

[54] **NOZZLE HOLDER**

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[52] U.S. Cl. ....239/15

[51] Int. Cl. ....B05b 5/06

[58] Field of Search .....239/3, 15

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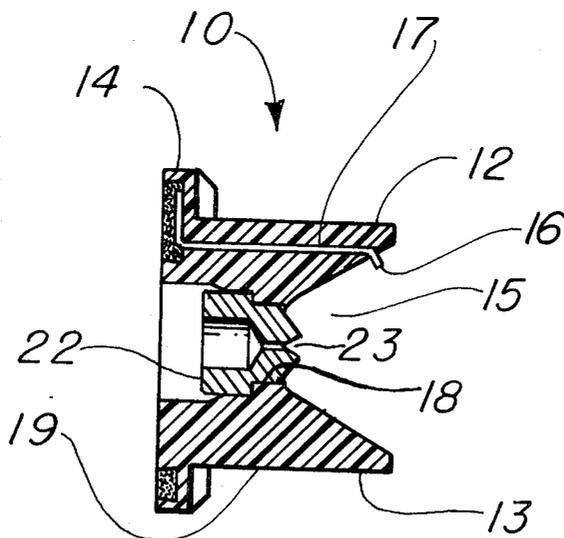
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[57] **ABSTRACT**

A holder adapted to receive a nozzle of an electrostatic spray coating apparatus. The holder includes a body of electrically insulative material having an aperture adapted to receive the nozzle, forwardly extending means formed in the body and an electrode carried by the means. The electrode terminates prior to the termination point of any of the forwardly extending means and is at an angle with respect to the axis of the aperture in the body adapted to receive the nozzle.

**11 Claims, 5 Drawing Figures**



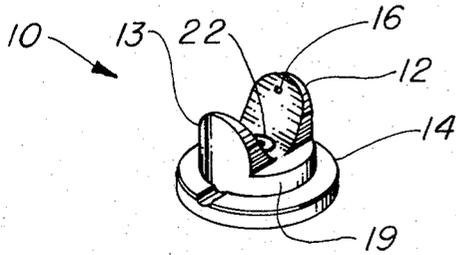


Fig. 1

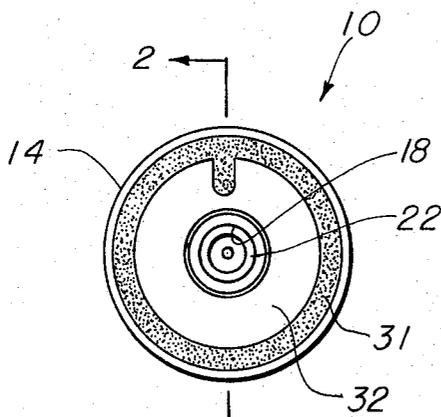


Fig. 3

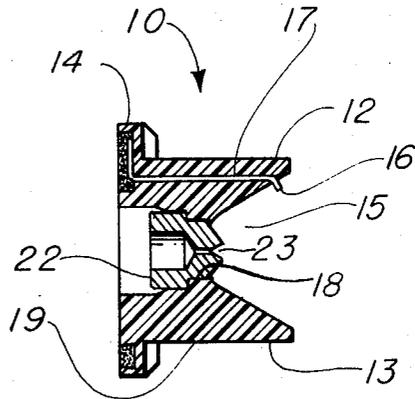


Fig. 2

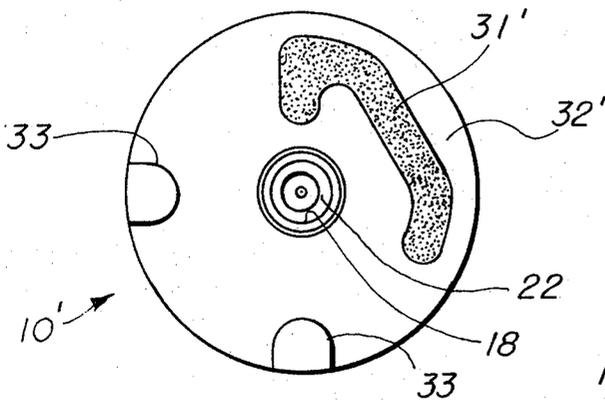


Fig. 4

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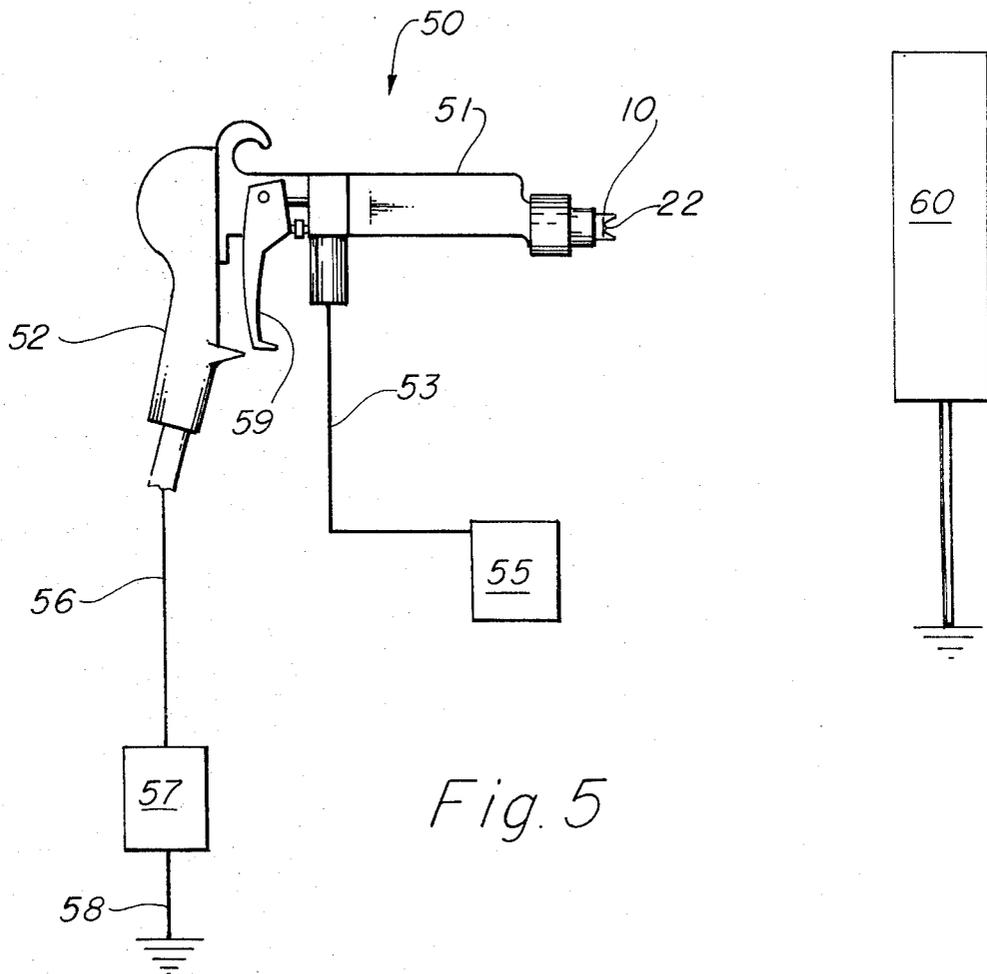


Fig. 5

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## NOZZLE HOLDER

The present invention relates to electrostatic spray coating apparatus, and more particularly to a holder adapted to receive a nozzle of such a coating apparatus.

Hydraulic atomization of coating materials such as paint and the like can be achieved by projecting a stream of the material under pressure and at high velocity from the nozzle of a spray coating apparatus into the surrounding atmosphere. The interaction of the coating material stream with the surrounding atmosphere causes the coating material to break up or atomize into finely divided particles. Forming a spray of finely divided coating material particles is a prerequisite condition for providing the surfaces of an article with a high quality film of coating material.

The present invention is specifically directed to a holder which is adapted to receive a nozzle of the electrostatic spray coating apparatus. The nozzle of the electrostatic spray coating apparatus in conjunction with other factors functions to assist in causing hydraulic atomization of the coating material stream. A charging electrode associated with the nozzle establishes a condition whereby the atomized particles of coating material are caused to acquire an electrical charge. An electrostatic field extends from the charging electrode of the spray coating apparatus to the article to be coated. The coating material particles are assisted in their movement toward the article by, among other things, electrostatic forces, the charge carried by the particles and by the spray attracting potential of the article. The finely divided charged particles of coating material and the electrostatic forces cooperate to minimize waste of the coating material by reducing overspray and cooperate to provide a high quality finish on the surfaces of the article at the spray attracting potential.

Several of the electrostatic spray coating apparatus which hydraulically atomize coating material use an elongated charging electrode that is substantially parallel to and spaced from the axis of an aperture in the body of a nozzle holder adapted to receive the nozzle of the electrostatic spray coating apparatus. The charging electrode is carried by the nozzle holder which is sometimes referred to as the end cap of the spray coating apparatus. Generally, the nozzle holder includes either one or two forwardly projecting ears. If the nozzle holder has two ears, the ears are usually spaced opposite each other on the circumference of the holder. In each nozzle holder, the ears project forwardly from the main central portion of the nozzle holder. The charging electrode carried by the nozzle holder projects outwardly from the main central portion of the holder on an axis generally parallel to the axis of the nozzle carried by the nozzle holder. In one nozzle holder, the electrode terminates prior to the forwardmost extent of the ear whereas in the other nozzle holder the electrode projects a significant distance beyond the forwardmost extent of the ears of the holder. It is seen that in both configurations, the elongated charging electrode is unsupported over a considerable extent of its length. It should be appreciated that in both configurations, the charging electrode is vulnerable to damage from negligent handling by the operator of the electrostatic spray coating apparatus. For example, the electrostatic spray coating apparatus may be handled in such a manner as to deform the charging electrode thereby straining the material composing the charging electrode. In some instances, the material of the charging electrode may be so strained as to fracture the charging electrode thereby necessitating replacement thereof. In other instances the charging electrode may be so deformed as to require reshaping of the electrode in such a manner that the electrode is caused to assume its approximate original shape. However, the location of the charging electrode and the configuration of the nozzle holder in each configuration mentioned above makes reshaping of the electrode difficult at best. The overzealous operator, in an attempt to reshape the electrode, may strain the charging electrode in such a manner that the electrode fractures thereby requiring replacement thereof. Furthermore, even a cautious reshaping of the charging electrode may tend to weaken the

bond between the electrode and the nozzle holder to such a degree that the electrode may become separated from the end cap necessitating replacement thereof.

The charging electrode of one of the nozzle holders is connected to a high voltage source through, among other items, a suitable semiconductive material such as semiconductive ink brushed on the rear surface of the nozzle holder. To clean the electrostatic coating apparatus using such a nozzle holder for the next day's coating operation, the nozzle holder may be immersed in an active cleaning solvent such as acetone, methyl ethyl ketone and the like. The ingredients of the active cleaning solvent may tend to harmfully effect the conductivity of the semiconductive material after several overnight immersions in the solvent.

One of the nozzle holders does not presently include a means for conveniently indexing the holder and its cooperatively associated nozzle with respect to the other component parts of the electrostatic spray apparatus. To index the holder so that the plane of the spray is in desired alignment with the axis of the spray apparatus, a means such as a wrench of similar tool is used to engage with flat portions formed in the ears formed in the holder. The wrench is arcuately displaced to thereby properly align the plane of the spray provided by the nozzle with respect to the other component parts of the electrostatic spray apparatus using the nozzle holder. To accommodate the wrench, the shape of the ears are such that each ear tends to acquire coating material during the coating operation. The coating material accumulated on the ears of the holder may become separated from the ears as large droplets of coating material. Large droplets of coating material in the spray of coating material tend to mar quality coating films or finishes associated with electrostatic coating apparatus.

Therefore, a feature of the present invention is that it overcomes several of the aforementioned problems by providing a nozzle holder wherein the charging electrode is carried by an ear of the nozzle holder in such a location that the electrode is protected by ears of the holder from deformation due to abusive handling. Another feature of the present invention which may be associated therewith is a suitable semiconductive plastic material formed with the rearmost surface of the holder to provide an electrical path from the charging electrode to a source of electrical energy. The semiconductive plastic material is not as harmfully effected by overnight immersion in active solvents as is the semiconductive ink of the presently available nozzle holder. The nozzle holder of the present invention may include suitable means for properly indexing the plane of the spray pattern emerging from the nozzle orifice in either the vertical or the horizontal axes with respect to the axis of the spray apparatus. The indexing means also substantially eliminates the possibility of improper alignment of the electrical contact of the spray apparatus with respect to the charging electrode. The ears of the nozzle holder are at such an angle with respect to the plane of the spray of coating material emerging from the orifice of the nozzle that the ears tend to accumulate very little, if any, coating material during the spraying operation.

Further features and advantages of the invention will be apparent from the following description and drawings.

In the drawings:

FIG. 1 is an enlarged perspective view of the nozzle holder of the present invention;

FIG. 2 is an enlarged cross sectional view of the nozzle holder illustrated in FIG. 1;

FIG. 3 is an enlarged rear view of the nozzle holder shown in FIGS. 1 and 2;

FIG. 4 is an enlarged rear view of an embodiment of the nozzle holder shown in FIG. 1; and

FIG. 5 is a schematic of a hydraulically atomizing electrostatic spray coating apparatus employing the nozzle of FIGS. 1 and 2.

It is to be understood that the concepts embodied in the nozzle holder of the present invention may be applicable to

electrostatic spray coating apparatus other than hydraulic atomization apparatus. For example, the concepts of the present invention may be used with electrostatic spray coating apparatus wherein the coating material is atomized with the use of air or with apparatus wherein the coating material is powder entrained in air. Coating material as used is meant to include, where applicable, fluid and semi-fluid material which is applied to surfaces in relatively thin layers and which changes to a solid coating with time such as paint and the like, powders which are capable of acquiring an electrical charge and being entrained in air such as epoxy powder and the like.

Referring now to FIGS. 1, 2 and 3, and in particular to FIG. 1, a nozzle holder for a hydraulically atomizing device which embodies the concepts of the present invention is indicated by reference numeral 10. The holder 10 is fabricated from a suitably electrically insulating material such as a moldable thermoplastic material or the like having good wear characteristics and being substantially uneffected by the chemical action of active cleaning solvents such as acetone, methyl ethyl ketone and the like.

The nozzle holder 10 includes forwardly extending projections or tapered ears 12 and 13 spaced opposite each other. The tapered ears 12 and 13 project outwardly from the main portion 14 of the nozzle holder 10 approximately ten thirty-seconds of an inch. The angle of opening 15 between the tapered ears 12 and 13 of the holder 10 is sufficiently great to permit the spray of coating material to pass by and beyond the ears of the holder without experiencing harmful deposition of coating material thereon. The angle of the opening 15 between the ears 12 and 13 of the holder 10 illustrated in FIG. 1 is about 60°.

As shown in FIG. 2, an extremity 16 of charging electrode 17 projects from ear 12 of the nozzle holder 10 a very short distance, such as for example about one thirty-second of an inch. The extremity 16 of the charging electrode 17 is at an angle with respect to the axis of an aperture 18 formed in the body 19 of the holder. The aperture 18 is adapted to receive a nozzle 22 from which coating material (not shown) emerges. The nozzle may be fabricated from any suitable wear resistant material such as stainless steel, tungsten carbide, sapphire or the like. The angle of the extremity 16 of the charging electrode with respect to the axis of opening 23 of nozzle 22 does not appear to be of critical nature. The extremity 16 of the charging electrode 17 may project from, be flush with or be slightly recessed in the ear of the nozzle holder 10. It is preferred that the extremity 16 of the charging electrode 17 projects slightly from the ear of the charging electrode because of the practicalities involved in maintaining the extremity relatively free of coating material.

The charging electrode 17 carried by the nozzle holder 10 may have a diameter of about 0.020 of an inch and project outwardly from tapered ear 12 about one thirty-second of an inch and terminate in a fairly sharp point or edge. The charging electrode 17 may be of any suitable conductive metallic material. It should be appreciated that the extremity 16 of charging electrode 17 is no longer as vulnerable to damage from negligent handling by the operator of the electrostatic spray coating apparatus since the electrode is adequately supported and is protected by the cooperative relationship existing between the tapered ears 12 and 13. Note that the exposed extremity 16 of the electrode 17, as illustrated in the several figures, is relatively short and the exposed portion of the electrode terminates in a relatively sharp edge prior to the termination of the forwardmost point of the ears 12 and 13.

The relatively short exposed extremity 16 of the charging electrode 17 does not harmfully effect the ability of electrode to cause the coating material particles to acquire an electrical charge. Locating the extremity 16 of charging electrode 17 at an angle with respect to the axis of the orifice 23 of the nozzle 22 does not harmfully effect the ability of the electrode to cause the coating material to acquire an electrical charge.

The extremity 16 of the charging electrode 17 is appropriately spaced from the closest surface of the stream of

coating material as it emerges from the orifice 23 of the nozzle 22 and, therefore, removed from the stream of coating material. In addition, the extremity 16 of the charging electrode is located adjacent the area or zone in which atomization of the stream of coating material occurs. It is recognized that the zone in which atomization of the coating material takes place may vary due to the physical characteristics of the nozzle (not shown); the characteristics of the coating material such as viscosity, density, surface tension, and the like; the hydraulic pressure applied to the coating material; the delivery rate of the coating material to the coating apparatus; and the like.

The nozzle holder 10, as shown in FIG. 3, includes a suitable annular semiconductive plastic material 31 formed in the rear surface 32 of the holder. The semiconductive plastic material 31 provides an electrical connection between the charging electrode 17 (not shown) and a terminal of a direct current power supply (not shown) capable of providing up to 50,000 volts d.c. or higher. Note that the continuous surface of semiconductive plastic material 31 reduces indexing problems.

The rear surface 32 of an embodiment of the nozzle holder as illustrated in FIG. 4 may incorporate a means such as index detents 33 for conveniently indexing the holder and its cooperatively associated nozzle with respect to the other component parts of the electrostatic spray apparatus (not shown) in FIG. 4 to index the holder 10' so that the plane of the spray is in proper alignment with the axis of the spray apparatus, the index detents 33 to cooperate with appropriate tabs (not shown) provided on the forwardmost portion of the barrel (not shown) of the spray apparatus. The index detents 33 and the tabs (not shown) cooperate to provide the plane of the spray either in the vertical or the horizontal plane with respect to the barrel (not shown) of the spray apparatus. It should be noted that the nozzle holder 10' is properly aligned without the use of wrenches, etc.

The holder 10', as shown in FIG. 4 includes a suitable semiconductive plastic material 31' provided in a quadrant in the rear surface 32' of the holder. The semiconductive plastic material 31' provides an electrical connection between the charging electrode 17 and a terminal of a direct current power supply (not shown) capable of providing up to 50,000 volts d.c. or higher.

Measurements such as lengths, widths, diameters, angles and the like are recited herein to further illustrate the embodiment of the nozzle holder illustrated in FIGS. 1, 2, 3 and 4 and should not be construed to be limiting in nature with respect to the concepts expressed.

The nozzle holder 10 or 10' of the present invention may be used with any suitable electrostatic spray apparatus such as hydraulic or airless electrostatic spray apparatus 50 as illustrated in FIG. 5 of the drawing. Nozzle holder 10 is illustrated in FIG. 5. The electrostatic spray apparatus 50 includes a barrel 51 and a handle 52. Conduit 53 connects the apparatus, and hence the nozzle 22 retained by the nozzle holder 10 to a source 55 of coating material under pressure to be sprayed. A voltage lead 56 extends into the handle 52 from an ungrounded terminal of a voltage source 57. The voltage source 57 is a direct current source capable of providing at least 50,000 volts d.c. or higher. The remaining terminal of voltage source 57 is grounded as indicated at 58. A trigger 59 carried by the apparatus controls the supply of coating material under pressure and voltage in any convenient manner to the apparatus. Exterior portions of the apparatus 50 including the handle 52 and trigger 59 may be grounded as through a conductive sheave surrounding, but insulated from, the voltage lead 56. An electrically grounded article 60 is illustrated as being in position to receive the spray emerging from the apparatus 50. The forwardmost edge of spray emerging from the apparatus 50 is spaced about 8 to 12 inches from the grounded article 60. An electrostatic spray apparatus is described in detail in U. S. Pat. No. 3,169,883. It is to be understood that the concepts of the nozzle holder are applicable to electrostatic hand guns as well as to automatic electrostatic spray apparatus.

While an embodiment of the present invention has been shown and described, it is to be understood that the invention is not limited to such embodiment and charges may be made as will occur to those skilled in the art.

We claim:

- 1. A nozzle holder for an electrostatic spray apparatus comprising  
a body of electrically insulative material having an aperture adapted to receive a nozzle,  
projection means of electrically insulative material provided in and extending forwardly of the body, and  
electrode means supported by the projection means over the major portion of its length, an extremity of the electrode means spaced from the aperture and adjacent to and removed from the main stream of material adapted to flow from the nozzle, the extremity of the electrode means terminating prior to the forwardmost extremity of the projection means.
- 2. The nozzle holder for an electrostatic spray apparatus as claimed in claim 1, wherein the projection means are a plurality of ears positioned substantially opposite each other.
- 3. The nozzle holder for an electrostatic spray apparatus as claimed in claim 1, wherein the projection means are a plurality of means spaced sufficiently far apart to permit a spray coating material passing therebetween to pass therebeyond without significant deposition of coating material on the projection means.
- 4. The nozzle holder for an electrostatic spray apparatus as claimed in claim 1, wherein the extremity of the electrode means extends from the projection means at an angle with respect to the axis of the aperture of the body.
- 5. The nozzle holder for an electrostatic spray apparatus as claimed in claim 1, wherein the holder includes means for in-

dexing the holder on the spray apparatus.

- 6. The nozzle holder for an electrostatic spray apparatus as claimed in claim 1, wherein the rear surface of the holder includes semiconductive material in at least one quadrant thereof, the semiconductive material electrically connected to the electrode means.
- 7. The nozzle holder for an electrostatic spray apparatus as claimed in claim 1, wherein the electrode means either extends from, is flush with the surface of, or is recessed in the projection means.
- 8. A nozzle holder for an electrostatic spray apparatus comprising  
a body of electrically insulative material having an aperture adapted to receive a nozzle,  
forwardly extending tapered ears formed in the body, the taper of the ears spacing the tapered surfaces of the ears sufficiently apart to permit a spray of coating material passing therebetween to pass therebeyond without significant deposition of coating material on such tapered surfaces of the ears, and  
electrode means carried by the holder, an extremity of the electrode means in an ear at an angle with respect to the axis of the aperture of the body.
- 9. In combination, the nozzle holder of claim 8 and an electrostatic spray apparatus.
- 10. The nozzle holder of claim 8, wherein the holder includes means for indexing the holder on the spray apparatus and wherein the rear surface of the holder includes a semiconductive material in at least one quadrant thereof.
- 11. The nozzle holder of claim 8, wherein the extremity of the electrode means projects from the ear, the extremity of the electrode means being spaced from the aperture.

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UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,677,470 Dated July 18, 1972

Inventor(s) Richard O. Probst et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 21, "32" should read -- 32' --;  
column 4, line 28, cancel "to".

Signed and sealed this 19th day of December 1972.

(SEAL)  
Attest:

EDWARD M. FLETCHER, JR.  
Attesting Officer

ROBERT GOTTSCHALK  
Commissioner of Patents