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ELECTROSTATIC METHOD AND APPARATUS USING NON-CONDUCTIVE DISCHARGE MEANS

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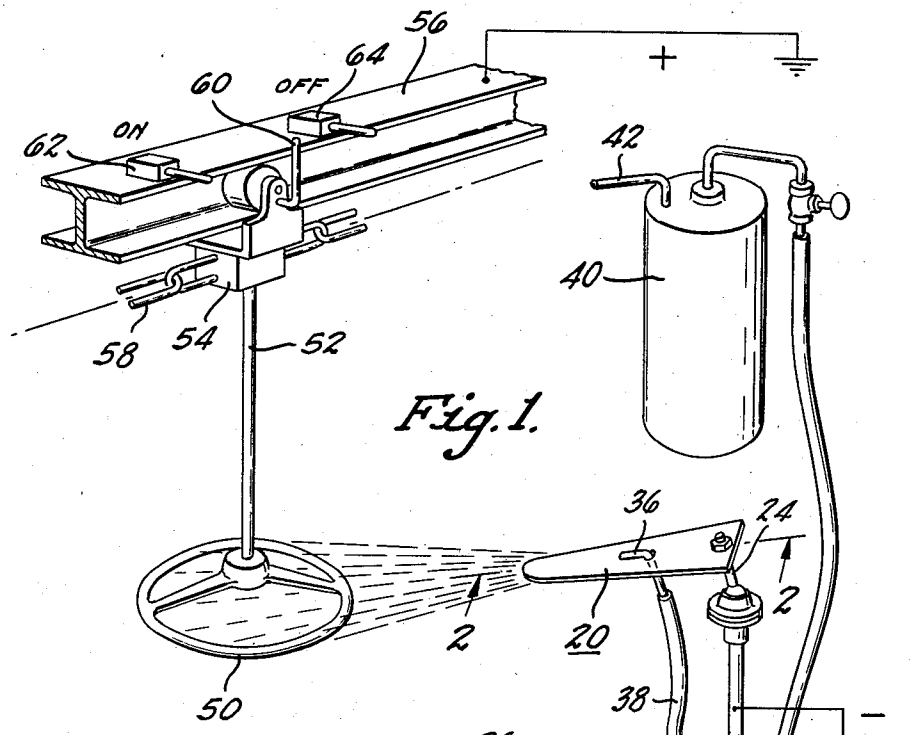


Fig. 1.

Fig. 2.

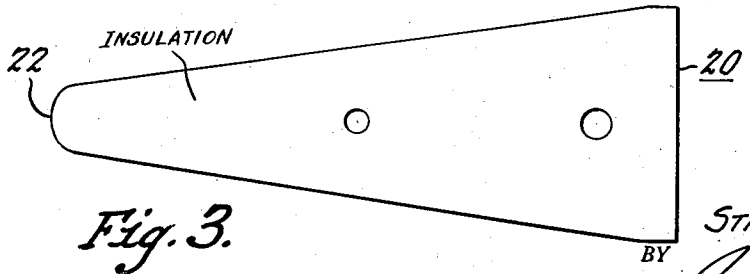


Fig. 3.

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ELECTROSTATIC METHOD AND APPARATUS USING NON-CONDUCTIVE DISCHARGE MEANS

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Application November 29, 1955, Serial No. 549,719

5 Claims. (Cl. 117—93)

This invention relates to an electrostatic coating method and apparatus and is particularly concerned with electrostatic painting or covering operations wherein the paint is applied at substantially atmospheric pressure to the spray head.

It is an object of the invention to provide an apparatus and method for the electrostatic deposition of paint wherein the paint is fed, by gravity, to a stationary non-metallic discharge electrode member, or spray head, and is atomized from said member onto the part to be painted.

A still further object of the invention is to provide electrostatic painting equipment which does not involve moving parts and wherein the painting pattern may be controlled by controlling the shape and disposition of the spray head.

A still further object of the invention is to provide an apparatus and method for painting objects electrostatically wherein paint is supplied to a spray head at substantially atmospheric pressure and is distributed in an atomized mist therefrom, wherein the directivity of the atomized paint may be readily controlled by the shape and/or disposition of the spray head.

In carrying out the above object it is a still further object of the invention to feed the paint to the surface of the spray head at a point intermediate the power source and the atomizing edge of the spray head.

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

In the drawings:

Figure 1 is a diagrammatic view of a spray head used to paint a steering wheel which is shown for illustrative purposes on a conveyer;

Figure 2 is a fragmentary sectional view taken on line 2—2 of Figure 1; and

Figure 3 is a plan view of the spray head with the paint supply means and the power supply means removed.

Electrostatic paint spraying operations are well known in the art. These operations generally comprise atomizing directly from air pressurized spray guns which direct paint to the objects to be painted wherein the objects to be painted are maintained within an electrostatic field whereby the paint is directed to the object more uniformly and economically than is possible with conventional paint spraying methods.

This type of spray painting equipment and method is described and shown in Ransburg et al. Patent 2,247,963.

Several new developments in electrostatic paint spraying have been made during the past few years and one of these is disclosed and claimed in copending application S.N. 527,723 assigned to the assignee of the present invention. In this instance a stationary relatively wide spray head is utilized which comprises a flat metal plate onto which paint is supplied at substantially atmospheric pressure. The plate forms one side of the electrostatic

circuit while the work to be painted forms the other side thereof. As the paint passes down the spray head or plate by gravity it is charged so that upon leaving the plate it is atomized into a mist which is attracted to the surface of the work. The present invention is directed to an improvement in the method and apparatus for spray painting articles electrostatically as is disclosed in said copending application.

The improved apparatus is shown diagrammatically in Figure 1 wherein the spray head or electrode, as it may be termed, is designated at **20**. This discharge electrode is a substantially flat plate-like member and is formed from nonmetallic material such as Bakelite, Formica, polystyrene, hard rubber, etc. The plate is of a generally triangular shape as shown in Figure 3 and is relatively thin, preferably in the order of $\frac{1}{32}$ to $\frac{1}{4}$ of an inch. The front edge or discharge edge of the plate is relatively narrow and may be rounded as at **22** forming a relatively narrow section at the discharge end of the plate **20**. The sides of the plate diverge from this rounded front edge at an acute angle and preferably at an angle of between 12° and 30°. The discharge end of the plate **22** should be relatively narrow and the transverse dimension taken normal to the main axis of the plate at this point should be no more than 1½ to 2 inches for most applications of the device and no less than ¾ of an inch although it is apparent that these dimensions may vary in accordance with the shape and size of the part to be sprayed. When spraying a steering wheel, for example, the dimensions set forth are entirely adequate. The width of the discharge end of the plate **20** and the shape, radius or rounded contour thereof may be varied to control to some extent the shape and size of the paint spray pattern. Such control is best arrived at by experimentation for the specific part to be sprayed.

The plate **20** is mounted adjacent the rear portion thereof on a threaded stud **24** which is secured to the plate **20** by means of nuts **26** and **28**. The stud **24** is hingedly connected at **30** to a standard **32**, all of said connections being metallic. The standard **32** connects to a power supply **34** and preferably to the negative terminal thereof. The other terminal of the power supply is grounded. Intermediate the stud **24** and the discharge end **22** of the plate is disposed a paint supply tube **36**. This tube is centrally located of the plate axially thereof and may be metallic or nonmetallic, preferably the latter, with its orifice facing the discharge end of the plate. To the tube **36** is connected a rubber hose or other suitable conduit **38** that attaches to a paint supply **40**. The paint spray **40** may be maintained above the plate **20** so that the paint flows by gravity alone or a pressurized tank may be used wherein air is supplied to the tank **40** through a conduit **42** in sufficient quantities to force the paint from the tank **40** and through the discharge tube **36** onto the surface of the plate **20** at substantially atmospheric pressure. No attempt should be made to cause the paint to flow under pressures substantially above atmospheric pressure from the paint supply tube **36**.

The object to be painted, in this instance a wheel **50**, is suspended on a hanger **52** that is carried by a conveying means **54** along the track **56**. The track **56**, the conveying means **54** and the hanger **52** are all metal as is the spider which is normally present within the wheel **50**. In this instance the steering wheel **50** has a rubber-like covering over the metallic reinforcing spider and it is this covering which is to accept the paint during the painting process. The conveying means **54** is moved along the track **56** by a chain **58** that is attached to a motivating source, not shown. The means **54** may include an arm **60** thereon which actuates on and off switches **62** and **64** mounted on the track **56**. In this

manner it is possible to connect the switches in circuit at the power supply **34** so that the power supply is turned on and off as the parts to be spray painted have moved through the field of spray. This electrical control prevents loss of paint although the on and off feature forms no part of this invention.

It will be noted that the spray head or plate **20** is preferably positioned at an angle to the horizontal. This angle should be between 10° and 30° from the horizontal to obtain best results. When the angle exceeds 30° the paint flowing from tube **36** moves too rapidly down the plate whereas when the angle is less than 5° the flow is too slow to provide satisfactory operation. A preferred angle is in the order of 15° to 20° from the horizontal. This angle obviously controls to some extent the quantity of paint sprayed since it controls the rate of gravity flow of the paint on the plate. In this connection the inside diameter of the paint supply tube may also be varied to control the quantity of paint delivered to the discharge edge of the plate **20**. It is desirable to maintain the paint which flows down the plate **20** in a relatively thin film thereon which is determined as is well known in the art by the quantity of solvent or thinner used in the paint mixture. Paints having viscosities of from 13 to 21 seconds (# 4 Ford Cup @ 83° F.) give excellent results with the discharge plate disclosed.

The basic difference between this invention and the invention disclosed in said copending application S.N. 527,723 resides in the paint supply plate **20** which in this instance is nonmetallic together with the specific disposition of the paint supply tube **36** with respect to the edge portion of the plate and the power supply means. I have found that the tube **36** should be substantially equidistant between two points for optimum results and in all cases should be between the spray edge and the power supply. It will be noted in said copending application that the power supply to the plate is attached intermediate the spray edge thereof and the point at which the paint supply tube first contacts the plate. The present disposition of parts tends to yield more uniform spray results although the device of the copending application will function satisfactorily. Furthermore, it appears that the nonmetallic spray plate gives more uniform and desirable results than does a metal plate. The explanation for this improvement with respect to the several parts as described herein is not entirely understood but actual tests have proved that the nonmetallic plate in substantially flat form maintained at an angle as noted and having a relatively narrow discharge edge is more easy to control, dispenses paint in a more uniform spray and in general yields improved results over any of the electrostatic spray heads heretofore noted.

While the forms of embodiment of the invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In a method for electrostatically painting the surface of an article with a paint, the steps comprising; providing a relatively flat, elongated plate of electrically nonconductive material, spacing said plate remote from the article to be painted, positioning said plate at a downward angle of not more than 30° from the horizontal, impressing a high voltage D.C. current across said plate and said article, and then flowing paint down the inclined plate from a stationary point substantially equidistant from the ends thereof by gravity alone, whereby the paint is atomized from the lower edge of the plate solely by the electrostatic field formed between the plate and the article to be painted.

2. In a method for electrostatically painting the surface of an article with paint, comprising the steps of; providing a relatively flat, elongated plate of electrically nonconductive material, positioning said plate at a downward angle of not more than 30° from the horizontal, spacing the article to be painted from the lower edge of said plate, attaching one terminal of a high voltage D.C. source adjacent the high end of said inclined plate, attaching the other terminal of said high voltage D.C. source to the article to be painted, supplying flowable paint to the plate at a stationary point intermediate the upper and lower edges thereof for causing the paint to flow down the plate by gravity alone, whereby said paint is atomized as it leaves the lower edge of the plate due solely to the electrostatic field between the plate and the article for painting the article.

3. An electrostatic spray head for use in electrostatic spray painting operations comprising an electrically nonconductive flat plate of generally truncated triangular shape wherein the base of the triangle is relatively wider than the truncated end thereof, supporting means attached to the plate adjacent the base portion thereof for supporting the plate in an angled position with respect to the horizontal plane wherein the truncated end of the plate is lower than the supported end and wherein the angle of the plate from the horizontal does not exceed 30°, a stationary paint supply means contacting the plate initially adjacent the central portion thereof and having an outlet adjacent the central portion of the plate and capable of supplying flowable paint onto the inclined surface of the plate, and an electrical connection to the plate adjacent the base portion thereof adapted to be connected to a high voltage D.C. source.

4. A spray head for an electrostatic spray painting apparatus comprising in combination; a nonmetallic and electrically nonconductive plate having a generally triangular shape wherein the angle between the sides thereof is between 12° and 30°, a support for the plate adapted to be attached adjacent the base of the generally triangular plate and capable of supporting the plate at a downward angle from the horizontal between 10° and 30°, stationary paint supply means initially contacting the plate at a point intermediate the point of support and the truncated edge thereof and including an outlet for paint whereby paint supplied to the plate will flow downwardly of the plate and over the lower edge thereof and an electrical connection on the plate adapted to be connected to a power source.

5. A spray head for electrostatic paint spray equipment comprising a relatively flat, generally truncated, triangular-shaped, electrically nonconductive plate having a base end and an opposed discharge end of less dimension than the base end, a support for said plate attached to the plate adjacent the base and disposed so that the end of the plate opposite to the base end is depressed from the horizontal and at an angle not exceeding 30°, paint supply means having a stationary outlet on the upper surface of the plate intermediate the two ends thereof, and an electrical connection, for connecting the plate to a power source, disposed adjacent the base end of the plate and between the base end of the plate and the paint supply means.

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