ABSTRACT

Apparatus for electrostatically applying a coating of a particle material to a substrate surface to which a settable adhesive has been applied, including a container for the particle material which can pass gravitationally to a power-driven agitating and metering device and through an electrostatically chargeable electrode from which the charged particle material can then pass downwardly through a main discharge opening to the substrate surface, or said main discharge opening can be closed and the charged particle material can then be fed by the agitating and metering device to an air operated injector device from which the particle material can be delivered through a flexible pipe to a portable handle device to which different subsidiary discharge heads can be applied and electrostatically charged electrodes are positioned at or adjacent subsidiary discharge head openings to again charge or boost the charge applied to the particle material prior to discharge towards the substrate surface.

6 Claims, 6 Drawing Figures
COATING OF SUBSTRATES WITH PARTICLE MATERIALS

BRIEF SUMMARY OF THE INVENTION

According to the present invention apparatus for electrostatically applying a coating of a particle material to a substrate surface to which a settable adhesive has been applied, is of the kind comprising a container for a stock of particle material, a main discharge head affording a main discharge head opening, an electrostatic generator, an electrode connected to the electrostatic generator so as to be charged thereby and disposed between the container and the discharge head opening to charge the particle material prior to discharge thereof through said opening wherein are the improvements comprising a metering device disposed between the container and the discharge head opening and connected to power operated driving means whereby the metering device is driven to accurately regulate the flow of particle material to the main discharge head opening in a uniform stream.

The metering device may comprise a rotatably mounted paddle having blades between which are formed measuring chambers for the particle material.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be more particularly described by way of example with reference to the accompanying drawings in which:

FIG. 1 is a part-sectional side view of a floor supported part of the apparatus including a main discharge head.

FIG. 2 is a sectional plan view of FIG. 1 on the lines 2—2 thereof.

FIG. 3 is a sectional side view on an enlarged scale of an injector device for propelling the particle material.

FIG. 4 is a sectional side view on an enlarged scale of a handle device for attachment thereto of a subsidiary discharge head.

FIG. 5 is a sectional side view of one subsidiary discharge head, and

FIG. 6 is a side view of a further subsidiary discharge head.

The floor supported part of the apparatus is indicated at 10 in FIG. 1 and comprises a frame 11 supported on a floor engaging wheels or castors 12 and supported by the frame at one end thereof is a cylindrical container 14 of which the longitudinal axis A—A is vertically disposed and at the top of the container is a removable perforate or imperforate lid 16 which can be to enable particle material such as fibres or granules such as of cork, wood chips, sand or other particle materials to be placed in the container after which the lid is replaced. At the lower end of the container 14 is a horizontal metal electrode 18 which is of openwork mesh formation of such dimensions as to resist the easy passage therethrough whilst, however, permitting the passage therethrough, of the selected particle material. The electrode 18 is connected by an electrically conductive lead 20 to an electrostatic generator unit 22 supported at the other end of the frame and suitably adapted to be connected to a mains electric supply source.

An imperforate blanking panel or closure means 24 can be removably secured to the lower end of the container 14 which is provided with a turn-button 26 and a socket 27 to be engaged by a tongue 29 of the panel which can be engaged by said turn-button so as to close the lower end of the container below the electrode 18 and said blanking panel 24 can be removed after manual release of the turn-button so that the lower end of the container 14 can form a main discharge head indicated generally at 28 and having a main discharge head opening 31.

A horizontal platform 30 of the frame extends partially into the container 14 and supports an electric motor 32 which is arranged to drive, at variable speeds, a vertical spindle 34 of which the axis is co-axial with the vertical axis A—A of the container 14 and supported at the lower end of the spindle 34 is a combined agitating and metering device in the form of a rotatable paddle 35 and composed of four radially disposed paddles or blades 36 which are equiangularly spaced apart and each blade comprises a rigid mounting strip 38 to which is secured a rubber or other flexible wiper blade 40 of which the lower portion extends below the mounting strip and the lower horizontal edge of the lower portion wipes over in contact with or closely adjacent the mesh electrode 18. Thus four equal substantially sector-shaped measuring chambers 42 are provided between the blades of the paddle to receive the particle material fed into the container 14.

The electric motor 32 and the upper part of the spindle 34 are separated from the container 14 by an imperforate protective cover 43.

An opening or port 44 is formed in a side wall of the container 14 adjacent the lower end thereof and, at least in main, is below the upper horizontal edges of the paddles 36 so that said opening or port is disposed horizontally opposite the measuring chambers 42 as the paddles 36 sweep across said opening or port in fairly close proximity thereto. The opening or port 44 can be closed by a control means in the form of a vertically movable slide 46 when said slide is manually moved downwardly and said port can be opened by manually moving the slide 46 upwardly in which upper position the opening or port is placed in communication with the interior of the chamber 14.

In order to apply a coating of particle material to a substrate surface such as the floor surface 48 or a sheet of any suitable material resting thereon, said surface has applied thereto a suitable settable adhesive and, after the container 14 has been at least partially filled with the particle material and the blanking panel 24 has been removed and the opening or port 44 has been closed, the electric motor 32 is started whereby the agitating and metering device 35 is rotated at a speed adjusted to suit the particular particle material and the electrode 18 is electrostatically charged and the particle material passes downwardly under gravitational compulsion through the electrode 18 so that a stream of electrostatically charged particles pass vertically downwardly and are attracted to the substrate surface 48 so as to coat said surface and form a part thereof after the adhesive has set. The entire substrate surface can easily be coated with the particle material by manually propelling the ground supported apparatus 10 over said surface by handle means 49.

In order to apply a coating of a particle material to a substrate surface, after a settable adhesive has been applied thereto, such as for example a vertical wall sur-
face or a ceiling surface, the portable subsidiary discharge head illustrated in FIG. 6 may be employed.

For this purpose there is mounted in the floor supported part 10 of an air operated injector device 50, see FIGS. 1 and 3, which comprises a tubular nozzle 51 which is screwed at one end into the container 14 and the bore of the nozzle affords the opening or port 44. The other end of the nozzle 51 is externally convergent, as indicated at 52, in an arcuate manner and an internally screw-threaded sleeve 53 is engaged with an externally screw-threaded part of the nozzle 51 so that an annular suction chamber 54 is provided within the sleeve and surrounding the convergent part 52 of the nozzle. As outlet pipe 55 is screwed into the bush 53 and is adjusted longitudinally thereof and locked in position by a lock-nut 56 so as to leave a gap 57 between the nozzle 51 and the outlet pipe 55 and the width of said gap 57 can be adjusted to suit various circumstances including the nature of the particle material being used.

An inlet nipple 59 is screwed into the sleeve 53 so that the bore of the nipple communicates with the annular suction chamber 54 and said nipple is connected by a flexible hose 58 to a powered air compressor indicated at 159 mounted on the platform 30 of the frame 11 so that a current of air under pressure can be fed into the air injector device 50 and the air passes around the chamber 54 and is directed by the convergent part 52 of the nozzle through the gap 57 and into the bore of the outlet pipe 55 whereby suction is created in the bore of the nozzle 51 and thus at the opening or port 44 so that particle material can be drawn into the injector device from the container 14 when the slide 46 has been manually moved upwardly into a position opening said port 44 and the blanking panel 24 has been secured to the lower end of said container 14 to close the main discharge head opening 31. During the suction effect exerted by the injector device 50 on the particle material in the container 14, the combined agitator and metering device 35 is rotated at a suitable speed for the material so that said material is agitated and delivered to the opening or port 44 in a metered or controlled manner at a constant rate and before entering the opening or port 44, the particle material is electrostatically charged by reason of its proximity to the electrode 18.

The outlet pipe 55 of the injector device 50 has connected thereto one end of a circular pipe 60, see more particularly FIG. 1, of which one end 61 extends beyond the frame 11 and which end forms a spigot coupling end to detachably receive a socket coupling end 62 of a flexible hose 63, see also FIG. 4, which at its other end has mounted thereon a tubular socket handle 64 of a handle device and through which a tubular extension 65 or connection part of the hose 63 extends and said pipe 60 and hose 63 form a connecting passage. At one end of the extension 65, which extends beyond the handle 64, there is mounted externally thereon an electrostatic connecting ring or electrode 66 which is connected to a lead 67 which is mounted on the exterior of the extension 65 and of the hose 63 and at its other end can be detachably connected by a connection diagrammatically indicated at 68 to a lead 69 which is mounted on the exterior of the tube 60 and is connected to the electrostatic generator 22. Thus the leads 67 and 69 are supported by the hose 63 and tube 60 respectively and can be electrically connected together and disconnected by simple acts of connecting the hose 63 to the pipe 60 and disconnecting said hose and pipe respectively.

Secured to the socket handle 64 is a housing 70 to which the socket handle is earthed at 71 and supported by the housing 70 is a manually rotatable clamping screw 72 of which the inner end 73 enters the socket handle 64 to clamp onto a feed tube or connection part 74, see FIG. 5, of a subsidiary discharge head 75 of the manually supported apparatus part previously referred to, after said tube 74 has been inserted over the ring 66 and extension tube 65 into the socket handle 64 until the outer end of the tube 74 abuts a stop shoulder 76 in the socket handle and in which position the electrostatic connecting ring 66 contacts a connecting end of a lead 78 at the inner end of the tube 74. The inner end of the feed tube 74 is secured in a cylindrical wall 79 of the subsidiary discharge head 75 which is closed at one end by an end plate 82 and at its other end provides a subsidiary discharge head opening 83 across which extends a metal electrode 84 of openwork mesh formation and connected to the lead 78. Spaced a small distance inwardly from the electrode 84 is a brush 86 which is in the form of a circular disc and of which the bristles extend from a backing pad towards the electrode 84 and said brush constitutes a discharge agitating means for the particle material and is secured to one end of a spindle 88 adapted to be rotated by an air-operated motor 90 supported by the end plate 82. The air motor 90 is connected by an air feed pipe 92 to a pipe union 93, see FIG. 4, mounted on the housing 70 which also supports a manually operable air control tap 94 communicating with the union 93 and with a pressure air feed pipe 96 connected to the air compressor 159 as indicated.

Mounted on the housing 70 is an electric switch 97 by which the electrostatic generator 22 can be readily connected to and disconnected from the mains supply and also a further electric switch 99 by which the electric motor 32 can be switched on and off and it will be appreciated that the control tap 94 and electric switches 97 and 99 are all conveniently placed for manual operation by a person holding the socket handle 64 which is shown in FIG. 3 mounted on the extension 65 resting on the top of the frame 11. If the air compressor 159 is electrically driven a further switch, not shown, may be mounted on the housing to start and stop the compressor.

The feed tube 74 of the subsidiary discharge head 75, see FIG. 5, enters the cylindrical wall 79 at an end portion thereof remote from the electrode 84 and disposed between said feed tube and electrode is a transverse baffle plate 98, which is of substantially semi-circular formation and extends between the wall 79 and the exterior of the air motor 90 which, in addition to having an air inlet in communication with the air feed pipe 92, preferably also has an air exhaust, not shown, externally of the head 75.

Formed in the cylindrical wall 79 at a diametrically opposite position to the feed tube 74 is a relief or bleed opening 100 across the entire area of which extends a perforated support grid 102 lined with a porous liner 104 which may be made of expanded polystyrene.

In order to apply a coating of particle material to a substrate wall or ceiling, after the feed tube 74 has been inserted into the socket handle 64 and the clamping screw 72 has been tightened onto the feed tube and the
substrate surface has had a suitable adhesive applied thereto, the operator grips the socket handle 64 and suitably orients the portable subsidiary discharge head 75 so that the subsidiary discharge head opening 83 thereof, across which the electrode 84 extends, is directed to said adhesively coated substrate surface and the two manually operable switches 97 and 99 are operated to charge the electrodes 18 and 84 and to start the electric motor 32. The air compressor 159 is also started in a manner dependent upon whether this is an electrically or, for example, an internal combustion engine driven air compressor and the control tap 94 is manually opened whereby the air motor 90 is caused to rotate the agitating brush 86.

The opening of port 44 is manually opened by operation of the slide 46 and particle material in the container 14 is supplied in a constant regulated manner to said opening or port by the measuring chambers 42 of the agitating and metering device 35 which is rotated at a constant selected speed by the electric motor 32 and which speed is found to be suitable for the particular particle material being used. Resulting from the action of the injector device 50, a stream of particle material which has been electrostatically charged by the electrode 18 is fed through the pipe 60, hose 63 and extension 65 into the portable subsidiary discharge head 75 and the material passes past the agitating brush 86 and through the electrode 84 and subsidiary discharge opening 83 and thence onto the adhesively coated substrate surface. Surplus air passes through the opening 100 and is filtered by the liner 104 so that particle material does not pass through said opening.

Whilst the subsidiary discharge head 75 is satisfactory for coating the major parts of a wall or ceiling surface, it is not ideally suitable for coating the surfaces forming an inside corner and for this purpose a portable subsidiary discharge head 106, illustrated in FIG. 6, is employed. This subsidiary discharge head 106 comprises a circular feed pipe or connection part 108 which is adapted to be inserted into the socket handle 64 against the stop shoulder 76 and is secured by the clamping screw 72. The subsidiary discharge head 106 is provided at its end opposite the feed tube 108 with a flattened fishtail formation 107 (illustrated in end elevation in FIG. 9) affording an elongated rectangular discharge opening 109. It follows, therefore, that the length of the opening is considerably greater than the width of the opening which is slightly smaller than the upright external width of the fishtail formation shown in FIG. 6. The flattened fishtail formation 107 is capable of being inserted into inside corner formations to apply a particle material coating to the substrate surface or surfaces to completely cover said surface or surfaces.

The subsidiary head discharge opening 109 is not provided with an electrode and it is found that as the particle material is initially charged by the electrode 18, it is sufficiently recharged or boosted by the electrostatically charged connecting ring or electrode 66 through which the particle material passes before being discharged through the opening 109.

The strength or intensity of the suction effect developed by the injector device 50 can be varied by altering the width of the gap 50 by adjustment of the outlet pipe 55 relative to the nozzle 51 so that the rate of flow of the stream of air and particle material through the outlet pipe 55 can be adjusted to suit requirements. Fur-
of particle material supplied to the discharge heads; the apparatus further including an electrostatic generator; main electrode means electrically connected to said generator and disposed in said chamber to electrically charge the particle material therein; and subsidiary electrode means electrically connected to said generator and associated with said portable discharge head.

2. Apparatus according to claim 1 wherein the main electrode means comprises a grid extending across said one exit.

3. Apparatus according to claim 1 and including a wheeled framework adapted to be movable over a horizontal floor surface, said downwardly directed discharge head being spaced above the level of the floor engaging wheels.

4. Apparatus according to claim 1 wherein a tubular connecting passage having a flexible part is provided in communication with said other exit and a pressure gas inlet is associated with the passage to provide a flow of gas under pressure to carry the particle material towards the manually portable discharge head when the pressure gas supply is operative.

5. Apparatus according to claim 1 wherein an agitating means is provided in the portable discharge head adjacent the subsidiary electrode means and power driving means are drivingly connected to the agitating means to operate same.

6. Apparatus according to claim 5 wherein the manually portable discharge head includes a relief opening having a porous covering, and a discharge opening spaced from said relief opening, the porous liner enabling surplus pressure gas to escape therethrough but preventing escape of particle material through the relief opening, and the agitating means and subsidiary electrode means being disposed in the path of the particle material as it passes to said discharge opening.