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ELECTROSTATIC HOLD-DOWN DEVICE

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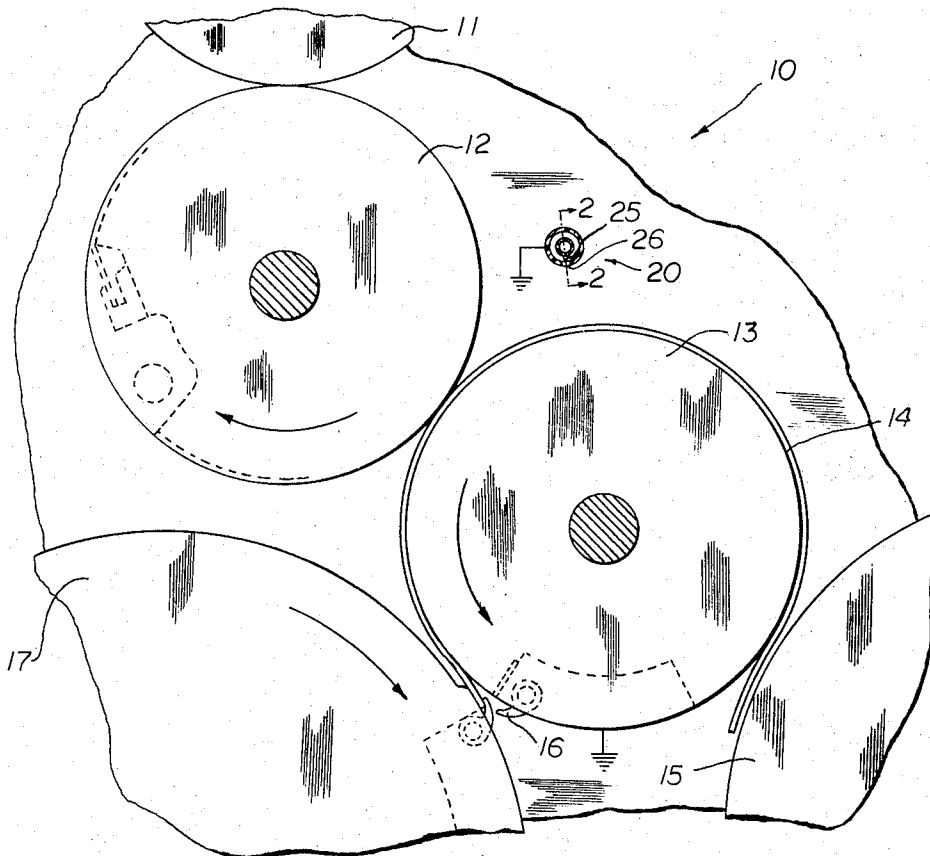


FIG. 1

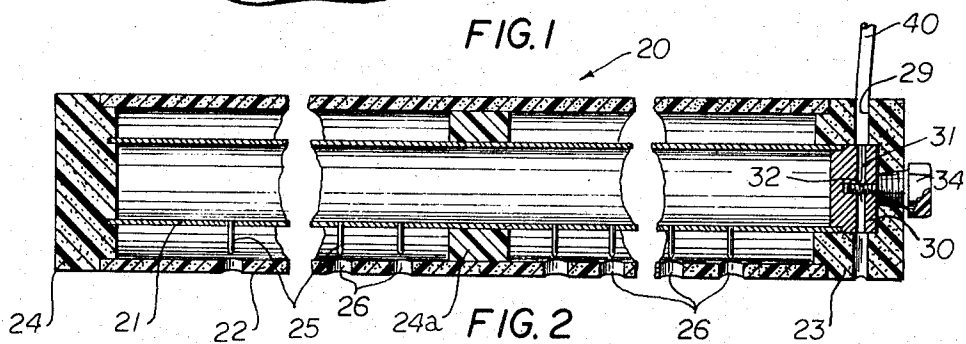


FIG. 2

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ELECTROSTATIC HOLD-DOWN DEVICE

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5 Claims. (Cl. 271—51)

The present invention relates to a device for establishing an electrostatic field and, more particularly, to an electrostatic hold-down device for use in holding a sheet against a member with which the sheet is movable.

Electrostatic devices for holding a sheet against a member with which the sheet is movable are known. Such devices have been used in sheet handling machines, such as printing presses, to cause sheet material to hug a member, such as a printing cylinder, with which the sheet is movable. These electrostatic sheet hold-down devices include an elongated conductor extending parallel of the sheet but disposed therefrom for establishing electric charges and an electric field. These devices also include an insulating member which houses the elongated conductor to provide protection to the operating personnel of the machine. The insulating member has created problems in that it adversely affects the electric field established by the conductor and thereby affects the reliability of the hold-down device.

Accordingly, the principal object of the present invention is the provision of an electrostatic device, as noted above, wherein the insulating member which encircles the elongated conductor is constructed so as to have minimal effect on the field established by the conductive member.

A further object of the present invention is the provision of a new and improved electrostatic device wherein the insulating member for the elongated electrical conductor carries or supports conductive means in the form of electrically conductive particles dispersed throughout the insulating material forming the insulating member.

A still further object of the present invention is the provision of a new and improved electrostatic device including an elongated conductor member and an insulating member housing the conductor member with the walls of the insulating member spaced from the conductor member and wherein the insulating member is made of a homogenous material, such as a plastic, having conductive particles dispersed therethrough and which is free of air pockets.

Yet another object of the present invention is the provision of a new and improved electrostatic device including an elongated conductor member and an insulating member housing the conductor member with the walls of the insulating member spaced from the conductor member and wherein the insulating member is made up of a homogenous material comprising polyvinyl chloride having carbon black particles dispersed therethrough.

A still further object of the present invention is the provision of a new and improved electrostatic device for use in establishing an electric field between the device and a cooperating rotating cylinder member which carries a sheet to effect a holding of the sheet against the cylinder member and including an elongated conductor member and an insulating member housing the conductor member and wherein the insulating member is made of a homogenous material including polyvinyl chloride and particles of carbon black.

Further objects and advantages of the present invention will be apparent to those skilled in the art to which it relates from the following detailed description of the preferred embodiment thereof made with reference to the accompanying drawings forming a part of this specification and in which:

FIG. 1 is a fragmentary sectional view of a printing press embodying the present invention; and

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FIG. 2 is a sectional view, taken approximately along the section line 2—2 of FIG. 1.

The present invention provides an improved electrostatic device for establishing an electrostatic field. The device embodying the present invention is useful in various machines where an electrostatic field is desired and, particularly, in a machine wherein sheet material is being handled and wherein it is desired to cause the sheet material to hug a member with which the sheet is movable. The present invention is particularly useful in a printing press as an electrostatic sheet hold-down device to cause a sheet to hug a cylinder of the press as the sheet is being moved through the press. Accordingly, the preferred embodiment of the present invention is shown in the drawings as embodied in a printing press 10.

The printing press 10 includes a plate cylinder 11, a blanket cylinder 12 cooperating with the plate cylinder 11, and an impression cylinder 13 which cooperates with the blanket cylinder 12. The plate cylinder 11 is disposed above the blanket cylinder 12 and carries the printing plate which has the image to be printed thereon and is inked by conventional means, not shown on the drawings, to effect a transfer of the image onto the blanket cylinder 12. The image on the blanket cylinder 12 is printed onto a sheet of material carried by the impression cylinder 13 disposed below and to one side of the blanket cylinder 12, the sheet passing between the impression cylinder 13 and the blanket cylinder 12 as the cylinders are rotated. The cylinders 12 and 13 form a nip into which the sheet is carried, and the sheet is printed as it is drawn between the cylinders 12 and 13.

The cylinders 11, 12 and 13 are rotatably supported on respective shafts which extend between and are journaled in spaced side frames of the press. A sheet being printed is indicated by the reference numeral 14, in FIG. 1, and is fed to the impression cylinder 13 by means of a conventional transfer cylinder 15 which constitutes part of a conventional feeding means, not shown or described. In the case of a multi-unit printing press, the transfer cylinder 15 may be a transfer cylinder between units of the press.

The impression cylinder 13, as is well known, is provided with gripper fingers 16 that grip the leading edge of the sheet as it fed to the impression cylinder 13 so that the sheet then rotates with the impression cylinder 13. The sheet 14 is transferred to the impression cylinder at a point in advance of the nip formed by the blanket cylinder 12 and the impression cylinder 13 and carried through the nip by the gripper fingers 16. The gripper fingers 16 are operated by conventional cam means to release the sheet for delivery to a delivery or transfer cylinder 17 which cooperates with the impression cylinder 13 for transferring the sheet from the printing unit 10, and in the case of a multi-unit press, to a succeeding printing unit. The cylinders 11, 12, 13, 15 and 17 are rotated by conventional drive means in a manner well known by those skilled in the art, and this drive is not important for an understanding of the present invention and thus will not be described.

When a sheet is fed to the impression cylinder 13 and the gripper fingers 16 operate to secure the sheet thereto, some air is inevitably trapped under the sheet 14. As the impression cylinder 13 is rotated to advance the sheet 14 so that the leading edge thereof enters the nip of the cylinders 12, 13, the air beneath the sheet 14 is pressed out as the sheet passes between the cylinder and builds up under the sheet and tends to form a bubble immediately adjacent the nip. As the rotation of the impression cylinder 13 continues, air actually causes the sheet 14 to, what may be termed, "float" relative to the impression cylinder 13 and as the trailing edge of the sheet ap-

proaches the nip, the air thereunder tends to "explode" and to cause, together with centrifugal force, the trailing edge of the sheet to flap against the blanket cylinder 12. It has been found, as described in Patent No. 3,039,388, that this flapping may be prevented by electrically attracting the sheet to the impression cylinder 13 to thereby hold the sheet to the impression cylinder 13 with which the sheet moves.

According to the present invention, the sheet 15 is electrically attracted to the impression cylinder 13 by subjecting the sheet to an electrostatic field formed in advance of the nip between the impression cylinder 13 and the blanket cylinder 12 by an electrostatic sheet hold-down device 20, which lies adjacent the outer periphery of the impression cylinder 13. The device 20 is spaced rearwardly from the nip of the impression cylinder 13 and blanket cylinder 12 along the circumference of the impression cylinder 13. Other electrostatic hold devices may be positioned at other locations about the impression cylinder 13, as is conventional. The electrostatic sheet hold-down device 20, in general, is operable to establish electric charges and an electric field adjacent the impression cylinder 13, and creates a field which ionizes the air, and causes a sheet passing through the field to hug the impression cylinder 13 and thereby provides for holding the sheet 14 down against the impression cylinder with which it moves.

The electrostatic sheet hold-down device 20 is shown in detail in FIG. 2 and, as shown therein, comprises an elongated conductive member 21 and an elongated insulating member 22 housing the conductive member 21. The insulating member 22 comprises an elongated hollow tubular member having open ends closed by plugs 23, 24. The plugs 23, 24 support the conductive member 21 which is disposed coaxially within the tubular insulating member 22. The plugs 23, 24 engage the conductive member 21 at its opposite ends, and a suitable support ring 24a may be used to support the conductive member 21 intermediate its ends. The conductive member 21 is made of an electrically conductive material, such as aluminum, and is smaller in diameter than the inside diameter of the tubular insulating member 22 so as to provide a space between the conductive member and the walls defining the internal diameter of the tubular insulating member 22. The conductive member 21 has a plurality of pins or needles 25 having pointed end portions extending radially therefrom toward the impression cylinder 13. In the illustrated embodiment, the needles 25 are uniformly spaced and the tubular insulating member 22 has an opening or an aperture 26 adjacent the outer end of each of the needles.

A high voltage generator, not shown having one side thereof grounded is connected to the conductive member 21 to establish an electrostatic field between the needles 25 of the conductive member 21 and the impression cylinder 13 which is a grounded metal cylinder. The high voltage generator is well known and will not be described in detail.

The connection from the high voltage generator to the conductive member 21 is made through a radially extending opening 29 in a portion of the plug 23 extending outwardly from the insulating tubular member 22. The conductive member 21 carries at its right end, as viewed in FIG. 2, a connecting plug member 30 having a radial opening 31 in alignment with the opening 29 in the plug member 23. The plug member 30 carries a setscrew 32 which is movable into and through the opening 31 in the plug member 30. The electrical connection to the conductive member 21 is through the setscrew 32 and plug 30. Access is provided to the setscrew 32 by means of a plastic threaded closure member 34 which is threaded into the outermost end of the plug member 23 and includes a head portion which may be engaged by a suitable wrench for loosening. When the plug member 34 is removed, the setscrew 32 may be moved inwardly or outwardly relative

to the plug member 30 by a suitable tool to effect electrical connection or disconnection of the conductor wire 40 to the conductive member 21.

In accordance with the present invention, the insulating tubular member 22 is constructed so as not to adversely affect the electrostatic field or destroy the non-uniformity of a field which is created nonuniformly. The insulating tubular member 22 supports conductive means for minimizing the effect of the insulating member 22 on the field established by the conductive member 21. The conductive means comprises conductive particles dispersed throughout the insulating tubular member.

Specifically, the insulating tubular member 22 and the plug members 23 and 24 are constructed of a homogenous material, such as a vinyl plastic, with electrically conductive particles dispersed throughout. The material of the member is void of air pockets. In the preferred embodiment of the present invention, the vinyl plastic preferably used is polyvinyl chloride and the conductive particles are carbon black. It should be understood that various other plastics or resins may be used and that other electrically conductive particles may likewise be utilized. The number of conductive particles is not critical but, of course, should not be large enough to destroy the insulating character of the insulating material. In practice, a material of polyvinyl chloride and about 2% by weight of carbon black has proved satisfactory. The insulating member is grounded as shown in the drawing.

As noted hereinabove, the insulating tubular member 22 is constructed of polyvinyl chloride with carbon black particles dispersed throughout providing an insulating member which does not adversely affect the electrostatic field produced by the conductive member 21 and, moreover, does not destroy non-uniformity of a non-uniform field, if such a field is being established.

In view of the above, it can be readily seen that applicant has provided a new and improved electrostatic device and that certain modifications, changes, and adaptations may be made therein by those skilled in the art to which it relates, and it is hereby intended to cover all such devices coming within the scope of the appended claims.

What is claimed is:

1. In an electrostatic system for establishing an electrostatic field and ionized particles in the field, an electrostatic device for establishing an electric field between the device and a conductive member and for producing ionized particles which are directed toward the conductive member by the field, said device comprising a conductor having a high voltage applied thereto relative to said conductive member to establish said field, an insulating housing having an exposed surface and surfaces adjacent said conductor covering said conductor to protect operating personnel from the high voltage applied thereto and exposing a part of said conductor facing said conductive member, said housing being electrically connected to ground and being made substantially entirely of a plastic insulating material free of voids and having high voltage insulating characteristics, said material having electrically conductive particles dispersed generally uniformly throughout the material to provide sufficient conduction to disperse electrostatic charges on the housing with the conductivity of said housing being insufficient to conduct any significant current due to the voltage applied to said member.

2. In an electrostatic system as defined in claim 1 wherein the electro-conductive particles consist of about 2% by weight of the material.

3. In an electrostatic system as defined in claim 1 wherein the material of said housing consists of polyvinyl chloride and said particles consist of about 2% by weight of the material.

4. In an electrostatic system as defined in claim 1 wherein said material engages said conductor and is elec-

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trically connected to the same side of the power supply as said member.

5. In an electrostatic system as defined in claim 3 wherein said conductive particles are carbon black.

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