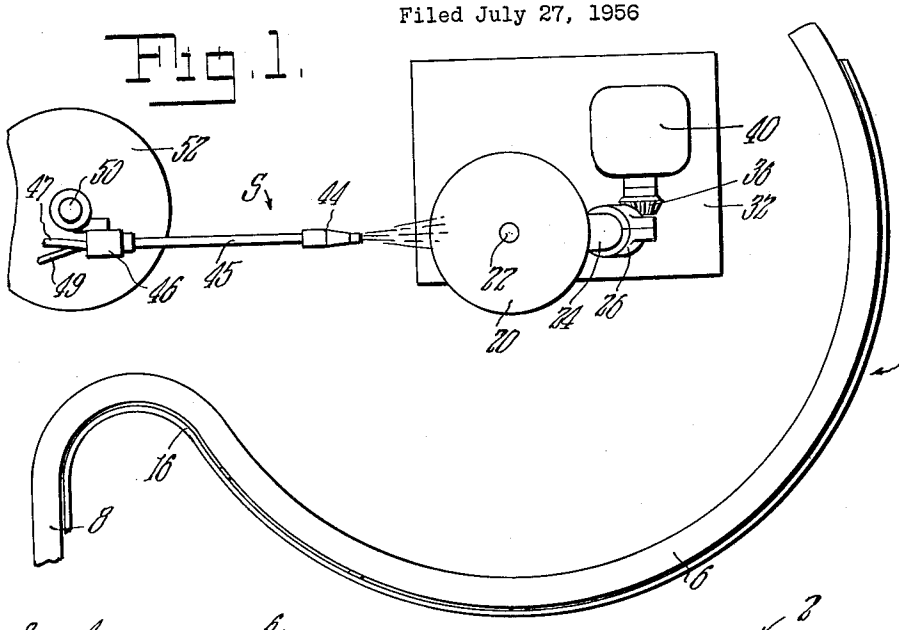
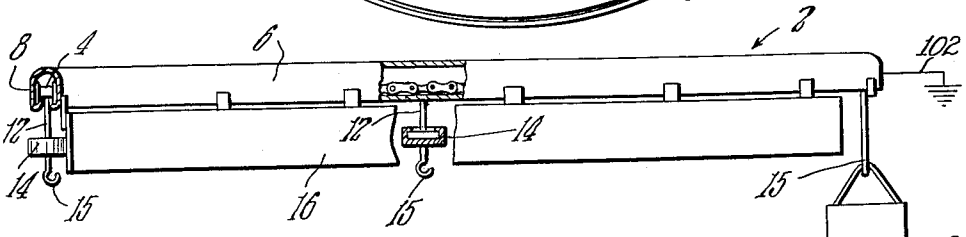
Sept. 26, 1961 J. SEDLACSIK, JR 3,001,890

ELECTROSTATIC DEPOSITION

Filed July 27, 1956

Fig. 1.





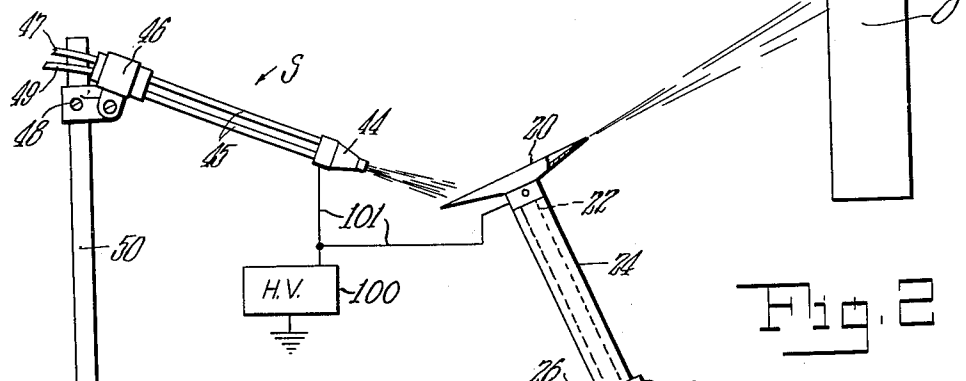


Fig. 2

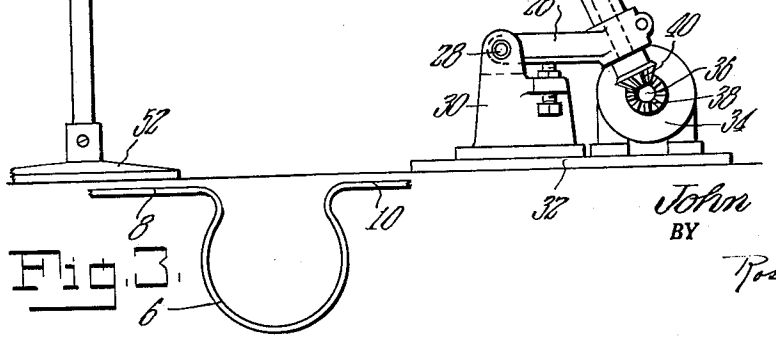


Fig. 3

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ELECTROSTATIC DEPOSITION

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12 Claims. (Cl. 117—93)

This invention relates to improvements in a process of and apparatus for electrostatic coating.

Electrostatic fields have been utilized previously in the art of coating. They have been utilized for charging and depositing liquid particles which have been previously atomized by air or mechanical means. Electrostatic fields have also been utilized for detearing articles which have been previously dip coated.

Electrostatic application of coating materials has many advantages. It greatly increases the efficient use of coating material. It diminishes the necessity of ventilation. It permits carrying on coating operations in smaller space or area and furthermore the required apparatus for electrostatic deposition is simplified. Coating is furthermore carried on under much cleaner conditions. And most importantly, great savings in coating materials expended are enjoyed.

One object of the present invention is to provide an improved method of and apparatus for coating in which electrostatic techniques are utilized.

Further objects of the present invention are to obtain more efficient use of the coating material, to obtain more uniform coating, and to obtain better control over the atomized coating material as it is dispensed.

The use of this invention increases efficiency of operation and creates a more uniform distribution of the coating material for the reason that same is initially ionized at the spray nozzle and is subsequently distributed onto a rotating disc which in turn reionizes the coating material and breaks it up into finer particles due to its centrifugal action.

In accordance with the present invention, new methods and apparatus are provided for breaking up the liquid material in the form of a spray, which spray may thereafter be utilized for coating surfaces.

Herein is an apparatus for the deposition of coating material onto objects which includes a rotatable disc or electrode which is adapted to receive and project the electrified coating material from the periphery thereof and envisions employment in combination therewith of a conveyor having a chain mechanism movable therealong for supporting the objects to be coated. A portion of this conveyor is disposed about the axis of rotation of the disc affording movement of the articles being coated about said axis.

As a special feature of the invention, there is provided a rotatable disc which may be angularly disposed or tilted relative to the objects being coated so that by such tilting of the disc, an enlarged area of the objects may be covered as some are moved around the disc. That is to say, by tilting the disc, a larger or greater area of coverage longitudinally of the vertical axis of the object as same moves around the disc is made possible. By such means, the necessity for any vertical reciprocation of the disc is obviated.

For some applications, a conveyor with a series of U's or loops may be employed depending upon the conveyor speed used and the film thickness of coating material required on the object to be coated.

The apparatus thus far described is adaptable for applying coating material to the surface of an article. In such adaptation, the apparatus comprises a conveyor support for an article to be coated, an applicator means,

means for supplying liquid coating material, and a source of electrical potential.

In the drawings forming a part of this specification, there has been indicated conventionally, suitable apparatus for carrying out my invention with respect to both the process and apparatus aspects. In said drawings, the apparatus shown is by way of illustration only, and not by way of limitation, inasmuch as my invention may be carried out in many other ways.

In the drawings;

FIG. 1 is a plan view of coating apparatus embodying the novel features of the invention;

FIG. 2 is a side elevational view of the apparatus shown in FIG. 1; and

FIG. 3 is a plan view, at small scale, of the conveyor of the apparatus shown in FIGS. 1 and 2.

In the following description and claims, various details will be identified by specific names for convenience. These names however are intended to be as generic in their application as the art will permit.

Referring now to the drawing more in detail, in which similar characters of reference indicate corresponding parts in the several figures, said drawing disclosing the preferred form of my invention selected for illustrative purposes, I have shown an overhead conveyor run which is in the form of an inverted U-shaped or circular track 2 in order that the general relation and utility of the device may be better understood.

The U-shaped or circular track 2 has the usual conveyor chain 4 slidable therealong.

The conveyor run, as in FIG. 3, has a loop or circular portion 6 and run portion 8 and 10 leading thereinto and extending outwardly therefrom respectively.

As will later appear, the loop or circular portion 6 of the conveyor track encircles apparatus for coating articles suspended from and carried by the conveyor chain 4.

Rod members 12 extend, at intervals, downwardly from the conveyor chain 4. Rollers 14 are rotatable on lower ends of the said rod members and depending hooks 15 are carried by the rotatable members for supporting objects to be coated, such as O.

In some instances, the object to be coated is preferably not rotated through the coating area in which case non-rotating hooks are employed.

A rail 16, adjacent the conveyor track, particularly the loop portion 6 thereof, is secured thereto. As the chain 4 moves in the conveyor track, the roll members 14 bear on the rail 16 so that they are rotated. The objects O to be coated are suspended from the rollers 14 and are rotated as they are carried around the curving or loop portion 6 of the track.

A distributing disc 20, which may be flat or dished, and ribbed or corrugated, is fixed on a shaft 22 that is rotatable in a supporting member 24. Said disc may be disposed in a horizontal plane or may be inclined at any desired angle.

The disc 20 is preferably made of electrical conducting material and is provided with an edge of knife like sharpness in cross section.

The disc 20 is insulated from the ground or base by means of an insulated shaft member.

Preferably, the film, at least at the discharge edge of the disc, is of substantially uniform thickness. If the disc is smooth and the edge thereof is knife like in sharpness, as is preferable, and is smooth and free from any abrupt changes in direction, the potential gradient of the field will be as uniform as possible along it.

The lower end of the member 24 is secured in the outer end of an arm 26 which is pivoted at 28 to a bracket 30. Said bracket 30 will preferably be secured to a floor plate 32. A motor 34 is secured to said floor plate 32 and has a shaft 36 to which is fixed a gear 38 that is in mesh with a

gear 40 fixed to the shaft 22. As the motor 34 is energized, the shaft 22 and thereby the disc 20 are rotated.

Depending upon the configuration of the article being coated, the disc may be used at any angle so as to best accommodate the same.

A spray device is represented by S which, for purposes of disclosure, includes a spray nozzle 44 or head and an inner body 46. The nozzle and body are connected by elongated insulating tubes 45 for the flow of coating material and air under pressure from the body to the nozzle by which the coating material is sprayed on to the disc 20. The body will of course be connected to a supply of coating material and air source by conduits 47 and 49 respectively.

The body 46 is secured to a bracket 48 that is slidable for adjustment on a post 50 which is fixed to and extends upwardly from a floor base 52. The body 46 may be rotatably adjustable on the bracket 48.

Objects to be coated and represented by O are carried by the hooks 15 of the conveyor chain around the axis of rotation of the disc 20 and simultaneously the objects O are rotated by means of the rolls 14 in engagement with the rail 16.

Coating material sprayed onto the rotating disc 20 by the nozzle 44 is distributed thereby or projected radially onto the objects O.

The axis of rotation of the disc 20 being angular to the axis of travel of the objects O around the track portion 6 of the conveyor track and the objects being in rotation, all sides of the objects throughout their length receive coating material.

The coating material will be directed by the nozzle 44 on to such a portion of the disc 20 that said disc will most efficiently distribute or project coating material onto the rotating objects as they are carried around the rotating disc 20.

The high voltage source (not shown) is led to the head end 44 of the spray gun S and to the disc 20 so as to raise same to a sufficiently high potential to charge the liquid supplied thereto and discharged therefrom. The output from the source may be a unidirectional or direct current of high potential.

The operation of the invention may be carried out by presenting in a predetermined position the leading annular edge of an extended, thin stream of liquid material and moving an article past this leading edge and in spaced relation thereto.

The electrical potential at the gun S is of sufficiently high value to electrostatically charge the liquid material therefrom as it passes to the disc and subsequently is deposited on the article to be coated. When the liquid material is under controlled pressure, the pressure may be adjusted for varying the atomization of the liquid material from the gun S. The potential source is electrically connected or coupled to the structure S and disc 20 and to raise the head 44 and disc 20 to a sufficiently high electrical potential for electrostatically charging liquid material supplied thereto.

When the first articles on the conveyor move into the coating zone, electrical potential is supplied to the device S and disc 20 and the liquid coating material is supplied to the disc and outwardly to the discharge edge thereof.

As the articles pass therearound, they are first sprayed with a mist coat of atomized material. As the articles move into the spray, a heavier spray of atomized material is applied thereto. As the articles move around and beyond the disc, the amount of material applied to them gradually decreases until they move out of the coating zone. At this time, the articles are completely coated.

If desired, a conventional grounded spray gun can also be used. In such instance, the high voltage may be applied directly to the insulated disc and the spray gun may be held at a distance from the disc so as to prevent arcing.

Also, if desired, the spray gun may be grounded and the high voltage may be applied directly to a grid ring or any shape of electrode which is disposed so as to charge the disc which is insulated. In this instance, the disc will also be at high potential due to the capacity effect between the grid ring or electrode and the disc itself.

One arrangement of electrical circuitry is shown in FIG. 3, wherein a block 100 carrying the legend H. V. (high voltage) is shown having a high voltage source connected to charge the nozzle 44 and the disc 20, via conductor means 101. The opposite side of the high voltage source 100 is connected to ground, shown by symbol. The conveyor, which is metal, is also connected to ground by conductor 102. With the electrical arrangement shown in FIG. 3, or at any time when the disc 20 is charged either directly or indirectly, and the object to be coated "O" is connected to ground either directly or indirectly, there is an electrostatic field between the atomizer and the object for charging the atomized coating material projected from the disc 20, to facilitate deposition of the atomized coating material onto the surface of the object to be coated.

The article O illustrated is a metal canister and is preferably electrically grounded. However, as the conveyor system is grounded, satisfactory coating may be obtained without separate grounding of the articles. Also, it is not necessary that the articles being coated be of electrical conducting material. Satisfactory coating results have been obtained where the articles have been made of electrical insulating material such, for example, as earthenware, wood, and the like.

By this invention, superior atomization of liquids is obtained. Also, it is possible to disperse the atomized liquid material over extended areas with improved uniformity. Also, the patterns of the deposited liquid material may be varied in many ways to facilitate coating articles of many different shapes and sizes. It will thus be seen that there has been provided by this invention methods and apparatus in which the various objects hereinbefore set forth, together with many thoroughly practical advantages, are successfully achieved.

As various possible embodiments might be made of the mechanical and electrical features of the above invention and as the art herein described might vary in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

What it is desired to claim and secure by Letters Patent of the United States is:

1. Apparatus for simultaneously coating articles in different spray areas along a loop path of a conveyor article carrier, spray device means having a plurality of discrete atomizers spatially disposed relative to each other adapted to provide multiple spray atomization sequentially and establish an annular spray pattern for coating said articles, said discrete atomizers including a rotary atomizer having an annular peripheral discharge edge disposed in a plane to centrifugally project liquid coating material therefrom for coating said articles in said different spray areas and a nozzle atomizer disposed adjacent thereto and adapted to project a supply of coating material in atomized form onto a surface of said rotary atomizer to produce a resultant thin film of liquid coating material thereon to be centrifugally urged to the atomizing edge of the rotary atomizer and centrifugally projected therefrom.

2. Apparatus for simultaneously coating articles in different spray areas along a loop path of a conveyor article carrier as set forth in claim 1 and wherein means are provided for varying the plane of the annular peripheral discharge edge for controlling the vertical height of the effective spray pattern projected from the rotary atomizer onto the articles.

3. Apparatus for simultaneously coating articles as set forth in claim 1 and wherein means are provided for

charging the coating material to electrostatically facilitate deposition of the coating material onto the article.

4. Apparatus for coating articles along a path of a conveyor article carrier, spraying means including a plurality of discrete atomizers spatially disposed relative to each other adapted to provide multiple spray atomization sequentially and establish an annular spray pattern for coating said articles, said discrete atomizers including a rotary atomizer having an annular peripheral discharge edge disposed to centrifugally project liquid coating material therefrom for coating said articles and a nozzle atomizer disposed adjacent thereto and adapted to project a supply of coating material in atomized form onto a surface of said rotary atomizer to produce a resultant thin film of liquid coating material thereon to be centrifugally urged to the atomizing edge of the rotary atomizer and centrifugally projected therefrom and adjustment means to vary the plane of the discharge edge relative to the path of the conveyor to alter the vertical extent of the annular spray coverage.

5. Apparatus for coating articles as set forth in claim 4 and wherein means are provided adapted to charge at least one of the atomizers to facilitate deposition of the coating material onto the articles to be coated.

6. Apparatus for coating articles in a loop path of a conveyor, spray device means having a plurality of discrete atomizers spatially disposed relative to each other adapted to provide multiple spray atomization sequentially and establish an annular spray pattern for coating said articles, said discrete atomizers including a rotary disc type atomizer having a peripheral discharge edge to project liquid coating material therefrom for coating said articles and a nozzle atomizer adapted to spray coating material onto said rotary atomizer to be thereafter centrifugally projected therefrom, and control means for controlling the angle of the nozzle atomizer relative to the rotary atomizer to establish the angle of the spray from the nozzle onto the rotary atomizer.

7. Apparatus for simultaneously coating articles along a path of a conveyor article carrier as set forth in claim 6 wherein means are provided for establishing the verticle height of the effective spray pattern projected from said rotary atomizer onto the articles.

8. Apparatus for coating articles in a loop path of a conveyor as set forth in claim 6 and wherein means are provided for altering the position of the rotary disc-type atomizer to establish the effective vertical extent of the spray pattern.

9. Apparatus for coating articles in a loop path of a conveyor as set forth in claim 6 wherein means are provided adapted for charging at least one of the atomizers to facilitate electrostatic deposition of the coating material onto the articles to be coated.

10. The method of electrostatically coating articles comprising atomizing coating material into a spray by urging coating material and compressed air through a nozzle, directing the particles of said spray unconfined through free air onto a rotating disc forming a film thereon and centrifugally atomizing said particles, and thereafter charging said particles electrostatically to facilitate deposition thereof onto said articles.

11. The method of electrostatically coating articles with liquid coating material particles comprising the steps of progressively subjecting said liquid coating material initially to pneumatic force to atomize same and thereafter subjecting said atomized liquid coating material to centrifugal force for additional atomization of said liquid coating material, and electrostatically charging said particles to assist deposition of the liquid coating material atomized by said centrifugal force onto the articles to be coated.

12. The method of electrostatically coating an article with atomized liquid coating material comprising the steps of initially converting liquid coating material into an atomized spray of fine particles, feeding said spray of fine particles of liquid coating material onto a rotating atomizer, generating a final spray by subjecting said particles of liquid coating material to centrifugal force for converting said particles of liquid coating material a second time for further atomization into an atomized spray of fine particles, and subjecting said final spray of fine particles to an electrostatic force to facilitate deposition of said particles onto the surface of an article by said electrostatic force.

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