Oct. 5, 1954 J. C. MARSH 2,690,730

ELECTROSTATIC COATING APPARATUS

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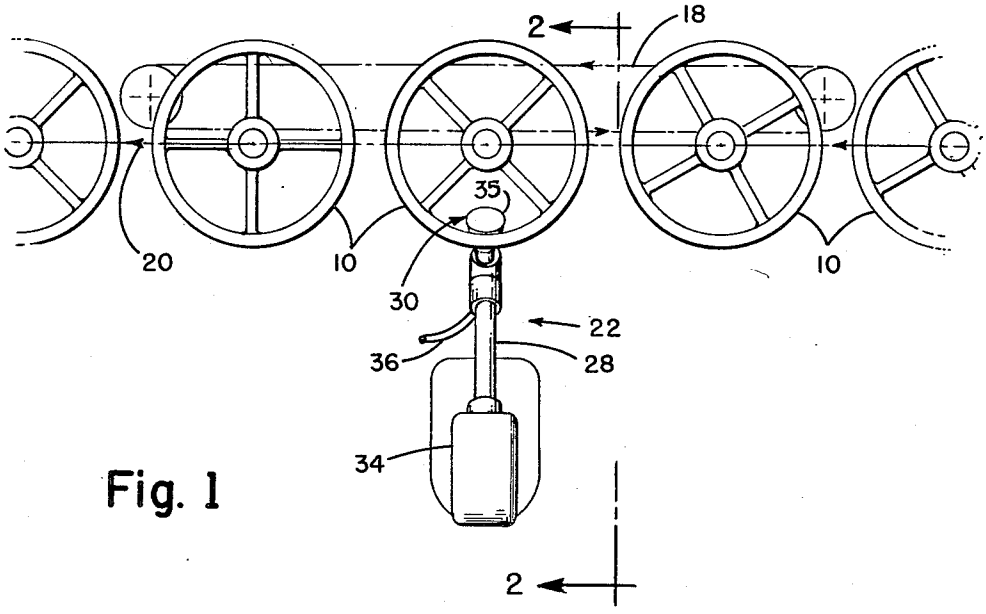


Fig. 1

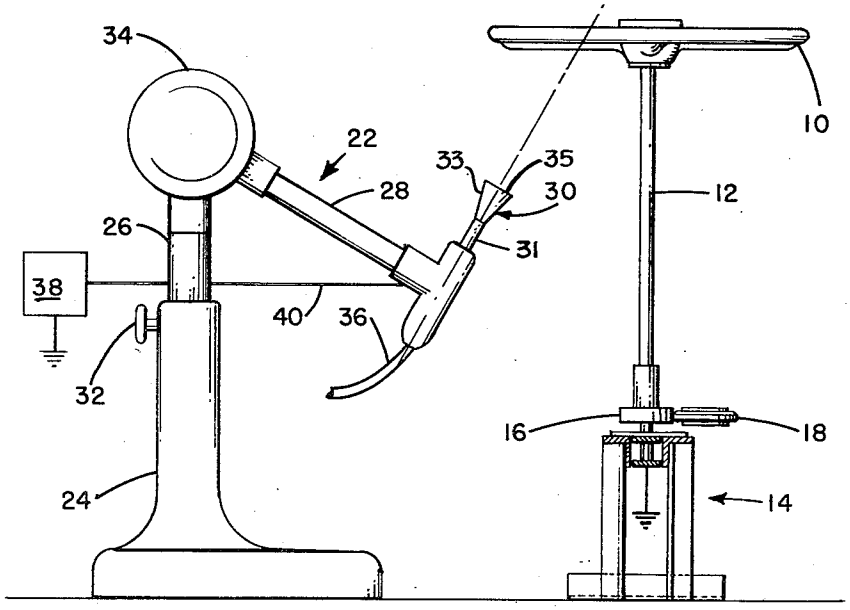


Fig. 2

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ELECTROSTATIC COATING APPARATUS

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6 Claims. (Cl. 118—51)

1

This invention relates to the electrostatic coating of articles.

Articles such as automobile steering wheels have previously been coated by electrostatically depositing an atomized paint on them as they are moved in an elongated coating zone as is shown in the copending application of William A. Starkey, Serial No. 689,116, filed August 8, 1946, now abandoned. While coating such articles by the method just referred to obtained markedly improved efficiency over conventional mechanical and hand spray methods, some paint still passed through the electrostatic field without being deposited on the articles, and therefore spray booths were still required for surrounding the coating station to carry away the overspray.

In order to improve still further the efficiency in applying coating material to such articles, electrostatic atomizing apparatus such as that illustrated in the copending application of E. M. Ransburg, Serial No. 143,994, filed February 13, 1950, was tried. However, it was found that while the efficiency of depositing the coating material sprayed on articles being coated with such apparatus was increased such that 97 percent of the coating material sprayed was deposited onto the article, the distribution of the deposited coating material was sufficiently uneven as to make the process unsatisfactory for commercial use.

Therefore, it is an object of this invention to provide novel electrostatic apparatus for applying a coating to three dimensional articles with a film thickness of commercially satisfactory uniformity.

Another object of this invention is to apply a coating to surfaces of open-work articles electrostatically whose film thickness is of commercially acceptable uniformity.

A further object of this invention is to provide novel electrostatic apparatus for applying a coating of improved uniformity to round or wheel-shaped articles.

Still another object of this invention is to provide novel electrostatic apparatus for applying a coating of improved uniformity to a surface of a supported article adjacent its support.

A further object of this invention is to apply a coating of commercially satisfactory uniformity to a downwardly presented surface with electrostatically atomized coating material.

In one embodiment of my invention for coating a three dimensional article, such as an automobile steering wheel, one dimension of which is materially less than the other two, there is provided an apparatus which comprises a support

2

for holding the article to maintain its larger plane defined by the two greatest dimensions in a predetermined position. This apparatus also includes an electrostatic atomizing head, means for supplying liquid coating material to the atomizing head, means including a high voltage source for establishing a high potential difference between the liquid coating material on the atomizing head and the article for electrostatically atomizing the coating material and electrostatically depositing the atomized coating material on the article, and means for supporting the head in spaced relation from the article. This head support is constructed to permit arranging the head so that there is an angle of approximately 30 degrees between the axis of the head and a perpendicular to the larger plane of the article which intersects the head axis at the larger plane. This angle may be a few degrees above or below thirty degrees, but I have found that if the angle is less than twenty degrees or more than forty degrees the desired results are not obtained. Also the head is so supported that its axis, when projected, passes through the article as it is moved past the head.

The invention will now be described with reference to the drawing of which:

Figure 1 is a top plan view of apparatus for coating automobile steering wheels and Figure 2 is an end elevation view taken on line 2—2 of Figure 1.

Referring more specifically to the drawing, there is shown a plurality of articles 10, illustrated as automobile steering wheels, supported on spaced spindles 12 rotatably connected to conveyor 14. Each spindle 12 is provided with a pulley 16 which is adapted to be brought into engagement with movable belt 18 to rotate the supported articles 10 while they are moved by the conveyor.

The conveyor 14 is arranged to move the articles 10 over a predetermined path in the direction of the arrow 20 past and in spaced relation to an electrostatic atomizing device generally indicated by the numeral 22.

The atomizing device comprises base 24, a standard 26, arm 28 and atomozing head 30. The standard 26 is mounted on the base 24 to move vertically and may be fixed in any desired position by knob 32. The arm 28 is pivotally connected to the standard 26 at 34 and may be fixed in any desired position. The arm is constructed of electrically insulating material to isolate the head 30 from ground. The head 30 is adapted to be rotated by being geared to a rotatable shaft (not

shown) in the hollow arm 28, which may be driven by any suitable means such as the motor at 34. The head 30 is arranged so that its axis is at right angles to the extent of the arm 28. The head 30 may be of any suitable construction. One such head is described in French Patent No. 982,327, published June 8, 1951. The head 30 shown comprises a shaft 31 and a flaring, recessed, conical bell 33 affixed to one end of the shaft. The shaft 31 is provided with an axial passage (not shown) which at one end communicates with the pipe 36 and at the other end communicates with the apex at the interior of the conical bell 33. Liquid coating material such as paint, lacquer or varnish is supplied to the conical bell 33 from a source (not shown) through pipe 36 and the passage in the shaft 31. Rotation of the head 30 distributes the liquid fed to the bell 33 in the form of a free-surfaced film over its inner surface and flows to its outer peripheral edge 35. A high potential difference for example 90 kilovolts D. C. is maintained between the liquid coating material supplied to the atomizing bell 33 and the articles 10 by connecting the head to one terminal of a high voltage source 38 by means of conductor 40. The other terminal of the high voltage source is grounded as is the conveyor 14.

In operation the articles 10 are supported on the spindles 12 of the conveyor 14 so that they are maintained in position so that their larger planes are in horizontal positions. These articles are moved by the conveyor 14 over a predetermined path past the atomizing device 22 for being coated thereby. In order to obtain the desired distribution of coating material on portions of the articles 10, the head 30 is arranged so that it is below and to one side of the articles 10 as they move past the head, and the head is sufficiently spaced from the conveyor 14 and articles 10 to avoid sparking. Also the head 30 is so arranged that the axis of the head or spray is at an angle of approximately 30 degrees to the vertical and, when projected, this axis passes within the bounds of the articles as they move past the head. While I have obtained excellent results with the axis of the head arranged at 30 degrees to the vertical, satisfactory results are also obtainable if this angle is not less than 20 degrees or more than 40 degrees.

While I have shown and described one particular embodiment of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. In apparatus for electrostatically coating a series of similar three-dimensional articles in each of which one of the three mutually perpendicular over-all dimensions is materially less than either of the other two, means for moving the articles translationally over a predetermined path in a coating zone, said article moving means including supports for holding the articles with the sides defined by the two greatest dimensions in generally horizontal positions, an electrostatic atomizing head, means for supplying liquid coating material to said head, means including a high voltage source for establishing an electrostatic field of sufficient strength between the liquid coating material on said head and the articles for electrostatically atomizing the coating material from said head and electrostatically depositing the coating material on the articles in the coating zone, means for supporting said head spaced from the path of article movement with the axis of said head lying in a plane normal to the article path and with the axis of said head being at an angle of approximately 20 to 40 degrees to the vertical and passing within the bounds of the articles as they move past said head, and means for rotating the articles during at least a portion of the translational movement in the coating zone.

2. In apparatus for electrostatically coating a series of similar three-dimensional open-work articles in each of which one of the three mutually perpendicular over-all dimensions is materially less than either of the other two, means for moving the articles over a predetermined path, said means including supports for holding the articles with the sides defined by the two greatest dimensions in generally horizontal positions, an electrostatic atomizing head, means for supplying liquid coating material to said head, means including a high voltage source for establishing an electrostatic field of sufficient strength between the liquid coating material on said head and the articles for electrostatically atomizing the coating material from said head and electrostatically depositing the coating material on the articles, and means for supporting said head spaced from the path of article movement below and to one side thereof and with the axis of said head being at an angle of approximately 30 degrees to the vertical and passing within the bounds of the articles as they move past said head.

3. In apparatus for electrostatically coating a three-dimensional article in which one of the three mutually perpendicular over-all dimensions is materially less than either of the other two, means for supporting the article to maintain the larger sides defined by the two greatest dimensions in predetermined positions, means for rotating the supported article, an electrostatic atomizing head, means for supplying liquid coating material to said head, means including a high voltage source for establishing an electrostatic field of sufficient strength between the liquid coating material on said head and the article for electrostatically atomizing the coating material from said head and electrostatically depositing the coating material on the article, and means for supporting said head spaced from the article and to one side of one of said larger sides, said head being so arranged that there is an angle of approximately 20 to 40 degrees between the axis of said head and a line generally perpendicular to one of said larger sides.

4. In apparatus for electrostatically coating a three-dimensional article in which one of the three mutually perpendicular over-all dimensions is materially less than either of the other two, a support for the article to maintain the sides of the article defined by its two greatest dimensions generally perpendicular to the longitudinal axis of said article support, an electrostatic atomizing head, means for supplying liquid coating material to said head, means including a high voltage source for establishing an electrostatic field of sufficient strength between the liquid coating material on said head and the article for electrostatically atomizing the coating material from said head and electrostatically depositing the atomized coating material on the article, and means for supporting said head spaced from the article and its support and on

the same side of said article as is said article support, said head being so arranged that there is an angle of approximately 20 to 40 degrees between the axis of said head and the longitudinal axis of said article support.

5. Apparatus for electrostatically coating a plurality of similar three-dimensional articles in each of which one of the three mutually perpendicular overall dimensions is materially less than either of the other two, comprising a conveyor for moving the articles over a predetermined path, said articles being oriented on said conveyor so that a side of each article defined by its two greatest dimensions moves generally in the same predetermined plane, means for creating a spray of charged coating material particles at a point spaced from said conveyor, said spray creating means being spaced close enough to the article path to envelop the articles with the spray as they move past said spray creating means and being arranged so that its axis lies in a plane generally transverse to the article path and is at an angle of approximately 20 to 40 degrees to a perpendicular to said predetermined plane, and means for establishing an electrostatic field between said spray creating means and the articles, said field being substantially the sole medium for depositing the spray onto the articles.

6. Apparatus for coating a plurality of automobile steering wheels or like articles, comprising a conveyor including suitable workholders for moving said wheels along a predetermined path with their faces arranged horizontally, an atomizing head spaced from said wheels for creating a spray of coating material particles, said head being arranged with its axis lying in a plane generally transverse to the conveyor path and at an angle of 20 to 40 degrees to the vertical, a projection of said axis passing through the bounds of the wheels moving past said head, and means including a source of high electrical potential for establishing an electrostatic field between said head and the wheels of sufficient strength to charge the coating material particles, move them from said head and deposit them onto the wheels as a coating.

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