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ELECTROSTATIC SPRAYER SYSTEM HAVING A SEPARATE HIGH RESISTIVITY CONDUCTOR

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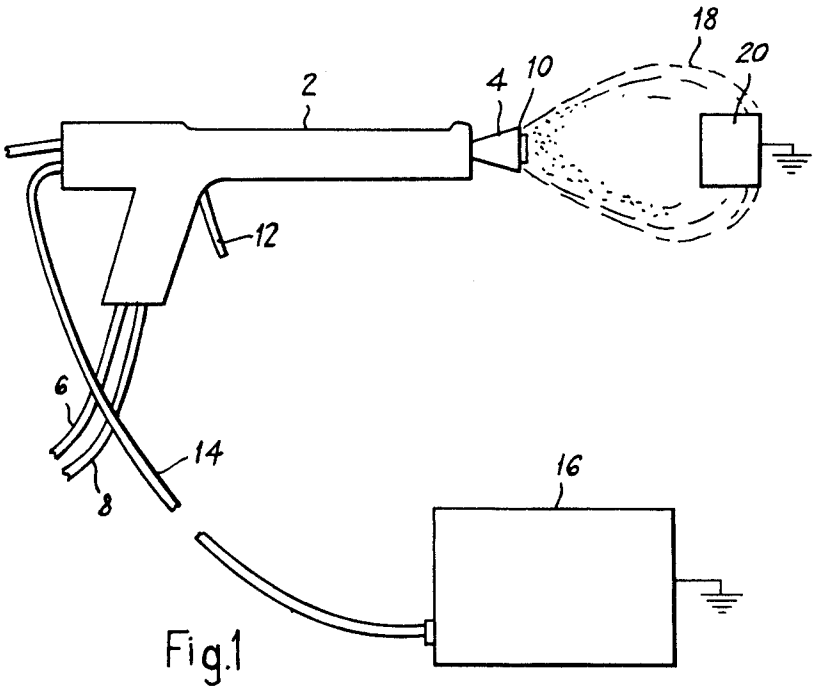

Fig.1

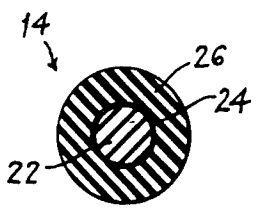

Fig.2

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ELECTROSTATIC SPRAYER SYSTEM HAVING A SEPARATE HIGH RESISTIVITY CONDUCTOR

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3 Claims. (Cl. 239—15)

This invention relates to electrostatic sprayer systems, in which a sprayer assembly, such as a spray gun, comprises a nozzle having an electrode positioned in the path of divided spray particles of a material to be sprayed for charging the particles individually to a high electric potential.

In recent years electrostatic spraying processes have been increasingly employed for the purpose of coating articles with paint, plastic and other sprayable coating materials. For such a process to be effective the spray particles must be charged to a very high common D.C. potential, of the order of 100 kilovolts. Usually the sprayer is in the form of an at least partly metallic nozzle body through which the spray particles are delivered and having a sharp annular edge or wire providing the electrode means which serves to charge the spray particles to the desired high potential as they issue from the nozzle. The sprayer body is connected to the high-voltage D.C. supply. In the use of such sprayers, the danger exists that the metallic sprayer body may be inadvertently brought close to some nearby conductive object at ground or near-ground potential whereupon spark-over will occur, and in view of the very high voltages involved such spark-over is liable to damage the apparatus and expose personnel to discomfort or injury.

To avoid this, it is usual to include a high protective resistance in series with the high voltage supply, and such a resistance is generally incorporated in the sprayer assembly itself. However, it is found that such resistances are relatively short-lived when subjected to high current surges. Moreover the presence of the large resistor in a spray gun near the forward end thereof tends to make the latter unwieldy.

It is an object of this invention to provide an improved electrostatic spray-coating system having enhanced spark-over protection. A further object is to provide improved safety during electrostatic spray-coating operations, as well as to reduce the weight and size of electrostatic spray guns.

Basically the invention comprises an electrostatic spray coating assembly having a high-voltage D.C. supply, a sprayer unit including means for forming a spray, electrode means in the path of said spray and means connecting the electrode means to the supply for bringing the electrode means to a high voltage potential to charge the spray particles, and including the improvement wherein said connecting means comprises a conductor having high distributed resistance over the length thereof for reducing spark-over current in case said sprayer unit is inadvertently approached adjacent a conductive object at low potential.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings, wherein:

FIG. 1 schematically illustrates an electrostatic spray coating system to which the invention is applied; and

FIG. 2 is an enlarged cross sectional view of a connector cable used in said assembly.

The electrostatic spraying system shown in FIG. 1 generally comprises a spray gun **2** fitted with a nozzle **4**

which may be e.g. of the type described and claimed in copending application No. 186,436, filed April 10, 1962. The gun is shown as having flexible hose connections **6** and **8** to a source of compressed air and pulverulent plastic material respectively. The nozzle **4** is at least partly metallic and has a sharp annular forward edge **10** to constitute an ionizing electrode. Finger pressure on a control shown as a trigger **12** acts to discharge a jet of particles of plastic coating material suspended in air in an annular stream from the outlet of nozzle **4**, and simultaneously applies a high direct voltage, of say 90 kilovolts or more, to the nozzle body, by way of a flexible cable conductor **14** connected to a high voltage D.C. supply source **16**. Details of the construction and operation of the system may be found in the aforementioned patent application, and it will be here sufficient to indicate that the particles of the annular stream **18** as they move past the sharp annular electrode part **10** of the nozzle are substantially all charged to a common high voltage throughout the thickness of the stream. The resulting charged cloud of particles is positively attracted to the surface of an object **20** to be coated, which is generally grounded and settle thereon and cling strongly to said surface by electrostatic attraction, with hardly any of the particles straying towards other surfaces.

In the operation of the system, should the spray gun be inadvertently held in a position where the nozzle **4** is too close to the surface of the object **20** or some other conductive surface at ground or near ground potential, so that the high voltage difference between the nozzle and the surface exceeds the spark-over potential of the intervening air path, a high-energy arc will be struck with possibly damaging results. In accordance with this invention, this is averted by providing the connector cable **14** with distributed resistance along its length. This may conveniently be achieved by using a wire of high resistivity material, such as natural or synthetic rubber having pulverulent conductive material uniformly incorporated therein.

Thus, as shown in FIG. 2, the cable **14** may include a core **22** of a high-resistivity material as just described, having a linear specific resistance of the order of a few megohms per meter length, and a sheath **26** of insulating material e.g. polyethylene. Preferably the high-resistivity core **22** is covered with an insulating tape **24** wound thereabout prior to applying the polyethylene sheath **26**. The provision of the tape insulation **24** is found advantageous in that it minimizes the temperature rise occurring in the core on application of the polyethylene sheath in an extruding or similar machine.

Extensive tests performed by the applicants with electrostatic spraying apparatus wherein the electrode voltage supply conductor was of the character just described, have shown that the time constant introduced into the circuit by the distributed resistance of the cable very efficiently dampens the current surge that would otherwise occur when the nozzle tip **4** is held adjacent to or in direct contact with a conductive object at ground potential; so that complete and foolproof safety is obtained throughout electrostatic spraying operations. The invention eliminates the requirement for the provision of a large localized resistance at the tip of the spray gun, whereby the gun is made more lightweight, and easier to wield, and its cost reduced. Experience has also shown that for a given degree of insulation a distributed-resistance cable according to the invention has higher strength and longer life than a localized resistance, since at no point along the connecting conductor will there occur a concentration of instantaneously releasable energy. At the same time, owing to the very low current values required in feeding the electrode means, the normal operation of the

electrostatic systems is not impaired by the presence of the additional resistance.

We are aware that distributed-resistance, e.g. high resistivity, conductors have been utilised in connection with internal combustion engine ignition systems for minimizing radio interference energy normally radiated from such systems. It is here noted that in such prior arrangements the resistance thus introduced into the circuits served to dampen the R.-F. oscillatory energy continually present during normal operation of the system. In contrast, according to this invention, which is directed to unrelated art, the distributed-resistance supply conductor is normally inoperative, but performs its safety function of outstanding utility solely in case of inadvertent manipulation of the electrostatic spray gun adjacent a grounded conductor.

It is to be understood that the specific embodiment of the invention shown herein as applied to one form of electrostatic spray coating system is illustrative only, and that other types of electrostatic spray coating systems for the application of both liquid and solid divided coating materials will benefit similarly from the teachings of this invention.

It should be understood that in the ensuing claims the expression "sprayable composition" is to be interpreted as designating any finely dispersable substance including both liquids and powders.

We claim:

1. An electrostatic spray-coating system comprising in combination, a sprayer unit having rear and forward ends, an external source of high voltage direct current, and an external supply means for supplying a sprayable composition, said sprayer unit having nozzle means including a body portion, a charging electrode at the forward end thereof, conduit means connecting the external supply means to said nozzle means in a location to discharge a spray of sprayable composition past said electrode during

operation of said sprayer unit, a separate high resistivity conductor having high stationary equally distributed resistance throughout the entire length thereof connected between said external source of high voltage direct current, and said electrode for bringing said electrode to a high direct current ionizing potential, said supply means and said conductor separately connected to said nozzle means at the rear end thereof.

2. The electrostatic spray-coating system claimed in claim 1, wherein said conductor is a high resistivity material.

3. The electrostatic spray-coating system claimed in claim 1 wherein said conductor comprises a core of high resistivity rubber-like material forming said conductor, insulating sheet material surrounding said core, and a sheath of polyethylene-base material surrounding said sheet material.

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