

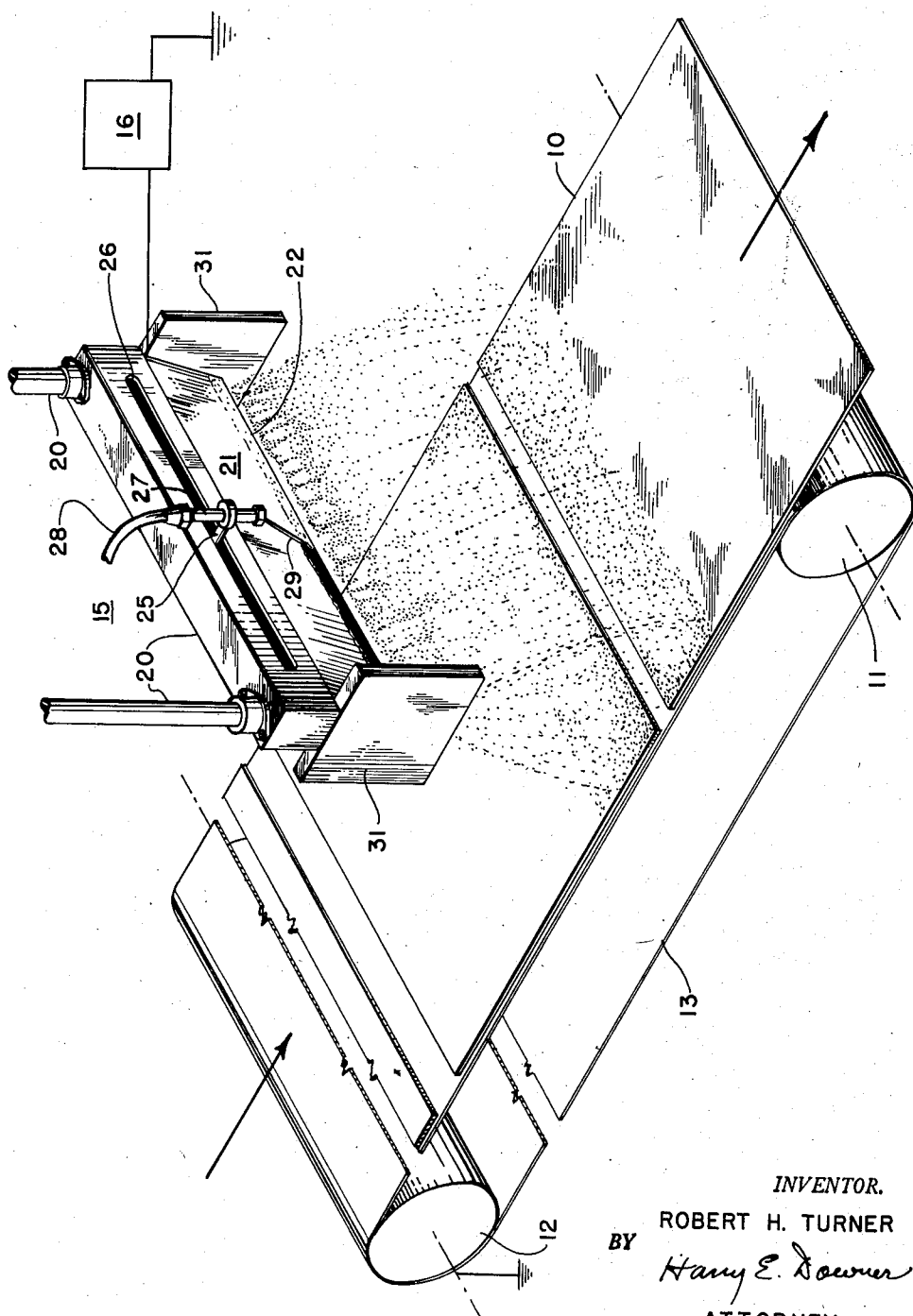
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ELECTROSTATIC COATING APPARATUS

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ELECTROSTATIC COATING APPARATUS

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1

This invention relates to electrostatic deposition of liquid coating materials and more particularly to an improved coating apparatus in which the liquid coating material is both electrostatically atomized and electrostatically deposited upon an article to be coated.

In apparatus employed for electrostatically applying a liquid coating to discrete articles, it is common to move the articles through a coating zone in which the coating is applied to them. Similar practice is followed in the electrostatic coating of sheet material, the coating being applied as the sheet moves progressively through a coating zone.

In prior electrostatic applications where an elongated applicator head or discharge member has been used, some difficulty has been experienced due to the concentration of field strength at the ends of such discharge heads or members and the consequent fanning out of the jet of coating material away from the article to be coated. Such fanning out causes uneven coating and may result in the loss of coating material.

It is an object of this invention to overcome the disadvantages heretofore attendant upon the electrostatic atomization and deposition of coating material from an elongated discharge head. More particularly, it is an object to facilitate the attainment of a uniform distribution of coating material onto an article being coated, and to prevent scattering of coating material particles at one or both ends of the spray pattern created when liquid coating material is atomized from an elongated head. A further object of the invention is to confine the effective electrostatic field by utilizing one or more end plates or end members in electrostatic coating apparatus for achieving improved coating results.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment of my invention when read in connection with the accompanying drawing which is an isometric view illustrating a coating apparatus in accordance with my invention.

In the drawing, I have illustrated an arrangement of apparatus suitable for coating sheet material 10. Such apparatus embodies a conveyor comprising rollers 11 and 12 and belt 13 which is adapted to move the sheet material through a coating zone. Either or both rolls 11 and 12

2

may be suitably connected to a driving means such as an electric motor not shown. While the conveyor here shown is adapted to handle sheet material, it is understood that conveyor mechanism adapted to carry discrete cylindrical objects or any other suitable objects are equally adapted for use with my invention. Disposed on one side of the path of material movement through the coating zone is a horizontally disposed atomizing device 15 from which the liquid coating material is electrostatically atomized. To effect atomization of the coating material and electrostatic deposition thereof on the sheet material 10 as it passes the device 15, an electrostatic field of appropriate strength is maintained between the device 15 and the sheet material. For this purpose, the sheet material may be grounded in any suitable manner such as through the roller 12 and belt 13 as shown while the device 15 is connected to one terminal of a high voltage source 16, the other terminal of which is grounded.

The atomizing device 15 comprises supporting structure 20 to which there is affixed in any convenient manner an elongated member 21 which is preferably of electrically conducting material and connected to the ungrounded terminal of high voltage source 16. The member 21 is shaped in cross section to present toward the article 10 a relatively sharp or attenuated edge 22. An average potential gradient in excess of 3,000 volts per inch and preferably in the neighborhood of 8,000 volts per inch average potential gradient is maintained between the member 21 and the sheet material 10 moving past it, and as a result an electrical discharge will exist along the edge 22 so that liquid coating material fed to such edge will be electrostatically atomized and electrostatically deposited onto the sheet material 10. The coating material is fed to the edge 22 in the form of a film extending along the edge between more or less definite limits, such film being created and maintained by any suitable distributing means. One such means may comprise a lever 25 mounted for horizontal reciprocation in slot 26 of support 20 and between appropriate guide means not shown. This lever may carry at its end a short length of tube or pipe 27 disposed transversely of the lever. One end of the tube 27 is connected as through a flexible hose 28 with a source of coating material which is adapted to be fed to the tube 27 either by gravity or by positively produced pressure. To the opposite end of the tube 27, there is connected a nozzle 29 having its outer end disposed close to the edge 22 of the discharge device but spaced rearwardly

3

a short distance from such edge so as to be electrically shielded thereby. The means employed to reciprocate the lever 25 and the nozzle 29 may take various forms. One such means is shown and described in application Serial No. 57,260 of Edwin M. Ransburg, filed October 29, 1948.

As previously stated, where an elongated applicator head or member is used the end portions of the jet or spray issuing therefrom waver erratically. This results in scattered dispersion of the particles composing these parts of the jet thereby causing the deposited pattern to be irregular and uneven and also may result in the loss of some of the coating particles. My invention is directed to improved apparatus for overcoming these objectionable characteristics in order to secure a spray pattern of improved uniformity and definition. In this improved apparatus, the elongated member 21 is provided with a field-modifying member 31 located on the member 21 beyond one or each end of the film thereon and projecting forwardly from the edge 22 toward the article to be coated. In most instances, the field-modifying members 31 will be located at the ends of the elongated member 21 and desirably project laterally therefrom at the sides as well as forwardly toward the article. In one device which was built and which operated satisfactorily at a potential of 80,000 volts and with the edge 22 ten inches from the article being coated, the members 31 extended two inches beyond the cross-sectional extremities of the applicator head. The members 31 may be made either of electrical insulating or electrical conducting material, but members of electrical conducting material have a more pronounced confining result on the effective electrostatic field than members of electrical insulating material.

By the use of the members 31, I have been able to diminish the tendency of the spray from an elongated head to fan out at its ends, and have thereby been able to obtain more concentrated and uniform coating as well as better definition of the deposited pattern at its ends.

What I claim is:

1. In an electrostatic atomizing device for use in the electrostatic deposition of liquid coating material on an article, a discharge head having an elongated member of electrically conductive material provided with an elongated, rectilinear edge, means for supplying liquid coating material to said edge, two field-modifying members provided on said head and comprising a pair of plates secured to said head normal to said edge, with each plate having a portion projecting laterally from said elongated member and forwardly from said edge, said plates being located at points adjacent to and beyond the opposite ends of the liquid at said edge, means for connecting the discharge head to a source of high electrical potential to create between said head and the article an electrostatic field sufficient to atomize coating material supplied to said edge and to move the same toward the article, and means for supporting the head in opposed relationship to the article and at a distance sufficient to permit substantial dispersion of the atomized particles during their movement toward the article.

2. Apparatus for coating an article comprising, in combination, an atomizer having an elongated discharge edge to which liquid is supplied as a film for atomization therefrom, means including a high voltage source for establishing between the article and liquid on said discharge

4

edge an electrostatic field having a potential difference sufficient to atomize the liquid and move the atomized particles toward said article in the form of a spray, means for supporting the article in opposed relation to the atomizer and at a sufficient distance to permit substantial dispersion of the atomized particles during their movement toward the article, and a field modifying member supported adjacent said discharge edge, said field-modifying member terminating in an extended edge which projects forwardly of said discharge edge toward said article and into the peripheral portion of the field to compress said portion of the field.

3. The invention set forth in claim 2 with the addition that said field modifying member is made of electrically insulating material and is maintained in the same electrical relationship to the article as is the atomizer.

4. In an electrostatic coating system, an atomizing device for use in the electrostatic deposition of liquid coating material on an article comprising a discharge head having an elongated edge, means for supplying liquid coating material to said edge as a film for atomization therefrom, means for causing relative movement between said head and the article, means for creating an electrostatic charge differential between the atomized particles and an article electrostatically to deposit the particles on the article, and field modifying means secured to said head with a terminal portion projecting beyond said elongated edge and located adjacent to and beyond the extremities of the liquid on said edge.

5. In an electrostatic coating system, an atomizing device for use in the electrostatic deposition of liquid coating material on an article comprising a discharge head having a member of electrically conductive material provided with an elongated edge, means for moving the article in a predetermined path adjacent said edge, means for supplying liquid material to said edge and for forming the material into a film thereat for atomization from an edge of the film, means for creating an electrostatic charge differential between the coating material particles atomized from said edge and the article to form therebetween an electrostatic field for moving the atomized particles of coating material through quiescent air and depositing them on said article, and a field modifying member positioned in fixed relationship to said head and provided with at least two spaced portions located adjacent to and projecting beyond said elongated edge to compress the peripheral portions of said depositing field.

6. Apparatus for coating an article comprising, in combination, an atomizer supported in opposed spaced relationship to an article to be coated and having a discharge member, means for supplying liquid coating material to said atomizer, means including said discharge member for forming the material fed to said atomizer into a film having an elongated edge for atomization from said edge, means for causing relative movement between the article and the atomizer, means including an electrode adapted to be connected to a high voltage source for establishing between the article and the coating material particles atomized from the atomizer an electrostatic field having a potential difference sufficient to move the particles through quiescent air toward the article for deposition thereon, with the spacing between said atomizer and the article being sufficient to permit substantial dispersion

5

of the particles during their movement toward the article, and a field-modifying member having an end portion, said end portion projecting forwardly of said edge to constrict the depositing field at the location of said end portion.

7. Apparatus for coating an article comprising, in combination, an atomizer supported in opposed spaced relationship to an article to be coated and having a discharge member, means for supplying liquid coating material to said atomizer, means including said discharge member for forming the material fed to said atomizer into a film having an elongated edge for atomization from said edge, means including a high voltage source for establishing between the article and the coating material particles atomized from the atomizer, an electrostatic field having a potential difference sufficient to move the liquid particles through quiescent air toward the article for deposition thereon, with the spacing be-

6

tween said atomizer and the article being sufficient to permit substantial dispersion of the particles during their movement toward the article, and field-modifying means having at least two portions supported to project in opposed relationship forwardly of said edge to constrict said field at the location of the projecting portions.

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