United States Patent [19]

Davidson

[11] **3,906,897**

[45] **Sept. 23, 1975**

[54] **DEVELOPMENT APPARATUS**

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[73] Assignee: **Xerox Corporation,** Stamford, Conn.

[22] Filed: **Jan. 4, 1974**

[21] Appl. No.: **430,867**

Related U.S. Application Data

[62] Division of Ser. No. 255,259, May 22, 1972, Pat. No. 3,854,449.

[52] **U.S. Cl.** **118/637;** 117/17.5; 118/7

[51] **Int. Cl.²** **G03G 15/08**

[58] **Field of Search** 118/630, 637, 2, 7, 4; 117/125

[56] **References Cited**

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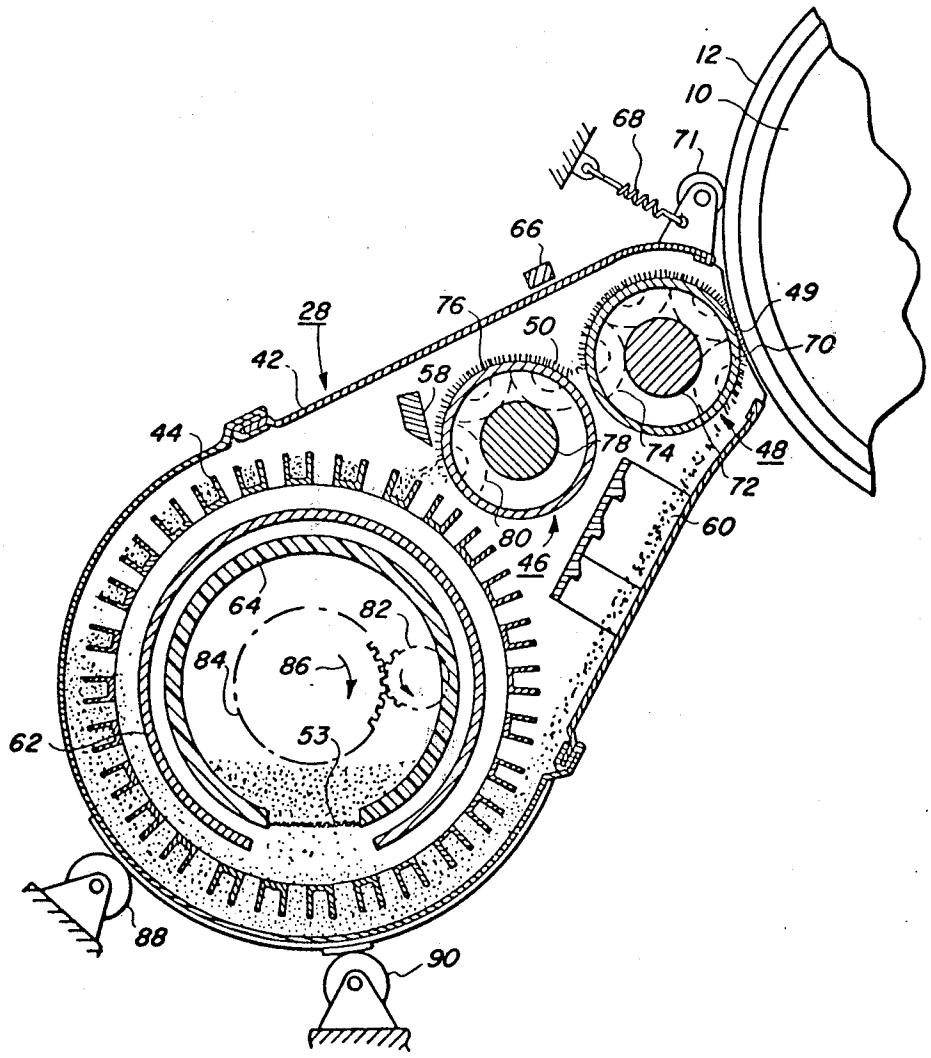
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Assistant Examiner—Douglas Salser
Attorney, Agent, or Firm—H. Fleischer; J. J. Ralabate; C. A. Green

[57] **ABSTRACT**

An apparatus for developing an electrostatic latent image. The apparatus is moved from an inoperative position spaced from the latent image to a position in operative communication therewith. After the latent image is developed, the apparatus is moved to the inoperative position thereof.

4 Claims, 3 Drawing Figures



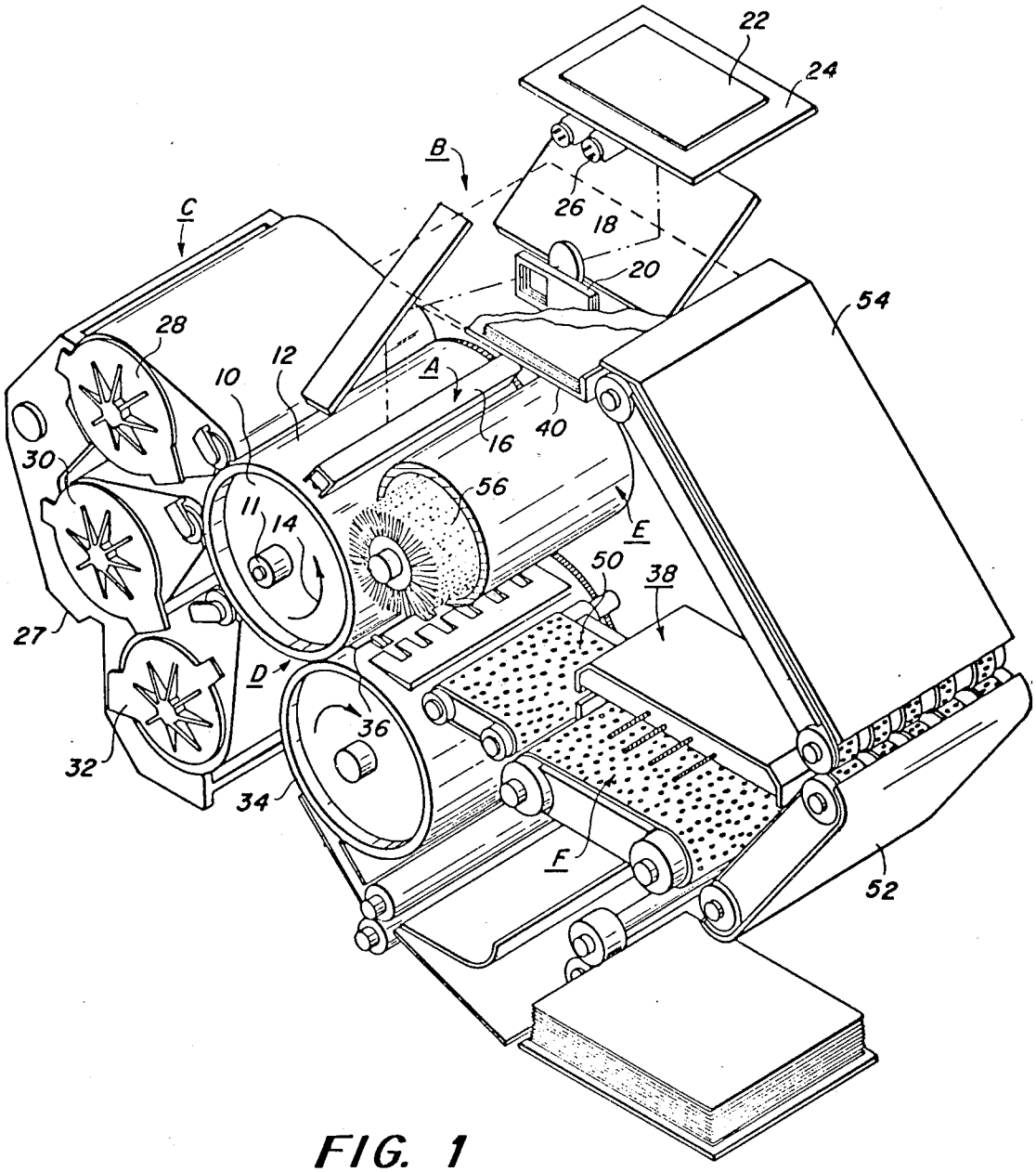

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FIG. 1

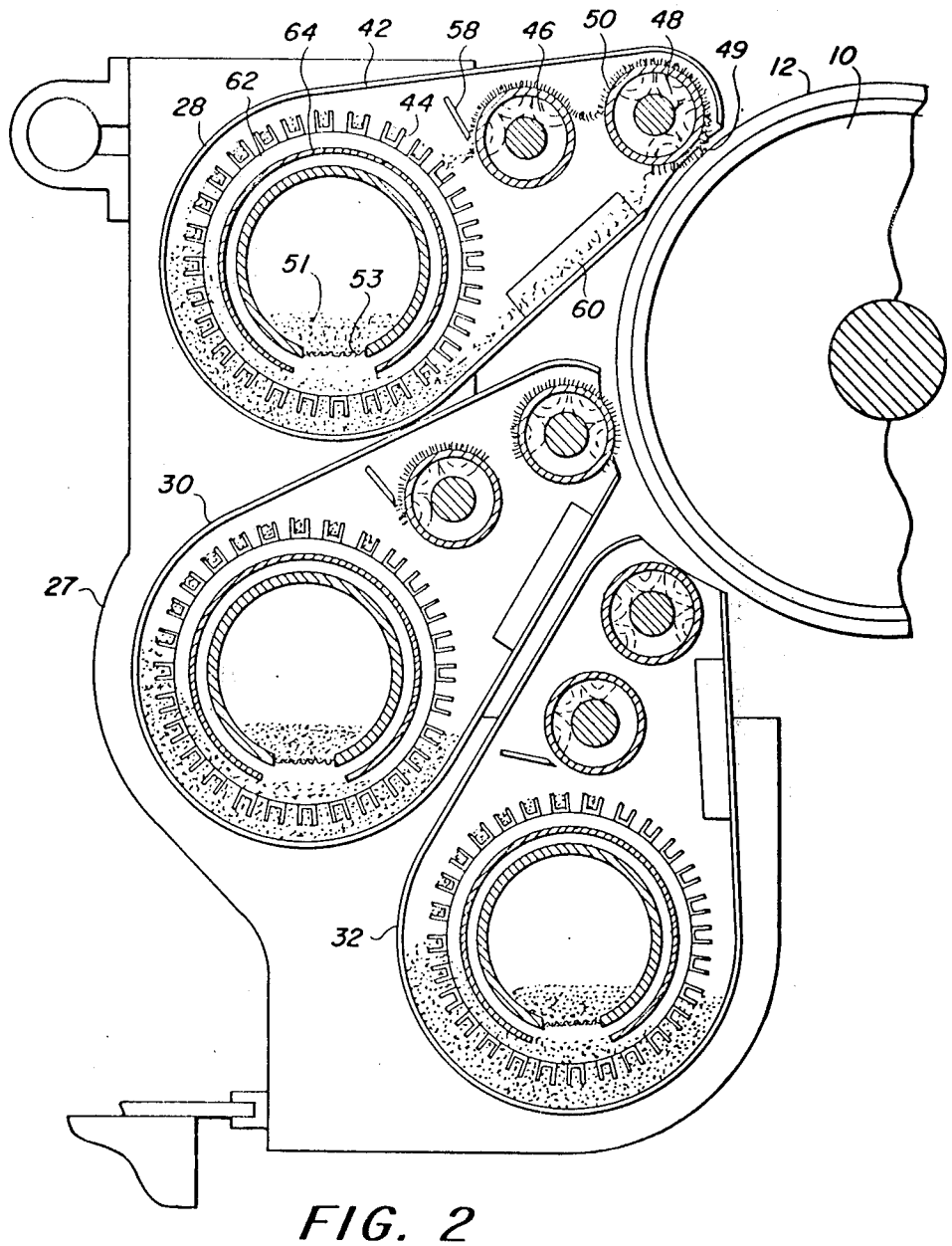


FIG. 2

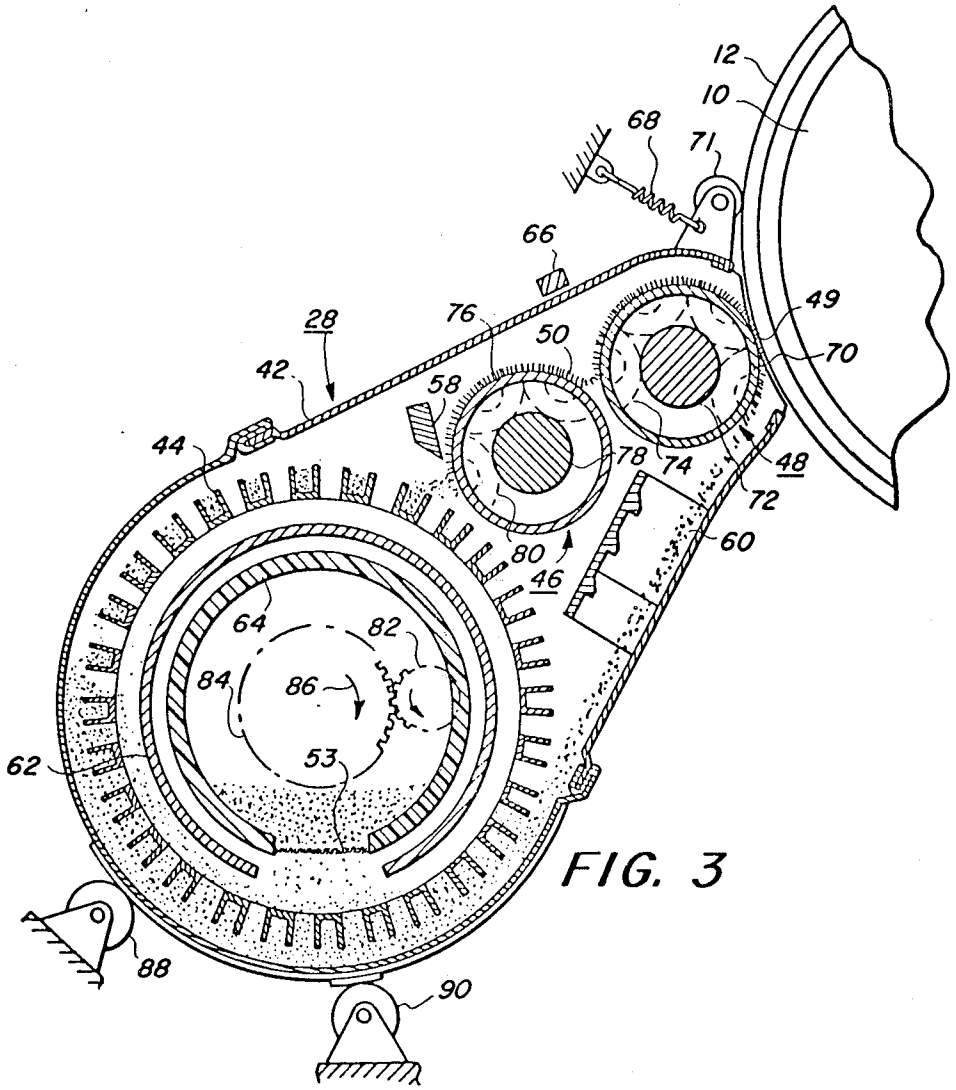

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FIG. 3

DEVELOPMENT APPARATUS

This is a division of application Ser. No. 255,259 filed May 22, 1972, now U.S. Pat. No. 3,854,449.

The foregoing abstract is neither intended to define the invention disclosed in the specification, nor is it intended to be limiting as to the scope of the invention in any way.

BACKGROUND OF THE INVENTION

This invention relates generally to an electrostatographic printing machine, and more particularly concerns an improved development system for use therein.

An electrostatographic process involves the formation and utilization of electrostatic latent charge patterns for the purpose of recording and reproducing the patterns in viewable form. The field of electrostatography includes electrophotography and electrography. Electrophotography is that class of electrostatography which employs a photosensitive medium to form, with the aid of electromagnetic radiation, the electrostatic latent charge pattern. Xerography, which employs infrared, visible or ultraviolet radiation, and xeroradiography, which employs x-rays or gamma rays, are subclasses of electrophotography. Electrography is that class of electrostatography which utilizes an insulating medium to form, without the aid of electromagnetic radiation, the electrostatic latent charge pattern. Xero printing, which uses a pattern of insulating material on a conductive medium to form electrostatic charge patterns, and electrographic recording, which uses a charge transfer between a plurality of electrodes to form directly, electrostatic charge patterns, are subclasses of electrography. Development, which is the act of rendering an electrostatic pattern or image viewable, is employed in all of the aforementioned classes of electrostatography. In the illustrated embodiment hereinafter discussed, an electrophotographic process is utilized.

An electrophotographic process involves the use of a photosensitive element having a photoconductive insulating layer which is charged to a substantially uniform potential in order to sensitize its surface. The charged photoconductive surface is exposed to a light image of an original document to be reproduced. As a consequence of the exposure, the charge is selectively dissipated in the irradiated areas in accordance with the light intensity reaching the surface, thereby creating an electrostatic latent image on the photoconductive surface. Development of the electrostatic latent image recorded on the photoconductive surface is achieved by bringing the charged photoconductive surface into contact with a developer mix. Typical developer mixes employed are well-known in the art, and generally comprise dyed or colored thermoplastic powders, known in the art as toner particles, which are mixed with coarser carrier granules, such as ferromagnetic granules. The toner particles and carrier granules are selected such that the toner particles acquire the appropriate charge relative to the electrostatic latent image recorded on the photoconductive surface. When the developer mix is brought into contact with the charged photoconductive surface, the greater attractive force of the latent electrostatic image recorded thereon causes the toner particles to transfer from the carrier granules and adhere to the latent electrostatic image. This concept was originally disclosed by Carlson

in U.S. Pat. No. 2,297,691 and is further amplified and described by many related patents in the art.

Many factors influence the quality of the developed image, the most significant factor being the uniformity with which the toner particles are deposited on the electrostatic latent image recorded on the photoconductive surface. Heretofore, development systems have employed rotary impellers, fur brushes, bucket conveyors and magnetic brush systems to achieve the requisite uniformity in toner deposition. The magnetic brush system achieves a high degree of uniform toner deposition, and, therefore, numerous electrostatographic printing machines utilize this type of development system. Magnetic brush systems usually include a developer roll having a directional flux field adapted to bring the magnetizable developer mix into contact with the charged photoconductive surface. Multi-color electrostatographic printing involves the utilization of various processing components adapted to produce a series of electrostatic latent images corresponding to a particular color of the original. In such a system, there is a need to develop successive partial color images. Each partial color image is developed with toner particles corresponding in color to the partial color image utilized to form the respective electrostatic latent image on the photoconductive surface.

Generally, the developer roll of the magnetic brush development system is mounted fixedly relative to the photoconductive surface. This places a practical limitation on the quality of multi-color copies. A multi-color development system utilizes a plurality of developer rolls, each being adapted to furnish the appropriate colored toner particles to the photoconductive surface. Hereinbefore, fixedly mounted developer rolls were closely spaced to the photoconductive surface, thereby permitting the operative developer roll, i.e. the developer roll having the developer mix adhering thereto, the deposit toner particles on the photoconductive surface. However, when a developer mix having toner particles of one color contacts a toner powder image of another color, intermingling of colors and mechanical scraping occurs. This results in the toner powder image being mis-colored, and the multi-color copy produced thereby lacking the appropriate color balance, i.e. the color does not correspond to the original to be copied. Therefore, it is apparent that the aforementioned type of magnetic brush development system, wherein each developer roll is fixedly mounted, does not produce high quality multi-color copies.

Accordingly, it is a primary object of the present invention to improve the development system of a multicolor electrostatographic printing machine.

SUMMARY OF THE INVENTION

Briefly stated and in accordance with the present invention, there is provided an apparatus and method therefore of rendering visible a latent electrostatic image. The apparatus is positioned adjacent the latent image in operative communication therewith for depositing toner particles thereon. In addition, the apparatus moves from the operative position in communication with the latent image to an inoperative position spaced therefrom.

The present invention is also concerned with actuating the development apparatus in response to the electrostatic latent image advancing to a pre-determined location. The apparatus is energized when the latent

image reaches the predetermined location to move in a position adjacent thereto in operative communication therewith, and deposits toner particles thereon. After the toner particles are deposited onto the latent image, the apparatus is de-energized and moved to its inoperative position spaced from the latent image.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the present invention will become apparent upon reading the following detailed description and upon reference to the drawings in which:

FIG. 1 is a schematic perspective view of an electrophotographic printing machine embodying the features of the present invention;

FIG. 2 is a sectional elevational view of the development system of the present invention used in the printing machine illustrated in FIG. 1; and

FIG. 3 is a fragmentary sectional elevational view depicting, in detail, one of the development units shown in FIG. 2.

While the present invention will hereinafter be described in connection with a preferred embodiment and method associated therewith, it will be understood that it is not intended to limit the invention to that embodiment and method. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE INVENTION

For a general understanding of the illustrated electrophotographic printing machine, in which the present invention may be incorporated, reference is had to the drawings wherein like reference numerals have been used throughout to designate like elements. FIG. 1 schematically illustrates the various components of a printing machine producing multi-color copies from a color original. As in all electrophotographic machines of the type illustrated, a light image of a document to be reproduced is projected onto a sensitized photoconductive surface to form an electrostatic latent image thereon. The latent image is developed by toner particles to form a powder image of the latent image recorded on the photoconductive surface. Thereafter, the powder image is electrostatically transferred to a sheet of support material to which it may be coalesced by a suitable fusing device, whereby the powder image is caused permanently to adhere to the support surface.

The printing machine depicted in FIG. 1 employs a photoconductive member, such as rotatably mounted drum **10**, having a photoconductive surface **12** thereon. Photoconductive surface **12**, preferably, is formed of a material having a relatively panchromatic response to white light. Drum **10** rotates in the direction indicated by arrow **14** to move photoconductive surface **12** sequentially through a series of processing stations.

First, photoconductive surface **12** passes through charging station A which has positioned thereat a corona generating device, indicated generally at **16**, extending transversely across photoconductive surface **12**. Corona generating device **16** charges drum surface **12** to a relatively high and substantially uniform potential.

The charged drum surface is next rotated to exposure station B which includes a moving lens system, generally designated by the reference numeral **18**, and a color filter mechanism, shown generally at **20**. An original document **22** is stationarily supported upon a transparent viewing platen **24** wherein successive incremental areas of original **22** are illuminated by means of a moving lamp assembly **26**. Lens system **18** is adapted to scan successive areas of original **22** being illuminated on platen **24** and to focus the light onto photoconductive surface **12**. Lamp assembly **26** and lens system **18** are moved in timed relation with photoconductive surface **12** to produce a non-distorted flowing light image of the original on photoconductive surface **12**. During exposure, filter mechanism **20** interposes selected color filters into the optical light path of lens **18**. Color filters **20** operate on the light passing through lens **18** to record an electrostatic latent image on photoconductive surface **12** corresponding to a specific color of the flowing light image of the original.

After the electrostatic latent image is recorded on photoconductive surface **12**, drum **10** is rotated to development station C which includes three individual development units generally indicated by the reference numerals **28, 30** and **32**, respectively. The development units are all of a type hereinbefore referred to as a magnetic brush development system. In a magnetic brush development system, a magnetizable developer mix having carrier granules and toner particles is continually brought through a directional flux field to form a brush of developer material. The developer mix is continually moving to provide fresh developer mix to the brush. Preferably, the brush in the magnetic brush system comprises a magnetic member with a mass of developer mix adhered thereto by magnetic attraction. The developer mix includes carrier granules having toner particles clinging thereto by triboelectric attraction. This chainlike arrangement of developer mix simulates the fibers of a brush. Development is achieved by bringing the brush of developer mix into contact with photoconductive surface **12**. Each of the development units **28, 30** and **32**, respectively, apply toner particles to photoconductive surface **12** which are adapted to absorb light within a pre-selected spectral region of the electromagnetic wave spectrum corresponding to the wavelength of light transmitted through the filter. For example, a latent image formed by passing the light image through a green filter will record the red and blue portions of the spectrum as areas of relatively high charge density on photoconductive surface **12**, while the green light rays will pass through the filter and cause the charge density on photoconductive surface **12** to be reduced to a voltage level ineffective for development. The charged areas are then made visible by applying green absorbing (magenta) toner particles to the latent image recorded on photoconductive surface **12**. Similarly a blue separation is developed with blue absorbing (yellow) toner particles, while a red separation is developed with red absorbing (cyan) toner particles.

After development, the now visible image is moved to transfer station D where the image is transferred to a sheet of final support material **36**, such as plain paper amongst others, by means of a transfer member, i.e. a bias transfer roll shown generally at **34**. The surface of transfer roll **34** is electrically biased to a potential having a magnitude and polarity sufficient to electrostatically attract toner particles from photoconductive surface **12** to support sheet **36**. Transfer roll **34** is adapted to secure releasably thereto a single sheet of final sup-

port material **36** for movement in a recirculating path, the roll being arranged to move in synchronism with photoconductive surface **12** enabling support material **36** to receive, in superimposed registration, successive toner powder images of the original document. The aforementioned steps of charging the photoconductive surface, exposing the photoconductive surface to a specific color of the flowing light image of the original, developing the electrostatic latent image recorded on the photoconductive surface with appropriate toner particles, and transferring the toner powder image to a sheet of final support material, e.g., a transparency or opaque copy sheet, are repeated a plurality of cycles to form a multi-color copy of a color original.

After the last transfer operation, support sheet **36** is stripped from roll **34** and transported on endless belt **50** to a fixing station F where a fuser, indicated generally at **38**, coalesces the toner powder image to support sheet **36**. Thereafter, sheet **36** is advanced by endless belts **52** and **54** to catch a tray **40** for subsequent removal by an operator.

The last processing station in the direction of rotation of drum **10**, as indicated by arrow **14**, is cleaning station E. A rotatably mounted fibrous brush **56** is positioned in cleaning station E and is maintained in contact with photoconductive surface **12** of rotating drum **10** to remove residual toner particles remaining thereon after each transfer operation.

Referring now to FIG. **2**, there is shown a multi-color development system with frame **27** supporting three toner depositing means or development units **28, 30** and **32**, respectively. The aforementioned development system is of the type utilized at processing station C. These development units are depicted in an elevational sectional view to indicate more clearly the various components included therein. Only development unit **28** will be described in detail as development units **30** and **32** are nearly identical thereto, the distinction between each developer unit being the color of toner particles contained therein and minor geometrical differences due to the mounting cycle. Developer unit **28** may have yellow toner particles, unit **30** magenta toner particles, and unit **32** cyan toner particles although different color combinations may be used. For purposes of explanation, development unit **28** will be hereinafter described in detail.

The principle components of developer unit **28** are a developer housing **42**, conveyor means or paddle wheel **44**, transport means or roll **46**, and developer means or roll **48**. Paddle wheel **44** is a cylindrical member with buckets or scoops around the periphery thereof and is adapted to rotate so as to elevate developer mix **50** from the lower region of housing **42** to the upper region thereof. When developer mix **50** reaches the upper region of housing **42**, it is lifted from the paddle wheel buckets to transport roll **46**. Alternate buckets of the paddle wheel have apertures in the root diameter so that developer mix carried in these areas is not carried to transport roll **46** but instead, falls back to the lower region of developer housing **42**. As the developer mix falls back to the lower region of developer housing **42**, it cascades over shroud **62** which is of a tubular configuration with an aperture **53** in the lower region thereof. Developer mix **50** is recirculated in this manner so that the carrier granules are continually agitated to mix with fresh toner particles. This generates a strong triboelectric charge between the carrier granules and toner particles. As developer mix **50**, in the paddle wheel buckets, approaches transport roll **46**, the magnetic fields produced by the fixed magnets therein attract developer mix **50**. Transport roll **46** moves developer mix **50** in an upwardly direction by the frictional force exerted between the roll surface and developer mix. A surplus of developer mix **56** is furnished, and metering blade **58** is provided to control the amount of developer mix **50** carried over the top of transport roll **46**. The surplus developer mix **50** is sheared from transport roll **46** and falls in a downwardly direction toward paddle wheel **44**. As the surplus developer mix descends, it falls through the apertures of paddle wheel **44** in a downwardly direction into the lower region of developer housing **42**.

The developer mix which passes metering blade **58** is carried over transport roll **46** to developer roll **48** and into development zone **49** located between photoconductive surface **12** and developer roll **48**. The electrostatic image recorded on the photoconductive surface is developed by contact with the moving developer mix **50**. The charged areas of photoconductive surface **12** electrostatically attract the toner particles from the carrier granules of developer mix **50**. At the exit of development zone **49**, the strong magnetic fields in a direction generally tangential to developer roll **48** continues to secure thereto the unused developer mix and denuded carrier granules. Upon passing from the development zone, the unused developer mix and denuded carrier granules enter a region relatively free from magnetic forces and fall from developer roll **48** in a downwardly direction into the lower region of developer housing **42**. As the unused developer mix and denuded carrier granules descend, they pass through mixing baffle **60** which diverts the flow from the ends towards the center of developer housing **42** to provide mixing in this direction.

When the complete image recorded on photoconductive surface **12** has passed development zone **49**, the development action must be discontinued and the developer mix removed from contact with the photoconductive drum **10** so that it will not effect subsequent images which are to be developed in different colors. To do this, a suitable drive motor (not shown) is disconnected from paddle wheel **44**, transport roll **46** and developer roll **48** stopping their rotation. This permits developer housing **28** to pivot due to the force of spring **68**, to the non-operative position thereof in which developer roll **48** is spaced from the latent image recorded on photoconductive surface **12**.

Cylindrical shroud **62** serves to control the fall of the unused developer mix and denuded carrier granules such that they mix with the toner particles rather than simply falling into the lower region of developer housing **42**. Furthermore, shroud **62** isolates, from the developer mix, an interior cylindrical enclosure which is used to house cylindrical toner dispenser **64**. Toner dispenser **64** contains a fresh supply of toner **51** which is dropped through aperture **53** in the shroud into the stream of developer mix **50**. Adding toner particles at this location ensures that it cannot be carried into development zone **49** without some degree of mixing with the carrier granules. Additional toner particles are added to the developer mix in order to replace the toner particles used in forming powder images, thereby maintaining the concentration thereof substantially

constant, providing uniform color image developability.

Turning now to FIG. 3, the operative procedure of developer unit 28 will be discussed in detail. Developer housing 42 is pivoted, as described hereinafter, about the center of paddle wheel 44 and is supported at the lower region of the exterior surface by rollers 88 and 90 mounted rotatably in frame 27. Rollers 88 and 90 rotate about their respective axes to permit developer housing 42 to pivot substantially about the center of paddle wheel 44. When development unit 28 is inoperative, biasing means or spring 68 pivots developer housing 42 against stop 66. In this position, developer roll 48 is in its non-operative position spaced from photoconductive surface 12. Operation begins when clutch gear 82 meshes with gear 84 which is attached to paddle wheel 44, thereby causing paddle wheel 44 to revolve clockwise as indicated by arrow 86. As gear 84 and paddle wheel 44 start to rotate, a reaction torque is exerted against developer housing 42 due to the resistance of motion of developer mix 50 which fills developer housing 42. The reaction torque causes housing 42 to rotate clockwise against the force of spring 68 until a stop, shown as wheel 70, is positioned against drum 10. The developer mix and internal parts then move within developer housing 42. Rolls 46 and 48 are rotated in conjunction with paddle wheel 44 by a gear train (not shown). When the complete image of photoconductive drum 10 has passed development zone 49, development action is discontinued and the developer mix removed from contact with photoconductive surface 12 to prevent its effecting subsequent images which are to be developed by different colored toner particles. To achieve this, the drive motor is disconnected from gear 82 by deenergizing the clutch leaving gear 82 free to turn in either direction. Paddle-wheel 44, developer roll 48, and transport roll 46 stop rotating, and developer housing 42 is pivoted clockwise by spring 68 until it engages stop 66 at its inoperative position. This completes the cycle.

The aforementioned procedure has been described for development unit 28, however, this procedure is repeated for development units 30 and 32, respectively. In the formation of a multi-color copy, development unit 23 initially positions developer roll 48 adjacent photoconductive surface 12 in operative communication therewith to develop the first partial color latent electrostatic image formed thereon with the appropriately colored toner particles. Thereafter, the toner particles are transferred to support material 36 (FIG. 1) forming a toner powder image of one color of the multi-color original. Subsequently, development unit 32 positions its respective developer roll adjacent photoconductive surface 12 in operative communication therewith to develop the next successive colored image which, in turn, is transferred to support material 36. Thereafter, development unit 30 is positioned adjacent photoconductive surface 12 in operative communication therewith to develop the next successive colored image. This toner powder image is also transferred to support material 36 forming a composite multi-color toner powder image of the original on the support material which is thereafter coalesced in fuser 38 (FIG. 1).

In the preferred embodiment thereof, developer means or roll 48, best shown in FIG. 3, includes a non-magnetic tubular member 70, preferably made from aluminum having an irregular or roughened exterior surface. Tubular member 70 is journaled for rotation by suitable means such as ball bearing mounts. A shaft 72 made preferably of steel is concentrically mounted within tubular member 70 and serves as a fixed mounting for magnetic means 74. Magnetic means 74, preferably, comprises magnets made of barrium ferrite in the form of annular rings and arranged with five poles on about a 284° arc about shaft 72.

As best shown in FIG. 3, transport means or roll 46 includes a non-magnetic tubular member 76, preferably, made from aluminum having an irregular or roughened exterior surface. Tubular member 76 is journaled for rotation by suitable means such as ball bearing mounts. A shaft 78 made, preferably, of steel is concentrically mounted within tubular member 76 and functions as a fixed mounting for magnetic means 80. Magnetic means 80, preferably, includes barrium ferrite magnets in the form of annular rings arranged with four poles on a 180° arc about shaft 78.

The means for actuating each of the toner depositing means or development units 28, 30 and 32, respectively, is a timing disc mounted to an extension of drum shaft 11 (FIG. 1). The timing disc is opaque with a plurality of spaced slots in the circumferential periphery thereof. The timing disc is interposed between an illuminating source and a photosensor to generate an electrical signal as each slot permits light rays to pass through the disc. The electrical signal, in association with a suitable machine logic control system, activates the appropriate development unit. Activation of the development unit energizes the drive motor which rotates the paddle wheel, transport roll and developer roll producing a reaction torque which overcomes the spring restraining force, wherein the developer roll is moved into operative communication with the photoconductive surface. After the photoconductive surface has rotated through an appropriate angle, a slot in the timing disc permits the light rays from the illumination source to once again cause the photosensor to generate a second electric signal, which, in association with the machine control logic, de-activates the development unit by de-energizing the driving motor. Inactivation of the development unit automatically causes the development unit to be moved to the inoperative position, wherein the developer roll is spaced from the photoconductive surface.

While the invention has been described in connection with a magnetic brush development system, one skilled in the art will appreciate that the invention is not necessarily so limited and that fur brush development may also be utilized. In fur brush development, brush fibers replace carrier granules, and when the brush is saturated with toner particles the toner particles become charged triboelectrically. A soft fur is used in the form of a cylindrical brush. Toner particles are fed continuously to the brush and when activated moves from it inoperative position spaced from the photoconductive surface to its operative position in communication therewith.

Fom the foregoing, it is apparent that developing system of the present invention improves multi-color copies produced on an electrostatic printing machine by maintaining inoperative development units spaced from the photoconductive surface. Furthermore, the development system is designed to move the appropriate development unit into operative communication with the photoconductive surface for transferring

thereto appropriately colored toner particles to render visible the electrostatic latent image recorded thereon.

It is, therefore, evident that there has been provided in accordance with this invention, an apparatus and method for developing an electrostatic latent image that fully satisfies the objects, aims and advantages set forth above. While this invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims.

What is claimed is:

1. An improved electrophotographic printing machine of the type having a photoconductive surface, a corona generating device adapted to charge the photoconductive surface to a substantially uniform charge potential, and an exposure mechanism for exposing the charged photoconductive surface to a light image of the original document to be reproduced to record thereon an electrostatic latent image thereof, wherein the improvement includes:

means for depositing toner particles onto the latent image;

means for actuating said toner depositing means in response to the latent image advancing to a predetermined location;

means, responsive to said toner depositing means being actuated, for moving said toner depositing means from an inoperative position spaced from the latent image to an operative position adjacent thereto; and

biasing means for resiliently urging said toner depositing means from the operative position adjacent the latent image to the inoperative position spaced therefrom when said toner depositing is de-energized.

2. An improved electrophotographic printing machine of the type having a photoconductive surface, a corona generating device adapted to charge the photoconductive surface to a substantially uniform charge potential, and an exposure mechanism for exposing the charged photoconductive surface to a light image of the original document to be reproduced to record thereon an electrostatic latent image thereof, wherein the improvement includes:

means for depositing toner particles onto the latent image, said toner depositing means comprising

a plurality of developer housings mounted pivotably within the machine, each of said developer housings defining a chamber storing a developer mix comprising carrier granules and toner particles,

means, positioned within the chamber of each of said developer housings, for advancing the developer mix from a first region to a second region for discharge thereat rotary driven developer means mounted within the chamber of each of said developer housings closely proximate to said advancing means for receiving the developer mix therefrom, and arranged to deposit toner particles on the latent image when in operative communication therewith, and means for driving selectively said advancing means associated with one of said developer housings such that the reaction torque to the driving moment applied to said advancing means pivots said one of said developer housings disposing said developer means located therein in operative communication with the latent image;

means for actuating said toner depositing means in response to the latent image advancing to a predetermined location, whereby said toner depositing means moves from an inoperative position spaced from the latent image to a position adjacent thereto in operative communication therewith; and

biasing means for resiliently urging said toner depositing means from the position adjacent the latent image in operative communication therewith to the inoperative position spaced therefrom.

3. A machine as recited in claim **2,** wherein said advancing means includes:

conveyor means mounted for movement within the chamber of each of said developer housings, and arranged to move the developer mix from a first region to an intermediate region; and

rotary driven transport means mounted within the chamber of each of said developer housings, and arranged to move the developer mix from the intermediate region to the second region for discharge thereat.

4. A machine as recited in claim **3,** wherein each of:

said transport means includes a first tubular member of non-magnetic material, and first magnetic means fixedly disposed within said first tubular member for creating a magnetic field in the path of the periphery of said first tubular member; and

said developer means includes a second tubular member of non-magnetic material, and second magnetic means fixedly disposed within said second tubular member for creating a magnetic field in the path of the periphery of said second tubular member.

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