United States Patent [19]

Charland et al.

[11] **3,865,081**

[45] **Feb. 11, 1975**

[54] **MAGNETIC BRUSH DEVELOPING APPARATUS**

[75] Inventors: **Terrence D. Charland**, Pittsford; **Stanley D. Klett**, Fairport, both of N.Y.

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

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

[21] Appl. No.: **439,195**

Related U.S. Application Data

[62] Division of Ser. No. 255,721, May 22, 1972, abandoned.

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

[51] **Int. Cl.** **G03g 13/08**

[58] **Field of Search** ..... 118/637, DIG. 23; 117/17.5; 355/3 DD, 15

[56] **References Cited**

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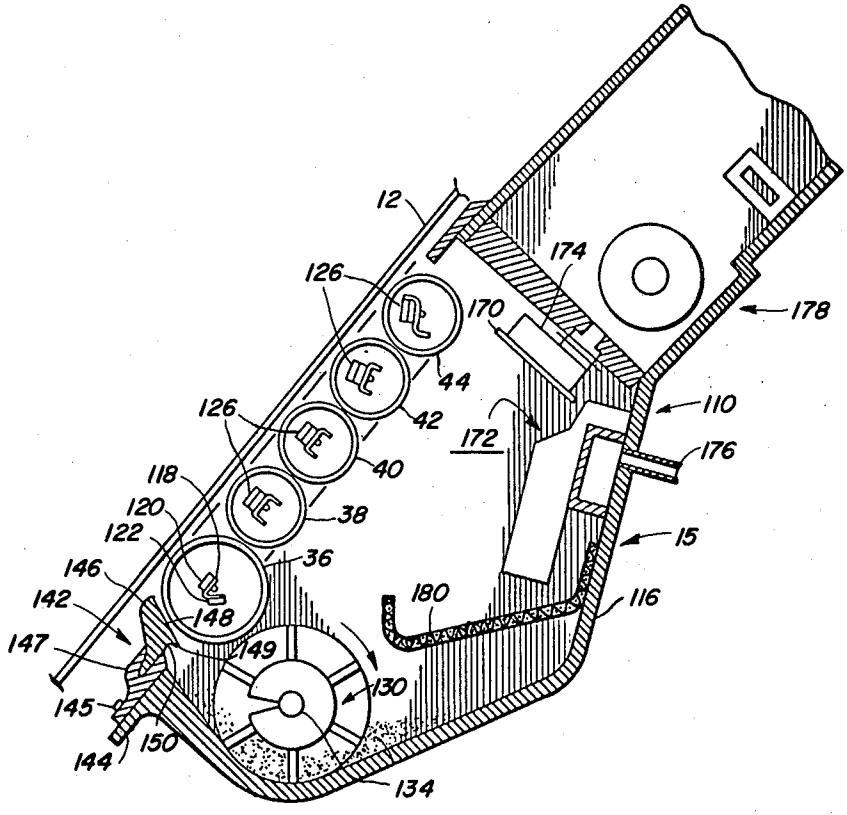
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Primary Examiner—Morris Kaplan

[57] **ABSTRACT**

A magnetic brush developing apparatus as disclosed having magnetic rollers with end sleeves formed of an insulating material. A trimming bar is provided having a concave portion below a leading edge thereof to facilitate the return to the sump zone of excess developing material. Magnets disposed within the rollers are mounted on channel members in a manner to direct the magnetic forces about each brush to ensure blanket coverage and a downstream configuration to direct developing material over a baffle associated with a cross-mixing baffle assembly. A screen is provided within the housing of the assembly to collect foreign objects. A mixing and transport device is positioned within the sump zone and is comprised of a plurality of spaced-apart augurs disposed on a shaft and a plurality of radially-extending bars affixed to the ends of the augurs.

1 Claim, 8 Drawing Figures



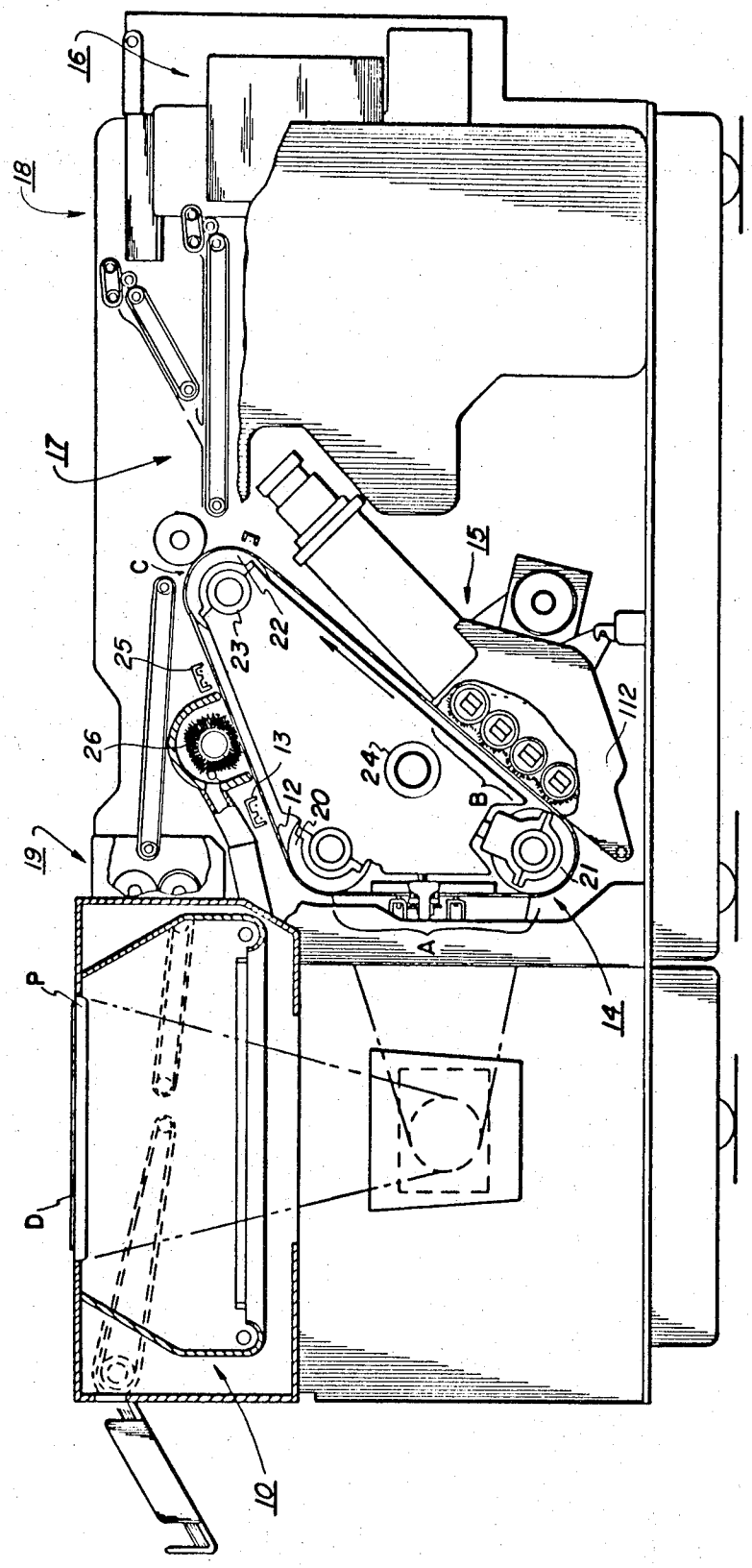


FIG. 1

FIG. 3

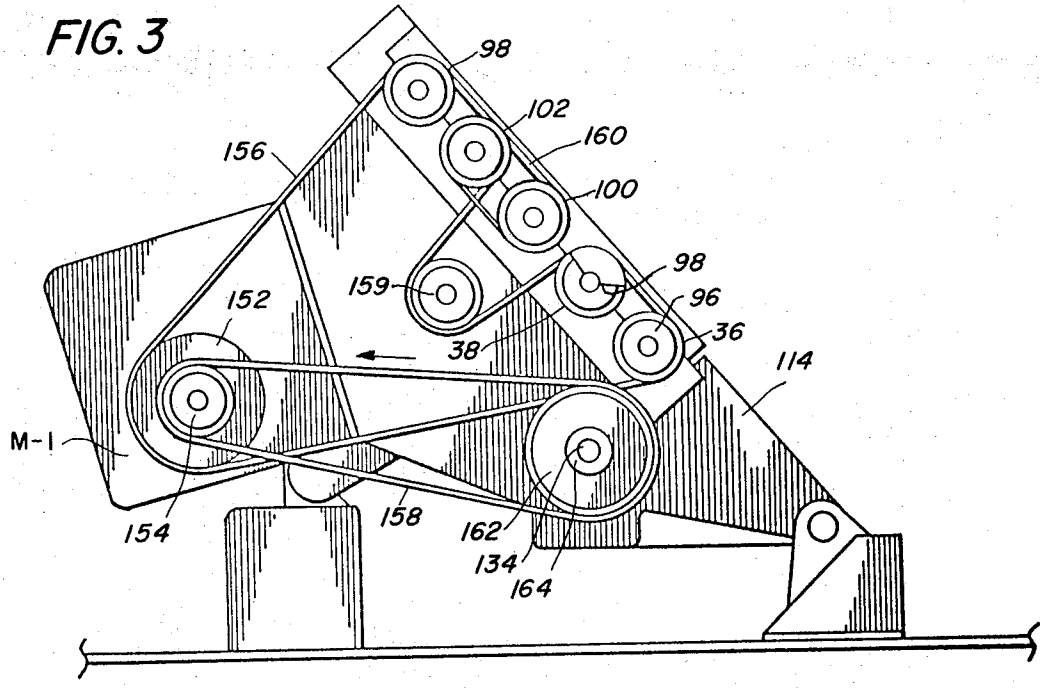
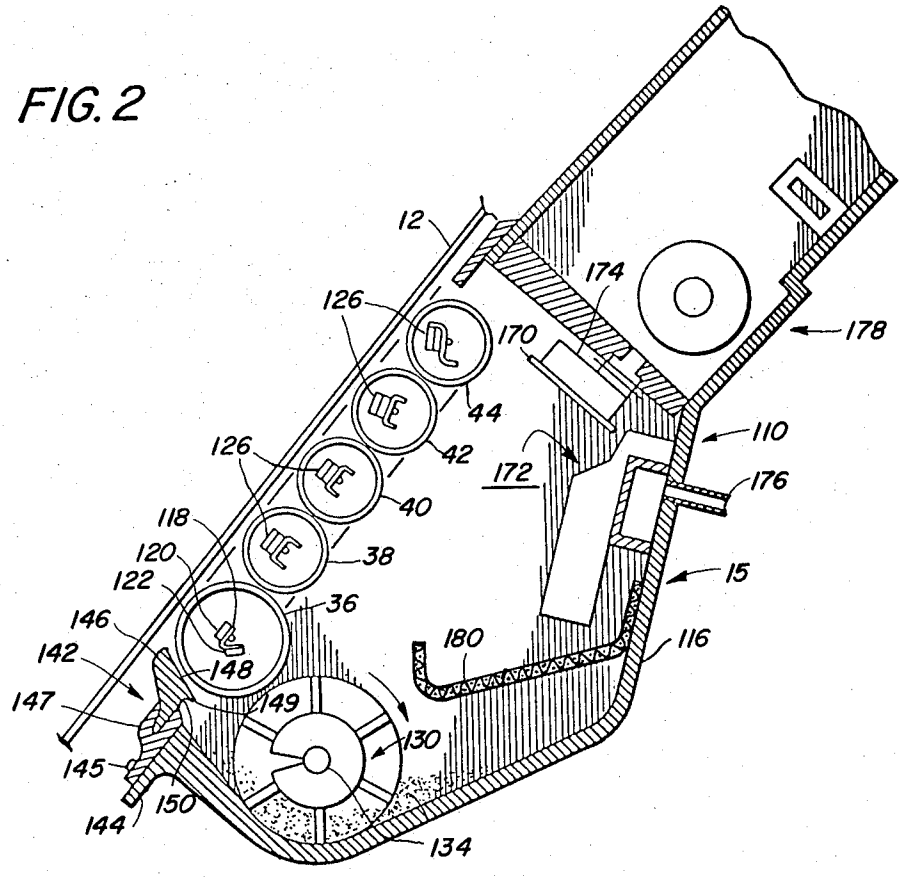

98
102
160
156
100
98
159
96
152
36
38
114
M-1
154
158
162
134
164

FIG. 2


12
174
126
178
170
44
110
126
42
172
176
40
118
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120
122
36
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180
116
142
148
147
149
130
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150
144
134

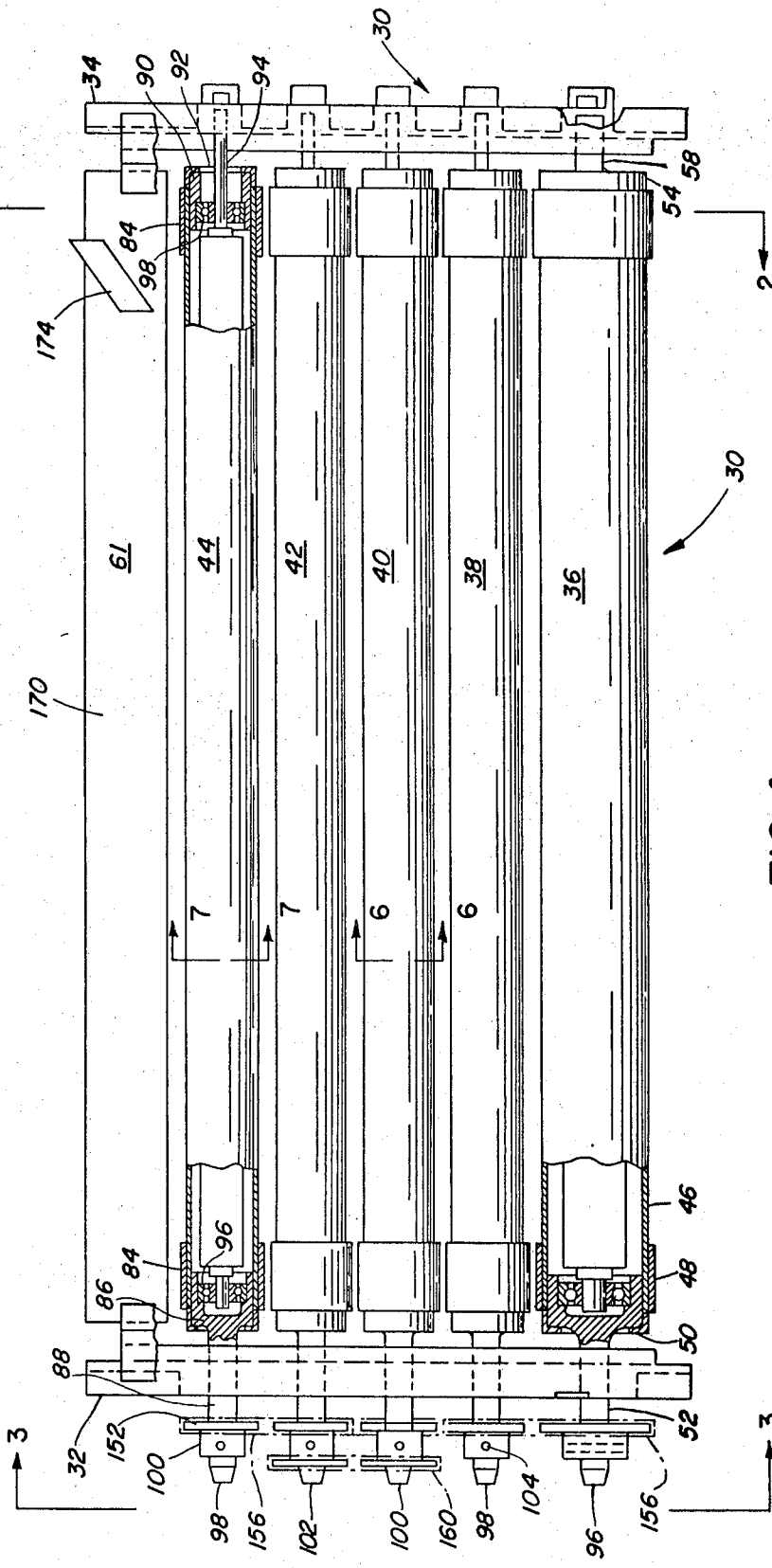

30
34
90
92
94
58
54
84
98
174
2
2
61
44
42
40
38
36
30
170
7
7
6
6
46
96
84
48
86
50
88
52
32
152
100
98
156
102
100
160
98
104
96
156
3
3

FIG. 4

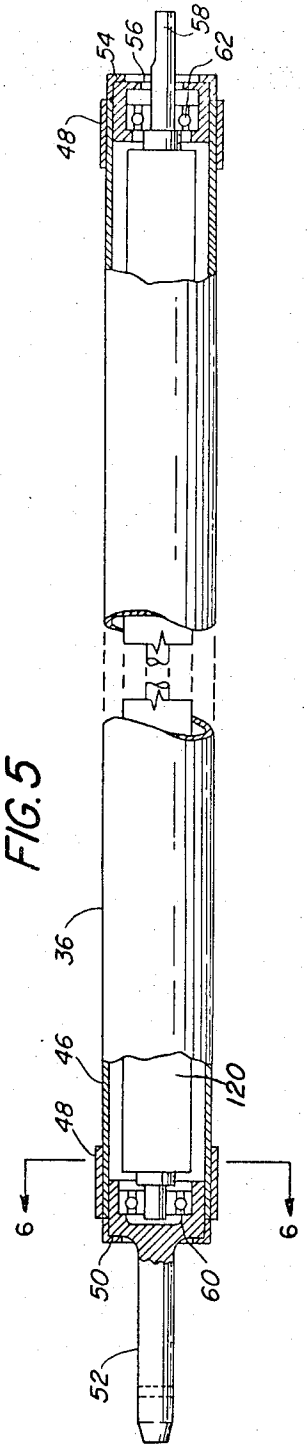


FIG. 5

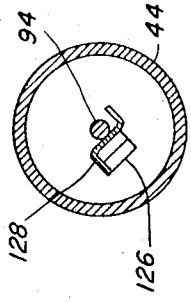


FIG. 7

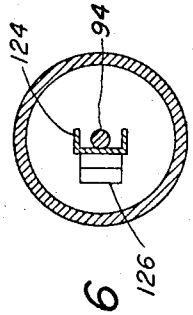


FIG. 6

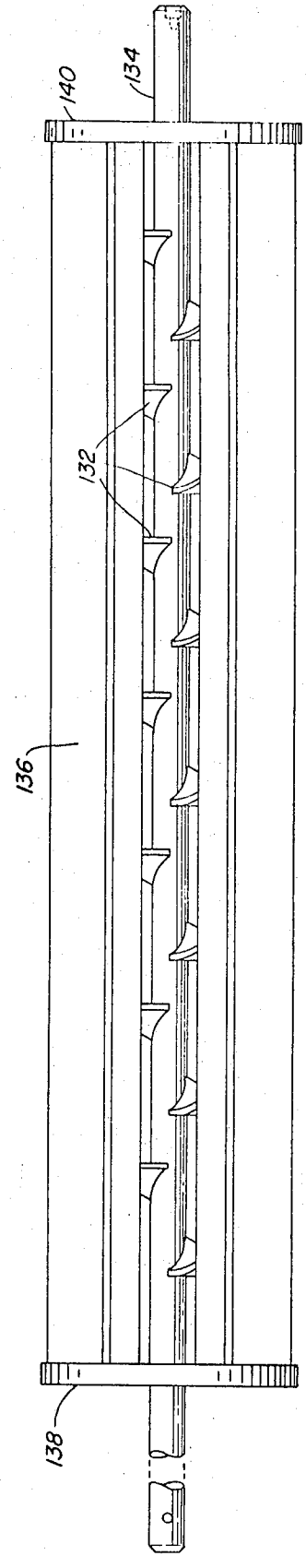


FIG. 8

MAGNETIC BRUSH DEVELOPING APPARATUS

This is a division, of application Ser. No. 255,721, filed May 22, 1972, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to improvements in developing apparatus for electrostatic printing machines, and more particularly, to improvements in a magnetic brush developing apparaus for accomplishing highly efficient, fast speed development of an electrostatically formed image.

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 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 image of the copy being reproduced. The powder is subsequently transferred to a sheet of paper or other transfer member and suitably affixed to thereby form a permanent print.

The latest concept for copiers utilizes high speed flash exposure of a document and the arrangement of a moving photoconductive material in the form of an endless belt which is continuously charged. Additionally, such copiers are provided with a developing system which supplies toner particles in relatively large quantities for solid area coverage, such as a magnetic brush developing apparatus.

The electrostatically attractable developing material commonly used in magnetic brush developing apparatus comprises a pigmented resinous powder referred to here as a "toner" and a "carrier" of larger granular beads formed with steel cores coated with a material removed in the triboelectric series from the toner so that a triboelectric charge is generated between the toner powder and the granular carrier. The magnetizable carrier also provides mechanical control for the formation of brush bristles by virtue of magnetic fields so that the toner can be readily handled and brought into contact with the exposed xerographic surface. The toner is then attracted to the electrostatic latent image from the carrier bristles to produce a visible powder image on an insulating surface of the photoconductive material. Generally, in an endless belt printing machine configuration which employs a plurality of magnetic brushes, the brushes are arranged for developing purposes with a run of the belt in the planar orientation.

In copending application by Salvatore Latone and Michael R. Stanley, entitled "Magnetic Brush Developing Apparatus," and assigned to the same assignee now

Patent No. 3,724,422, issued April 3, 1973, there is described a magnetic brush developing assembly comprised of a plurality of magnetic brushes having their axes arranged in parallel and in a plane generally parallel to the inclined plane of the photoreceptor belt at the zone of development therefor. The brushes are arranged so that the developing material in bristle form is moved in the inclined plane, whereupon, after moving past the last brush in the string of brushes, the material is returned for reuse to the sump at the beginning end of the string by gravity forces.

In order to improve homogeneity of the developing mixture and prevent toner particle depletion in any zone of the apparatus, a cross-mixing baffle assembly is provided, such as described in copending application to Michael R. Stanley, entitled "Cross-Mixing Baffle," and assigned to the same assignee and now U.S. Pat. No. 3,697,050, issued Oct. 10, 1972. In the lower portion of the sump of the developing apparatus, a paddle wheel impeller is provided to transport developing material towards the area adjacent the first magnetic brush of the magnetic brush developing apparatus.

In the magnetic brush developing apparatus heretofore used, arcing at various locations occurred which constituted a potential hazardous situation, as well as to effect the charge on the photo-conductive surface thereby effecting the quality of the resulting image on a transfer member. Additionally, the developing material in the sump zone has suffered from lack of homogeneity, especially when a plurality of copies are being produced having large selected portions of solid area coverage. The relative positioning of the magnets within the rollers of the magnetic brush developing apparatus has resulted in the piling-up of developing material in undesirable locations within the housing with concomitant excessive clean-up requirements. Still further, caking of developing material has occurred about the trimming bar configurations heretofore employed.

OBJECTS OF THE INVENTION

An object of this invention is to provide an improved magnetic brush developing apparatus.

Another object of this invention is to provide an improved magnetic brush developing apparatus wherein arcing is minimized thereby eliminating the necessity of insulating the magnetic brush developing apparatus from the frame of the electrostatic copier machine.

Still another object of the invention is to provide an improved magnetic brush developing apparatus having an improved mixing and transport device in the sump zone to improve the homogeneity of the development material.

A further object of the invention is to provide an improved magnetic brush developing apparatus having an improved trim bar to minimize caking about the area of formation of the magnetic brush.

A still further object of the invention is to provide an improved magnetic brush developing apparatus wherein the quantity of toner added to the developing material is more efficaciously monitored.

Still another object of the invention is to provide an improved magnetic brush developing apparatus including means for removing foreign objects inadvertently introduced with make-up toner which could deleteriously effect operation of the machine as well as the machine, per se.

SUMMARY OF THE INVENTION

These and other objects of the invention are obtained in a magnetic brush developing apparatus by providing magnetic rollers therefor having end sleeves formed of an insulating material, such as Teflon (a trademark of duPont), and wherein the drive sprocket for such rollers are formed from an insulating material, such as Nylon (a trademark of duPont). A trimming bar is provided having a lead edge for trimming the bristles forming on the proximate brush of the magnetic brush developing assembly and having a concave portion below such leading edge to facilitate the return to the sump zone of development material removed by the trimming bar. The trimming bar is mounted in an insulating holder formed of a material, such as polypropylene, which holder is affixed to the housing of the magnetic brush developing apparatus, as more fully hereinafter discussed.

The magnetic disposed within the rollers of the apparatus, much as described in copending application Ser. No. 220,965, filed Jan. 26, 1972 to Stanley Klett, entitled "Magnetic Brush Assembly," assigned to the same assignee and now U.S. Pat. No. 3,823,688, are mounted on channel members in a manner to direct the magnetic forces about each brush to insure blanket coverage and a downstream configuration to direct more efficaciously the development material over a baffle associated with the hereinbefore mentioned cross-mixing baffle assembly. A screen is disposed beneath the discharge conduits of the cross-mixing baffle to collect foreign objects which may be readily removed during any turn-around period of the machine. A mixing and transport device is positioned within the sump zone of the apparatus and is comprised of a plurality of spaced apart augurs disposed on a shaft and a plurality of radially extending bars affixed to the ends of the augurs to improve the homogeneity of developing material.

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 partial sectional view of the magnetic brush developing apparatus, in part, taken along the lines 2—2 of FIG. 4;

FIG. 3 is an elevational view of the other side of the magnetic brush developing assembly shown in FIG. 2 and illustrating the drive mechanism for the magnetic brush roller apparatus;

FIG. 4 is a top plane view of the roller assembly for a magnetic brush developing apparatus;

FIG. 5 is a partial sectional view of the proximate roller of the roller apparatus;

FIG. 6 is a cross-sectional view of an intermediate roller taken along the lines 6—6 of FIG. 4;

FIG. 7 is an enlarged cross-sectional view of the ultimate roller of the magnetic brush roller apparatus taken along the lines 7—7 of FIG. 4; and

FIG. 8 is a front view of the mixing and transport device included in the magnetic brush developing apparatus.

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 magnetic brush developing apparatus, generally indicated by the reference numeral 15, and which provides development of the electrostatic image by means of multiple brushes as the same moves through the development zone, as more fully hereinafter described.

The developed electrostatic image is transported by the belt to a transfer station C whereat a sheet of copy paper or transfer member 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.

The toner particles remaining as residue on the developed image, background particles and those particles otherwise not transferred are carried by the belt **12** to a cleaning apparatus **26** positioned on the rim of the belt between rollers **20** and **22** adjacent a charge device **25.** 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, assigned to the same assignee.

Referring first to FIGS. **2** to **5**, particularly FIGS. **4** and **5**, there is illustrated a roller assembly, generally indicated as **30**, comprised of end plates **32** and **34** which receive rollers **36, 38, 40, 42** and **44** and provided with a plurality of holes (not shown) for mounting the roller assembly **30** within the magnetic brush developing apparatus **15** of the machine.

The roller **36** is comprised of a cylindrical sleeve **46** of a roughened surface formed of a non-magnetizable material and extending almost the length of the housing of the developing apparatus **15.** End sleeves **48,** formed of an insulating material, such as Teflon (a trademark of duPont), are suitably disposed on the cylindrical sleeve **46** such as by a heat treatment whereby the sleeves **48** shrink about the ends of the roller **36.** One end of the sleeve **46** is closed by a cap **50** which supports a drive shaft **52** in coaxial alignment with the sleeve **46.** The other end of the sleeve **46** is closed by a cap **54** having an orifice **56** through which extends a shaft **58.** Suitable bearing means **60** and **62** are provided on the shaft **58** which cooperates with inner bearing surfaces formed in the end caps **50** and **54,** respectively, to permit the sleeve **48** to rotate about shaft **58.** Within the sleeve **46,** there are positioned elongated bar magnets **120, 122,** as more fully hereinafter discussed, extending nearly the full length of the sleeve **46** and suitably affixed to the shaft **58,** such as by welding.

Rollers **38, 40, 42** and **44** are comprised of cylindrical sleeves **82** of a roughened surface formed of non-magnetizable material and co-extensive with sleeve **46** of the roller **36,** and are provided with end sleeves **84,** similar to the end sleeves **48** of roller **56.** One end of the sleeve **82** is closed by a cap **86** which supports a drive shaft **88.** The other end of the sleeve **82** is closed by a cap **90** having an orifice **92** through which extends a shaft **94.** Suitable bearing means **96** and **98** are provided on the shaft **94** which cooperates with inner bearing surfaces formed in caps **86** and **90,** respectively, to permit the sleeve **82** to rotate about the shaft **94.** Within the sleeve **82** there is positioned an elongated bar magnet **126,** as more fully hereinafter described, extending nearly the full length of the sleeve **82** and suitably affixed to the shaft **94.**

The drive shafts of the rollers **36, 38, 40, 42** and **44** are suitably mounted in bearings in end plate **32.** The ends of the drive shafts **52** and **88** of the roller **36,** the rollers **38** and **44,** the roller **40,** and the roller **42,** respectively, extending beyond the end plate **32** are provided with sprockets **96, 98, 100** and **102,** respectively, suitably affixed to their respective drive shaft, such as by pins **104.** The sprockets are formed of an insulating material, such as Nylon (a trademark of duPont).

Referring specifically to FIGS. **2** and **3,** the magnet roller assembly **30** is disposed with the magnetic brush developing assembly **15** comprised of a housing, generally indicated at **110,** having a generally rectangular cross section and a length extending beyond the width of the photoconductive belt **12.** The housing **110** is substantially closed except for an opening adjacent the photoconductive belt **12** whereat development of the latent image is effected. The housing **110** serves as a container, closed at its sides, by end walls **112** and **114** and supporting an inclined bottom wall **116** for containing developing material comprising carrier beads from magnetizable material and colored electrostatic toner particles which adhere thereto.

As hereinabove discussed, the magnetic rollers **36, 38, 40, 42** and **44** are mounted for rotation within the housing **110** with their axes parallel and below the selenium belt **12.** Within sleeve **46** of roller **36,** there is provided an angle bar **118** extending nearly the full length of the sleeve **46** on which are mounted elongated bar magnets **120** and **122** with the front surface of bar magnet **120** being substantially parallel to the belt **12.** The bar magnet **122** provides a means for transporting developing material from the lower sump portion of the housing **116** adjacent the periphery of sleeve **46** of **36.**

Within each sleeve **82** of the rollers **38, 40** and **42,** a U-shaped channel member **124** is mounted on each of the shafts **54** extending nearly the full length of the sleeves with elongated bar magnets **126** being affixed to the outer surface of the innerly member extending between the outer legs of the U-shaped channel member **124** (see FIG. **6**). The surface of bar magnets **126** of rollers **38** and **40** are substantially parallel to the surface of the photoconductive belt **12.** The surface of bar magnet **126** of roller **42** is disposed at an angle of about 15° with the plane of the surface of the belt **12.** As seen in FIG. **1,** the roller **44** is provided with a generally S-shaped support member **128** mounted on the shaft **94** and extending nearly the full length of the sleeve **82.** An elongated bar magnet **126** is mounted on the middle portion thereof with the surface of the magnet **126** being disposed at an angle of about 30° with the plane of the surface of the belt **12.**

As shown in FIGS. **2** and **4,** the peripheral walls of the roller **36** and those for the other rollers are relatively close to each other. During a development cycle when all rollers are rotating in unison in the same direction and with their respective magnetic bars held stationary, the brush bristles produced by the influence of the magnetic field emanating from the bar magnets acting upon the magnetizable carrier beads in the developing material will form on the upper region of the sleeve **36** between this cylinder and the undersurface of the selenium belt **12.** Bristles remain formed during the developing cycle, being initiated by the influence of the bar magnet **122** disposed within sleeve **46** of the roller **36,** and being maintained during rotation of the sleeve **46** by the magnetic field of the magnet **120.** When the bristles are moved out of the influence of the magnet **120** of the roller **36** beyond the closest distance between the belt **12** and the sleeve **46** thereof, bristle formation is maintained by the influence of the magnetic field for the magnet **126** associated with the sleeve **82** of the roller **38,** which influence is stronger at this point than the diminished strength of the magnetic field attributed to the magnets **120** and **122** of the roller **36.** This phenomenon is repeated until the last roller **44** is reached whereupon the developing material is eventually returned to the sump zone via the hereinabove mentioned chute assembly.

During movement of the carrier beads and toner through the development zone B, the magnetic bristles

and, therefore, the development material, is in the form of a "magnetic blanket" extending continuously over all of the brushes of rollers 36, 38, 40, 42 and 44 for the entire width of the development zone B wherein the material is disposed or available to some degree for developing purposes. It will be apparent that the width of the development zone B is larger than the sum of the individual development zones for each of the magnetic brushes. Further details regarding the formation and effect of the "magnetic blanket" are described in the copending application Ser. No. 830,285, assigned to the same assignee and now U.S. Pat. No. 3,640,248, issued Feb. 8, 1972.

The relative positioning of the bar magnet 126 mounted on U-shaped channel member 124 of roller 42 as well as the bar magnet 126 mounted on S-shaped member 128 of roller 44 results in a reduction of the magnetic flux thereabout to facilitate release of toner particles attached to the roller 44 to direct more accurately the toner depleted developing material to the hereinbefore described cross-mixing baffle assembly thereby minimizing build-up of developing material in undesirable locations which would necessitate frequent cleanup. In the absence of such configuration, the carrier particles have a tendency to adhere to the rollers and flow down the reverse side of the brush assembly 30.

Also mounted for rotation within the development housing 116 and below the magnetic roller assembly 30, there is provided a mixing and transport device, generally indicated as 130. Referring to FIG. 8, the mixing and transport device 130 is comprised of a plurality of spaced-apart augur element 132 mounted on a drive shaft 134. A plurality of radially extending flat bars 136 are mounted to the outer extending surface portion of the augur elements 132. Cylindrically-shaped caps 138 and 140 are force fitted into the end portions of the bars 136. During a development cycle, the device 130 is caused to rotate in the direction shown by the arrow in FIG. 2 and serves to mix developing material within the zone defined by the augur elements 132 and to transport developing material by the flat bars 136 toward the pick-up adjacent the lower surface of the roller 36 independent of the state of levelness and the amount of carrier beads in the system. The development material in this vicinity is caused to be raised towards the roller 36 which will effect the formation of bristles on the sleeve 46 of the roller 36. As this sleeve 46 is caused to rotate, the newly formed bristles come under the influence of the magnet 120 and the "magnetic blanket" for the assembly 17 is initiated. It is noted that the augur elements 132 are disposed on the shaft 134 in a manner to permit localized intromixing of the developing material without conveying development material from one end of the sump zone to another thereby minimizing localized concentration of developing material while enhancing homogeneity thereof.

In order to optimize the length of the bristles during the formation of the "magnetic blanket" upon the sleeves, there is associated with roller 36 a trimming blade assembly, generally indicated as 142, extending the width of the housing 116 and secured to a lower bottom wall portion 144 of the housing 116 such as by bolts 145. The trimming blade assembly 142 is comprised of a trimming blade 146 disposed within a mounting assembly 147 formed of an insulating material, such as thermoplastic resin, and is provided with an upper flat surface 148 substantially tangential to the sleeve 36. The portion of the trimming blade 146 extending towards the mixing and transport devive 130 is terminated in a knife edge 149 formed by the intersection of the flat surface 148 with a concave section 150 longitudinally formed in the trimming blade below the surface 148 thereof. Such configuration effectively determines the length of the bristles without the caking of developing material about the base thereof. The trimming blade 148 is spaced apart from the periphery of the roller 36 a short distance equal to the desired length of the bristles to be formed on the magnet brush assembly 30. It is noted that the trimming blade 146 does not directly contact the housing 116 but is insulated therefrom by the plastic mounting assembly 147.

The rotational motion for all of the rotary components of the developing apparatus 15, is illustrated in FIG. 3, and is derived from a motor M-1 and a drive system comprising, a sprocket 152 secured to a shaft of the motor, a smaller sprocket 154 also secured to the shaft, and timing chains 156 and 158 for connecting the sprockets 152 and 154, respectively, to the rotary components. Specifically, the chain 156 is drivingly engageable with suitable sprockets 96 and 98, mounted on the drive shafts of each of the rollers 36 and 38, respectively; an idler sprocket 159 formed of an insulating material, such as Nylon (a trademark of duPont); and sprockets 102 and 98 secured to the drive shafts of the rollers 42 and 44, respectively. A small chain 160 is provided to connect sprocket 100 of roller 40 with sprocket 102 of the roller 42 (see FIG. 3) thereby simultaneously driving roller 40 which is not directly connected to timing chain 156. With this arrangement, the magnetic brush rollers are rotated with the same peripheral speeds, in the same direction and in a direction which moves the "magnetic blanket" comprising magnetic brush bristles upwardly in an inclined plane arranged at the same angle as the angle of the plane of the belt in the development mode.

The timing belt 158 is connected to the drive sprocket 154 and with a driven sprocket 162 secured to the shaft 134 for the mixing and transport device 130 thereby to assure that the device 130 and the magnetic brush sleeves rotate in unison. The relative speed of the device 130 is slightly less than the peripheral speeds of the magnetic brush sleeve but is provided with a surface capacity which provides an excess of developing material being transported to the area about the sleeve 46 of the proximate roller 36.

The depleted developing material which is carried beyond the magnetic brush of roller 44 (the last brush in the series of magnetic brushes that comprise the developing device) is returned to the housing 110 in order to be re-used for development purposes. As the developing material is moved by the cylinder 44 away from the development zone B, it is directed by a longitudinal planar baffle plate 170 secured at its ends to the end walls 112 and 114 of the developer housing 116 to the upper end of a cross-mixing baffle assembly, generally indicated by the numeral 172. Another baffle plate 174 is mounted on the planar baffle plate 170 to direct representative portions of the depleted developing material through an automatic developer control, generally indicated at 176, to monitor effectively the rate of toner depletion and thereby appropriately add toner

from a supply reservoir, generally indicated as **178,** as warranted by the rate of toner depletion.

Disposed below the cross-mixing baffle assembly **172,** there is provided a generally U-shaped screen **180** suitably mounted to the back wall **116** of the housing **110** and extending the width thereof. The lower leg of the screen is disposed within the housing **110** in a manner to classify and collect any foreign objects, such as paper clips and the like which may be inadvertently introduced into the toner supply reservoir **178.**

While the description of the present invention has been directed to a magnetic brush apparatus having five rollers, it should be understood that less rollers, e.g., one roller, may be employed depending on the designed duty of the machine. Additionally, while the invention has been described with reference to a machine having an endless photoconductive belt assembly, it is understood that the principle of the invention is applicable to a machine employing a photoconductor drum wherein one or more rollers are provided in the magnetic brush assembly.

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 a magnetic brush developing apparatus for applying developing materials to a photoconductive surface including electrostatic latent images in an electrostatic printing machine, having a housing defining a sump zone and wherein a cross-mixing baffle is provided to redistribute depleted developing material within said sump zone, the improvement comprising:

a U-shaped screen member positioned below said cross-mixing baffle and extending the width of said housing.

* * * * *