

Nov. 21, 1961

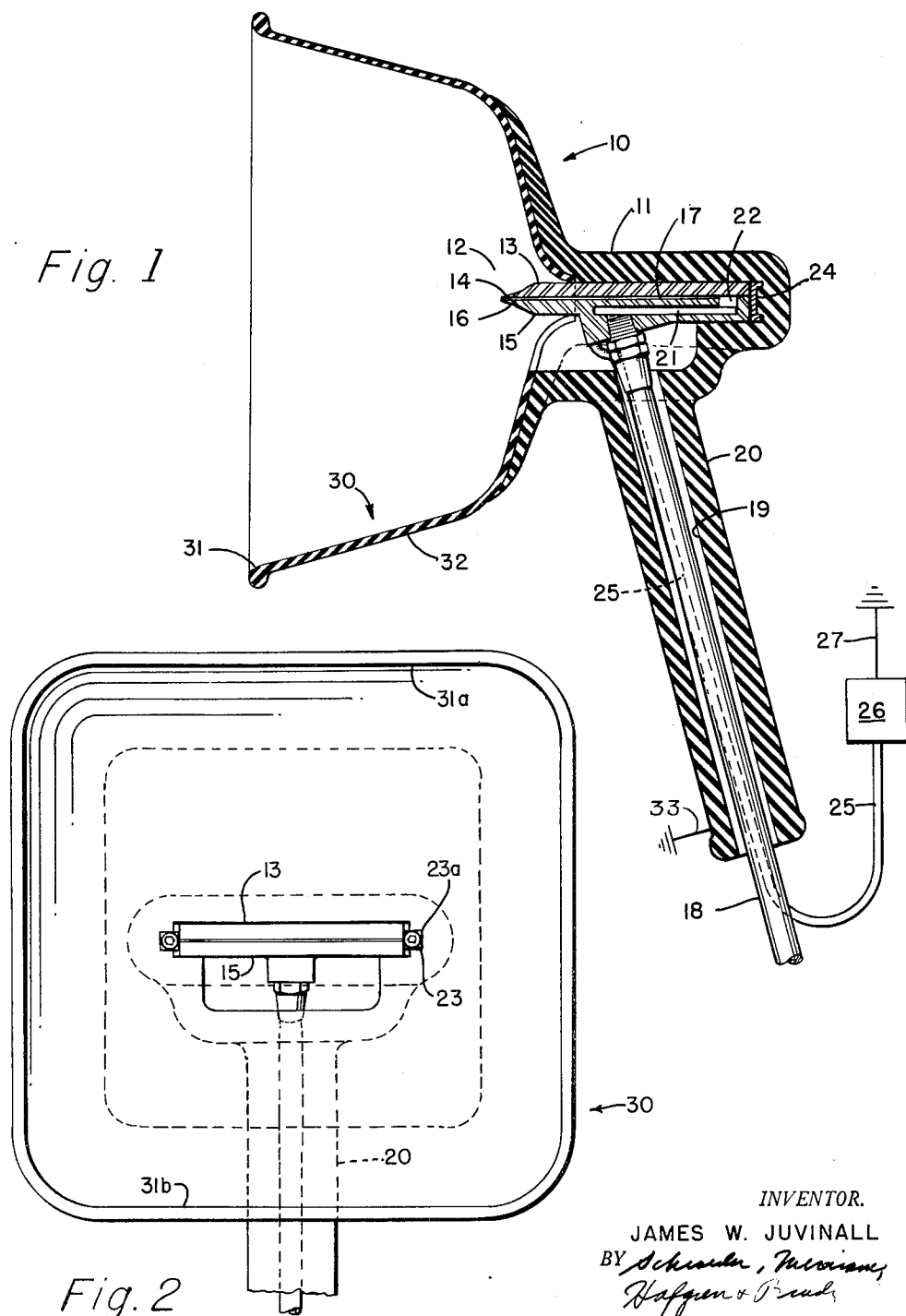
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3,009,441

APPARATUS FOR ELECTROSTATICALLY SPRAY COATING

Filed June 18, 1959

3 Sheets-Sheet 1



Nov. 21, 1961

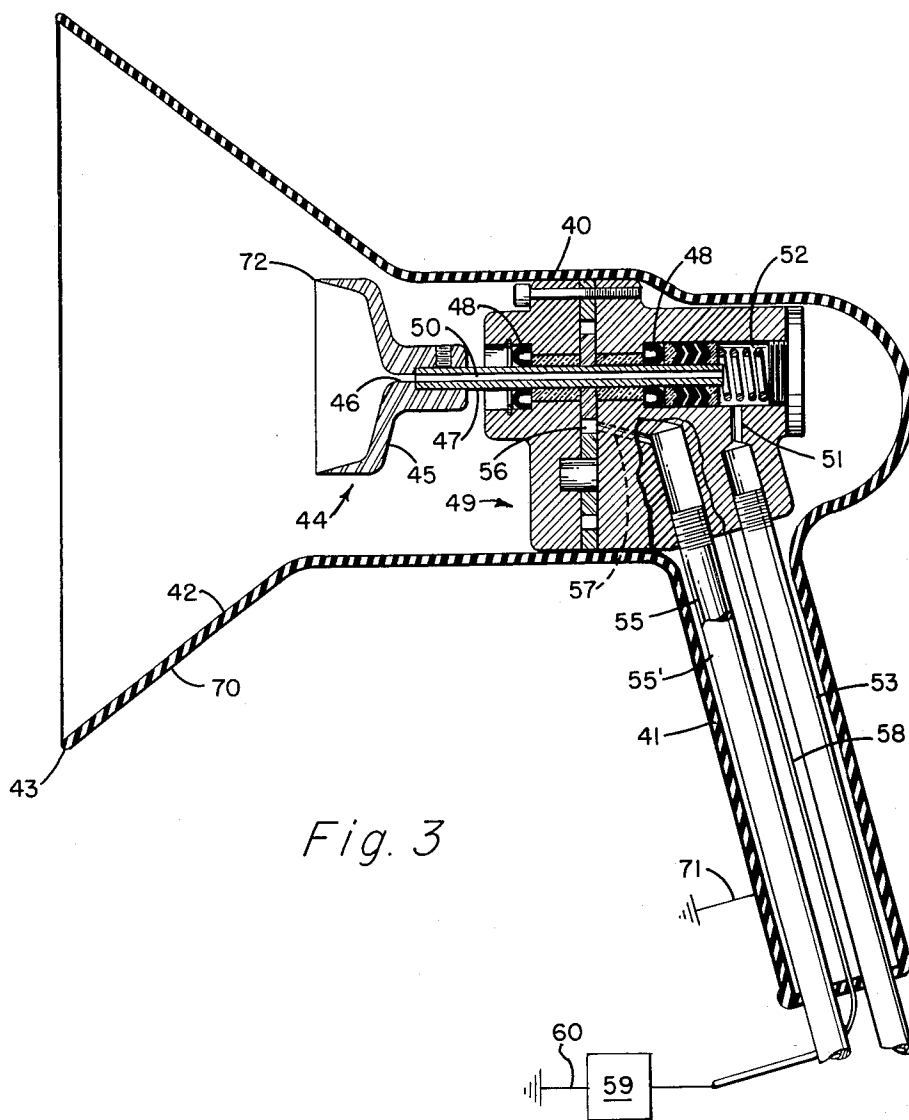
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APPARATUS FOR ELECTROSTATICALLY SPRAY COATING

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

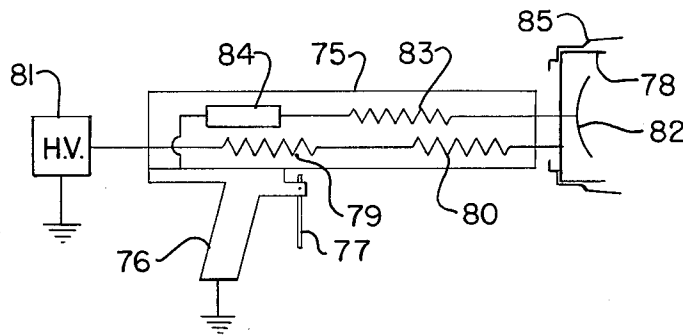


Fig. 4

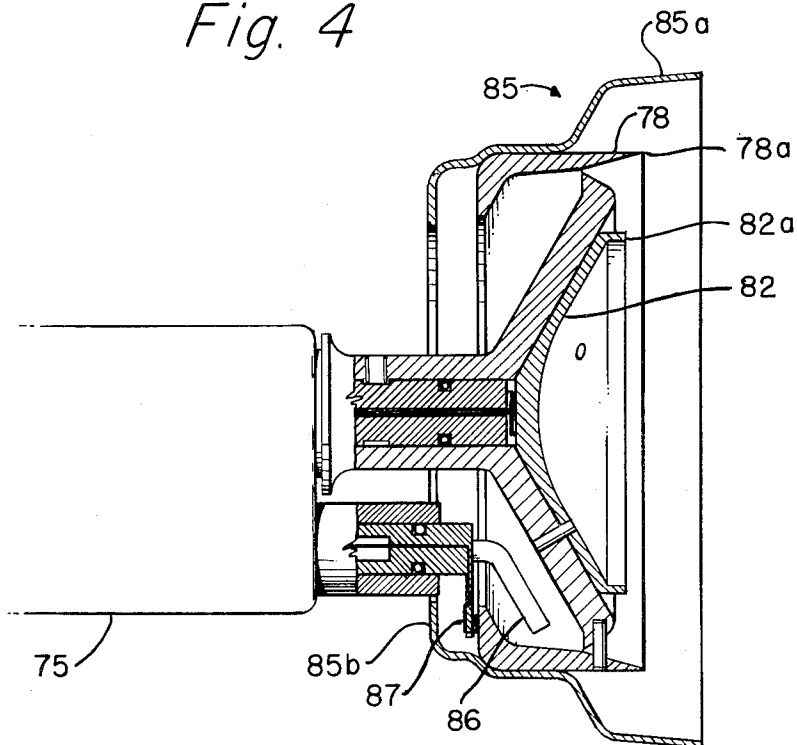


Fig. 5

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1

3,009,441

APPARATUS FOR ELECTROSTATICALLY SPRAY COATING

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Filed June 18, 1959, Ser. No. 821,319
15 Claims. (Cl. 118-624)

This invention relates to the spray coating of articles and more particularly to an electrostatic spray coating system.

It is the general object of this invention to produce a new and improved electrostatic spray coating apparatus and method.

This application is a continuation-in-part of my application Serial No. 283,095, filed April 18, 1952, now abandoned.

The economies which can be effected by the use of electrostatic spray coating systems are leading to the adoption of such systems on an ever increasing scale. In electrostatic coating systems the atomized particles of coating material are given an electrostatic charge, either at the time they are atomized or shortly thereafter, and deposition of many of the atomized particles on the article to be coated is primarily the result of electrostatic forces. Because of the fact that the article being coated, if metallic, may be used as one of the electrodes in the electrostatic coating field (or where the article is non-conductive an electrode may be placed within or immediately behind the article) a very high coating efficiency can be achieved and very little coating material is lost from over-spray.

For the most part, previous electrostatic coating systems have included a relatively fixed atomizing means, and coating is achieved by moving the articles to be coated on a conveyor other suitable mechanism within coating range of the fixed atomizer. Such conveyors often employ means for rotating the articles as they move into the coating zone so as to facilitate deposition of coating material on all sides of the article. In some systems, such as shown in U.S. Patents No. 2,559,225 and No. 2,546,701, a limited degree of movement is permitted the atomizing means, in the first case such movement being achieved mechanically and in the latter manually by an operator. In both instances, however, the range of movement of the atomizer is extremely limited and a conveyor system is still necessary.

One of the features of the present invention is the provision of a hand gun for use in an electrostatic coating system with the gun being so shielded as to permit it to be safely used by an operator for coating an article. The gun of this invention is completely mobile and, where the article is too large to be carried on a mechanical conveyor system or if for any reason a fixed atomizing means and attending conveyor is not desired, the gun can be hand-held and operated as the user walks around a large article applying coating thereto.

A further feature of the hand gun of the invention is the fact that the operator is adequately shielded from shock. To this end there is provided a mechanical barrier between the handle portion and the electrode of the gun. In the preferred form the barrier may be in the form of a shield of insulating material which surrounds the electrode and extends outwardly therefrom to an open end which is intended to face the article being coated. As the operator normally holds the gun facing away from him, no parts are exposed toward him which are at high potential. Further to safeguard the operator, the shield and handle may be provided with an exterior metal coating which is grounded so that any current which leaks onto the exterior surface of the shield is disposed of by the conductive coating.

2

Because of the high voltages employed in electrostatic coating systems, it is necessary that the electrode adjacent the source of atomized particles be maintained a distance from the other electrode of the field (which is normally the article) in excess of the maximum sparking distance of the electrodes. This sparking distance is normally about one inch for each 20,000 volts of potential. While in all electrostatic coating systems the spacing must exceed at least the maximum sparking distance, if the atomizing means and its attending electrode are fixed and the articles are moved along a conveyor, it is merely necessary initially to separate the electrodes sufficiently to prevent sparking. In a mobile hand gun, however, additional safeguards must be employed in order to prevent the operator from inadvertently moving the gun too close to the article. Another feature of the present invention is the provision on an electrostatic coating gun of an insulating member which extends outwardly from the electrode a distance at least equal to the maximum sparking distance of the electrode so as to maintain at all times at least the minimum safe distance between electrodes. In the preferred form of the invention such insulating member comprises the shield hereinabove referred to.

Where the coating material is atomized from a rotating bell-shaped head of the type disclosed in the copending application of E. M. Ransburg filed February 13, 1950, Serial No. 143,994, it has been found that the coating material is deposited on the article in an annular or doughnut-shaped pattern. If an unshielded head of this type is operated in particle depositing relationship to a fixed flat plate, coating material is deposited on the plate in an annular pattern. In commercial use relative movement between the head and article serves to move the pattern across the article and thus to coat the entire surface. The coating thickness varies somewhat throughout the pattern with the minimum film thickness being about 50% of the maximum thickness. It has been found that the provision of a cone-shaped shield around such a head with the shield being of insulating material modifies the resulting pattern so that the minimum film thickness is approximately 70% of the maximum film thickness, thus a more uniform coating from a single head can be applied. Similar desirable modifications in coating uniformity can be achieved where other types of atomizers are used and thus a further feature of the invention is the provision of a field modifying member which produces a more uniform deposition of coating material.

Other and further features of the invention will be readily apparent from the following description and drawings, in which:

FIG. 1 is a sectional view through one form of apparatus embodying the invention;

FIG. 2 is a front elevation of the device shown in FIG. 1;

FIG. 3 is a view like FIG. 1 of a modified form of apparatus;

FIG. 4 is a schematic view of another form of apparatus; and

FIG. 5 is a view, partially in section, of the forward portion of the apparatus shown in FIG. 4.

While different forms of apparatus are illustrated in the accompanying drawings and will be described hereafter as providing means for practicing the present invention, it will be understood that these are representative embodiments only. It will also be understood that forms of spraying device other than the particular electrostatic atomizing devices illustrated may be utilized and that other forms of apparatus may be employed; and it is to be understood that other embodiments may be utilized without departing from the contemplated scope of the present invention and that no limitations are to be im-

plied from such specific description as shall now be provided.

Referring now to FIG. 1, the hand gun 10 includes a housing 11 of insulating material such as a plastic, for example, polyethylene or polyester. Mounted within the housing is a wedge-type electrostatic atomizing unit 12 which includes an upper plate 13 which tapers to a relatively sharp edge 14 and a lower plate 15 similarly tapered to an edge 16. The upper and lower plates are spaced by suitable shims so as to provide therebetween an elongated feed orifice 17 which extends the entire width of the plates. Coating material is fed to the feed orifice under pressure through a conduit 18 of insulating material, such as rubber or plastic, which extends through a hollow 19 in a handle portion 20. The handle is also of insulating material, preferably the same plastic as and cast integral with the housing 11. The feed tube 18 connects with a fluid passage 21 connected in turn to a longitudinal passage 22 opening along its entire length to the feed orifice 17. Suitable pressure producing means such as a pump (not shown) is provided for feeding coating material under pressure through the tube 18.

The unit 12 is supported in position by bolts 23 which engage collars 23a secured to the unit and are threaded into a channel member 24 imbedded in the housing.

The electrostatic atomizing unit 12 is maintained at high potential relative to the article to be coated by means of a suitable wire 25 connected at one end to the atomizer 12 and extending therefrom through the hollow 19 in the handle for connection to the hot terminal of a suitable power pack 26. The opposite terminal of the power pack is grounded as indicated at 27.

The atomizing unit 12 is maintained at a high electrostatic potential sufficient to cause the coating material which is fed to the edges 14 and 16 to atomize therefrom in the form of finely divided discrete particles of coating material. For commercial purposes I prefer to use a potential providing an average field gradient of the order of 10,000 volts per inch for the intended distance of use. As the article to be coated is preferably maintained at ground potential, the electrostatic field existing between the atomized particles and the article causes the deposition of such atomized particles onto the surface of the article.

Secured to and flaring outwardly from the housing 11 is a shield member 30. The shield 30 is also constructed of insulating material, such as polyethylene or polyester, and if desired the shield may be molded together with the housing and handle in a single operation integrally to connect such portion together. The shield 30 flares outwardly from the atomizing means and terminates in an opening 31 spaced forwardly of the atomizing means a distance approximately equal to the "point to point" sparking distance of the electrode. Thus where the article being coated has a transverse dimension at least equal to the diameter of the opening 31, the gun 10 cannot be moved so close to the article as to cause sparking between it and the atomizing means 12. It will be noted by referring to FIG. 2 that the opening 31 is substantially rectangular in shape with the top side 31a and bottom side 31b paralleling the upper and lower plates 13 and 15.

The entire outer surface of the plastic shield is plated with a metallic coating 32. This coating is grounded as indicated at 33 so that the operator in grasping the gun is always in contact with the grounded handle. Because of this the operator cannot receive a shock and even if the insulating material should break down, an overload relay is provided in the power pack unit 26 so that the resulting increase in secondary current operates the relay to interrupt the electric power supplied to the atomizing unit.

The shield serves not only to protect the operator and to prevent too close approach of the electrode to the article, but also may serve as a field modifying member to produce desirable increases in coating uniformity. Where the electrode is unshielded, the lines of force extend outwardly from the electrode and curve toward the

article with the lines of force becoming progressively weaker toward the outer reaches of the field. Very weak lines of force are not effective for causing the deposition of atomized coating material particles and may, for this purpose, be disregarded. Inasmuch as the shield surrounds the electrode on all sides except the side to be faced toward the article being coated, the shield may be constructed to compress all or parts of the effective depositing electrostatic field and by such compression modify the shape and density of the pattern of coating material particles deposited by such field. Thus in the embodiment shown in FIG. 1, the two sides of the opening normal to the length of the edge are closer to the edge than the other pair of sides. The distance between the ends of the edge and the adjacent side normal thereto is less than the width at this point of an unrestricted electrostatic field originating at the edge and effective to cause the deposition of atomized coating material particles. Thus these two sides serve to compress the field at the ends of the edge and produce a resulting pattern of deposited material which has a sharper cut off at its ends and thus there is less "fanning out" or thinning of the material at the ends of the pattern. If desired the shield may be constructed so that the other two sides which are parallel to the edge also serve to compress the field by reducing the width of the opening 31 between such sides to less than the diameter of an unrestricted effective electrostatic depositing field and thus narrow the width of the pattern deposited on a stationary target while simultaneously increasing the density and the uniformity of coating material deposited thereby.

A somewhat modified form of construction is shown in FIG. 3. Referring to that figure there is provided a housing 40, a handle 41 integral with the housing and a cone-shaped shield 42 flaring outwardly from the housing and terminating in a substantially circular opening 43. Located within the housing 40 is a rotatable bell type atomizing unit 44 of the type shown in the aforementioned Ransburg application Serial No. 143,994 which includes a bell-shaped head 45 provided with a central feed opening 46 with the head being carried by a shaft 47, rotatably mounted on anti-friction bearings 48, to be driven by a motor unit 49. The shaft 47 is hollow as indicated at 50 and receives coating material from fluid delivery tube 53 by means of opening 51 and chamber 52. The tube 53, which is made of insulating material, such as rubber, is in turn connected to a pump.

Rotation of the shaft 47 and hence of the bell 45 is achieved through the motor unit 49, which may be of the hydraulic type shown or any other suitable form, and hydraulic fluid under pressure is supplied to and carried away from the motor by flexible tubes of insulating material such as tubes 55 and 55'. Fluid fed to the tube 55 is directed to contact and drive the motor rotating vanes 56 by way of connecting passage 57. The tubes 53, 55 and 55' extend through a hollow formed in the handle 41 as does an insulated wire 58 which is connected at one end to the motor unit 49, and thus, because of the metallic construction of that unit and the shaft 47 and the bell 45, to the atomizing unit 44, with the wire being connected at its opposite end to the hot terminal of a power pack 59, the other terminal of which is suitably grounded as indicated at 60.

The handle, housing and shield portion of the unit shown in FIG. 3 are, like that of the previous embodiment, provided on their exterior surfaces with a metallic coating 70 suitably grounded as indicated at 71 for the purposes previously pointed out with reference to the embodiment of FIGS. 1 and 2.

In the operation of the device shown in FIG. 3, hydraulic fluid under pressure is provided through the tube 55 to rotate the motor 49 and hence to rotate the atomizing unit 44. Coating material is then forced through the tube 53 and passes by way of passage 51, chamber 52, opening 50 and opening 46 in the bell to its inside surface and, because of the rotation of the bell, spreads

5

out in a thin film up to the edge 72 thereof. The rotating bell 45 is maintained at a suitable electric potential by means of the power pack 59 so that particles of coating material atomized from the edge carry an electrostatic charge sufficient to cause their deposition on the article to be coated.

Inasmuch as the shield 42 surrounds the electrode on all sides as did the shield in the previous embodiment, the shield may also be constructed so as to compress the field and thus to appreciably increase the uniformity of deposition of coating material atomized from the atomizing means 44. To achieve this result the diameter of the shield should be less than the diameter of the effective portions of an unrestricted electrostatic depositing field.

As previously pointed out, the pattern of an atomizing unit such as the unit 44 is annular in shape and when deposited on a moving target produces a pattern having a normal variation in coating thickness between areas of maximum and minimum coating of about 2 to 1. If, however, the diameter of the opening 43 in the shield is made less than the diameter of the portions of the electrostatic field effective to cause deposition of coating particles in an unrestricted field, such shield serves to compress the field and thereby to increase the uniformity in the pattern of deposited coating material particles so that the minimum coating thickness in the pattern is approximately 70% of the thickness of the maximum.

The shielding member shown and described herein may be used advantageously in electrostatic coating systems wherein the atomization takes place in quiescent air, that is where atomization occurs in the absence of a carrier air stream. Where atomization occurs electrostatically, such as from the particular atomizing means heretofore described, there is little tendency for the atomized particles to impinge against the inner face of the shield not only because of the absence of a carrier air stream, but also because of the fact that the inner surface of the shield acquires an electrostatic charge by induction of a polarity similar to the charge on the paint particles; and since substantially all of the paint particles are given an electrostatic charge at the time of atomization, the charge on the insulating sheath repels the paint particles and thus maintains the interior surface thereof in a clean condition. Operations where the interior of the shield collects coating material are to be avoided inasmuch as such material would either drip by gravity onto the floor or would be attracted in large drops by the electrostatic forces to the article, in either case resulting in inefficient and messy operation.

Obviously it is preferable that the metallic parts of the apparatus in both modifications be made as light as possible in order to reduce the over-all weight of the gun so that it may be manipulated with ease. To this end it is preferred that the hydraulic motor be made largely of magnesium or aluminum and its size be reduced to a minimum.

I have found that under many conditions the full advantages of a shield of the type heretofore illustrated and described can be retained while at the same time greatly reducing its physical dimensions, and making it quite light. Moreover, particularly where a circuit connection is to be made from a stationary part of a hand-held device to a rotating atomizing device having low effective capacity, the shield can be arranged to also minimize current leakage from such a connection. An embodiment of such a shielding arrangement is illustrated in FIGURES 4 and 5, and will now be described.

A hand-held atomizing and charging device is illustrated schematically in FIGURE 4. An elongated body portion 75 of insulating material is provided with a metal grip portion 76 and trigger means 77 for operating a valve which controls the flow of liquid coating material. An annular atomizing member 78 is rotatably mounted at the forward end of the body 75. This annular atomizing member is preferably of insulating material coated

6

with a layer of material providing very slight conductivity, and having relatively high electrical resistance. This rotating atomizing device is charged to a high voltage, as 80 or 90 kv., through a circuit having a high effective impedance, in this case provided by resistors 79 and 80 of the order of 500 megohms each. The resistors are supplied with high voltage from a power supply 81 adapted to provide an output voltage of the order of 100 kv., for example. Within the rotating atomizing member 78 is an inner electrode 82 of insulating material coated with a high resistance but slightly conductive film. During operation, this is maintained at a voltage intermediate that of the atomizing device and ground by leakage current traveling from the annular atomizing member 78 to this inner electrode 82 and then through a voltage developing resistor 83, which may, for example, have a value of the order of 10,000 megohms.

A connection to ground from the resistor 83 is completed through the electric motor 84 which rotates the rotatable parts at the forward end of the device, the motor being grounded through the grounded metal grip 76. The rotating annular atomizing member 78 has associated with it a very light and compact shield here identified as 85, and this shield and its relation to the other parts will now be more fully described.

Referring now more particularly to FIGURE 5, it will be seen that the rotating atomizing member 78 is tapered on its inner surface to a relatively sharp outer edge 78a. Liquid coating material supplied through the feed tube 86 flows in a thin film on the inner surface of the rotating member to the edge 78a where it is electrostatically atomized. The high potential atomizing and charging field at this edge is created in part by the voltage differential between this edge and the grounded article being coated, and in part by the potential drop between this edge and the edge 82a of the inner counter-electrode. Potential is delivered to the high resistance (but slightly conductive) coating on the outer surface of the atomizing member 78 by a small metal finger or brush 87 which makes contact with this conductive film during rotation of the member.

The shield 85 is here shown as carried by and rotating with the annular atomizing member 78, preferably being a push-fit thereon. It is made of good high-voltage insulating material, preferably flexible, as for example, of polyethylene. The forward portion 85a of the shield may be relatively close to the atomizing edge, and need project but little forwardly of the edge. It is my belief that the presence of the inner counter-electrode provided by the member 82 permits the shield to be brought very close to the atomizing edge without detracting from the quality of the electrostatic atomization; but whatever the reason may be, I find that in the type of hand-held atomizing device here illustrated, the shield may be within a half inch of the atomizing edge. The shield here shown still exerts a very desirable compressing effect on the exterior diameter of the pattern, and minimizes the thin fringe of somewhat drier spray particles which would otherwise surround the desirable portion of the spray pattern, without in any way detracting from the quality of atomization.

Moreover, I find that by providing the shield with an inwardly extending back portion here identified as 85b, leakage currents from the metal finger or brush 87 are greatly reduced, and it as well as the atomizing edge are shielded from accidental undesired contacts. In a high impedance hand-held atomizing device of the kind here described, I find that the presence of this shield portion around the metal connector finger or brush 87 results in as much as 5 kv. higher atomizing voltage at the atomizing edge 78a. It will thus be seen that the shield 85, particularly in combination with an atomizing and charging device of the general character of that here last illustrated and described, provides good mechanical protection, desirable reduction in external diameter of

7

the pattern without reducing the quality of the electrostatic atomization, and shields the brush connection in a manner improving transfer of voltage to the atomizing edge.

While I have shown and described certain embodiments 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. A hand gun for an electrostatic coating system comprising a housing of insulating material, an atomizing means secured to the housing, means for supplying liquid coating material to said means for atomization therefrom, means for creating an electrostatic field for causing the deposition of atomized particles on an article to be coated and including an electrode secured to the housing, a cup shaped shield of insulating material secured to the housing and having a rear closed portion enclosing the electrode and the atomizing means, said shield being flared outwardly from the rear portion and terminating in an opening spaced forwardly of the electrode a distance at least equal to the maximum sparking distance of the electrode, with said opening having a diameter less than the normal diameter of an unrestricted electrostatic field at the spacing of the opening from the electrode, a handle of insulating material secured to the housing, a thin layer of conducting material covering the exterior surface of the shield, housing and handle, and means for grounding said layer.

2. A hand gun for an electrostatic coating system comprising a housing of insulating material, a shaft rotatably supported in the housing, a bell-shaped atomizer secured to the shaft and positioned exteriorly of the housing, means for supplying liquid coating material to the interior surface of the atomizer, a cone-shaped shield of insulating material secured to and flaring outwardly from the housing and terminating in an edge of insulating material with the axis of the shield being coincident with the axis of rotation of the atomizer, means for rotating the shaft to rotate the atomizer, means for maintaining the edge of the atomizer at a high electrostatic potential relative to an article to be coated to create an electrostatic field therebetween for causing the deposition of atomized particles on the article, and a handle of insulating material secured to the housing.

3. An atomizing gun for an electrostatic coating system comprising an atomizing means, means for supplying liquid coating material to said atomizing means, means for maintaining said atomizing means at a high electric potential electrostatically to atomize coating material therefrom and for creating an electrostatic field between said atomizing means and an article to be coated effective to cause the deposition of atomized particles thereon, and a member of insulating material having a rear closed portion enclosing the atomizing means and said member flaring outwardly and forwardly therefrom to an opening in said member with said opening having a diameter less than the normal diameter of an unrestricted effective electrostatic field at the spacing of the opening from the atomizing means.

4. In apparatus for electrostatically spray coating an article, a support, means on the support for forming and projecting a spray of electrically charged, finely divided particles of liquid coating material, said means including an electrode, means comprising a high-voltage source for maintaining the electrode at a different potential from the article, and a spacing member of insulating material on the support disposed exteriorly of the path of the spray and extending forwardly of the electrode in the direction of spray projection to be engageable with the article, said spacing member so extending from the electrode for a distance greater than the sparking distance at the potential difference existing between the article and electrode and

8

having the general form of a hollow cone flaring from the electrode in the direction of spray-projection.

5. In apparatus for electrostatically spray coating an article, a support, means on the support for forming and projecting a spray of electrically charged, finely divided particles of liquid coating material, said means including an electrode, means comprising a high-voltage source for maintaining the electrode at a different potential from the article, a spacing member of insulating material on the support disposed exteriorly of the path of the spray and extending forwardly of the electrode in the direction of spray projection to be engageable with the article, said spacing member so extending from the electrode for a distance greater than the sparking distance at the potential difference existing between the article and electrode, and having the form of a hollow spray-surrounding sleeve, and a shield of electroconductive material surrounding said sleeve.

6. In apparatus for electrostatically spray coating an article, means for forming and projecting a spray of electrically charged coating material particles, said means having a handle, being manually movable as a unit relative to the article and including an electrode, a high-voltage source for maintaining a potential difference between the electrode and the article, and a member of insulating material supported by said handle, disposed exteriorly of the path of the spray, and extending forwardly of the electrode along the path of the spray for a distance greater than the sparking distance at the potential difference maintained between the electrode and article and having the general form of a hollow cone flaring from the electrode in the direction of spray-projection.

7. In apparatus for electrostatically spray coating an article, means for forming and projecting a spray of electrically charged coating material particles, said means having a handle, being manually movable as a unit relative to the article and including an electrode, a high-voltage source for maintaining a potential difference between the electrode and the article, and a member of insulating material supported by said handle, disposed exteriorly of the path of the spray, and extending forwardly of the electrode along the path of the spray for a distance greater than the sparking distance at the potential difference maintained between the electrode and article, said member having the general form of a hollow cone flaring from the electrode in the direction of spray-projection and including a portion interposed between said handle and the electrode.

8. In apparatus for electrostatically spray coating an article, means for forming and projecting a spray of electrically charged coating material particles, said means having a handle, being manually movable as a unit relative to the article and including an electrode, a high-voltage source for maintaining a potential difference between the electrode and the article, and a spray-surrounding shield of insulating material supported by said handle, extending forwardly from the electrode in the direction of spray-projection for a distance greater than the sparking distance at the potential difference maintained between the electrode and article, and capable in operation of the apparatus of acquiring a surface charge which, throughout the region between the electrode and the forward end of the shield, exercises a particle-repelling effect which is substantially uniform circumferentially of the spray.

9. In apparatus for electrostatically spray coating an article, means including an annular atomizer for forming and projecting toward the article an annular spray of electrically charged coating material particles, means including a high-voltage source for maintaining a difference of potential between said atomizer and the article, and means comprising a member of insulating material surrounding and spaced outwardly from the spray at a point spaced from the atomizer in the direction of spray-projection whereby said member acquires by induction a surface charge for maintaining an annular spray-surrounding zone

of particle-repelling potential to reduce the diameter of the pattern of the annular spray.

10. In apparatus for electrostatically spray coating an article, means for forming and projecting a spray of electrically charged coating material particles, said means being manually movable as a unit relative to the article and including a rotating atomizing member of low effective capacity having an annular atomizing edge, means for completing a high voltage circuit between said article and atomizing edge and including a stationary connector making rubbing contact with said rotating member, the high voltage circuit including high effective impedance, and a shield of insulating material mounted on said first mentioned means and surrounding said atomizing edge and said connector.

11. Apparatus of the character claimed in claim 10, including a counter-electrode within said atomizing edge.

12. In apparatus for electrostatically spray coating an article, means for forming and projecting a spray of electrically charged coating material particles, said means being manually movable as a unit relative to the article and including an electrode, a high voltage source for maintaining a particle-charging potential on the electrode, and a shield of insulating material mounted on said means and having an edge of insulating material surrounding said electrode.

13. In apparatus for electrostatically spray coating an article, an atomizing device having an annular atomizing edge for projecting generally axially thereof a spray of charged liquid coating material particles in an annular pattern toward the article, means for maintaining said device at a high electrical potential relative to the article, and a shielding device of insulating material mounted on said device immediately rearwardly of said edge and extending forwardly thereof and exteriorly of the spray.

14. In apparatus for electrostatically spray coating an article, a rotating atomizing device having an annular atomizing edge for projecting generally axially thereof a spray of charged liquid coating material particles in an annular pattern toward the article, means for maintaining said device at a high electrical potential, relative to the article, and an annular device of insulating material mounted on said atomizer rearwardly of the spray source and extending forwardly thereof sufficiently to electrostatically effect the path of at least some of the spray but not sufficiently to extend into the path of the spray.

15. In apparatus for electrostatically spray coating an article, means for forming and projecting a spray of electrically charged coating material particles, said means having a handle, being manually movable as a unit relative to the article and including an electrode, a high-voltage source for maintaining a potential difference between the electrode and the article, and a member of insulating material supported by said handle, disposed exteriorly of the path of the spray, and extending forwardly of the electrode along the path of the spray for a distance greater than the sparking distance at the potential difference maintained between the electrode and article.

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