ELECTROSTATIC SPRAY COATING APPARATUS

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6 Claims. (Cl. 118—51)

This application is a division of prior application Serial No. 516,778, filed January 3, 1944, by Norman Curtis, Emory P. Miller, and one now abandoned. The subject matter of this application is also disclosed in a second prior application Serial No. 596,870, filed by the same inventors on May 31, 1945, as a continuation-in-part of application Serial No. 516,778.

Application Serial No. 596,870 has resulted in Patent No. 2,546,701, granted March 27, 1951, claiming an electrostatic coating apparatus employing electrostatic forces to deposit electrostatically charged particles of coating material on articles being coated. The present application is directed to apparatus for forming a spray of electrostatically charged particles.

It is an object of the invention to produce an effective means for creating a spray of finely divided liquid and for impressing electric charges on the particles constituting such spray.

In carrying out the invention, I employ a spray gun which may conveniently be of the air-atmosphere type and which is adapted to discharge a divergent spray of finely divided liquid. I also employ at least one elongated electrode arranged at one side of the spray discharged from the gun. Preferably there are two elongated electrodes arranged on opposite sides of the spray, but in any event, the electrode or electrodes extend for a considerable distance from the gun in a direction transversely to the spray axis. The electrodes or electrodes are connected to one terminal of a high-voltage source the other terminal of which is connected to the spray gun. It is intended in general that a substantial difference of electrical potential will exist between the spray gun and the elongated electrode or electrodes adjacent the spray.

In the accompanying drawing, Fig. 1 is a perspective view showing an electrostatic coating apparatus employing the present invention as a source of charged particles, and Fig. 2 is a wiring diagram.

The invention of this application is shown in the drawing as embodied in electrostatic painting equipment, and more particularly equipment in which a spray gun is charged with a spray of atomized paint is capable of being manipulated manually. The equipment comprises a conveyer embodying a track 10 and hangers 11 upon which the articles 12 and 12a to be coated are supported. A stationary bar 13 cooperating with pulleys 14 rigidly respectively with the hangers 11 is shown for rotating the articles 12 and 12a as they pass through the coating station.

The spray gun, indicated at 25, is suitably supported to discharge a spray of atomized liquid between two spaced, parallel electrode elements 21 which are desirably wires or are otherwise rod-like—that is, their longitudinal dimension is great relative to their transverse dimension. It is intended in the structure shown that the spray of finely divided liquid provided by the gun 25 will be used to coat the articles 12, 12a, the gun being located on the opposite side of the electrodes 21 and 21a. The article path the spray will necessarily pass in proximity to each of such electrodes. The gun shown is of the common type employing air to effect atomization of the liquid employed, such air and liquid being supplied to the gun through the flexible hoses 27 and 28.

The particular application of the invention illustrated comprises that the gun is to be freely movable, within limits, in a vertical plane parallel to the article path. Accordingly, the gun is swiveled on a ring 26 which is slideably supported on a horizontal control bar 19, and such bar is vertically slideably on an operating frame 17. The electrodes 21 are supported from the control bar through high-voltage insulators 20 and extend parallel to the path of gun movement therealong, with the result that while the gun may be moved both horizontally and vertically it always occupies such a position relative to the gun that the spray will be discharged therewith. To permit variation in the distance between the article-path and the gun and electrodes, the operating frame 17 is shown as slideably supported in the frame 15.

The gun 25 is intended to be operated by an operator 15 standing on a grounded surface, and the gun is likewise grounded through the bar 19, frame 17, and supports 16. The conveyer 10 is likewise grounded as indicated at 43. A source of high-voltage 22 (Fig. 2) includes a step-up transformer whose secondary 41 has one of its terminals grounded, as at 40, and its other terminal connected to the electrodes 21 through a rectifier 42 and conductors 23 and 24, the latter being extensible to permit vertical movement of the electrodes.

As a result of these connections, a high difference of potential will exist between the electrodes 21 on the one hand and the gun 25 and articles 12 and 12a on the other hand, such difference of potential creating an electrostatic field into which the atomized liquid from the gun 25 is discharged. Entering this field, the fine liquid particles acquire electric charges and continue under their own momentum past the electrodes 21 in the form of the desired charged liquid spray. Approaching the article path, the charged particles will be electrostatically attracted to and deposited on the grounded articles 12, 12a.

Since the operator and the gun 25 are both grounded as above set forth, the operator may handle the gun without danger of shock. The insulators 20 support the electrodes in safely spaced relation to the grounded gun 25 and frame 17. However, in the specific apparatus shown, the cathode 21a connected to the articles 12, 12a to the charged electrodes, makes certain precautionary features advisable. Those features, which are more fully set forth in prior patent No. 2,546,701, of myself and others, issued March 27, 1951, include a relay 39, having switch contacts controlling the supply of current to the voltage source 22, and a control circuit for such relay, all the various and other operator-controlled switches 35 and 37 and a barrier relay 36. The switch 37 is normally open and arranged on the handle of gun 25 to be closed by that hand with which the operator manipulates such gun. The switch 35 is likewise normally open and may be closed by the other hand of the operator through a cord 34. The automatic switch 36, which is adapted to de-energize the voltage source 22 before an article project into the electrostatic field beyond the normal path of article travel can enter the electrostatic field, is controlled by a photosensitive device 33 positioned to receive a beam of light from a light source 32. The light-beam from it will be located along the path of article travel forwardly of the electrodes 21 and closer to such path than are the electrodes 21. As will be obvious, energization of the voltage source and consequent charging of the electrodes 21 require that the switches 35 and 37 and the relay 36 be closed. If the operator permits either of the switches 35 or 37 to open, or if the relay 39 is approaching the coating station interrupts the light beam incident on the photosensitive device 33, the relay 39 will be opened and the high-voltage source 22 de-energized.

Referring to the drawings, it will be clear that the discharge end or nozzle-tip of the spray gun 25 lies near the vertical plane which is tangent to the electrodes at the rear sides thereof and is pointed on that side of such plane which is directed away from the electrodes. It will likewise be clear that, wherever the gun lies along the bar 19, the electrodes will extend lengthwise, beyond the nearest extremity of the spray gun for a distance which, at least in one direction, is greater than the distance between such nearest point and either electrode.

While I prefer to employ two of the electrodes 21 located on opposite sides of the spray discharged from the tip of the gun 25, a single electrode arranged with refer-
ence to the spray as either of the electrodes 21 is arranged may be used. A more effective charging of the sprayed particles is produced, however, by the arrangement shown in the drawing.

1. Means for producing a charged spray comprising a pair of elongated parallel metal electrodes, spraying nozzle-means having a spraying nozzle-tip insulated from said electrodes, said nozzle-tip being near the plane nearest thereto which includes a part of each of said electrodes, but lying on a side of said plane directed away from said electrodes, said nozzle-tip being directed to provide a spray in the space between said electrodes which spray is chargeable by an electric field between said nozzle-tip and said electrode, said electrodes extending lengthwise beyond the nearest point of said nozzle-means for a distance greater than the distance of said nearest point to either of said electrodes.

2. Means for producing a charged spray comprising a pair of elongated rod-like substantially parallel electrodes, a spray-nozzle-means having a spraying point insulated from said electrodes and providing a spray in the space between said electrodes, and chargeable by an electric field between said spraying point and said electrodes, said electrodes being lengthwise substantially straight and transversely curved on the sides facing said spraying point, said spraying point being near a plane nearest thereto that includes a part of each of said electrodes, said spraying point lying on a side of said plane facing away from said electrodes, said electrodes extending lengthwise beyond the nearest point of said spraying nozzle-means for a distance greater than the distance of said nearest point to either of said electrodes.

3. Charged-spray-producing means as defined in claim 2 but further characterized by pneumatic means associated with said nozzle-means to provide a spray at said spraying point.

4. Means for producing a charged spray, comprising an elongated metal electrode, a spray gun for discharging a spray of finely divided liquid, said electrode being disposed adjacent said spray but offset from the axis thereof and extending in a direction transverse to such spray-axis, said electrode and spray gun being electrically insulated from each other, and means including a high-voltage source having opposite terminals connected respectively to said gun and electrode for creating between them an electrostatic field, said electrode extending lengthwise of itself beyond the nearest point of said spray gun for a distance greater than the distance between such nearest point and the electrode.

5. The invention set forth in claim 4 with the addition that said electrode has a sharply curved surface presented toward the spray-axis.

6. The invention set forth in claim 4 with the addition that said electrode is a wire.

References Cited in the file of this patent

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