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Vock

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[54] **CORONA TRANSFER MECHANISM**

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[52] **U.S. Cl.** **118/637;**

[51] **Int. Cl.**[2] **B05B 5/02**

[58] **Field of Search** 355/5; 118/637; 117/17.5; 96/1.4

[56] **References Cited**

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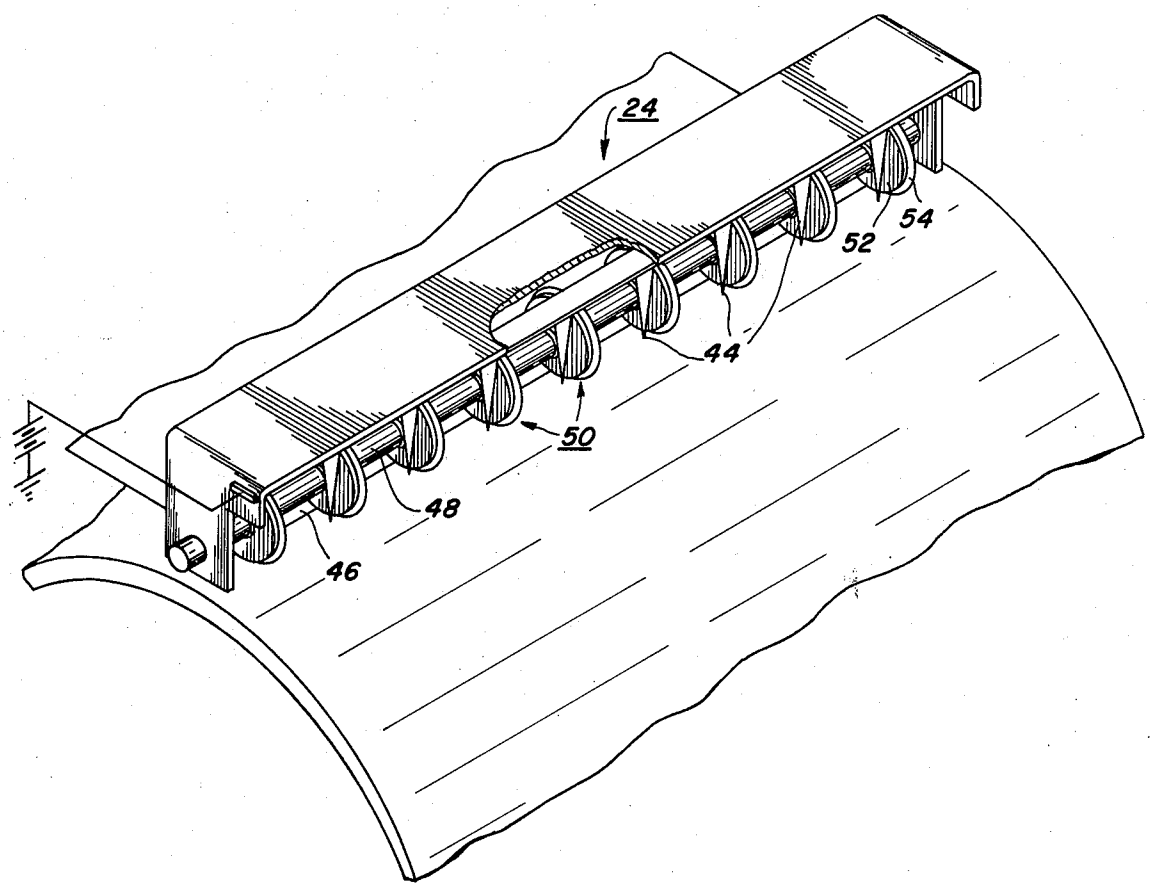
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[57] **ABSTRACT**

An electrostatic reproduction machine has an improved transfer mechanism for effecting transfer of a developed image from a photoconductive surface of the machine to a sheet of paper, the mechanism having a plurality of point discharge needles disposed adjacent the photoconductive surface, and a plurality of rotatably mounted rollers located among the needles and which are in contact with the paper during transfer so as to maintain contact between the latter and photoconductive surface.

2 Claims, 2 Drawing Figures



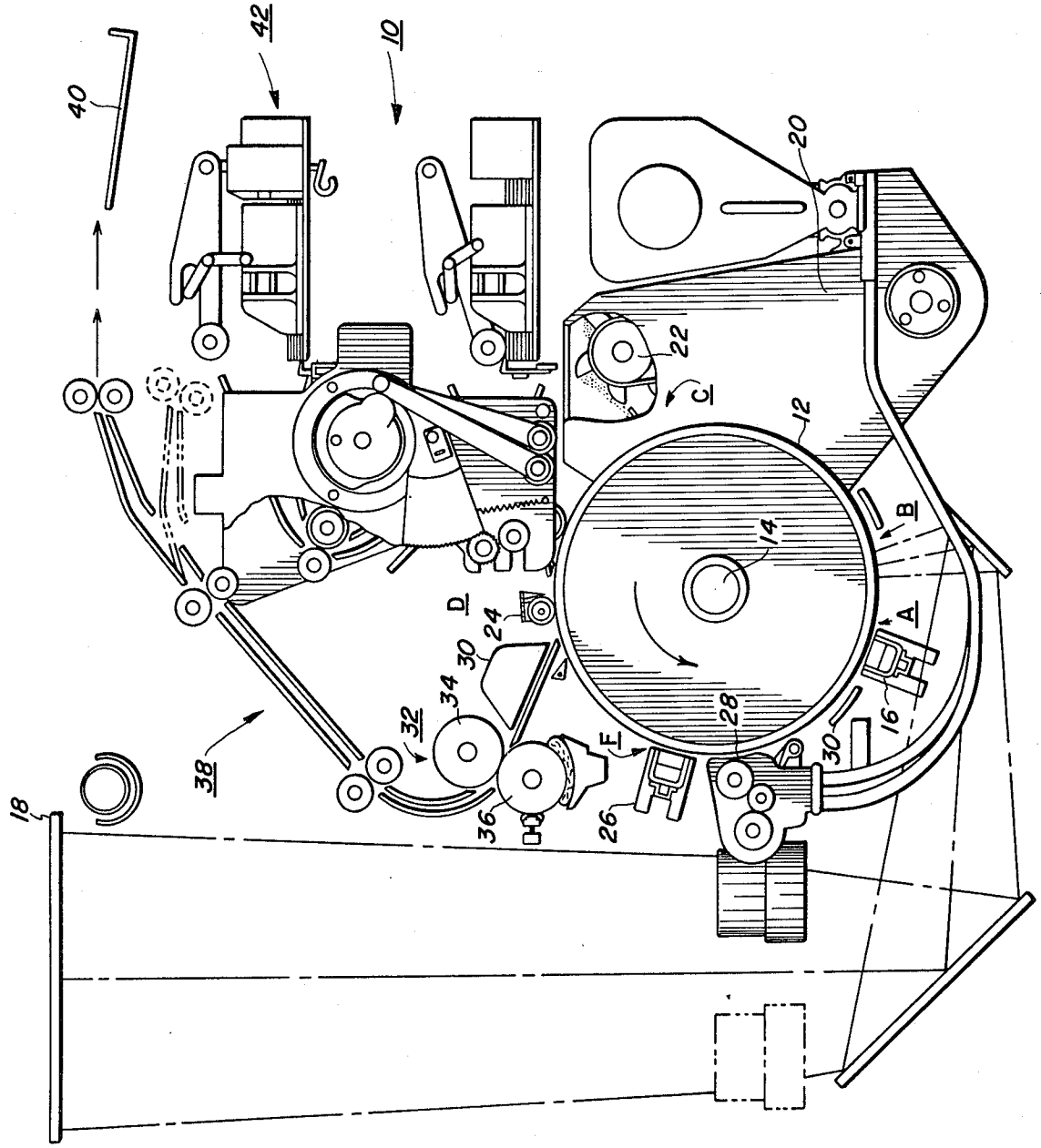


FIG. 1

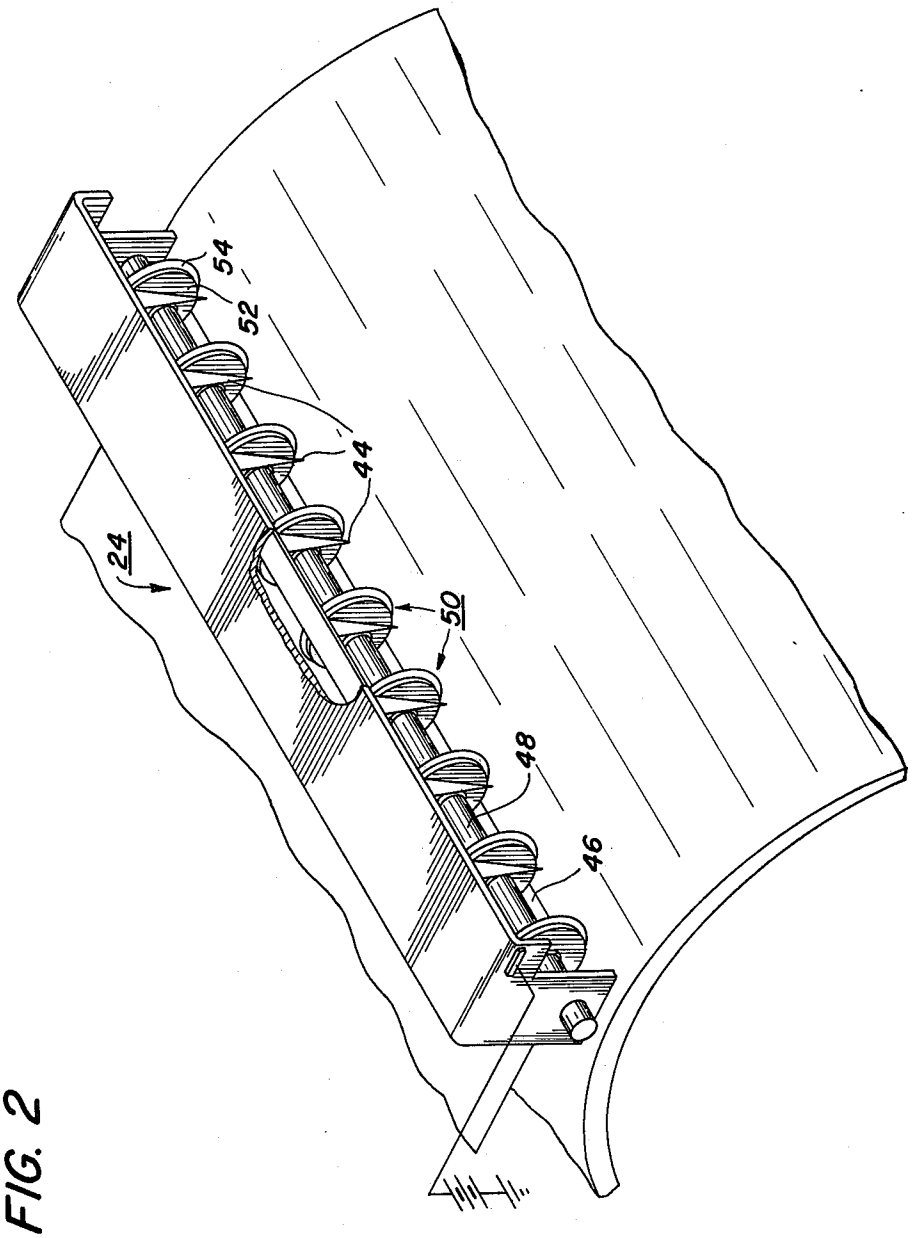


FIG. 2

CORONA TRANSFER MECHANISM

BACKGROUND OF THE INVENTION

This invention relates generally to transferring a developed electrostatic image from a first surface to a second surface, but more particularly to a transfer mechanism utilizing a plurality of spaced point discharge needles to produce the corona discharge necessary for effecting transfer, and a plurality of rollers disposed among the needles to keep the surfaces in contact in the transfer zone during the transfer operation or step. Such a mechanism will be described herein in conjunction with an electrostatic reproduction machine.

In the process of xerography, for example, as disclosed in Carlson Pat. No. 2,297,691, issued Oct. 6, 1942, a xerographic plate comprising a layer of photoconductive insulating material on a conductive backing is given a uniform electric charge over its surface and is then exposed to the subject matter to be reproduced, usually by conventional projection techniques. This exposure discharges the plate area in accordance with the radiation intensity that reaches them, and thereby creates an electrostatic latent image on or in the photoconductive layer. Development of the latent image is effected with an electrostatically charged, finely divided material such as an electroscopic powder that is brought into surface contact with the photoconductive layer and is held thereon electrostatically in a pattern corresponding to the electrostatic latent image. Thereafter, the developed xerographic powder image is usually transferred to a support surface to which it may be fixed by any suitable means.

In automatic xerographic equipment, it is common to employ a xerographic plate in the form of a cylindrical drum or endless belt which is continuously moved through a cycle of sequential operations including charging exposure, developing and transfer. During the cycle, copy is reproduced on the drum or belt and then transferred to a support surface such as a sheet of paper.

Various means and circuits are typically used for effecting transfer of a developed electrostatic image from the xerographic drum to a sheet of paper. One device commonly used is the conventional corona charging device comprised of a length of wire surrounded by a generally U-shaped shield. With such a device, it is often difficult to keep the paper in contact with the photoconductive surface during the transfer step. This is because electrostatic tacking force is small, which may be due to either high humidity or heavy paper stock. Also, because of "nodes" which may form on the corona wire, there may be uneven charging of the paper. With some transfer systems there may also be pre-transfer sparking.

Thus, what is needed is a transfer mechanism which will generate a uniform charge while keeping the paper in contact with the photoconductive surface so as to result in a uniform transfer of the developed image.

SUMMARY OF THE INVENTION

The present invention is directed to a transfer mechanism having a plurality of point discharge needles geometrically spaced so as to uniformly charge the paper or other medium to which a developed electrostatic image is to be transferred. The mechanism has a plurality of rollers spaced among the needles to keep the paper in contact with the photoconductive or other surface containing the developed image. The rollers are preferably comprised of metal hubs, the peripheries of which are covered with a suitable rubber which is relatively insensitive to humidity and which has the desired resistivity.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic side elevation of an electrostatic printing machine utilizing the present invention;

FIG. **2** is a perspective view of a transfer mechanism constructed according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The general apparatus of the instant invention is shown herein embodied in an automatic electrostatic printing machine **10** employing a xerographic plate in the form of a drum **12** comprising a photoconductive layer which is placed upon a conductive backing.

Drum **12** is mounted on shaft **14** journaled in the machine frame (not shown) and is rotated in the direction indicated by the arrow by means of motor causing the drum surface to sequentially pass through a plurality of xerographic processing stations. The support member (e.g., paper) on which an image is to be fixed is fed to the drum **12** via paper feeding mechanism.

For purposes of the present invention, the several xerographic processing stations positioned in the path of movement of drum **12** as shown in FIG. **1** may be described functionally as follows:

- a charging station A, at which is positioned a corona-generating device **16** for placing a uniform positive electrostatic charge on the photoconductive layer of the drum surface as the drum is driven in the direction indicated;
- an exposure station B, at which a light or radiation pattern of the original document to be reproduced which is supported on platen **18,** is projected onto the drum surface thereby dissipating the charge found thereon in the areas exposed so as to form a latent electrostatic image of the original document;
- a developing station C having a housing generally designated **20,** in which a developed material utilizing, in this case, negatively charged toner particles is delivered to the entrance of the development zone from where it is caused to flow in opposition over an upwardly moving portion of the drum surface by means of bucket conveyors system **22,** thus enabling the toner particles to contact and adhere to the electrostatic image on the drum surface to form a developed powder image in image configuration of the original document to be reproduced;
- a transfer station D, at which the xerographic powder image is electrostatically transferred from the drum surface to a sheet of final support material by means of transfer corona generating device (transfer mechanism) **24** which is constructed according to the subject invention, and
- a drum-cleaning and discharge station E, at which the drum surface is exposed to a cleaning corona generating device **26** and then contacted by means of a doctor blade **28** to remove residual toner particles which may remain thereon after the transfer operation and where the drum surface is exposed to the source of illumination **30** to effect substantially complete discharge of any residual electrostatic charge remaining thereon.

Transfer mechanism **24** located at station D sprays the backside of the final support material with positive ions, thus producing a charge of sufficient magnitude on the back of the paper to attract the toner from the drum surface to the final support material. A plurality of arcuate-shaped stripper fingers positioned subsequent to the transfer station are arranged to lift the leading edge of the support material from the drum when necessary and direct the material upwardly. As the drum continues to drive the support material forward, the fingers strip the material from the drum and guide it into contact with vacuum transport **30.** The support material is then caused to move along the vacuum transport towards fuser assembly **32.**

Under the influence of the rotating drum, the support material is moved along the stationary vacuum transport **30** into the nip between the upper fuser roller **34** and the lower fuser roll **36** to fix the image. The coacting fuser rolls are arranged to apply a pressure-driving force to the sheet of support material positioned therebetween and to forward the sheet at a synchronous speed with the rotating drum surface.

The copy, with the fixed image thereon, is transported through a circular path of travel, generally referred to as **38** comprising a series of pinch rolls arranged to either discharge a final support material from the apparatus into catch tray **40** or to feed the support material back into a second feed tray **42.** Support material stored in feed tray **42** are once again redirected through the xerographic processing stations to form a second or duplex image on the backside thereof.

Referring to FIG. **2,** it can be seen that the transfer mechanism **24** is comprised of a plurality of point discharge needles **44.** The needles are spaced so as to uniformly charge the paper **46** passing beneath them, and as can be seen, are preferably arranged so that the tips of the needles are not located directly over the shaft **48,** but are located to one side of the shaft with the tips of the needles being located at about the center of the shaft. To assist in effecting uniform transfer the mechanism **24** is provided with a plurality of rollers **50** mounted to rotate about the axis of shaft **48,** the rollers preferably being spaced so that each roller is located midway between the adjacent needles as shown. The rollers not only maintain contact between the paper **46** and the drum **12,** but can assist in transporting the paper as well.

Each of the rollers **50** is comprised of a metal hub **52** covered by a rubber wheel **54.** A suitable rubber for the wheel **54** is urethane having a bulk resistivity in the range of 10^8 to 10^{12} ohm cm, but preferably around 10^9 ohm cm.

It has been found that if the humidity is high enough, there is sufficient lateral migration of the charge on the paper to assure uniform charging across the paper **46;** in this event, the hubs **52** are preferably grounded. In the event the humidity is not high enough, uniform charging of the paper can be effected by electrically biasing the hubs **52.**

While the invention has been described with reference to the structure disclosed, it is not confined to the details set forth, but is intended to cover such modifications or changes as may come within the scope of the following claims.

What is claimed is:

1. An improved apparatus for effecting transfer of a developed electrostatic image from a first support member to a second support member, the apparatus comprising a plurality of spaced point discharge needles disposed adjacent to the first support member, and a plurality of rollers disposed among the needles, the rollers being mounted in contact with the first support member and mounted for rotation around a common axis whereby the rollers keep the first support member and the second support member in contact with each other during transfer.

2. An improved apparatus as set forth in claim **1,** wherein each of said rollers comprises a metallic hub and a rubber wheel surrounding said hub.

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