

[54] ELECTROSTATIC POWDER SPRAYING METHOD AND APPARATUS

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[52] U.S. Cl..... 317/3, 239/3, 239/15

[51] **Int. Cl.** **H05b 3/60**

[58] **Field of Search** 239/3, 15; 317/3,
317/262 AE

[56] References Cited

UNITED STATES PATENTS

3,263,127	7/1966	Point et al.	239/3 X
3,413,545	11/1968	Whitby	317/3 X

Primary Examiner—M. Henson Wood, Jr.

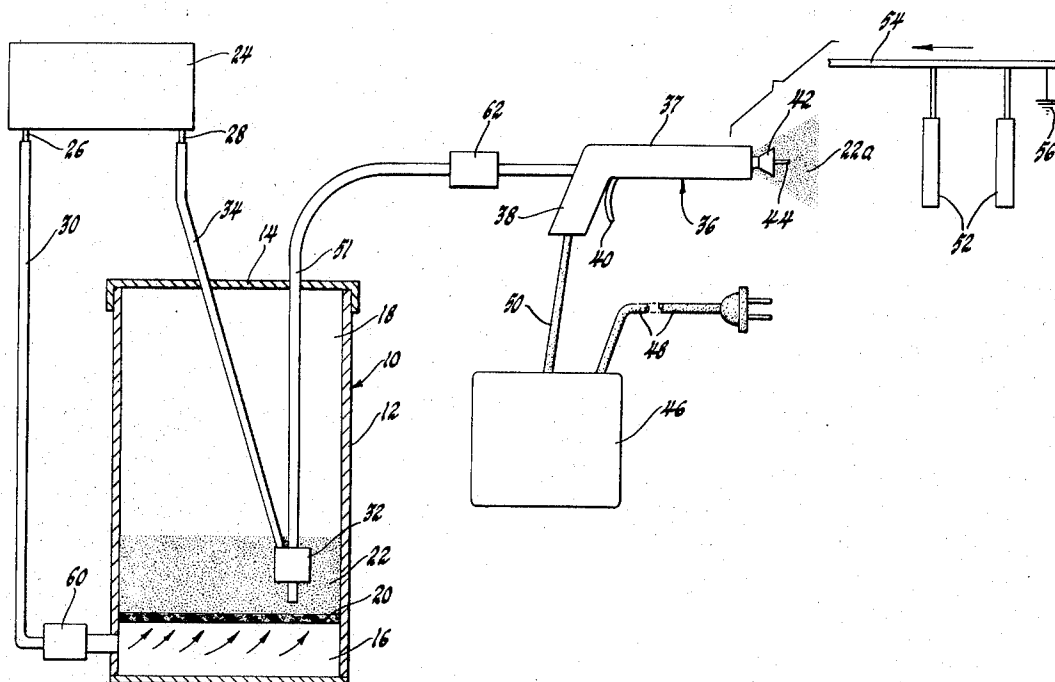
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[57] **ABSTRACT**

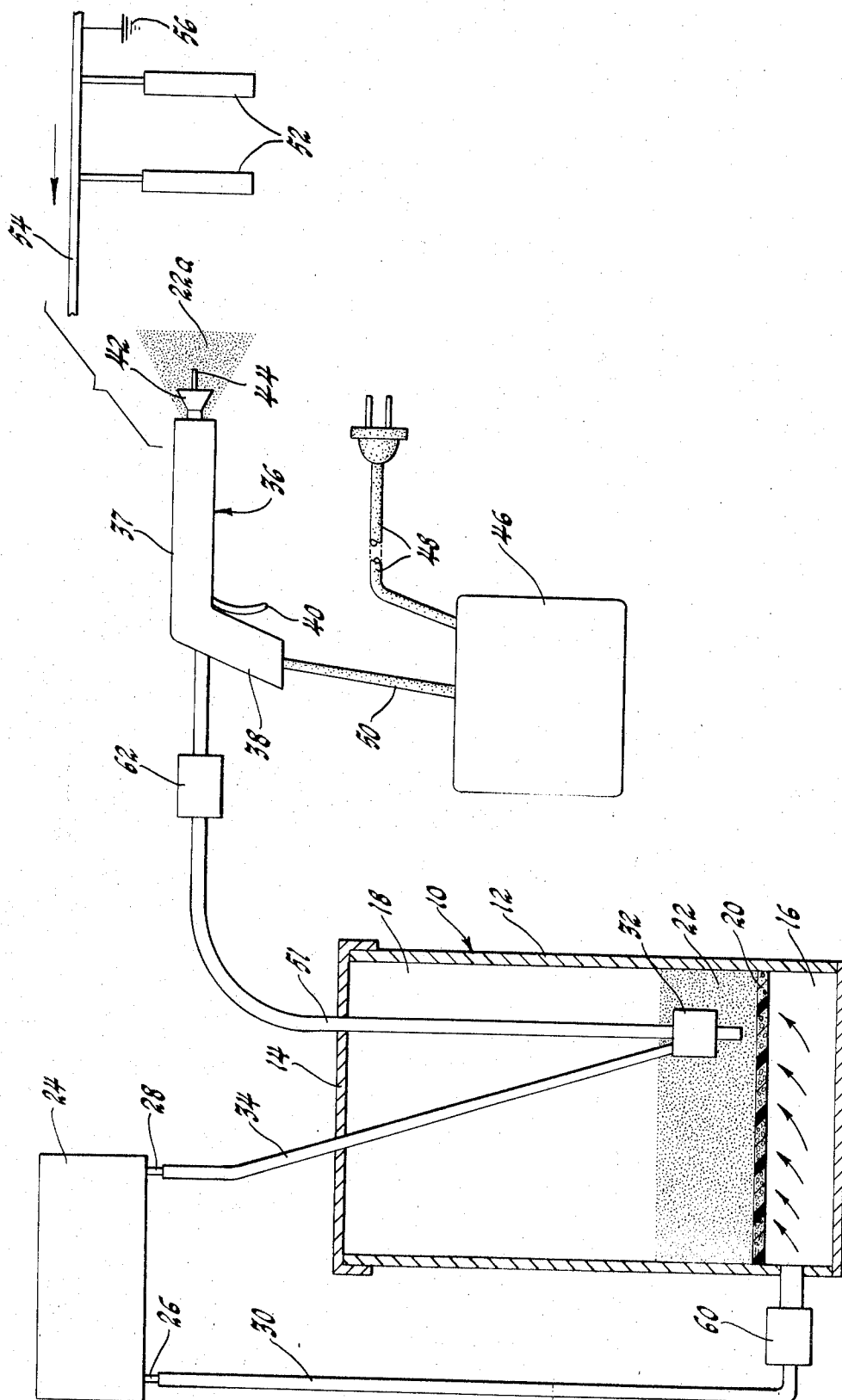
An electrostatic powder spraying method and apparatus wherein random electrical charges are neutralized on the powder to be sprayed prior to delivery of the powder particles to an electrostatic powder spray gun.

6 Claims, 1 Drawing Figure



PATENTED JAN 15 1974

3,786,309



ELECTROSTATIC POWDER SPRAYING METHOD AND APPARATUS

This invention relates to an electrostatic powder spraying method and apparatus, and more particularly to an electrostatic powder spraying method and apparatus wherein random electrical charges are neutralized on the powder to be sprayed.

One feature of the invention is that it provides an improved electrostatic powder spraying method and apparatus. Another feature of the invention is that it reduces or substantially entirely eliminates random electrical charges on the powder to be sprayed prior to delivery of the powder particles to an electrostatic powder spray gun, which charges may cause powder particles to agglomerate in the fluidizing bed, to cling to the walls of portions of the spraying apparatus, and to clog the spraying apparatus. A further feature of the invention is that it provides for more uniform coating of a workpiece by electrostatically sprayed powder particles.

Additional features and advantages of the invention will be apparent from the following description, having reference to the drawing which is a diagrammatic representation of an electrostatic powder spraying system incorporating the invention.

Powder coatings are replacing liquid paint coatings in many applications. This is desirable for many reasons, including in particular the fact that when powder coatings are utilized, volatile solvents are eliminated. Consequently, air contamination is minimized and clean up is rendered simpler and less expensive. Powder spraying is generally accomplished through a system utilizing an electrostatic powder spray gun which electrically charges fluidized powder particles and sprays them toward a work piece. The particles and the work piece are maintained at different electrical potentials, the particles generally being highly charged and the articles being grounded. The reverse situation can be utilized wherein the work pieces are charged and the particles are grounded or maintained at a voltage different from that of the work pieces so that electrostatic attraction exists between the work pieces and the sprayed particles.

A characteristic of known systems is that, prior to being charged in the spray gun, the coating particles may develop random electrical charges, generally caused by friction. These random charges may cause the particles to agglomerate in the fluidized bed with consequent choking of the pump which delivers them to the spray gun. Furthermore, electrostatic attraction between the random charged particles and the walls of various parts of the coating system may cause the particles to cling to the walls, choking the system. A further characteristic is that the particles, prior to their charging in the spray gun, may be at differing electrical potentials. Consequently they may be charged to differing potentials by the spray gun. This may result in significant differences in the voltage level of the various charged particles after they leave the spray gun, causing an uneven coating on the work pieces since the attractive force to the work pieces will vary among different particles.

In accordance with this invention, means are provided for neutralizing random electrical charges on the powder particles before delivery to the spray gun. Specifically, the particles may be neutralized in the fluidiz-

ing bed and may again be neutralized immediately prior to delivery to the spray gun.

Referring now more particularly to the drawing, 10 represents a conventional powder fluidizing bed including a container 12, generally of steel, closed by a cover 14, and provided with a lower air chamber 16 and an upper fluidizing chamber 18. A porous plate 20 separates the two chambers. The powder particles to be coated, here designated as 22, are located in the fluidizing chamber 18.

The reference character 24 represents a conventional air compressor having an outlet 26 providing a source of fluidizing air and an outlet 28 providing a source of carrier air. Obviously, separate compressors or any of various other means providing the sources of pressurized air may be utilized if desired. A first air line 30 connects the fluidizing air to the air chamber 16. A conventional powder pump 32 is immersed in the powder 22 in the powder chamber 18 and the carrier air is connected by a second air line 34 to said pump. A conventional electrostatic powder spray gun designated generally as 36 includes a gun body 37, a handle 38 and a hand operated trigger 40.

Protruding forwardly of the body 37 is a spraying head 42 and a charging electrode 44. The charging electrode is maintained at a high voltage (generally negative) which may be of the order of 60 kilovolts. A power pack 46, which is adapted to be connected through an input line 48 to a conventional source of alternating current, has its high voltage output line 50 entering the gun handle 38. Internally of the gun the high voltage line is connected to the charging electrode 44. A powder carrier line 52 connects the pump 32 to the gun 36.

As diagrammatically illustrated, work pieces 52 move in front of the gun along a conveyor 54. The conveyor and the work pieces are grounded as indicated at 56.

The powder spraying apparatus above described is conventional and well known in the art. Fluidizing air under pressure passes through the porous plate 20 and fluidizes the powder particles 22 in the fluidizing bed. The fluidized particles are sucked into the pump 32 and carried in the carrier air stream through the carrier line 51 to the spray gun 36. As the particles are sprayed from the spray gun, as indicated at 22a, an electrical charge is imparted to them by the charging electrode 44. Electrostatic forces aid deposition and adherence of the charged particles on the grounded work pieces 52. In the use of such apparatus, the powder particles, which are formed of dielectric material, may become charged in random manner, particularly due to friction inherent in the fluidizing procedure. These random charges, some of which may be positive and some of which may be negative, result in several deleterious effects. First, positively charged and negatively charged particles may agglomerate in the fluidizing bed, clogging the pump. Second, charged particles, be they positive or negative, may be attracted to and cling to the walls and even to the cover of the fluidizing bed. Thirdly, charged fluidized particles may cling to the interior wall of the carrier line 51, reducing its carrying capacity and ultimately choking it. Another deleterious effect may occur since the sprayed particles indicated at 22a may not be uniformly charged. Since the particles may be randomly charged, at different voltages and even different polarities before passing adjacent

electrode 44, the ultimate charge on the various particles may not be uniform. As a result, different particles will be acted upon by different attractive forces and an uneven coating will be formed on the work pieces 52.

The invention will now be described with reference to the accompanying drawing, wherein:

The FIGURE is a schematic view with parts in section of a general layout of apparatus use in carrying out an electrostatic powder spraying process according to the invention.

In order to minimize or entirely eliminate these deleterious effects, means are provided for neutralizing random electrical charges on the powder particles prior to their delivery to the spray gun. A first air ionizing device 60 is incorporated in the fluidizing air line 30, preferably at a location closely adjacent the fluidizing bed. This device may be an Ionized Air Source, Model 906, of Minnesota Mining and Manufacturing Company. Other similar suitable devices may be used. Reference is had to U.S. Pat. No. 3,147,225 issued Sept. 1, 1964, to J. P. Ryan for a disclosure of a suitable composition for such an air ionizing device.

As the fluidizing air passes through the ionizing device 60 in the air line 30 it is ionized so that in its passage through the particles 22 in the fluidizing bed it neutralizes random charges on the particles. Since new random charges may be developed by friction on the fluidized particles as they pass through the carrier line 51, a second similar air ionizing device 62 is incorporated in the carrier line 51, preferably at a location closely adjacent the spray gun 36. This second device causes neutralization of random electrical charges on the fluidized powder particles immediately prior to their delivery to the spray gun.

By this means agglomeration of the particles in the fluidized bed and in the pump and clinging of the particles to the walls of the fluidized bed, the pump 32, the carrier line 51 and the internal passages of the spray gun 36 is minimized or entirely avoided. Furthermore, since the particles are all in substantially the same electrical condition, i.e., neutral, as they are sprayed past the charging electrode, they all develop substantially identical electrical charges so that electrostatic attraction of the sprayed particles toward the work piece is quite uniform throughout the spray and a more uniform coating is provided on the work piece.

After coating, the work pieces may be heated in conventional manner to melt the coating particles and provide an adherent uniform coating on the work piece.

While I have shown and described one embodiment of my invention, it is capable of various modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is as follows:

1. Electrostatic powder spraying apparatus of the character described, comprising:
 - a powder fluidizing bed;
 - a source of fluidizing air for fluidizing powder particles in said bed;
 - a first air line connecting said fluidizing air to said bed;
 - a powder pump in said fluidized bed;
 - a source of carrier air;

a second air line connecting said carrier air to said pump;

an electrostatic powder spray gun for electrically charging said fluidized powder particles and spraying the same;

a carrier line connecting said powder pump to said gun for delivering fluidized powder particles to said gun;

and means for neutralizing random electrical charges on said powder particles before delivery to said gun.

2. Electrostatic powder spraying apparatus of the character described, comprising:

a powder fluidizing bed;

a source of fluidizing air for fluidizing powder particles in said bed;

a first air line connecting said fluidizing air to said bed;

a powder pump in said fluidized bed;

a source of carrier air;

a second air line connecting said carrier air to said pump;

an electrostatic powder spray gun for electrically charging said fluidized powder particles and spraying the same;

a carrier line connecting said powder pump to said gun for delivering fluidized powder particles to said gun;

and an air ionizing device in said carrier line closely adjacent said gun for neutralizing random electrical charges on said fluidized powder particles before delivery to said gun.

3. Electrostatic powder spraying apparatus of the character described, comprising:

a powder fluidizing bed;

a source of fluidizing air for fluidizing powder particles in said bed;

a first air line connecting said fluidizing air to said bed;

an air ionizing device in said first air line at a location closely adjacent said fluidizing bed for neutralizing random electrical charges on said powder particles in said fluidized bed;

a powder pump in said fluidized bed;

a source of carrier air;

a second air line connecting said carrier air to said pump;

an electrostatic powder spray gun for electrically charging said fluidized powder particles and spraying the same;

and a carrier line connecting said powder pump to said gun for delivering fluidized powder particles to said gun.

4. Electrostatic powder spraying apparatus of the character described, comprising:

a powder fluidizing bed;

a source of fluidizing air for fluidizing powder particles in said bed;

a first air line connecting said fluidizing air to said bed;

a first air ionizing device in said first air line at a location closely adjacent said fluidizing bed for neutralizing random electrical charges on said powder particles in said fluidized bed;

a powder pump in said fluidized bed;

a source of carrier air;

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a second air line connecting said carrier air to said pump;
 an electrostatic powder spray gun for electrically charging said fluidized powder particles and spraying the same;
 a carrier line connecting said powder pump to said gun for delivering fluidized powder particles to said gun;
 and a second air ionizing device in said carrier line closely adjacent said gun for neutralizing random electrical charges on said fluidized powder particles before delivery to said gun.

5. A method of electrostatically spraying a powder comprising:
 fluidizing the powder particles to be sprayed,
 delivering said fluidized powder particles to an electrostatic spray gun;

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neutralizing random electrical charges on said powder particles prior to their delivery to said spray gun;
 and electrically charging said fluidized powder particles and spraying them from said gun.
 6. A method of electrostatically spraying a powder, comprising:
 neutralizing random electrical charges on powder particles in a fluidizing bed while fluidizing said powder particles;
 neutralizing random electrical charges on said fluidized powder particles while delivering them to an electrostatic spray gun;
 and electrically charging said fluidized powder particles and spraying them from said gun.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,786,309 Dated January 15, 1973

Inventor(s) Norman O. Miottel

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

Col. 1 - Cancel lines 22-26.

Col. 2 - After line 2, insert the two following paragraphs:

-- The invention will now be described with reference to the accompanying drawing, wherein:

The FIGURE is a schematic view with parts in section of a general layout of apparatus used in carrying out an electrostatic powder spraying process according to the invention. --

Col. 2, line 33, change "52" to -- 51 --.

Col. 3, cancel lines 6 through 11.

Col. 5, line 1 of Claim 5, change "sparying" to -- spraying --.

Signed and sealed this 14th day of May 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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