles and the article. During the atomization the housing may be oscillated by the means described so as to more uniformly distribute the coating material over the surface of the article. In the event the interior surface of the drum becomes loaded with coating material, the same may drain to the bottom of the drum and be drained therefrom by a drain hose 42 and for this purpose each of the atomizing means is slightly spaced from the interior housing as shown at 43 at a number of places along its extent.

A slightly modified form of the invention is shown in Figs. 3 and 4. Referring now to those figures, there is provided a housing 50 in the form of a generally cylindrical drum 51 open at its ends 52 and 53 and rotatably supported on rollers 54 for rotation about its longitudinal axis. The rollers 54 are journaled in brackets 55 carried by a frame 56 mounted on insulating supports 57. The article to be coated, shown as pipe 58, is moved axially through the central section of housing 50 by means of a grounded conveyor (not shown) so that pipe 58 itself remains at ground potential. The drum is rotated by means of an endless belt 60 passing around the drum in a suitable grove and carried by a pulley 61 rotated by an electric motor 62. Carried by the frame and adjacent each end of the housing are vertical upstanding end plates 65 and 66. Fixed in the end plates is a plurality of bearings 67 which rotatably carry shafts 68 fixed to and extending from the ends of cylindrical rollers 69. The rollers are carried so as to have their peripheries contacting the inner surface of the drum. The coating material is fed to the interior of the drum by an insulating hose 70 and the material itself spreads along the bottom of the drum by gravity flow.

When coating material is fed to the interior of the drum and the same is rotated by the means described, coating material is carried on the inner surface of the drum around and into contact with the several rollers 69 so as to provide a covering of coating material on each of the rollers. The rollers contact wires 71 which are fixed at each end to the end plates. The wires produce a discontinuity in the surface of the coating material carried by the rollers and thus, when maintained at high potential with respect to the article, serve to cause the coating material thereon electrostatically to atomize for subsequent deposition on the article. As previously noted atomization takes place along a multiplicity of closely spaced points which extend along the length of the wires and thus substantially from end to end of the housing. As can readily be seen from the drawings, the atomizing means including the rollers 69 and wires 71 extend a substantial distance parallel to but spaced from the path of article movement.

The frame and housing and hence the wires 71 are maintained at high electrical potential by means of a high voltage source 72 electrically connected thereto.

In operation the wires are maintained at high electrical potential with respect to ground by virtue of their being electrically connected to the high voltage source and coating material is fed to the interior of the drum through the hose 70. As the drum is rotated coating material spread along the interior surface of the drum is passed to each of the rollers 69 and forms a film thereon. The wires 70 interrupt the continuity of the film and, being at high potential because of their connection with the frame, cause the material thereon electrostatically to atomize.

The atomized particles are then deposited on the exterior surface of the article by the electrostatic forces.

I claim:

1. Apparatus for electrostatically coating an elongated article comprising a substantially cylindrical open ended housing, means for passing the article through the housing along a predetermined path parallel to the major axis of the article and the axis of the housing, a plurality of atomizing means secured at spaced points to the interior surface of the housing with each of said atomizing means providing an atomizing edge extending an appreciable distance parallel to but spaced from said path, a passage in each atomizing means for delivering coating material to the edge thereof, a supply manifold secured to the housing and connected to each of said passages and to a source of coating material, means for maintaining each of said edges at an electrical potential relative to the article capable of electrostatically atomizing coating material particles from said edges and depositing the same on the article, and means for oscillating said housing about its axis.

2. The method of coating an elongated article which comprises passing the article along a predetermined path parallel to its major axis, providing a member surrounding a portion of said path, feeding coating material to the interior of said member while rotating the member to distribute the coating material over its inner surface, contacting the inner surface with a roller extending an ap-

preciable distance parallel to but spaced from said portion of the path to form a film of coating material on the roller, disrupting a portion of the film, creating an electrostatic field extending from said film portion to the article, said field having sufficient strength electrostatically to atomize coating material in said film portion and electrostatically to deposit the atomized coating material particles on the article.

3. Apparatus for electrostatically coating an article comprising a frame, a substantially cylindrical open-ended housing rotatably carried by the frame, means for passing the article through the housing along a predetermined path parallel to the axis of the housing, a plurality of elongated rollers each journalled in the frame for rotation about an axis substantially parallel to the path of article movement and positioned to have its periphery contacting the inner surface of the housing, means for feeding coating material to the inner suface of said housing, means for rotating the housing to form a film of coating material on the rollers, a member positioned to contact the film on each roller to disrupt a portion of the film thereon, and means for creating an electrostatic field between each disrupted film portion and the article electrostatically to atomize coating material in said film portions and electrostatically to deposit the atomized particles on the article.

4. The method of coating an elongated article which comprises passing the article along a predetermined path

parallel to its major axis, providing a member surrounding a portion of said path, maintaining within said member a plurality of films of coating material each providing an edge portion of short radius extending continuously and for a substantial distance parallel to said path, and creating an electrostatic field extending from said film edges to the article, said field having sufficient strength electrostatically to atomize coating material from said film edges and electrostatically to deposit the atomized coating material particles on the article.

References Cited in the file of this patent

UNITED STATES PATENTS

1,710,747	Smith	Apr. 30, 1929
1,855,869	Pugh	Apr. 26, 1932
2,114,377	Goss	Apr. 19, 1938
2,128,327	Russell	Aug. 30, 1938
2,187,306	Formhals	Jan. 16, 1940
2,334,648	Ransburg	Nov. 16, 1943
2,562,358	Huebner	July 31, 1951
2,597,021	Norris	May 20, 1952
2,658,472	Ransburg	Nov. 10, 1953
2,685,536	Starkey et al.	Aug. 3, 1954

FOREIGN PATENTS

594,564	Great Britain	of 1947
599,466	Great Britain	of 1948