

[54] PRE-DEVELOPMENT EXPOSURE
ASSEMBLY

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[51] Int. Cl. G03g 15/00
[58] Field of Search 355/3, 14, 16, 7,
355/74, 125, 126, 55

[56] References Cited
UNITED STATES PATENTS

3,122,455 2/1964 Grimm et al. 355/3 X

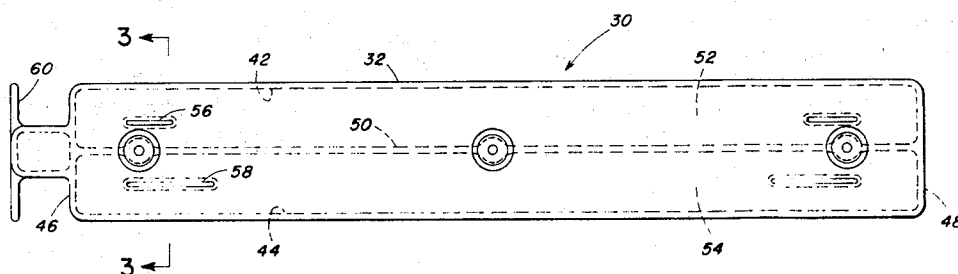
3,471,233 10/1969 Clark 355/125
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Attorney—James J. Ralabate et al.

[57] ABSTRACT

A pre-development exposure assembly is provided within an electrostatic reproduction machine transverse to the photoconductive surface thereof to selectively expose side portions of the photoconductive surface in response to a signal generated by a switch responsive to the dimension of an image receiving member being transported therethrough.

3 Claims, 3 Drawing Figures



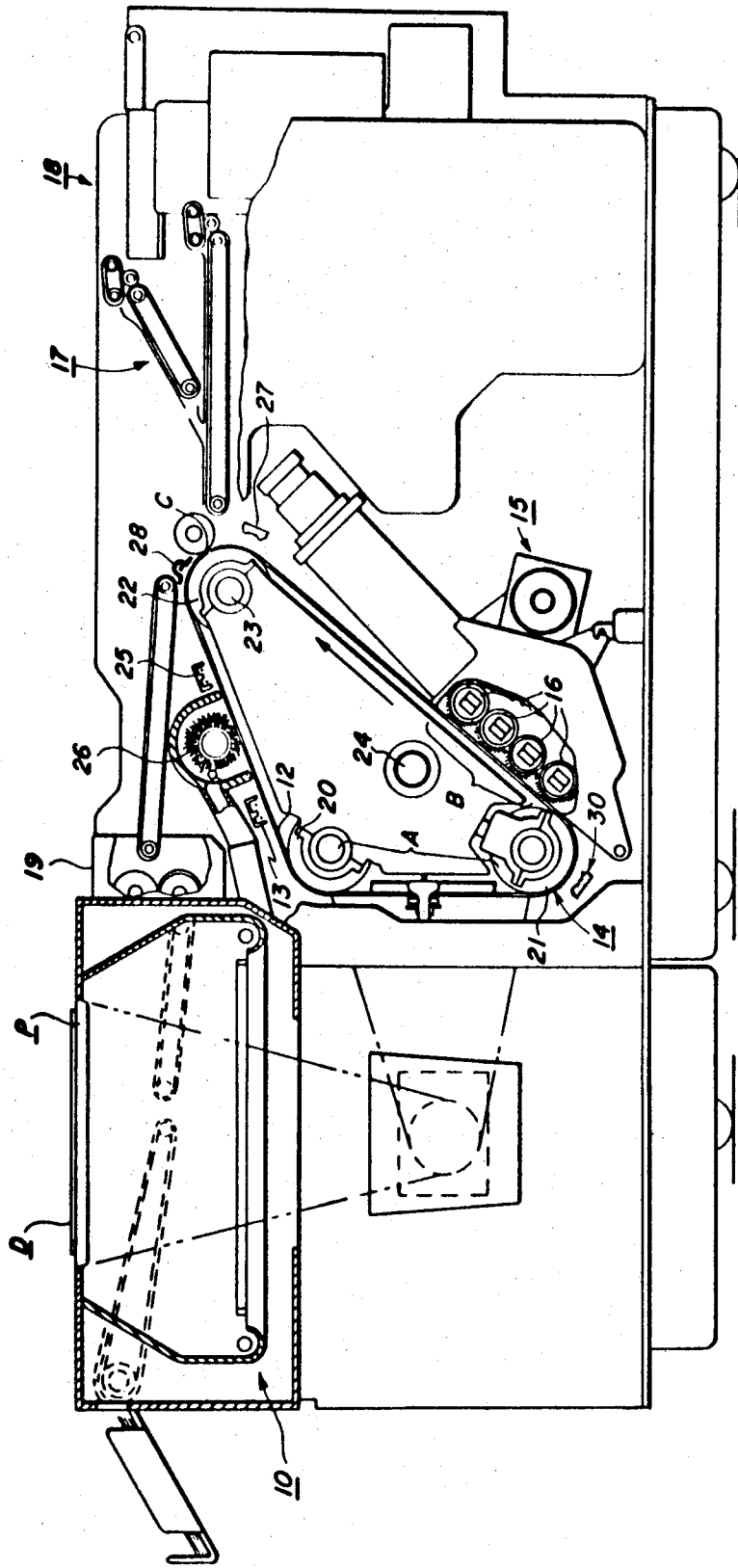


Fig. 1.

Fig. 2.

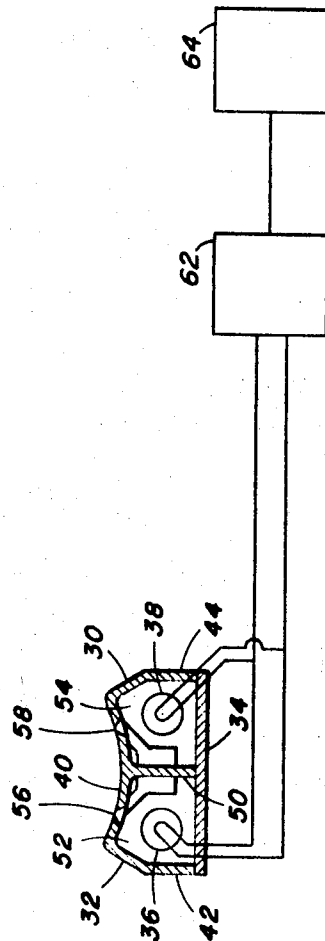
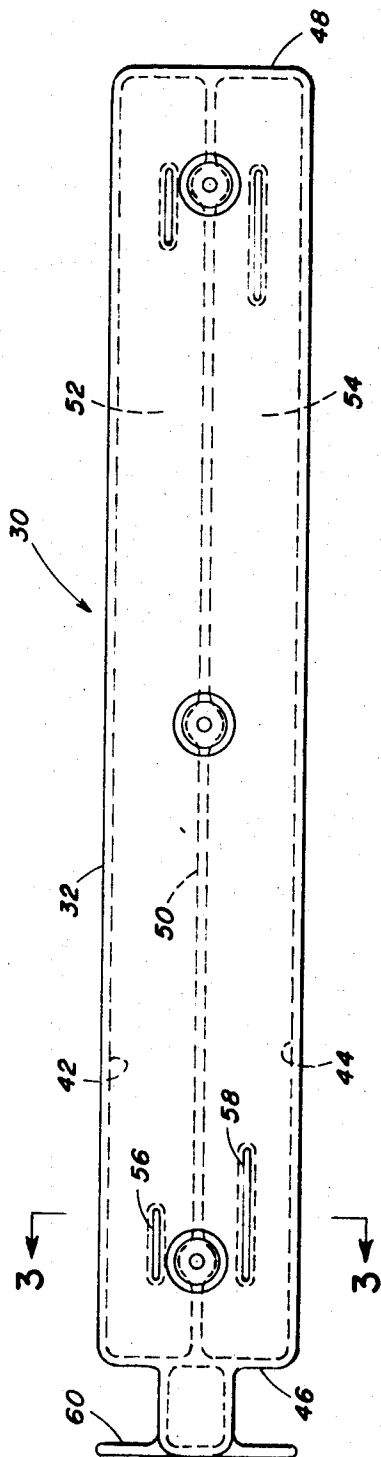


Fig. 3.

PRE-DEVELOPMENT EXPOSURE ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates to electrostatography, and more particularly to improvements in the control of development with particulate toner material that is adapted for use in electrostatographic apparatus.

In the practice of xerography as described in U.S. Pat. No. 2,297,691 to Chester F. Carlson, 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 may then be developed by contacting it with a finely divided electrostatically attractable material, such as a resinous powder. The powder is held in the image areas by the electrostatic fields on the layer. Where the field is greatest, the greatest amount of material is deposited; and where the field 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 to thereby form a permanent print.

For high speed copying, the latest machine concept for copiers utilizes flash exposure of a document and the arrangement of a moving photoconductor material in the form of an endless belt continuously charged, for example, by corona charging from a coronode array, as described in U.S. Pat. No. 2,588,698. In order to effectively develop the latent image produced in such machine with the provision for solid area coverage, a developing system is employed which supplies toner particles in relatively large quantities.

Electrostatic machines are now being provided with optic systems having image reducing capabilities. Exposure of a document to be reproduced in reduced size results in an unexposed plane on the photoconductive surface if an edge of the document is the reference point on a platen, and unexposed planes if a centerline of the document is the reference point. After passage through a developing station, such a plane or planes on the photoconductive surface would contain a high concentration of toner, i.e. in effect a developed solid area image, although not in response to exposure of such area imagewise to light of an image to be reproduced. If the photoconductive surface is passed through a transfer station in contact with a receiving member of a dimension equal to the original document, the top and bottom of the resulting receiving member will have a margin of solid area coverage. If the receiving member is of a dimension corresponding to that of the reduced image or less, the toner particles will pass through such station, with a portion adhering to the transfer roller. The remaining portion of the toner particles are passed to the cleaning assembly for removal prior to cleaning of the photoconductive surface. Such a condition would require excessive cleaning tech-

niques, burden toner particle handling assemblies and result in excessive toner consumption.

OBJECTS OF THE INVENTION

It is an object of this invention to improve electrostatic reproduction machines for effecting the development of line copy and solid area with minimum handling and waste of developing material.

Another object of this invention is to provide a method for adjusting for size reduction of a document to be reproduced and the latent image development thereof in an electrostatic reproduction machine thereby allowing the high speed operation thereof.

SUMMARY OF THE INVENTION

These and other objects of the invention are obtained by a pre-development exposure assembly disposed transverse to the photoconductive surface. In one embodiment, the pre-development exposure assembly is provided with a pair of cooperating slits and a discharge device positioned within the assembly for selective exposure of side portions of the moving photoconductive surface through such slits prior to development of an electrostatic latent image thereon. A control circuit is associated with each discharge device and is arranged to control the energization thereof in response to a signal, e.g. from a switch responsive to the dimension of paper being transported or to be transported through the machine, or generated by a reduced magnification mode of the machine. The energization of the respective sources of the discharge devices dissipates the charged areas along of the photoconductive surface not exposed imagewise to a light pattern as hereinabove discussed. In another embodiment, only one slit is provided wherein an edge of a document is the reference point of the machine.

DESCRIPTION OF THE DRAWINGS

A better understanding of the present invention as well as other objects and further features thereof will become apparent upon consideration of the following detailed disclosure thereof, especially when taken with the accompanying drawings, wherein like numerals designate like parts throughout.

FIG. 1 is a schematic sectional view of an electrostatic reproduction machine embodying the principles of the invention;

FIG. 2 is a plane view of the pre-development exposure assembly;

FIG. 3 is a cross-sectional view of the predevelopment exposure assembly taken along the lines of 3—3 of FIG. 2.

For a general understanding of the illustrated copier/reproduction machine in which the invention may be incorporated, reference is had to FIG. 1 in which the various system components for the machine are schematically illustrated. A document D to be copied is placed upon a transparent support platen P fixedly arranged in an illumination assembly, generally indicated by the reference numeral 10, positioned at the left end of the machine. Light rays from an illumination system are flashed upon the document to produce image rays corresponding to the informational areas. The image rays are projected by means of an optical system onto the photosensitive surface of a xerographic plate in the form of a flexible photoconductive

belt 12 arranged on a belt assembly, generally indicated by the reference numeral 14.

The belt 12 comprises a photoconductive layer of selenium which is the light receiving surface and imaging medium for the apparatus, on a conductive backing. The surface of the photoconductive belt is made photosensitive by a previous step of uniformly charging the same by means of a corona generating device or corotron 13.

The belt is journaled for continuous movement upon three rollers 20, 21 and 22 positioned with their axes in parallel. The photoconductive belt assembly 14 is slidably mounted upon two support shafts 23 and 24 with the roller 22 rotatably supported on the shaft 23 which is secured to the frame of the apparatus and is rotatably driven by a suitable motor and drive assembly (not shown) in the direction of the arrow at a constant rate. During exposure of the belt 12, the portion exposed is that portion of the belt running between rollers 20 and 21. During such movement of the belt 12, the reflected light image of such original document positioned on the platen is flashed on the surface of the belt to produce an electrostatic latent image thereon at exposure station A.

As the belt surface continues its movement, the electrostatic image passes through a developing station B in which there is positioned a developer assembly generally indicated by the reference numeral 15, and which provides development of the electrostatic image by means of multiple brushes 16 as the same moves through the development zone.

The developed electrostatic image is transported by the belt to a transfer station C whereat a sheet of copy paper is moved between a transfer roller and the belt at a speed in synchronism with the moving belt in order to accomplish transfer of the developed image solely by an electrical bias on the transfer roller. There is provided at this station a sheet transport mechanism generally indicated at 17 adapted to transport sheets of paper from a paper handling mechanism generally indicated by the reference numeral 18 to the developed image on the belt at the station C.

After the sheet is stripped from the belt 12, it is conveyed into a fuser assembly, generally indicated by the reference numeral 19, wherein the developed and transferred xerographic powder image on the sheet material is permanently affixed thereto. After fusing, the finished copy is discharged from the apparatus at a suitable point for collection externally of the apparatus.

Further details regarding the structure of the belt assembly 14 and its relationship with the machine and support therefor may be found in the copending Application Ser. No. 102,312 filed Dec. 29, 1970 assigned to the same assignee.

The pre-development exposure assembly of the present invention, generally indicated as 30, may be positioned within the lower portion of the reproduction machine illustrated in FIG. 1 between the exposure station A and the developing station B. Referring now to FIGS. 2 and 3, the pre-development assembly 30 is comprised of a molded housing 32, a base 34 and sources of actinic electromagnetic radiation, such as fluorescent lamps 36 and 38 activated by a conventional energizing source (not shown). The housing 32 is formed with a top wall 40, side walls 42 and 44, and end walls 46 and 48. Within the housing 32, there is provided an intermediate wall 50 forming chambers 52 and 54 in which

fluorescent lamps 36 and 38, respectively are disposed. The top wall 40 of the housing 32 is formed with pairs of cooperating slits 56 and 58 which permit the passage of actinic radiation therethrough from fluorescent lamps 36 and 38, respectively. The pre-development exposure assembly 30 is provided with a bracket means, generally indicated as 60, for mounting the assembly 30 within the electrostatic machine.

Each of the fluorescent lamps 36 and 38 may be provided with a control circuit 62, such as described in copending application Ser. No. 145,013, filed May 19, 1971, which is a continuation of Application Ser. No. 731,967, filed May 24, 1968, now abandoned, filed by James M. Donohue, entitled SELECTIVE DEVELOPMENT CONTROL FOR ELECTROSTATIC REPRODUCTION MACHINES, each of which control circuits being energized by a signal from a switch 64 provided on the paper supply elevator assembly, as described in copending application Ser. No. 214,345, filed Dec. 30, 1971, by Sission, et al. relating to paper width sensing. For low-speed machines, it is not necessary to employ a control circuit having a biasing circuit to provide a threshold biasing potential. Additionally, other discharge devices, such as corotrons, etc., may be employed.

In operation of the copier/reproduction machine, hereinabove described, the endless photoconductive belt is continuously charged, for example, by corona charging from a coronode array, such as disclosed in U.S. Pat. No. 2,588,698 to Carlson. If in one mode, for example, the maximum dimension of the receiving member in the supply assembly corresponds to the dimension of the document to be copied, neither of the control circuits associated with the respective fluorescent lamps will be energized. Should a signal be developed by a switch disposed on the supply assembly, sensing that the supply paper is of a small dimension than the designed maximum dimension of the supply assembly, the corresponding control system is energized thereby illuminating the respective fluorescent lamp to expose the side portions (i.e. cylindrical planes at the roller 21) of the photoconductive surface corresponding to an area determined by the width of the pair of slits through which the light passes. Alternatively, the size of a receiving member may be sensed during the transit thereof through the machine, for example, by use of a photoelectric device, such as disclosed in copending application Ser. No. 131,114, filed Apr. 15, 1971, by Robert E. Gerace. While such description relates to the sensing of the leading and trailing edge of a receiving member, the photoelectric device may be disposed within a machine to sense the width of such a receiving member in relationship to the width of the photoconductive surface, if the member is transported lengthwise, or to sense the length thereof if transported sideways through the machine. Either of the fluorescent lamps may also be energized by the operator of the machine by activating of a switch on the console thereof representative of the size of the paper being placed on the supply assembly therefor. Further, the size of the image to be reproduced may be sensed by use of photoelectric means in association with the optic system of the machine.

While the present invention has been described with reference to the incorporation of two pairs of slits in the pre-development exposure assembly, it will be understood that one, or three or more slits may be pro-

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vided depending on the design capabilities of the machine. Additionally, it will be understood that a pre-development exposure assembly may be provided having slits at one end thereof instead of at both ends dependent on the reference positioning of the original on the platen as well as the optic system to be employed in the machine. The principle of the present invention, while discussed with reference to a high speed machine employing an endless photo-conductive belt being continuously charged is applicable to intermittently charged drum-type electrostatographic machines having size reduction modes regardless of the orientation in which the receiving members are transported there-through.

While the instant invention as to its objects and advantages has been described herein as carried in specific embodiments thereof, it is not desired to be limited thereby, but it is intended to cover the invention broadly within the scope of the appended claims.

What is claimed is:

1. In an electrostatic reproduction machine having a moving photoconductive surface adapted to be charged and to carry an electrostatic latent image thereon, developing means positioned at a development zone to develop the moving electrostatic image on said surface, the developed image being adapted for transfer to a suitable receiver member,

a discharge device adapted when activated to discharge a charged portion of said surface, said device being positioned to influence portions of the surface after exposure thereof, the combination comprising:

a receiver member supply assembly, said assembly

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being adjustable to accommodate a range of receiver member sizes; and, control means responsive to the adjusted position of said receiver member supply assembly to render said discharge device operable to discharge a side portion of said surface.

2. An electrostatic reproduction machine according to claim 1 wherein said control means includes a switch operatively associated with said receiver member supply assembly, said switch being adapted to provide a signal indicative of the adjustment of said receiver member supply assembly for activating said discharge device to discharge a charged area on a side portion of said surface relative to the size of the receiver member in said receiver member supply assembly.

3. In an electrostatic reproduction machine having a moving photoconductive surface adapted to be charged and to carry an electrostatic latent image thereon, developing means positioned at a development zone to develop the moving electrostatic image on said surface, the developed image being adapted for transfer to a suitable receiver member, means to provide an uncharged strip along an edge portion of said surface prior to development thereof, the combination comprising:

a receiver member supply assembly, said assembly being adjustable to accommodate a range of receiver member sizes; and,

control means responsive to the adjusted position of said receiver member supply assembly to activate said means to provide an uncharged strip along the edge portion of said surface.

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