

[54] **TRANSFER CORONA GENERATING  
DEVICE WITH SUPPORT BRUSHES**

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[51] Int. Cl. .... **G03g 13/16**

[58] Field of Search .... **118/637, 500; 96/1.4;  
117/17.5**

[56] **References Cited**

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| 3,263,649 | 8/1966  | Heyl et al. ....    | 118/637    |
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| 3,806,391 | 4/1974  | Clay et al. ....    | 117/17.5 X |

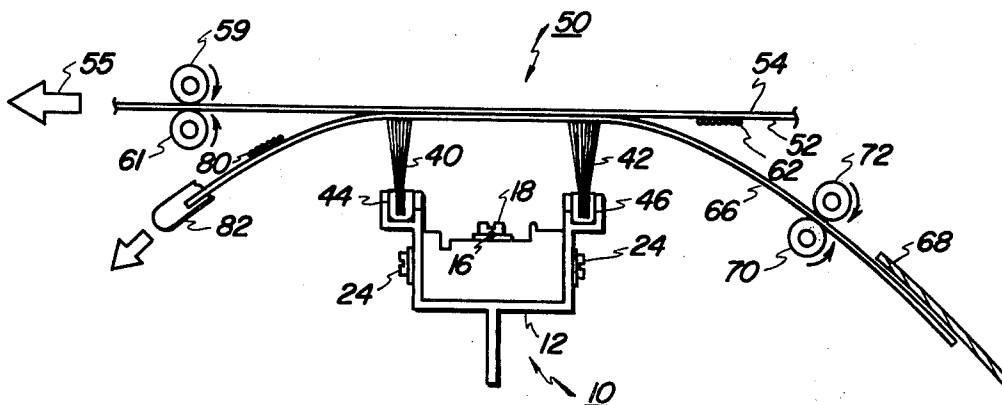
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[57]

**ABSTRACT**

Apparatus for transferring developed latent electrostatic images from a support surface to a transfer member using electrostatic techniques. A corona generating device has a plurality of spaced-apart brushes mounted such that the brushes force the transfer member into contact with the support surface. Energization of the corona generating device causes the developed image to be transferred to the transfer member.

**15 Claims, 2 Drawing Figures**



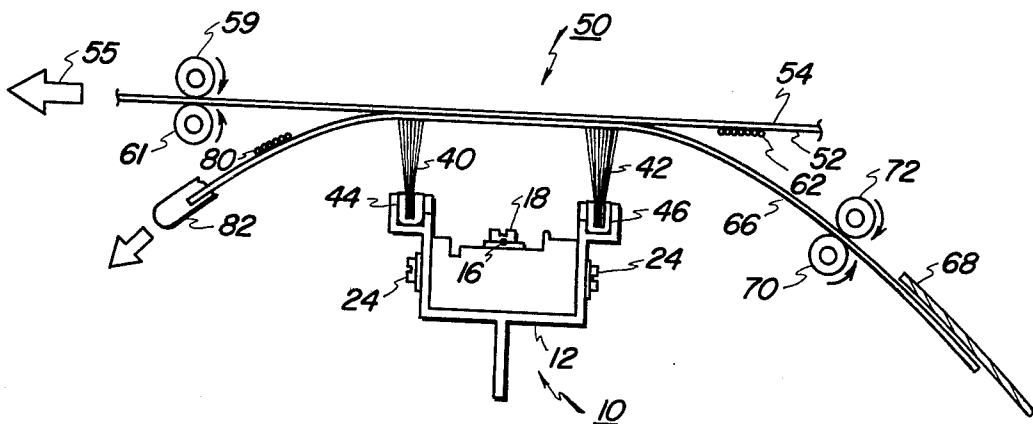


FIG. 2

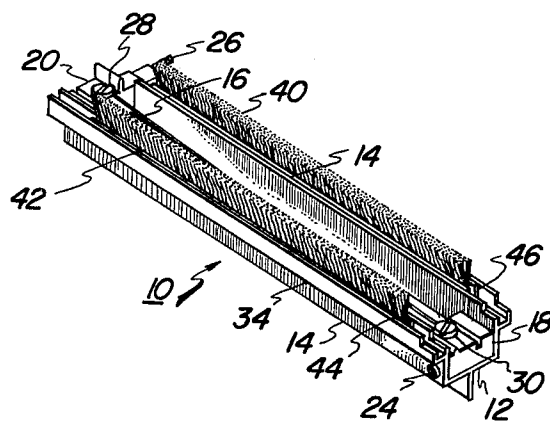


FIG. 1

## TRANSFER CORONA GENERATING DEVICE WITH SUPPORT BRUSHES

### BACKGROUND OF THE INVENTION

In the practice of xerography, as described for example in U.S. Pat. No. 2,297,691, a xerographic surface comprising a layer of photoconductive insulating material affixed to a conductive backing is used to support electrostatic images. In the usual method of carrying out the process, the xerographic plate is electrostatically charged uniformly over its surface and then exposed to a light pattern of the image being reproduced to thereby discharge the charge in the areas where light strikes the layer. The undischarged areas of the layer thus form an electrostatic charge pattern in conformity with the configuration of the original light pattern.

The latent electrostatic image can then be developed by contacting it with a finely divided electrostatically attractable material such as a powder. The powder is held in image areas by the electrostatic charge on the layer. Where the charge is greatest, the greatest amount of material is deposited; and where the charge is least, little or no material is deposited. Thus, a powder image is produced in conformity with the light image of the copy being reproduced. The powder is subsequently transferred to a sheet of paper or other surface and suitably affixed thereto to form a permanent print.

Generally speaking, any electrostatic latent image formed on a support surface may be developed in a similar manner as described hereinabove. For example, an electrostatic pattern can be printed on an insulating medium by means of a pin matrix, energization of selected pins applying a desired latent electrostatic image to the medium. The latent electrostatic image is made visible by developing the image with powder, the developed image being transferred to a suitable transfer medium if so desired.

One prior art technique for transferring a developed image to a transfer medium utilizes a corona discharge device. The transfer medium makes contact with the surface supporting the developed image, the powder forming the image being of a first polarity. The corona discharge device produces a charge of opposite polarity on the free surface of the transfer medium, thereby tacking the transfer medium against the image bearing surface and simultaneously attracting the powder image from the image bearing surface to the transfer medium.

The utilization of corona transfer techniques is deficient in certain respects. For example, vibration of the corona wire or dirt accumulation on the wire can cause a variation in ionization whereby uneven toner transfer may be observable on the transfer medium. Additionally, the efficiency of the corona discharge varies widely with environmental conditions. If an air gap is maintained between the powder image and the transfer medium, transfer is usually inefficient and incomplete.

Where the transfer medium is unusually thick when compared to ordinary transfer mediums utilized in electrostatic imaging systems, the electrostatic tacking described hereinabove is not sufficient to bring the transfer medium into contact with the surface supporting the developed image, producing an air gap with attendant inefficient and incomplete image transfer.

Notwithstanding the aforementioned deficiencies, corona transfer techniques are still widely employed.

### SUMMARY OF THE PRESENT INVENTION

The present invention provides improved apparatus for transferring developed images from a support surface to a transfer medium. In particular, a plurality of support brushes are mounted to a corona generating, or transfer charging, device to force the transfer medium into substantially uniform contact with the support surface. The electrostatic charge produced by the device and the contact established between the transfer medium and the support surface transfers the developed image to the support surface efficiently and completely.

It is an object of the present invention to provide apparatus for transferring developed images formed on a support surface to a transfer medium.

It is still an object of the present invention to provide apparatus for transferring developed images from a support surface to a transfer medium wherein a corona generating device includes a plurality of brushes mounted thereon, the brushes forcing the transfer medium into contact with the support surface, the electrostatic charge produced by the corona generating device and the contact established between the transfer medium and the support surface transferring substantially all of the developed image to the transfer medium.

It is still a further object of the present invention to provide apparatus for transferring developed powder images from a support surface to a transfer medium wherein a plurality of support brushes are mounted to a corona generating device positioned adjacent the support surface, the brushes forcing the transfer medium into contact with said surface over a predetermined contact area.

It is an object of the present invention to provide an improved apparatus for transferring a developed image to a transfer medium which is particularly useful in the medical diagnostic area of xeroradiography.

### DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention as well as further objects and features thereof, reference is made to the following description wherein:

FIG. 1 is a perspective view of the corona generating device of the present invention; and

FIG. 2 is a schematic view of an electrophotographic transfer station which utilizes the apparatus of the present invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings, in which the like reference numerals refer to the same parts in FIGS. 1 and 2, the corona generating device 10 shown is exemplary of one practical embodiment and consists of a grounded conducting shield housing preferably of aluminum or stainless steel. The shield is of generally U-shaped cross section and includes a bottom wall 12 and sidewalls 14 in perpendicular relation to the bottom wall 12.

The sidewalls 14 are spaced apart to afford a perspective discharge opening of approximately 1 inch in width while 16 designates a high-voltage wire or any suitable noncorrosive material such as stainless steel, platinum alloy, etc., having a uniform exterior and a diameter of approximately 0.0035 inches. The high-voltage wire 16 is stretched between and attached to

blocks 18 and 20 of suitable insulating material which are arranged between the sidewalls 14 and attached at the ends of the shield by means of suitable fastening screws 24 extending through the sidewall and into the insulating blocks (screws for block 20 are not shown in the perspective view) or in any other suitable fashion. The insulating block 20 has attached thereto a conducting element 26 to which one end of the high-voltage wire 18 is connected, by screw 28, the conducting element being disposed for engagement with a suitable conducting bar or source carrying a high-voltage supply as usual in this class of device. The opposite end of the conducting wire 16 is attached to an insulating block 18 by screw 30.

In accordance with the teachings of the present invention, sidewalls 14 include members 32 and 34, which together with sidewalls 14, form a channel, or recess, along the length of the sidewalls. Brush means 40 and 42, each comprising a plurality of fibers, are secured in their respective channels in any suitable manner, such as by crimping sidewalls 14. The bottom of the brush fibers are mounted in retaining means 44 and 46, respectively, which are inserted in their associated channels. In the preferred embodiment, the brush fibers are comprised of a non-conducting material, such as nylon, dnyel or rayon. Alternately conductive material, such as steel or graphite, for example, may be used for the brush fibers.

The thickness of the fiber material selected is such that damage to the image forming surface and the transfer medium, described with reference to FIG. 2, is prevented. Further, the thickness of the individual fibers is small so that a substantially constant force can be exerted by the brush fibers on the transfer medium so that intimate contact with the image surface can be produced without regard to the density of the toner, or developer, particles in the different portions of the developed image.

The fibers extend substantially outward from the retaining means 44 and 46 and are of substantially uniform length.

A brush material which has been successfully utilized is nylon, the fibers having a length of approximately  $\frac{3}{4}$  inch and a thickness of approximately 5 mils.

Additional desired characteristics of the brush material fibers are that they be flexible and should not react with ozone, a gaseous by-product of air ionization.

FIG. 2 illustrates the corona generating device of FIG. 1 at the transfer station of an electrophotographic station. In particular, an electrophotographic plate 50 comprising an electrophotographic photoconductive member 52 overlying conductive substrate 54 is transported in the direction of arrow 55 by guide rollers 59 and 61. Roller 61 should be selected such that it does not harm the surface of photoconductive member 52. Although the present invention may be utilized in any system requiring the transfer of a developed powder image to a transfer medium, the invention is particularly adapted for use in the medical diagnostic area and in particular may be used in the xeroradiographic apparatus described in U.S. Pat. No. 3,650,620.

In this regard, it should be noted that although FIG. 2 illustrates the invention in highly schematic form, the plate transport means, the transfer medium transport and removal means as will be described hereinafter may utilize the mechanisms shown in the aforemen-

tioned patent which perform the corresponding functions.

The surface of photoconductive member 52 has a developed powder, or toner image 62, formed thereon corresponding to a latent electrostatic image applied to photoconductive member 52 at a preceding information recording or imaging station. The particular steps of developing a latent electrostatic image are well known and are described, for example, in the aforementioned U.S. Pat. No. 3,650,620 and also in U.S. Pat. No. 3,640,246. For the purposes of the present invention which is directed to the transfer technique utilized, it will be assumed that the latent electrostatic image has been developed prior to being transported to the transfer area shown in FIG. 2.

A transfer medium, such as copy paper 66, is guided in an arcuate direction by guide member 68 and transported by rollers 70 and 72 into contact with the surface of photoconductive member 52 above corona generating device 10.

When a high voltage is applied to conducting element 26 (FIG. 1), the air adjacent the high voltage wire 16 is ionized, the ions having the same polarity as the latent electrostatic image initially formed on the surface of photoconductive member 52 being attracted to the free surface 74 of transfer medium 66.

In operation, the transfer medium 66 is guided in an arcuate direction by guide member 68 towards the surface of photoconductive member 52 and the plate 50 is transported in the direction of arrow 55 by rollers 59 and 61. Brush members 40 and 42 are initially positioned such that the fiber tips interfere with the surface of photoconductive member 52 whereby the transfer medium 66 is moved into intimate contact with the surface of photoconductive member 52 as plate 50 is transported in the direction of arrow 55.

The brushes 40 and 42 provide uniform contact at substantially constant pressure between the transfer medium 66 and the surface of photoconductive member 52 over a band of contact, or contact area, determined by the spacing between the brushes 40 and 42. Energization of high-voltage wire 16 by applying a potential of the proper polarity to conducting element 26 causes the powder, or toner, image on the surface of photoconductive member 52 to be transferred to the surface of transfer medium 66 in contact therewith. As shown in FIG. 2, a portion of the image 80 has been transferred to transfer medium 66.

As set forth hereinabove, the present invention is useful in the field of medical diagnostics. In particular, the art of X-ray recording by xerography, generally known as xeroradiography, has been utilized in the field of medical diagnostics to examine, for example, the extremities. Apparatus for automatically providing a permanent print, or xerogram, of the examined extremity is described in U.S. Pat. No. 3,650,620. The transfer medium for the permanent print is of a thickness (i.e., 0.008 mils) which is generally greater than that utilized in the normal electrophotographic (i.e., xerographic) process. The increased thickness, with the attendant increase in weight and stiffness, prevents efficient transfer of the toner image to the transfer medium using corona generating transfer techniques. However, the present invention allows the use of this technique by forcing the transfer medium into intimate contact with the surface of the photoconductive mem-

ber 52 as the free surface of the transfer medium is charged to the proper polarity.

After the powder image has been transferred to the transfer medium, or support sheet 66, the leading edge of the transfer medium comes into contact with a gripper bar assembly 82 (more fully described in the aforementioned U.S. Pat. No. 3,650,620) which strips the transfer medium 66 from plate 50 to deliver it to another operational area whereat the transferred image may be fused to the transfer medium.

While the invention has been described with reference to its preferred embodiments, it will be understood by those skilled in the art, that various changes may be made and equivalents may be substituted for elements thereof without departing from the true spirit and scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from its essential teachings.

What is claimed is:

1. Apparatus for transferring a developed image formed on a support surface to a transfer member comprising:

- a support surface having a developed image formed thereon,
- a corona generating device located adjacent said support surface,
- means supported on said corona generating device for forcing a transfer member into contact with said support surface,
- means for introducing a transfer member between said support surface and said corona generating device whereby said transfer member is forced into contact with said support surface by said forcing means, and
- means for producing relative motion between said corona generating device and said support surface, energization of said corona generating device causing said developed image to be transferred to said transfer member.

2. The apparatus as defined in claim 1 wherein said forcing means comprises brush means.

3. The apparatus as defined in claim 2 wherein said corona generating device includes a pair of sidewalls said brush means comprising a pair of brushes, each of said brushes being supported adjacent a sidewall.

4. The apparatus as defined in claim 2 wherein said brush means comprises a plurality of non-conductive fibers, the tips of said fibers forcing said transfer member into contact with said support surface.

5. The apparatus as defined in claim 4 wherein said support surface comprises a plate member.

6. Apparatus for transferring a developed image formed on a support surface to a transfer member comprising:

- a support surface having a developed image formed thereon,
- a corona generating device located adjacent said support surface, said corona generating device comprising a housing including a pair of sidewalls and a bottom wall, a corona wire supported within said housing and means supported at each sidewall and

extending substantially along the length thereof for forcing a transfer member into contact with said support surface,

means for introducing a transfer member between said support surface and said corona generating device whereby said transfer member is forced into contact with said support surface by said forcing means,

means for producing relative motion between said corona generating device and said support surface, and

means for energizing said corona wire whereby said developed image is transferred to said transfer member.

7. The apparatus as defined in claim 6 wherein said forcing means comprises brush means.

8. The apparatus as defined in claim 7 wherein each of said brush means comprises a plurality of non-conductive fibers, the tips of said fibers forcing said transfer member into contact with said support surface.

9. The apparatus as defined in claim 8 wherein said support surface comprises a plate member.

10. The apparatus as defined in claim 9 wherein said brush means extends along the length of said plate member.

11. Apparatus for transferring a developed image formed on a support surface to a transfer member comprising:

- a support surface having a developed image formed thereon,
- a corona generating device located adjacent said support surface, said corona generating device comprising a housing having a pair of sidewalls and a bottom wall, each sidewall having channel forming members associated therewith which extend along the length of the sidewall, a corona wire supported within said housing and means secured within each channel for forcing a transfer member into contact with said support surface,

means for introducing a transfer member between said support surface and said corona generating device whereby said transfer member is forced into contact with said support surface by said forcing means,

means for producing relative motion between said corona generating device and said support surface, and

means for energizing said corona wire whereby said developed image is transferred to said transfer member.

12. The apparatus as defined in claim 11 wherein said forcing means comprises brush means.

13. The apparatus as defined in claim 12 wherein each of said brush means comprises a plurality of non-conductive fibers, the tips of said fibers forcing said transfer member into contact with said support surface.

14. The apparatus as defined in claim 13 wherein said support surface comprises a plate member.

15. The apparatus as defined in claim 14 wherein said brush means extends along the length of said plate member.

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