

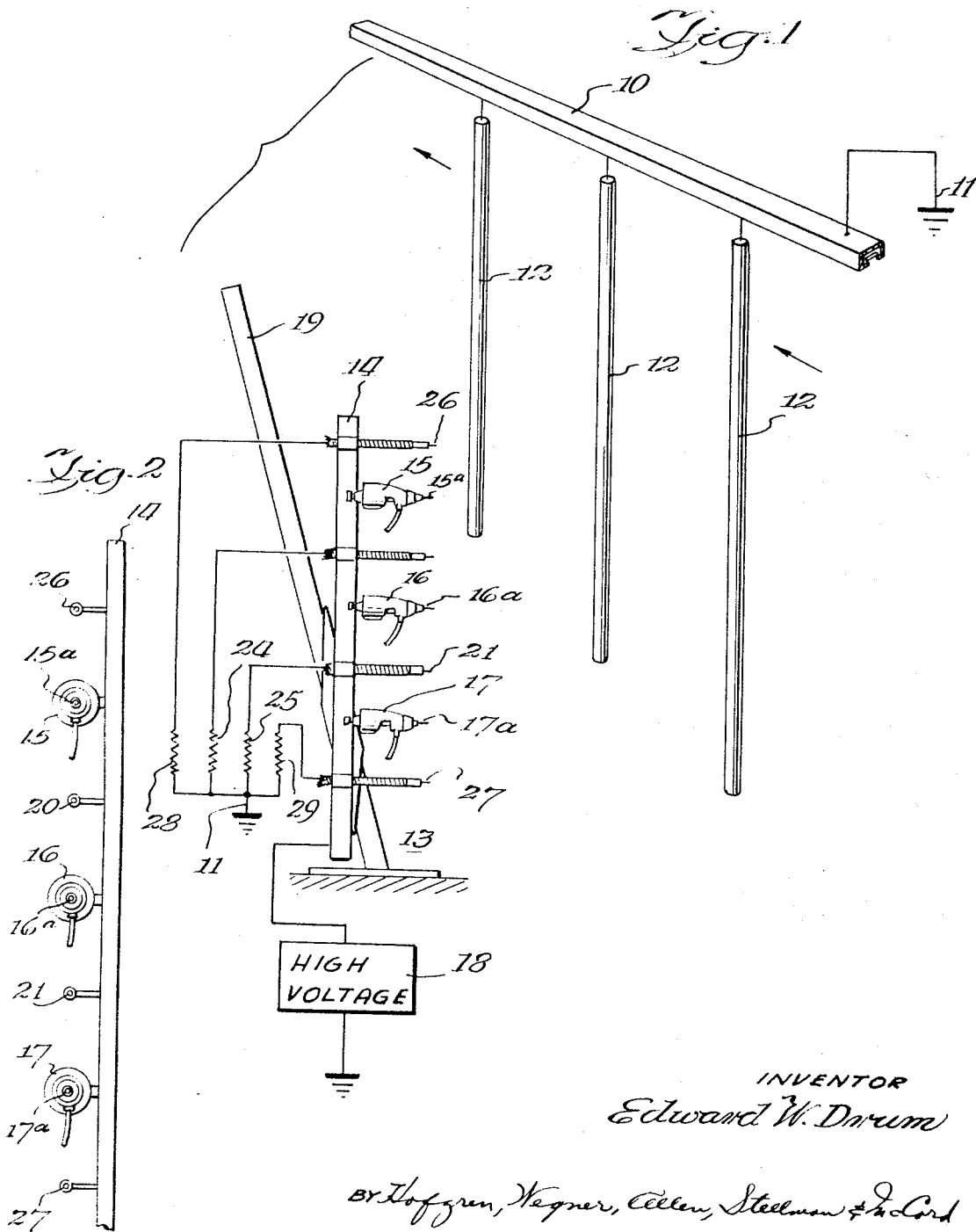
**May 27, 1969**

E. W. DRUM

**3,446,183**

COATING SYSTEM

Filed July 14, 1967



1

3,446,183

## COATING SYSTEM

Edward W. Drum, Indianapolis, Ind., assignor to Ransburg Electro-Coating Corporation, a corporation of Indiana

Filed July 14, 1967, Ser. No. 653,390

Int. Cl. B05b 5/02

U.S. Cl. 118—629

13 Claims

### ABSTRACT OF THE DISCLOSURE

A coating system including a plurality of electrostatically charged coating devices of conductive material, with electrodes between adjacent devices, connected to ground through resistors. The grounded electrodes establish an electrostatic reference for the coating system and increase the efficiency thereof.

In an electrostatic coating system, a coating material in particulate form is electrostatically charged by causing the particles to pass through an electrostatic field. The charged particles are attracted to a grounded article to be coated so that the coating material lost as overspray is greatly reduced, and the uniformity of the coating is improved.

In many instances a plurality of coating devices are utilized to coat articles which are too large to be coated by a single device. It has been found that some types of electrostatic coating devices, when operated in proximity to each other, interact with the result that the overall efficiency of the system is degraded.

More specifically, experience with all-metal electrostatic spray guns of the type illustrated in French Patents 1,421,783 and 1,427,912, described in more detail below, has shown that when the guns are mounted in proximity, as illustrated in the latter patent, the transfer efficiency of the system is less than that of an individual gun. The term "transfer efficiency" as used herein is the percentage of the coating material discharged which is deposited on the article being coated. It is believed that this reduction in efficiency is a result of a diminution of the electrostatic field gradient caused by the proximity of the charged gun bodies. The lower field gradient in the zone where the particles are charged produces a lesser charge on the coating material particles and more particles are lost.

It is a principal object of this invention to provide an electrostatic coating system utilizing plural coating devices principally of conductive material, each having a charging electrode, and having improved operation.

One feature of the invention is the provision of a means establishing an electrostatic reference potential for the charging field of the devices, between adjacent devices, and at a voltage level less than that of the devices and charging electrodes.

Another feature is that conductive means are provided adjacent the discharge devices, electrically connected through resistance means to ground, establishing an electrostatic reference for the particle charging field.

A further feature is that reference electrodes, located between adjacent guns, are connected through resistance with ground, providing an electrostatic reference for the charging field.

Further features and advantages of the invention will readily be apparent from the following specification and from the drawings, in which:

FIGURE 1 is a diagrammatic perspective view of a coating system embodying the invention; and

FIGURE 2 is a view of the coating device and electrode assembly looking from the right in FIGURE 1.

The invention will be illustrated and described in con-

2

nection with a coating system utilizing electrostatic paint spray guns in which the paint is atomized by the interaction of an air stream and a paint stream. It is applicable to other electrostatic coating systems, including those in which a liquid is atomized by other means, and to powder coating systems. Each gun has a slender charging electrode connected with a source of high voltage and establishing an electrostatic field through which the paint particles pass, becoming charged, which aids in depositing the charged particles on the grounded article to be coated. The spray guns shown in the French Patent 1,421,783, which may be used in the practice of this invention, are made substantially entirely of metal, with the charging electrode projecting forwardly from the paint discharge orifice. The gun body is connected directly to the high voltage source so that the gun, in addition to the electrode, is at an elevated potential. A plurality of such guns may be mounted in close proximity on a support as shown in French Patent 1,427,912. The invention may be utilized with other types of discharge devices, as guns utilizing hydrostatic rather than air atomization, for example.

Referring now to FIGURE 1 of the drawings, a conveyor 10, of conductive material and connected with a ground or reference potential 11, carries articles to be painted, as metal broom handles 12, through a coating zone adjacent a reciprocating mechanism 13 having a mounting arm 14 on which are carried three spray guns 15, 16 and 17. The conductive bodies of the guns are mounted directly to arm 14 which is also of conductive material and is connected with a terminal of a source 18 of high voltage. The other terminal of the voltage source is connected with ground. Charging electrodes 15a', 16a' and 17a' project forwardly of the guns in the area where paint particles are discharged. Paint is delivered to the guns through hoses 15b, 16b and 17b. The air hoses are not shown.

Arm 14 is insulated from support 19 on which it reciprocates. As the articles 12 move along the conveyor, arm 14 moves upwardly along inclined support 19 and paint is discharged to coat the articles from bottom to top. Arm 14 then returns to the bottom of support 19 and the cycle is repeated. Details of the traversing mechanism are not shown.

Where plural conductive guns are used in such close proximity that the paint patterns overlap, as is desirable to achieve uniform coating, the electrostatic charging fields are diffused by the proximity of a charged body, as adjacent guns or mounting arm 14. The diffusion of the field reduces the coating material particle charge and transfer efficiency of the system is less than that for a single isolated gun.

In accordance with the invention, auxiliary electrodes 20 and 21 are provided between adjacent guns, with electrode 20 between guns 15 and 16 and electrode 21 between guns 16 and 17. The electrodes are, in a preferred form of the invention, merely a conductive wire. More specifically, a length of high voltage cable has the insulating body stripped from the center conductor for a distance of approximately one inch. The cable is supported from arm 14 between adjacent guns with the end of the center conductor aligned with the ends of the charging electrodes of the guns. The intermediate electrodes 20, 21 are returned to ground 11 through multimegohm resistors 24, 25, which may be mounted at the electrodes, or may be remote therefrom.

A portion of the fields from each of the charging electrodes 15a, 16a and 17a terminates at electrodes 20 and 21 causing currents to flow through resistors 24 and 25. As a result, voltages are established at electrodes 20, 21, intermediate the voltage of source 16 and the reference or ground potential. The presence of the intermediate volt-

age between the charged guns makes the electrostatic field more intense around the front of each gun resulting in establishment of a higher charge on the paint particles and a higher transfer efficiency.

A further improvement in transfer efficiency can be realized by mounting additional auxiliary electrodes 26 and 27 outside guns 15 and 17. The additional auxiliary electrodes, the ends of which are aligned with the charging electrodes and with auxiliary electrodes 20, 21, are returned to ground through resistors 28 and 29.

In a specific example of a system embodying the invention, the guns were spaced apart a distance of 15 inches and charged from a source of the order of 120 kilovolts. The auxiliary electrodes were returned to ground through 25 megohm resistors.

I claim:

1. In an electrostatic system for coating grounded articles, including a plurality of coating material discharge devices, principally of conductive material, for discharging particles of coating material, charging electrode means associated with said discharge devices, and a source of high voltage relative to said articles, connected with said discharge devices and charging electrode means to establish a charging field for coating particles, the devices being in such close proximity that the charging fields are diffused, the improvement which comprises: means establishing an electrostatic reference potential for said charging fields, between adjacent discharge devices, and at a voltage level lower and substantially different than that of said discharge devices and electrode means.

2. In an electrostatic system for coating grounded articles including a plurality of coating material discharge devices, principally of conductive material, for discharging particles of coating material, charging electrode means associated with said discharge devices, and a source of high voltage relative to said articles, connected with said discharge devices and charging electrodes means to establish a charging field for coating particles, the devices being in such close proximity that the charging fields are diffused, the improvement which comprises: conductive means adjacent said discharge devices, electrically connected through resistance means to ground, establishing an electrostatic reference for the charging field.

3. The coating system of claim 2 wherein said conductive means includes an electrode between adjacent discharge devices.

4. The coating system of claim 1 wherein said reference establishing means includes an electrode connected with said reference potential.

5. The coating system of claim 4 wherein said electrode is connected with ground through a resistance.

6. The coating system of claim 3 wherein said electrode is a slender needle.

7. The coating system of claim 2 wherein a plurality of reference electrodes is provided, each connected with ground through a separate resistor.

8. The coating system of claim 7 wherein said discharge devices are located generally in side-by-side alignment with reference electrodes between each adjacent pair of devices.

9. The coating system of claim 8 including reference electrodes located exteriorly of the end discharge devices and in alignment therewith.

10. The coating system of claim 5 wherein said resistance is of the order of one-half megohm per kilovolt of the voltage of said high voltage source.

11. The coating system of claim 6 wherein the discharge devices have slender electrodes and the electrodes of the reference establishing means and of the coating devices have their tips lying generally in the same plane, and said plane is generally parallel with the surface of the article to be coated.

12. The coating system of claim 11 wherein said discharge devices are located generally in side-by-side alignment with reference electrodes between each adjacent pair of devices.

13. The coating system of claim 11 wherein said discharge devices are located generally in side-by-side alignment with a reference electrode between each adjacent pair of devices and a separate resistor connected between each electrode and ground.

#### References Cited

##### UNITED STATES PATENTS

|           |         |                 |            |
|-----------|---------|-----------------|------------|
| 2,658,009 | 11/1953 | Ransburg        | 239—3 XR   |
| 2,754,226 | 7/1956  | Juvinall        | 118—323 XR |
| 2,805,642 | 9/1957  | Tuttle et al.   | 118—635    |
| 2,877,137 | 3/1959  | Juvinall et al. | 117—93.44  |

##### FOREIGN PATENTS

|           |         |          |
|-----------|---------|----------|
| 1,427,912 | 1/1966  | France.  |
| 1,156,341 | 10/1963 | Germany. |
| 1,162,728 | 2/1964  | Germany. |

PETER FELDMAN, *Primary Examiner.*

U.S. Cl. X.R.

118—624; 239—15