

Dec. 9, 1969

R. W. BENSON
CORONA CHARGING DEVICE WITH CONDUCTIVE SHIELD AND INSULATING
MEANS ON SAID SHIELD

3,483,372

Filed May 11, 1966

2 Sheets-Sheet 1

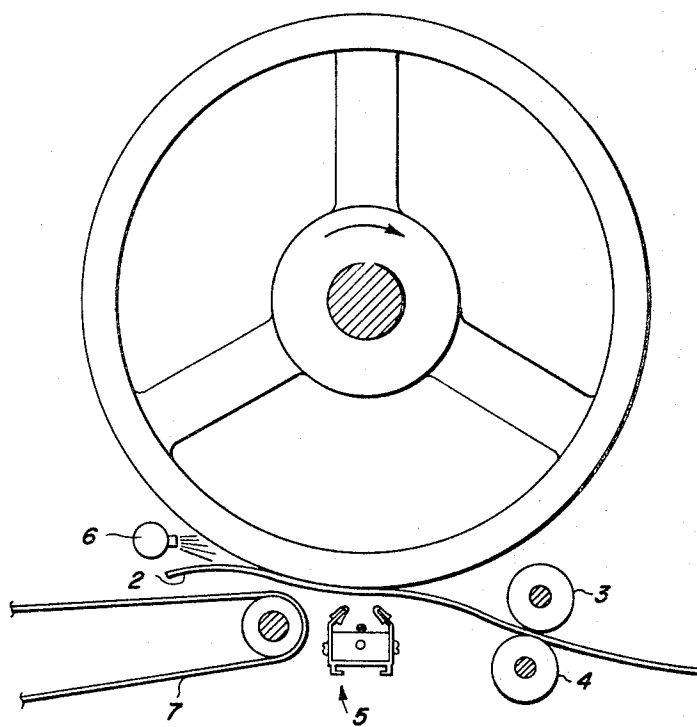


FIG. 1

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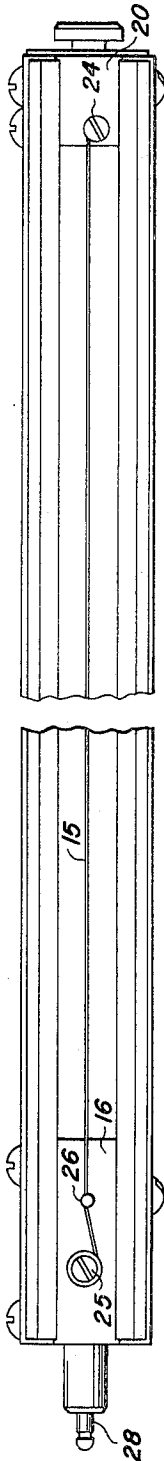


FIG. 2

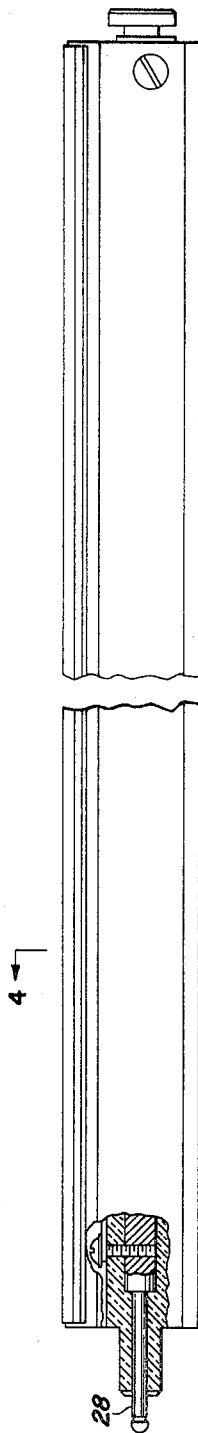


FIG. 3

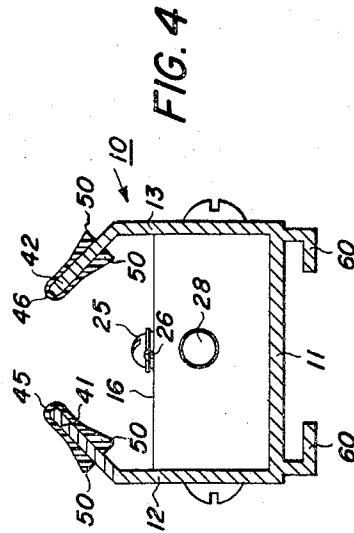


FIG. 4

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3,483,372

CORONA CHARGING DEVICE WITH CONDUCTIVE SHIELD AND INSULATING MEANS ON SAID SHIELD

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Filed May 11, 1966, Ser. No. 549,312

Int. Cl. H01j 37/26

U.S. Cl. 250—49.5

1 Claim

ABSTRACT OF THE DISCLOSURE

A corona charging device having a conductive shield including side walls, a corona wire supported in insulating block at the ends of the shields and a dielectric shield mounted on each edge of the conductive shield.

This invention relates to the field of xerography and, particularly, to an improved corona generating device for composing and maintaining a constant electrostatic charge on a support surface or on a xerographic plate.

In one mode of reproduction of copy by xerographic techniques, a uniform electrostatic charge is applied to a xerographic plate, comprising a photoconductive insulating material on a conductive backing. This charged xerographic plate is then exposed to the subject matter to be reproduced, usually by conventional projection techniques. This exposure of the xerographic plate, discharges the plate areas in accordance with the radiation intensity which reaches them and thereby creates an electrostatic latent image on or in the plate coating which may then be developed with an electroscopic material which clings to the plate electrostatically in a pattern corresponding to the latent electrostatic image. The thus formed powder image is usually transferred to a support surface by superposing the support thereon and applying an electrostatic charge to the exposed area of the support surface, whereby the xerographic powder image is electrostatically attracted and bonded to the support surface. The support surface is then separated from the xerographic plate and the xerographic powder image on the support surface may then be fixed thereto by any of a variety of techniques, such as heat fusing.

In general, the electrostatic charging of the xerographic plate in preparation for the exposure step and the electrostatic charging of the support surface to effect transfer are accomplished by means of corona generating devices whereby electrostatic charge on the order of 800–1100 volts is applied to the respective surface, in each instance. A form of corona generating device for this purpose is disclosed in Vyverberg Patent 2,836,725, issued May 27, 1958, wherein a single corona wire is connected to a high voltage source and is supported in a conductive shield that is arranged in closely spaced relation to the surface to be charged. Suitable means are usually provided to effect relative movement of the surface to be charged and the corona generating device whereby a uniform electrostatic charge is deposited.

As is well known, the corona threshold potential and the corona current from a charged wire are functions of the thickness of the wire such that the corona threshold increases with any increasing thickness of the wire and

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the corona current for any given potential decreases with any increasing thickness of the wire. In addition, the corona threshold potential and corona current are also effected directly by the deposit of dust that may accumulate on the wire or on the conductive shield and by variations of movement and ionized condition of the air surrounding the wire.

In continuous automatic xerographic reproducing machines using cut sheet material, such as paper, for the support surface onto which the xerographic powder image formed on the drum is transferred, a sheet stripping apparatus of the type disclosed in Rutkus et al. Patent 3,062,536 is used to separate the support surface from the xerographic drum after transfer. In this type of device, air under pressure is directed against the leading edge of the support surface on the drum to force it away from the drum, the support surface then peeling away from the drum due to its own weight. Although this high pressure air is directed against the drum surface and the leading edge of the support surface in pulses of short duration, this air blast will periodically dislodge small quantities of toner from the surface of the drum or from the leading edge of the support material. The loose powder will eventually settle on various components in the xerographic apparatus, and in particular, onto the corona wire and shield of the corona charging device used at the transfer station of the xerographic apparatus. This toner powder, which can be considered dust, accumulating on the corona wire and shield drastically effects the corona generating capability of the wire and causes a non-uniform and/or non-constant electrostatic charge to be deposited on the support surface during transfer.

Accordingly, the principal object of the present invention is to improve the construction of corona generating devices whereby a uniform and constant electrostatic charge may be deposited on a xerographic plate or other surface.

Another object of the present invention is to provide a corona generating device of simple and inexpensive construction that is particularly suitable for continuous operation in automatic machines.

A further object of this invention is to improve existing corona generating by the addition of an easy to install insulating shield.

These and other objects of the invention are attained by employing a single corona wire or electrode that is connected to a high voltage source and is insulated from but supported within an angled conductive shield of such a construction to limit the accumulation of dust on the corona wire. The corona wire is supported on insulated blocks within this conductive shield in such a manner as to prevent the corona wire from vibrating which would cause damage to the wire. By this arrangement, it is possible to energize the corona wire to a potential substantially in excess of the corona threshold potential of the wire and, since the shield is maintained at ground potential, most of the corona current emitted goes directly to the shield and only a small portion thereof is effective to charge the plate or support surface. In addition, a dielectric shield is mounted on the angled portion of the shield to prevent a change of the electrostatic charge generated due to the accumulation of dust.

For a better understanding of the invention as well as other objects and features thereof, reference is had to the following detailed description of the invention to be

read in connection with the accompanying drawings wherein:

FIG. 1 illustrates schematically the transfer station of an automatic xerographic reproducing apparatus incorporating a corona generating apparatus in accordance with the invention to apply an electrostatic charge to a support surface advanced into contact with the xerographic plate of the apparatus;

FIG. 2 is a top view of a corona charging device constructed in accordance with the invention;

FIG. 3 is a side elevational view of the corona charging device of FIG. 2 with parts broken away; and

FIG. 4 is a cross-sectional view taken along line 4—4 of FIG. 2;

Referring now to FIG. 1, there is shown schematically the image transfer station of an automatic xerographic reproducing apparatus, at which, the xerographic powder image previously formed on the xerographic plate is electrostatically transferred from the xerographic plate to a support surface, such as cut sheet paper.

As shown, the image transfer station includes a sheet feeding arrangement adapted to feed sheets of support material successively to the xerographic plate in coordination with the presentation of the developed image on the plate surface at the transfer station.

A xerographic plate 1, including a photoconductive layer or light-receiving surface on a conductive backing and formed in the shape of a drum, is mounted to rotate in the direction indicated by the arrow to cause the drum surface sequentially to pass a plurality of xerographic processing stations, only the transfer station being shown.

Sheets of support material 2 are advanced serially by feed rolls 3 and 4 into contact with the xerographic drum in registration with a previously formed xerographic powder image on the drum.

The transfer of the xerographic powder image from the drum surface to the sheets of support material is effected by means of a corona charging device 5, constructed in accordance with the invention, that is located at/or immediately after the line of contact between the support material and the rotating drum. In operation, the electrostatic field created by the corona charging device is effective to tack the support material electrostatically to the drum surface, whereby the support material moves synchronously with the drum while in contact therewith. Simultaneously with the tacking action, electrostatic field is effective to attract the toner particles comprising the xerographic powder image from the drum surface and cause them to adhere electrostatically to the surface of the support material.

Immediately subsequent to the image transfer station, there is positioned a stripping apparatus to paper pick-off mechanism 6 for removing the sheets of support material from the drum surface. This device, which is of the type disclosed in Rutkus et al., United States Patent 3,062,536, includes a plurality of small diameter orifices supplied with pressurized aeriform fluid by a suitable pulsator or other device. The pulsator is adapted to force jets of pressurized aeriform fluid through the outlet orifices into contact with the surface of the xerographic drum slightly in advance of the sheet of support material to strip the leading edge of the sheet from the drum surface and to direct it onto an endless conveyor 7.

In this arrangement, toner particles can and are dislodged from either the surface of the drum or from the surface of the support material. These loose toner particles still carrying an electrostatic charge are attracted to various internal elements of the apparatus, including the wire and shield of the corona generating device.

Referring now to the subject matter of the invention and, in particular to FIGS. 2, 3, and 4 illustrating a preferred embodiment of the invention, the corona charging device 5 includes a grounded conducting shield preferably of aluminum or stainless steel. The shield, generally designed

10, is of generally U-shaped cross-section and includes a bottom wall 11 and side walls 12 and 13 in perpendicular relation to the bottom wall 11.

A high voltage, or corona wire 15, of any suitable non-corrosive material, such as stainless steel, having a uniform exterior and a diameter of appropriate size is located within the shield.

The corona wire 15 is stretched between and attached to blocks 16 and 20 of suitable insulating material which are arranged between the side walls 12 and 13 at opposite ends thereof, and attached thereto as by screws 24 and 25 extending through these walls into the blocks 16 and 20. One end of the corona wire is secured to the screw 24 while the other end is wound around or clamped against the metal pin 26 and then secured by a screw 25 extending through the block 16.

As shown in FIGS. 2 and 3, this end of the wire is wound around or clamped against a metal pin 26 and held in position by a screw 25 extending through the block 16 and is threaded into a terminal plug 28, the end of which extends into a suitable bored hole in the outboard end of block 16. The exposed portions of the terminal plug is disposed for engagement with a suitable conducting bar or source carrying the high voltage supply.

The corona charging device is supported in spaced relation to the drum as by a bracket (not shown) suitably grounded to other elements of the xerographic apparatus, the bottom wall 11 of the shield being provided with rails 60, which are attached to the mounting bracket within the xerographic apparatus.

Although the above-described corona charging device, will still accumulate dust, if operated in an area where dust is present, its operating characteristics, unlike previously known corona charging devices, will not be significantly changed by dust accumulation. This is true because of the dielectric shields 45 and 46. With this arrangement, the surface may accumulate dirt and still not effect the electrostatic charge emanated from the device. Thus the instant device may accumulate dust and will be insensitive to dirt accumulation. Each of the side walls 12 and 13 has inwardly extending or angled portion 41 and 42 respectively which affords an outlet for the corona discharge. Each of these portions 41 and 42 has a shield 45 and 46 mounted thereon. The shield is preferably formed such that it covers the interior and the exterior surfaces of the angled portion of the conductive shields 12 and 13. Each dielectric shield 45 and 46 may be formed with a thicker portion 50 at the base of each side of the shield for easy installation.

The purpose of the dielectric shield is to enable the corona discharge device to maintain a constant or uniform electrostatic charge that is emitted therefrom. In prior art devices when dust accumulated on the angled portion of the conductive shield, the electrostatic charge imposed varied as the dust built up thereon. Since the conductive shield of the instant device has a dielectric shield mounted thereon any additional build up or collection of dust thereon does not change the electrostatic charge imposed by the device and therefore the instant device maintains a constant and uniform electrostatic charge.

While the invention has been described with reference to the structure disclosed herein, it is not to be confined to the details set forth or the specific environment set forth. In addition, although the structure has been defined in terms such as bottom wall and side wall, and a particular mounting arrangement has been shown, it is realized that the corona charging device can be mounted in any position around the peripheral surface of the xerographic drum. Thus, for example, if the corona charging device were mounted at the 12 o'clock position instead of the 6 o'clock position, as shown, the bottom wall of the conductive shield could then be described as the top wall of the conductive shield. Therefore, this application is intended to cover such modifications or changes as may

come within the purposes of the improvements or the scope of the following claims.

What is claimed is:

1. A corona charging device for the emission of corona discharge including:

a conductive shield comprising a bottom wall and side walls perpendicular to said bottom wall thereof, insulating support blocks connected to opposite ends of said shield between said side walls, a corona wire secured at opposite ends to said insulating support blocks in insulated relation to the conductive shield and positioned within the confines of the bottom and side walls, means connected to one end of said corona wire and adapted to be connected to a source of high voltage potential, and

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a shield formed of a dielectric material mounted on the edge of each side wall of the conductive shield said dielectric shield covering a portion of the inside and the outside surfaces of the side walls of the conductive shield.

References Cited

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U.S. Cl. X.R.

95—1.9; 250—65.1