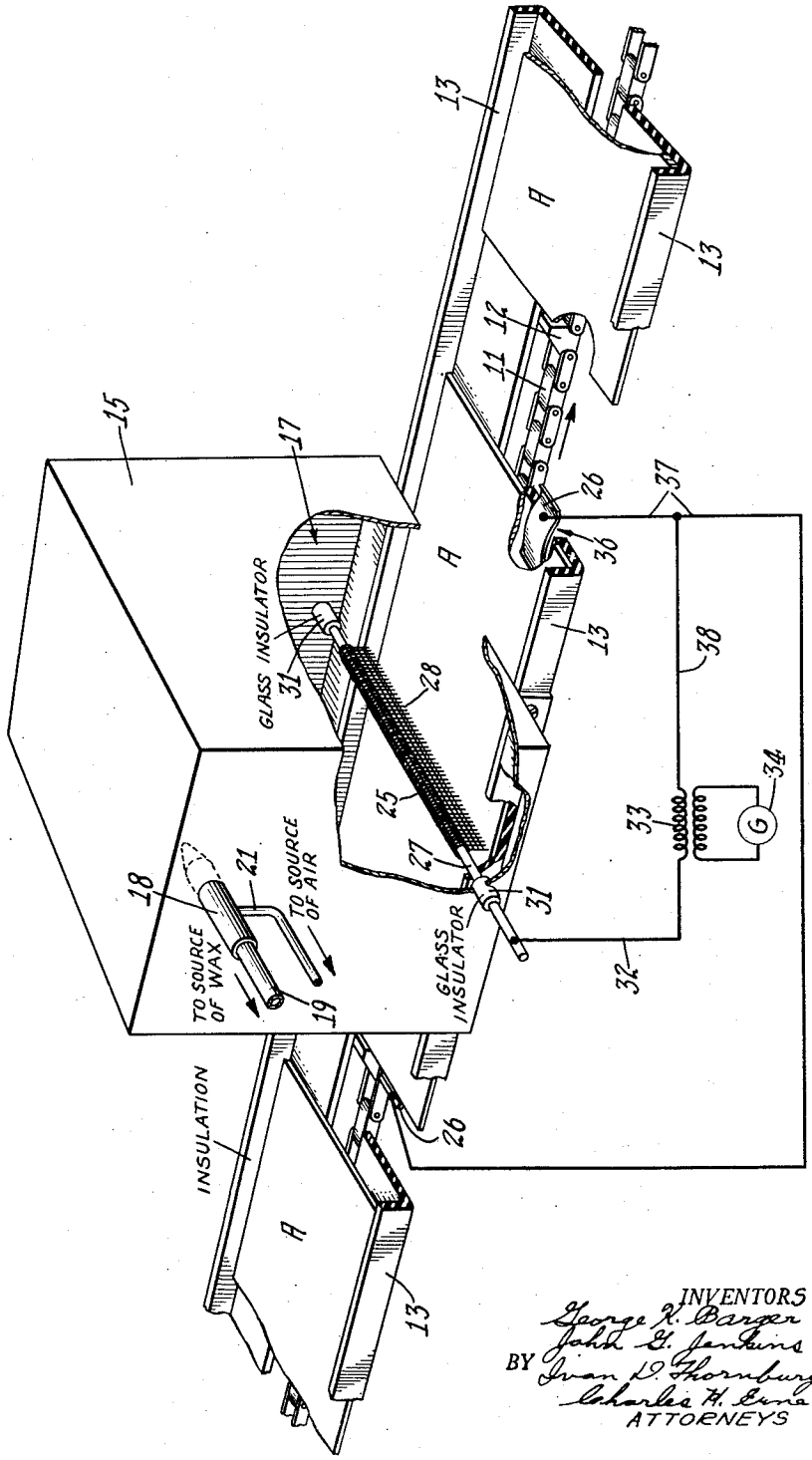
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APPARATUS FOR ELECTROSTATICALLY COATING ARTICLES

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APPARATUS FOR ELECTROSTATICALLY COATING ARTICLES

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1

The present invention relates to a method of and apparatus for electrostatically depositing finely divided material particles upon an article and has particular reference to a self-rectifying electric circuit using alternating current for establishing a unidirectional electrostatic field used in the method and apparatus.

An object of the invention is the provision of a method of and apparatus for electrostatically depositing finely divided coating material particles upon an article wherein a unidirectional electrostatic field for charging the material particles may be readily established by the use of alternating current without the aid of extraneous rectifiers so that the electric equipment needed is greatly simplified and the use of expensive and elaborate rectifiers is entirely eliminated.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawing, the single figure is a perspective view illustrating method steps and apparatus embodying the instant invention, the view including a wiring diagram of the electric apparatus used, parts of the apparatus and articles passing therethrough being broken away and shown in section.

As a preferred embodiment of the invention the drawings illustrate a method of and apparatus for electrostatically depositing finely divided material particles upon articles in a manner which is an inventive improvement upon that disclosed in United States patent Reissue 22,419, issued January 11, 1944, to J. S. Smyser on Method for Making Abrasive Articles and Apparatus Therefor and United States Patent 1,855,869, issued April 26, 1932, to E. Pugh, on Method of and Apparatus for Coating Articles.

In the instant method invention finely divided particles of coating or lubricating material such as wax are electrostatically deposited onto metal sheets A, such as tin plate or the like from which containers or cans and parts thereof are made, the material being deposited in a uniform film over one entire surface of the sheets to coat or lubricate and protect this surface during subsequent handling. Usually the surface to be coated or protected is a newly lithographed or otherwise decorated or coated surface. Lubrication of the surface is provided for subsequent cutting and drawing operations to be performed on the sheets.

2

As an illustration of the steps of the invention, heated, molten or liquid paraffin, micro crystalline wax or other suitable lubricating or coating material is precipitated or dispersed in a finely divided state into an enclosed space or housing disposed adjacent a pair of spaced electrodes, one of which is multiple pointed or attenuated and the other in the form of a plate. These electrodes are energized to set up between them an electrostatic field of force. The sheets A are passed through this electrostatic field to receive the film of wax hereinbefore mentioned.

The electrostatic field of force is established by applying alternating current directly to the electrodes without the aid of a separate rectifier. In thus directly applying alternating current to the electrodes it has been found that the electrodes possess self-rectifying characteristics which set up a high potential gradient on the pointed or attenuated electrode and a low potential gradient on the plate electrode. Thus the attenuated or multiple pointed or sectioned electrode tends to discharge a high voltage more readily than the plate electrode.

Hence the electrostatic field is predominantly unidirectional from the attenuated electrode to the plate electrode. It is believed that this rectification of the directly applied alternating current is slightly imperfect, inasmuch as there is a slight tendency for some negatively charged electrons to return from the plate electrode. However these returning electrons are so small in number that they may be considered negligible and for all practical purposes the electrostatic field is unidirectional.

In such an electrostatic field, the finely divided material particles floating in the intervening space between the electrodes, become charged and travel toward and impinge against the sheets A as they pass through the field and do not reverse and impinge in any great quantity against the attenuated electrode. As a matter of convenience the sheet A itself may be made the plate electrode by having the sheet engage against an electric contact.

In one exemplified form of apparatus shown in the drawing for carrying out the steps of the instant method, the sheets A to be coated are fed in spaced and timed order in a continuous procession along a straight line path of travel by a continuously moving chain conveyor 11 having feed dogs 12 secured thereto for propelling engagement with the sheets. The conveyor may be operated in any suitable manner. The moving sheets are supported and guided, in a horizontal

position with the surface to be coated facing upward, by a pair of longitudinal spaced and parallel guide rails 13 preferably made of insulating material.

During their travel along the guide rails 13, the sheets A pass under a housing 15 which is secured to the guide rails and which is provided with an open bottom adjacent the path of travel of the sheets. The housing encloses a space 17 which constitutes a precipitating chamber and into which the finely divided particles of wax hereinbefore mentioned are precipitated or dispersed.

The particles of wax are precipitated into the chamber 17 by a conventional spray gun or nozzle 18 which extends through one side of the housing, preferably adjacent its closed top as shown in the drawing. This nozzle is connected to a pipe 19 which leads from a suitable source of molten, heated or liquid lubricating or coating material. The nozzle is also connected to a tube 21 which leads from a suitable supply of compressed air for spraying the wax into the chamber.

The electrostatic field of force for charging the floating particles of wax dispersed into the chamber 17 is established between a stationary comb or attenuated electrode member 25 disposed within the chamber 17 and a pair of stationary plate electrodes 26 disposed below the path of travel of the sheets A. The comb electrode member 25 preferably is made of copper mesh screening wound around a conductor bar 27 and having a plurality of closely spaced wires or electrodes 28 depending therefrom. This comb member is disposed transversely of the path of travel of the sheets A with the wire electrodes 28 extending downward toward the passing sheets and terminating in spaced relation to the sheets. It has been found that a space of approximately an inch and a quarter between the terminal ends of the wire electrodes and the sheets is sufficient for all practical purposes.

The conductor bar 27 that supports the comb electrode member 25 extends through glass insulators 31 carried in the side walls of the housing 15. One end of this bar extends beyond the housing and is connected by a lead wire 32 to the secondary of a transformer 33 receiving alternating current from a suitable source of such current such as a generator 34. For best results the transformer should have an output of from 10,000 to 30,000 volts.

The plate electrodes 26 preferably are spring brushes or fingers disposed in recesses 36 formed in one of the guide rails 13 for contact with the metallic sheets A as they pass along the rail. These brushes are secured to the rail in any suitable manner and are connected by lead wires 37, 38 to the secondary of the transformer 33. There are two plate electrodes 26 located so that a sheet passing under the housing 15 will always be in contact with one of them. Thus the sheet itself serves as the plate electrode.

Thus with a high voltage alternating current connected to the comb or attenuated electrode member 25 and the plate electrodes 26 an electrostatic field of force is set up between these electrodes as hereinbefore mentioned. Since the comb electrode member 25 comprises a plurality of slender sharp wire electrodes 28, the potential on these electrodes is somewhat higher than that on the plate electrodes 26. Hence electrons on the electrodes 28 tend to be impelled toward the plate electrodes 26 and do not return in any great quantity. Thus these electrodes with a difference in alternating potentials possess self-rectifying characteristics which produce a unidirectional electrostatic field of force without the aid of any extraneous and more complicated rectifiers. It is this self-rectified unidirectional electrostatic field of force that charges the particles of wax that float into the field and thereby propels them toward and impinges them against the sheets A in a uniform film thereon as the sheets pass between the electrodes.

If the sheets to be coated are made of a material other than a metallic material so that they are unsuited in themselves to serve as the plate electrode, the guide rails 13 may be made of a metallic material and connected to the transformer 33 to serve as the plate electrode, the sheets being passed as above described between the electrodes to receive the charged particles of coating material.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction, and arrangement of parts of the apparatus mentioned herein and in the steps and their order of accomplishment of the process described herein, without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the apparatus and process hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. In an apparatus for electrostatically depositing finely divided particles of material upon an article, the combination of a precipitating chamber, a plate electrode in the bottom of said chamber, a plurality of closely spaced attenuated and pointed electrodes in said chamber spaced above and directed generally toward said plate electrode, electric means connected to said electrodes for applying an alternating potential thereto for establishing a self-rectified unidirectional electrostatic field of force between said electrodes, means for precipitating finely divided particles of material into said precipitating chamber above said electrostatic field to insure thorough distribution of the particles while floating downwardly toward said field, and means for introducing an article into said field, said finely divided particles floating into said field and being charged therein to cause electrostatic deposition of the finely divided particles of material upon the article.

2. In an apparatus for electrostatically depositing finely divided material particles upon a metallic article, the combination of a precipitating chamber, a feeding device for advancing metallic articles in a predetermined path along the bottom of said chamber, a plurality of closely spaced and aligned attenuated and pointed electrodes disposed in the bottom of said chamber above the advancing articles said electrodes being directed downwardly toward the articles advancing along the bottom of said chamber, an opposed electrode disposed in the bottom of said chamber adjacent said path of the articles advancing under said pointed electrodes and being arranged to electrically engage said articles, electric means connected to said electrodes for applying an alternating potential thereto the charge on said pointed electrodes always being different from the charge on said opposed electrode and on its engaged article for establishing a self-rectified unidirectional electrostatic field of force between said attenuated electrodes and said article, and

means located in the top of said precipitating chamber for spraying finely divided particles of material into a space above said electrostatic field to insure thorough distribution of said particles while floating down in said chamber, said particles as they float into the field being charged therein and electrostatically deposited upon the article.

3. In an apparatus for electrostatically depositing finely divided particles of material in a uniform film coating upon an article, the combination of a plate electrode, a fine wire mesh screen disposed above said plate electrode and having a plurality of fine wire ends freely projecting along an edge of the screen and constituting a multiplicity of substantially pointed electrodes each directed generally toward said plate electrode, a source of electric energy directly connected to said plate and wire electrodes for applying an alternating potential thereto to establish a self-rectified unidirectional electrostatic field of force between said wire electrodes and said plate electrode, means for introducing finely divided particles of material into the upper part

of said electrostatic field said particles floating into the field and being electrically charged therein, and means for moving an article into said field between said wire and plate electrodes to cause electrostatic deposition of the charged particles on said article.

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