May 4, 1965 H. J. REINDL ETAL 3,181,502

MANUFACTURING APPARATUS AND METHOD FOR OPERATING THE SAME

Filed March 15, 1961 2 Sheets-Sheet 1

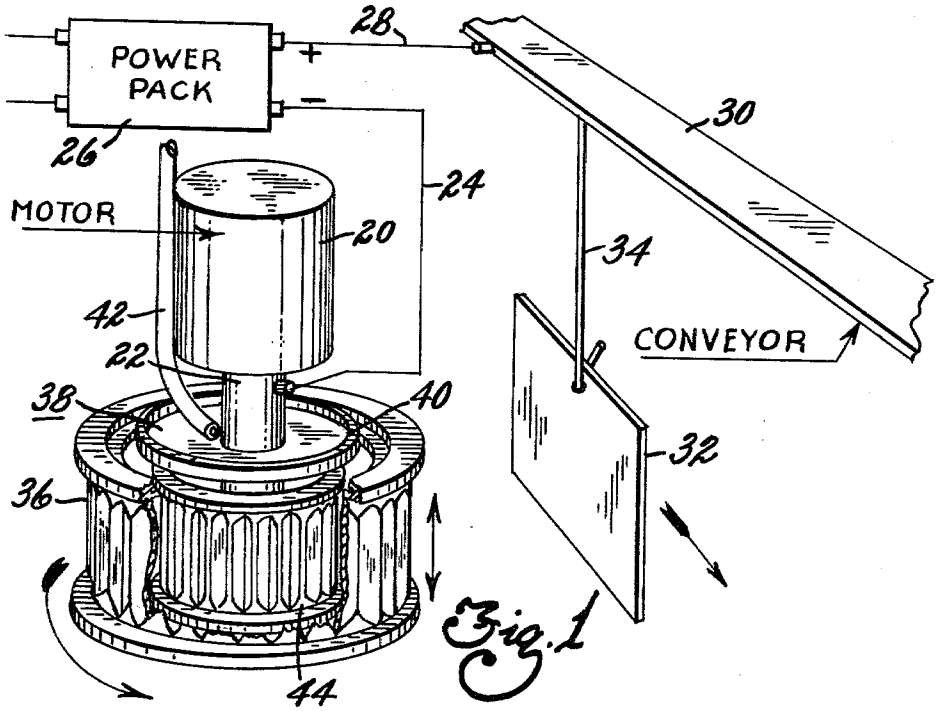


Fig. 1

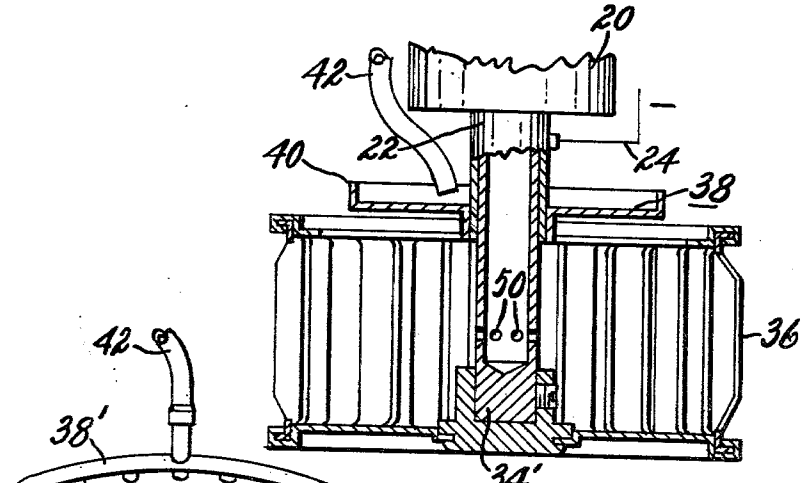


Fig. 2

Fig. 2a

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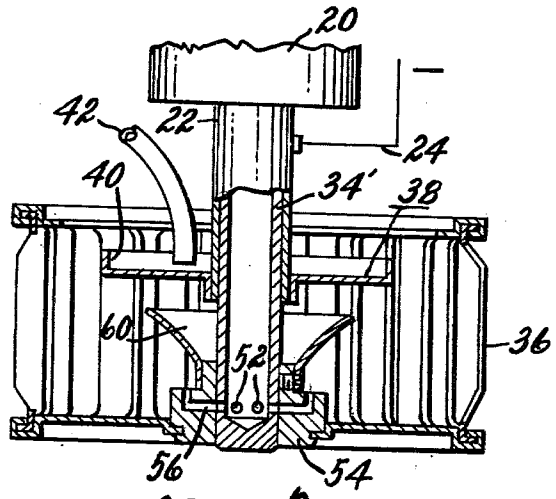


Fig. 3

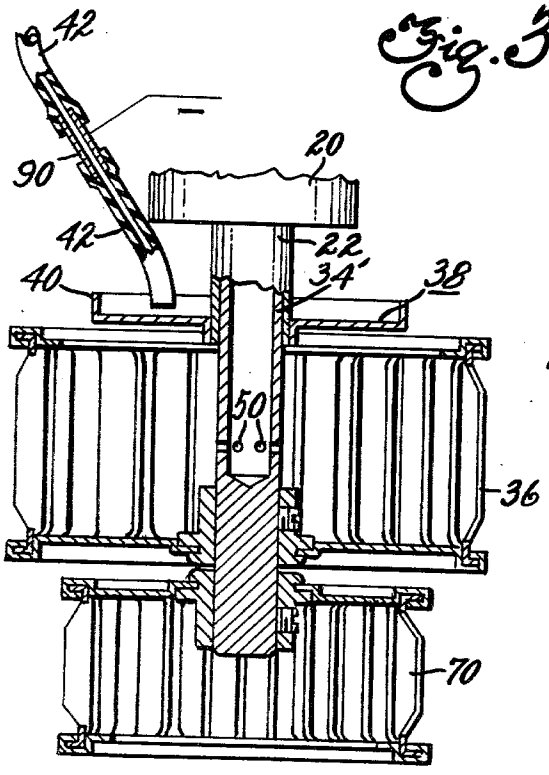


Fig. 4

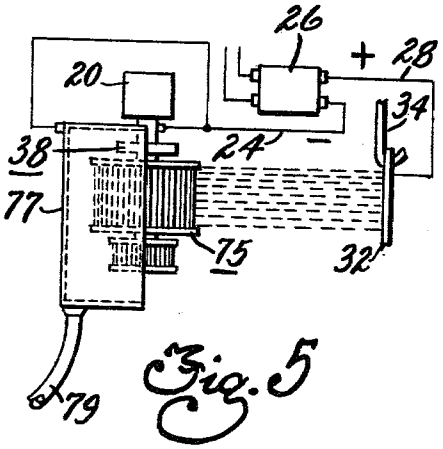


Fig. 5

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MANUFACTURING APPARATUS AND METHOD FOR OPERATING THE SAME

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Filed Mar. 15, 1961, Ser. No. 95,986
2 Claims. (Cl. 118—627)

This invention relates to coating operations and is particularly concerned with electrostatic coating operations and apparatus for carrying out the same.

The main object of the invention is to provide a new and improved method and apparatus for coating articles with a coating material wherein electrostatic forces are used in conjunction with moving air wherein the air transports the coating material in charged condition and to the part to be coated whereupon the electrostatic charges aid in deposition thereof.

In carrying out the above object, it is a further object to provide a method for electrostatically depositing paint onto an article wherein paint is supplied at a controlled rate through an electrostic charging zone and thereafter is concentrated and subdivided by supplemental physical forces for directing the charged paint and depositing the same on the article.

Another object of the invention is to provide an apparatus for carrying out the above object wherein an air moving means is utilized for concentrating charged paint material and for throwing the charged paint outwardly thereof in dispersed condition, means also being provided for supplying additional air to said first air moving means for aiding in the mechanical dispersion of the paint.

Another object of the invention is to utilize a squirrel cage blower as an air moving means and supplement the movement of air thereby through the use of additional air supply which provides additional air to the blower.

A still further object of the invention is to provide a second air moving means below the first air moving means for creating a physical movement of air in a zone beneath the first mentioned air moving means whereby paint particles being distributed and dispersed by the first air moving means are concentrated and the pattern thereof is modified.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIG. 1 is a perspective view partly in section showing one type of apparatus with a diagrammatic electrical circuit therefor.

FIG. 2 is a view in section of another type of air moving means.

FIG. 2*a* is a perspective view of a modified supply device.

FIG. 3 is a view in section of a third type of air moving means.

FIG. 4 is a view in section of the device shown in FIG. 2 incorporating a supplemental blower for controlling the pattern of paint deposition and FIG. 5 is a diagrammatic view showing the device of FIG. 4 in operation wherein the paint pattern is depicted by dash lines onto the article to be coated.

In copending application Serial No. 710,665, now Patent Number 2,976,175, filed January 23, 1958, a paint depositing method and apparatus are described. In this application a squirrel cage blower is used as a means for moving paint particles from the charging zone to the zone of deposition on the article. This apparatus operates efficiently and does a satisfactory job of depositing paint electrostatically. In this apparatus, however, it is necessary to control within rather precise limits the quantity of paint or other coating material which is supplied to the device in order to obtain optimum results. In other words, excessive power is required if the paint is not fully broken up by the electrostatic and mechanical forces.

The present invention is directed to an improvement over the invention disclosed in said Patent 2,976,175. In the present invention the same squirrel cage blower is used as an air moving means and a cup or supply dam is used as a means for supplying the paint thereto. However, the critical nature of the paint supply is greatly lessened through the use of supplemental air moving means. Thus, by following the present invention it is possible to utilize a greater quantity of paint or other coating material during the same time interval and with the same size blower mechanism and power source while obtaining a highly efficient coating operation wherein the particles of paint or other coating material are extremely small and uniform in size.

Specifically referring to FIG. 1, a motor 20 is shown which may be either electric or air driven and which has a housing 22 depended and insulated therefrom that is connected by wire 24 to one side of a power pack 26. The other side of the power pack 26 is connected by wire 28 to a conveyor 30 which carries an article 32 to be coated thereon by means of a conductive hanger 34. The hanger is suitably covered or coated to prevent any substantial paint deposition thereon except for the areas of contact with the article.

The housing 22 acts as a journal for a motor shaft 34', that is also insulated from the motor, when an electric motor is used, which carries at its lower end a squirrel cage blower unit 36. Electrically connected to the housing 22 and carried thereby is a shallow tray or paint supply plate 38 which is circular in form and concentrically mounted upon the housing 22. The plate has a rim 40 therearound preferably about 3/8 of an inch high which acts as a dam for paint or other coating material supplied to the plate 38. Fluid paint is supplied through a paint supply tube 42 from a paint source and only sufficient pressure is supplied to the paint to cause the desired rate of flow through the tube. As paint on the plate 38 reaches the top of the dam 40 it overflows around the dam and drops into the interior of the squirrel cage rotor 36. In this connection it is preferable, but not necessary, that the plate be slightly above the top of the blower 36. If the plate is placed lower and within the blower the only effect will be to lessen the width of the paint throwing pattern.

Also mounted on the shaft 34' is a second and smaller squirrel cage blower 44. The second blower 44 is preferably slightly less in diameter than the outer diameter of the plate 38 so that it is shielded against paint dropping directly thereon. Similarly, the height of the rotor 44 is preferably less than the height of the rotor 36 and the rotor 44 is preferably spaced equidistant from opposite end faces of the rotor 36.

As the two rotors are caused to rotate simultaneously the paint which overflows the dam 40 drops in charged condition in between the two rotors, namely on the outside of the small rotor and on the inside of the large rotor. Furthermore, the paint is drawn inwardly into this space between the two rotors by suction since the bases of the two rotors are either solid or restricted while the top portions of the two rotors are fully open. It has been found that sufficient paint may be supplied through the tube 42 to flow over the dam 40 in a film or sheet

wherein the electrostatic forces alone are sufficient to disperse the paint to any appreciable extent. However, due to the extreme turbulence between the two rotors and the considerable suction created thereby, the paint, as it is drawn between the rotors, is thrown outwardly of rotor 36 in a finely dispersed and fully charged condition wherein each particle of paint is charged and wherein the uniformity of size of the dispersed particles is extremely uniform and fine. These particles are obviously attracted to the article 32 which bears an opposite electrical charge to the charge on the particles whereby the article becomes coated with the particles of coating material. Since the rotor produces a cloud of particles considerably wider than the article 32 the particles passing the article 32 are drawn onto the surface thereof so that considerable wrap around of coating material is obtained without any substantial loss thereof. In this connection, the width of the rotor 36 is chosen so that it will be substantially the same as the height of the article 32 or if the rotor 36 is narrower than the article the entire rotor assembly may be reciprocated vertically within the limits shown at the arrow in FIG. 1 so that the upper and lower limit of the pattern will completely envelop the article. These deviations are well known in the art.

Referring to FIG. 2, a modification of the device shown in FIG. 1 is illustrated. In this instance all of the parts of the device are the same with respect to the motor, plate, and rotor 36. However, the shaft 34' which carries the rotor 36 is hollow in this instance and is connected to a suitable source of compressed air. This may be the exhaust of the motor, if the motor is air driven. In any event, the shaft 34' is apertured a plurality of times as at 50 and the air issuing from the apertures 50 is used to supplement the air stream created by the blower 36. The apertures, therefore, act in much the same manner as does the supplemental rotor 44 as shown in FIG. 1.

A somewhat similar device is shown in FIG. 3. In this instance the hollow shaft 34' is used but includes apertures 52 at the base thereof that connect through a bearing fitting 54 to ducts 56 in the fitting 54. Immediately above the ducts 56 is a flared shield 60 that preferably rotates with the remainder of the device and which shields the plate 38 from direct impingement of air from the ducts 56 thereon. The plate 38 is the same as previously noted except that in this instance the plate is positioned within the rotor 36. As previously mentioned this will reduce the height of the pattern slightly, however, due to the flow of the air from the ducts 56 as directed by the shield 60 there is a tendency for the paint or other material coming off the dam 40 to be blown upwardly so that the entire field is reasonably well covered. Here, again, the supplemental air is used as a means for aiding in the conveyance and breaking up of the coating material which flows over the dam 40 and here, again, a considerably greater quantity of material can be supplied than in the device as shown in said Patent 2,976,175.

FIG. 4 shows a device similar to that shown in FIG. 2 with the exception that a second blower 70 is mounted on the same shaft which blower is preferably smaller in diameter than the blower 36 and is mounted below the blower 36. The effect of this second blower is to create a definite flow of air beneath the first blower whereby the tendency for paint particles to drop downwardly is prevented. Generally speaking, in any device of this character the paint pattern at a distance from the blower will be wider than the blower and the excess width will be noted below the plane of the blower indicating a tendency for the coating particles to drop slightly by gravity. By adding the second blower 70, additional air is supplied to supplement the normal movement of the particles and thereby overcome this gravitational pull.

The effect of the blower 70 is shown in FIG. 5 wherein a diagrammatic view is shown. In this instance the power pack is shown at 26 and the article to be painted at 32 whereas the dual blower arrangement is noted at 75. The pattern is indicated by the dash lines and is substantially the same width throughout its extent. In this instance a rear shield 77 is provided which prevents painting from the back side of the device wherein the paint which is thrown onto the shield is recovered and returned to the paint supply through tube 79.

In connection with the rear shield 77, it is apparent that improved action may be obtained by using a supply plate 38 which is a segment of a circle, for example or a semi-circular plate and dam 40. This may be rotatably adjustable on the housing 22 so that a minimum of paint will be directed against the shield 77.

We have also found that the electrical charge may be imposed on the paint by several means other than using a charged plate 38. For example, the paint supply line, which is formed from a non-conducting material, may be broken as noted in FIG. 4. A tubular metal segment 90 is then inserted as a connector in the line. The segment 90 is connected to one side of the power pack and is the only connection thereto on the paint distributor side of the device. The distance from the exit of the line is not important, preferably from 6" to 18" from the exit. The painting results are not effected and satisfactory operation is obtained. In place of a metal tube 90 other conductors, such as a metal screen or conductive screw etc., placed within the non-conducting supply pipe may be used. The conductive insert, of course, should be connected to one side of the power pack. In each case the plate 38 will then merely act as a distributor.

In all of the embodiments shown in this application the criticality of control is greatly reduced. This may be explained by the fact that in the device shown in application 710,665 the control of the paint supply must be maintained so that substantial dispersion is obtained as the paint runs off the distributing plate. This atomized or partially atomized paint is in a dispersed condition as it enters the blower and the blower merely subdivides it into a finer dispersion and lends kinetic impetus and direction to the particles to enable them to bridge the gap between the blower and the article to be painted. Thus, in each instance it is highly desirable to cause substantial dispersion of the coating material from the plate. This, of course, limits the quantity of coating material which may be supplied to the plate and, similarly, limits the quantity of coating material that can be distributed by the device. In the present instance this critical factor is substantially eliminated and large quantities of paint may be supplied to the plate 38 wherein it is not necessary to break up any great amount of the paint electrostatically since sufficient turbulence and air movement is present within the blower due to the supplemental air being supplied thereto to effect dispersion of the paint particles whereby the electrostatic forces are merely used as a charging means and are not depended upon as a means for dispersing the paint. This condition is created by the conjoint action of the blower and the secondary air supply means which not only disperses the paint into fine particles of uniform size but likewise aids in transporting these particles across the gap between the blower and the article to be painted hurling them with substantial force onto the article to be painted. The electrostatic forces on the other hand are used for their ability to cause wrap around of particles that pass the article to be painted whereby the back side of the article receives a substantial coating which is not possible when the electrostatic forces are not present. The electrostatic forces alone are not sufficient to cause deposition of any paint particles on the article until the air moving device is in operation, thus demonstrating the conjoint action of the several forces to effect efficient painting.

It is apparent that in place of the plate 38 and dam 40 that a ring type manifold 38' as shown in FIG. 2*a* could be substituted therefor. In this case this manifold would be apertured with the apertures preferably pointing in a downward direction and spraying the paint into the blower

36. Any number of apertures could be used as desired. Here, again, the paint is charged and is later fully dispersed through the action of the air moving means.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. An apparatus for electrostatically depositing paint on an article to be painted comprising in combination, a source of electrostatic power having one pole thereof attached to the article to be painted, a horizontally disposed stationary paint distributor spaced from the article and attached to the other pole of said power source, means for supplying paint to the distributor and for causing flow of the paint from the distributor whereby the said paint carries an electrostatic charge similar to the charge on the distributor, an air moving means comprising a squirrel cage blower rotating on an axis substantially concentric with the distributor and surrounding the paint being discharged therefrom for throwing the charged paint outwardly thereof in dispersed condition in a plane substantially normal to the axis of rotation of said means, and a second, auxiliary air moving means comprising a plurality of compressed air jets substantially concentric with the first mentioned air moving means for supplying additional air within said first air moving means for aiding in the mechanical dispersion of paint therefrom.

2. An apparatus for electrostatically depositing paint on an article to be painted comprising in combination, a source of electrostatic power having one pole thereof attached to the article to be painted, a horizontally disposed stationary paint distributor spaced from the article and attached to the other pole of said power source, means for supplying paint to the distributor and for causing flow of the paint from the distributor whereby the said paint carries an electrostatic charge similar to the charge on the distributor, an air moving means rotating on an axis substantially concentric with the distributor and surrounding the paint being discharged therefrom for throwing the charged paint outwardly thereof in dispersed condition in a plane substantially normal to the axis of rotation of the said means, a second auxiliary air moving means substantially concentric with the first mentioned air moving means for supplying additional air within said first air moving means for aiding in the mechanical dispersion of paint therefrom, and a third air moving means positioned below the first air moving means for aiding in the concentration and direction of the paint particles discharged from the first air moving means.

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