

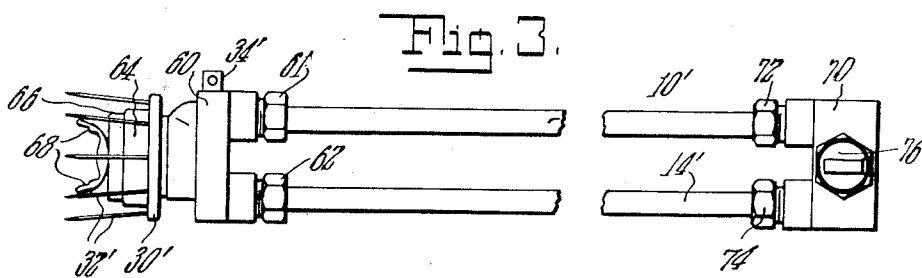
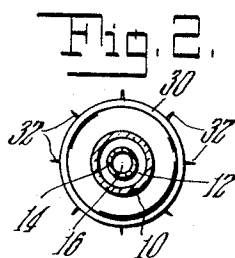
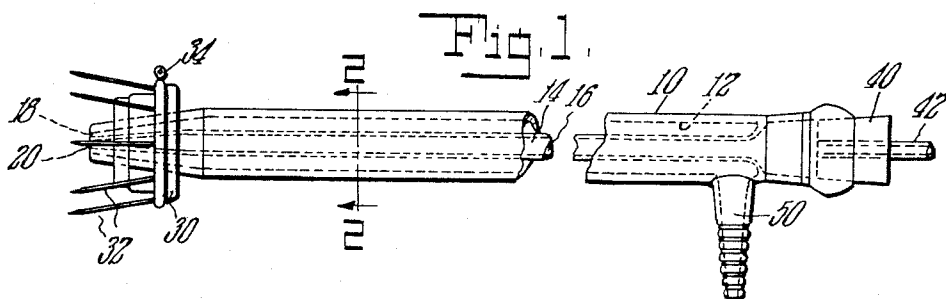
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ELECTROSTATIC SPRAY COATING APPARATUS

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ELECTROSTATIC SPRAY COATING APPARATUS

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4 Claims. (Cl. 299—1)

My invention relates to new and useful apparatus for imparting an electrical charge to liquids such as paints or the like, solids such as powdered materials or the like, and gases such as smoke or the like, which electrical charge is of such character that when the liquid or solid or gas is atomized and discharged, the sprayed charge is smoothly deposited upon the object toward which the atomized material is directed. That is to say, my invention is directed to a means for facilitating the electrostatic deposition upon an article of a liquified coating material which has been electrostatically charged. Broadly, my invention refers to a high voltage insulated electrode.

It is a principal object of my invention to provide a novel apparatus for accomplishing the electrostatic coating of articles. In particular, I provide a gun mechanism whereby the forward atomizing and spray elements are isolated from the rear support and control elements. Such an arrangement results in a desired elimination of a transmittal of an electrical charge in the forward area of the structure rearwardly to the rear area thereof. The rear portion of the mechanism is at ground potential for the convenience and safety of the operator while at the same time the forward portion thereof is adapted to receive a high electrical potential.

It is a further object of my invention to provide a new concept in the electro-coating field which will lead to increased efficiency over the conventional spray methods.

Another of the primary purposes of my invention is to provide structural and operational improvements in devices of the class to which reference has been made, which improvements not only simplify the structure as such as compared with known prior art devices, but also provide important distinct advantages in safety and the like.

With the above primary objects in view, it is another object of my invention to provide a construction in which the number of operating parts is considerably reduced, and which is practical in its value and reliable in its use.

It is well known, in applying coating materials and the like upon objects by spray devices, or so-called spray guns, to employ compressed air as a means for atomizing or reducing the material into a fluid of fine particles or comminuted condition and also as a carrying medium in spraying same upon the surface of the object being covered.

According to my invention, the atomizing element of my apparatus consists essentially of a small head or nozzle from which the coating material is metered at a predetermined rate. A source of electrostatic high potential, having one terminal grounded and its other terminal connected to the atomizing head creates a strong electrostatic field between the head and the article to be coated, which article is also grounded. The force of this field transforms the material into a spray of fine, charged particles and creates an attraction which pulls the spray to the grounded article thus accounting for complete electrostatic deposition.

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I have determined through considerable investigative effort that optimum results are obtained where the mass of the atomizing head or nozzle is maintained as small as possible whereas the mass of the article being coated is relatively larger, thereby facilitating leakage of the atomized material from the high potential nozzle to the article. The smaller the area at the high potential, the greater the leakage off to the mass of the article being coated.

Further, I have determined that by isolating the atomizing head or gun tip, as it may be called, from the remainder of the gun, as by an insulating material, the desideratum of maintaining the smallest portion or area of the gun at a high potential is achieved.

According to the novel features of the invention, in order to separate or isolate the atomizing head from the support or control elements of the gun, I have employed a connector or connectors therebetween which are non-conductors of electricity. They may be of glass, rubber, plastic or similar non-conducting material. By keeping the bore of the connectors at a minimum diameter, especially good results are obtained, particularly when the coating materials employed possess any metallic properties. The larger the tube in internal diameter, the lower the resistance, and conversely, the smaller the tube, the higher the resistance. It is to be appreciated that in the case of large tubes carrying large quantities of the material being sprayed, the tendency for voltage leakage from the atomizing head rearwardly through the bore of the connectors by way of the conductive liquid to the liquid supply source is increased. By minimizing the diameter of the bore of the insulated connector, this tendency is decreased.

By means of the apparatus of my invention, the liquid coating material is fed to the atomizing head where an electrical potential is imparted to the coating material. A different electrical potential is given to the article to be coated, which is spaced away from the head. The electrostatic field, thus created, causes atomized material to move from the head to the article.

By means of my invention, the nozzle or head end (high voltage end) of my apparatus is separated from the grounded support or control end by insulating means in such manner, that the support and control mechanisms of the gun are at ground potential and the same, as well as the operator thereof, are safeguarded against any dangerous backfiring of the head end by means of the insulation elements disposed therebetween.

All the above cited objects, I accomplish by means of such structure and relative arrangement of parts thereof and by such methods as will fully appear by a perusal of the description below and by various specific features which will be hereinafter set forth. To these above and other ends and with the foregoing and various other features and advantages and objects of my invention, it consists in certain novel features of construction, in a mode of operation, and in the combination, organization and arrangements of parts as will be hereinafter more particularly pointed out in the claims hereunto annexed and more fully described and referred to in conjunction with the accompanying drawings wherein:

Fig. 1 is a side elevational view of the device of my invention with certain parts broken away for purposes of clarity;

Fig. 2 is a sectional view on the line 2—2 of Fig. 1; and

Fig. 3 is a side elevational view of a modified form of the device of my invention.

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

Referring now to the drawing more in detail, in which similar characters of reference indicate corresponding parts in the several figures, and referring more particularly to the preferred form of my invention selected for illustrative purposes, I have shown an elongated outer tube 10 made from glass, rubber, plastic or any similar material which serves as a non-conductor of electricity and is provided with a longitudinal bore 12.

An elongated inner secondary tube 14 is disposed centrally of the bore 12 and extends coaxially of the tube 10 throughout the greater portion of its length. The tube 14 is likewise provided with a longitudinal bore 16.

The bores 12 and 16 are not in communication with each other except at the outer nozzle end of the device (the right-hand end as viewed in Fig. 1) where the tubes 10 and 14 may each be of reduced diameter and where the liquid or solid material passing through one of the bores merges with gaseous material passing through the other at the orifices 18 and 20 of the tubes 10 and 12 respectively. The orifices may be of any relative diameters desired for the purpose of the invention.

An annular metallic ring 30 is fitted around and secured to the tube 10 at the outer nozzle end thereof and may be, if desired, provided with a plurality of outwardly extending needle-like members 32 which are spaced throughout the periphery of the ring 30. A connection 34 is connected to the ring 30 by means of which a unidirectional high potential is supplied to the ring 30. This assembly shall be referred to as the high potential nozzle assembly.

At the inner end of the structure (the left-hand end as viewed in Fig. 1), the tube 14 has a flared end portion 15 which is joined to the inner wall of the tube 10, as shown.

A connection 40 is receivable in the bore 12 of the tube 10 at the inner extremity thereof. This connection supports an inlet duct 42 which extends therethrough and centrally thereof coaxially of the tube 10. The duct 42 is connected to a source of supply of the material being atomized (not shown).

An inlet nipple 50 leads into the bore 12 and has an outer free extremity which may be engaged with a source of air (not shown) by which means the air is introduced to the bore 12 and eventually to the material being atomized.

In operation, a unidirectional electric potential is maintained at the high potential nozzle assembly. The liquid or solid material and gaseous material are supplied through their respective tubes to the nozzle assembly. These materials issue from their respective orifices in the nozzle in the form of high velocity streams where they meet and mix with each other under pressure. The resulting mixture is directed outwardly with high turbulence in the form of a finely atomized stream.

As the thus formed stream is directed outwardly away from the nozzle, it is subjected to the ionizing effect of the corona discharge from the isolated nozzle whereby the finely divided particles comprising the spray are each imparted electrical charges of like polarity and of substantially equal potential with respect to the annular ring electrode.

The positively charged particles tend to repel one another and thus resist coalescence with the result that the electrified cloud of spray thus produced is attracted to surrounding grounded objects desired to be sprayed and/or coated. The particles are attracted to and precipitate in a layer upon the nearest surfaces of the grounded object which is to be coated.

For optimum results, the distance between the discharge end of the device and the article to be coated will be somewhat less than the distance between the opposite ends of the device.

As a modified form of my invention, I have shown in Fig. 3, a construction wherein the elongated tubes are not disposed one within the other.

An elongated tube 10' made from glass, rubber, plastic

or similar material is provided with a longitudinal bore. Another elongated tube 14' extends parallel to the tube 10'. This tube is also provided with a longitudinal bore.

At the opposite extremities of the tubes connecting means are provided.

At the head or nozzle end of the structure a nose piece 60 is provided and the tubes 10' and 14' are threadedly engaged therewith by means of couplings 61 and 62 respectively.

A spray head 64 of the type disclosed in United States Letters Patent No. 2,004,033 is secured to the nose piece 60 by means of which the coating material passing through tube 14' and the air or other gaseous material passing through tube 10' are thoroughly mixed.

As is disclosed in that patent, the head 64 provided with a nozzle 66 having a pair of forwardly and outwardly projecting horns 68 provided with oppositely disposed orifices through which flattened air jets are discharged at any angle to the spray stream in the well known manner.

A connection 34' is connected to the member 60 by means of which a unidirectional high potential is supplied.

On the outer periphery of member 64, an annular ring member 36' is disposed and same may be, if desired, provided with a plurality of outwardly extending needle-like members 32' which are spaced throughout the periphery of the member 30.

The inner extremities of the tubes 10' and 14' are threadedly engaged with a tail piece 70 by means of couplings 72 and 74 respectively.

The tail piece is connected to sources of supply of the coating material and air (not shown) by means of connections of any of the conventional designs. In the drawing, a connection 76 is shown which may be connected to a source of air (not shown).

As in the case of the preferred embodiment shown and described above, the operation of my modified form of the invention is by means of a unidirectional electric potential which is maintained at the nozzle end of the structure.

The liquid or solid material and the gaseous material are supplied through their respective tubes to the nozzle assembly. These materials issue from their respective orifices in the nozzle in the form of streams where they mix with each other. The resulting mixture is directed outwardly in the form of a finely atomized stream as hereinbefore described.

The invention may be embodied in other specific forms without departing from the essential characteristics thereof. Hence, the present embodiments are therefore to be considered in all respects merely as being illustrative and not as being restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all modifications and variations as fall within the meaning and purview and range of equivalency of the appended claims are therefore intended to be embraced therein.

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

1. Coating apparatus comprising in combination, an inner tube formed from insulating material for conducting a coating material and having an inner and outer end, an outer tube formed from insulating material around and concentrically related to said inner tube for conducting a gaseous material and having an inner and outer end, means associated with the inner end of said inner tube for conducting the coating material thereto, connecting means associated with the inner end of said outer tube for conducting the gaseous material thereto, the outer ends of said inner and outer tubes having concentrically related outlets whereby the emitted coating material is atomized in the emitted gaseous material in an area adjacent thereto and outwardly thereof, and an annular

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high voltage electrode disposed around the outer end of said outer tube and surrounding the atomizing area for creating an isolated electrical field at the outer ends of said tubes in which the atomized coating material is electrically charged.

2. A coating apparatus structure for transmitting a coating material and a gaseous material to an atomizing means comprising in combination, a pair of conducting members formed from conducting material for separately conducting the coating material and the gaseous material having inner and outer ends, means at the inner ends of said conducting members for conducting and controlling the supply of the coating and gaseous materials thereto in the absence of electrical energy, atomizing means at the outer ends of said conducting members for dispersing a finely divided coating material in a stream of the gaseous material, and an annular electrode positioned substantially coaxially around said atomizing means having a capacity for creating an isolated electrical field thereat in which the dispersed coating and gaseous materials are electrically charged.

3. Paint spray apparatus comprising in combination, an elongated inner paint tube and an elongated outer air tube around and concentrically related thereto, said tubes formed from insulating material, said tubes having outer concentrically related outlets and opposite inner ends thereof being connected together providing an air passageway around the inner tube closed at the inner ends of said tubes and extending to outer ends thereof, connecting means for conducting paint to the inner end of said

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paint tube, connecting means adjacent inner ends of said tubes for conducting air to said air passageway, and a metallic ring electrode around said outer air tube adjacent the outer end thereof.

4. Paint spray apparatus comprising in combination, an elongated inner paint tube and an elongated outer air tube around and concentrically related thereto, said tubes formed from insulating material, said tubes having outer concentrically related outlets and opposite inner ends thereof being connected together providing an air passageway around the inner tube closed at the inner ends of the tubes and extending to outer ends thereof, connecting means for conducting paint to the inner end of the paint tube, connecting means adjacent inner ends of the tubes for conducting air to said air passageway, and a metallic ring electrode around the outer tube adjacent the outer end thereof, and a plurality of needle-like members having inner ends fixed in circumferentially spaced relation to said ring and extending forwardly therefrom relative to the outer end of said tubes.

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