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Otubo et al.

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[45] **Nov. 19, 1974**

[54] **ELECTROPHOTOGRAPHIC COLOR COPYING APPARATUS**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **355/4,** 355/10

[51] **Int. Cl.** **G03g 15/22**

[58] **Field of Search** ..... 355/4, 3 P, 10, 14, 27, 355/32, 88; 95/95

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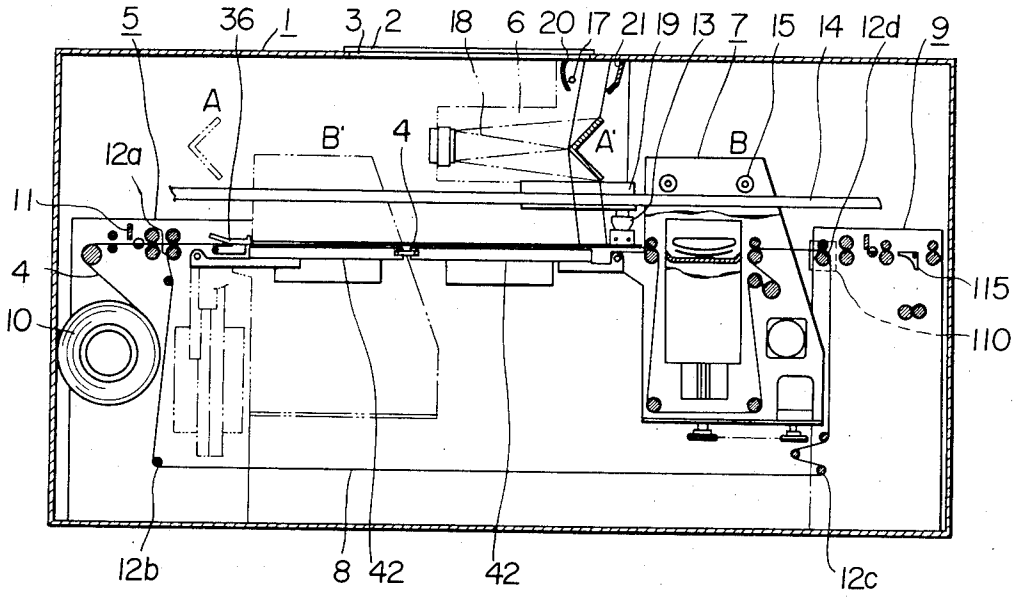
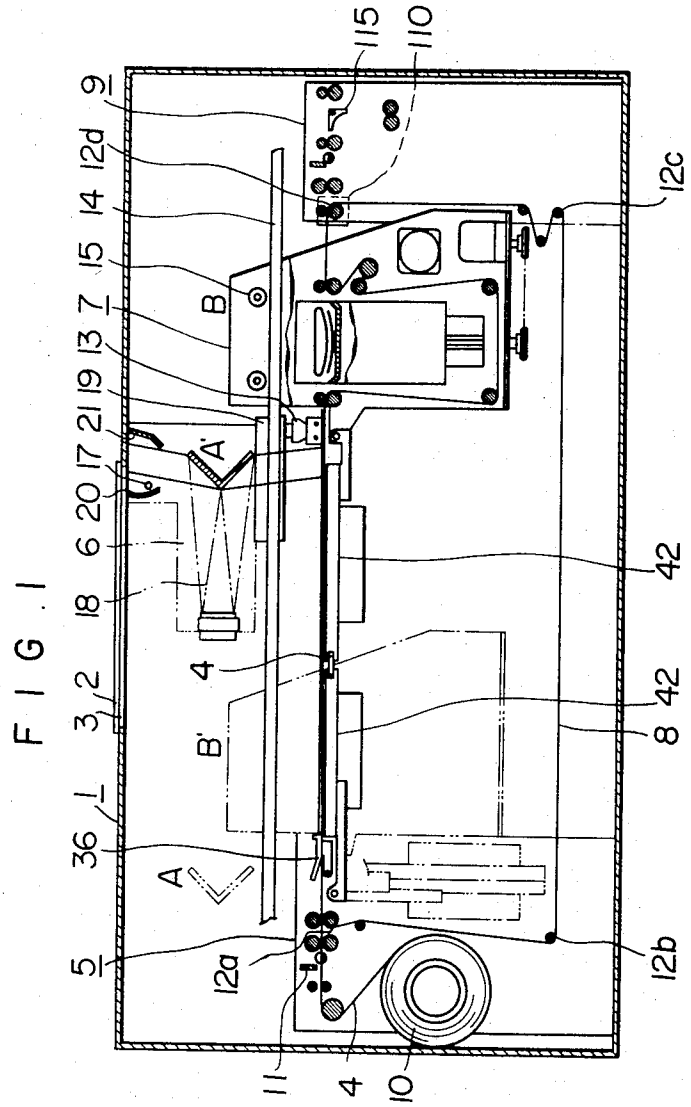
Primary Examiner—Samuel S. Matthews
Assistant Examiner—Kenneth C. Hutchinson
Attorney, Agent, or Firm—Craig & Antonelli

[57] **ABSTRACT**

An electrophotographic color copying apparatus comprising an original mount on a housing, means for lighting an original placed on the original mount and thereby exposing a record medium or paper properly to original light images, a belt means supported on a plurality of guide rollers for guiding the recording medium to an exposure position, means for electrically charging part of the medium uniformly prior to the exposure of the original, developing means including as many pigments as primary colors involved which is disposed inside of a recess defined by the belt means for developing the exposed medium, means for transporting the developing means relative to the medium, and means for holding the belt means to prevent the movement of the medium at the time of transportation of the developing means.

14 Claims, 11 Drawing Figures

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12a
11
4
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12b
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12c
A
A'
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FIG. 1

FIG. 2

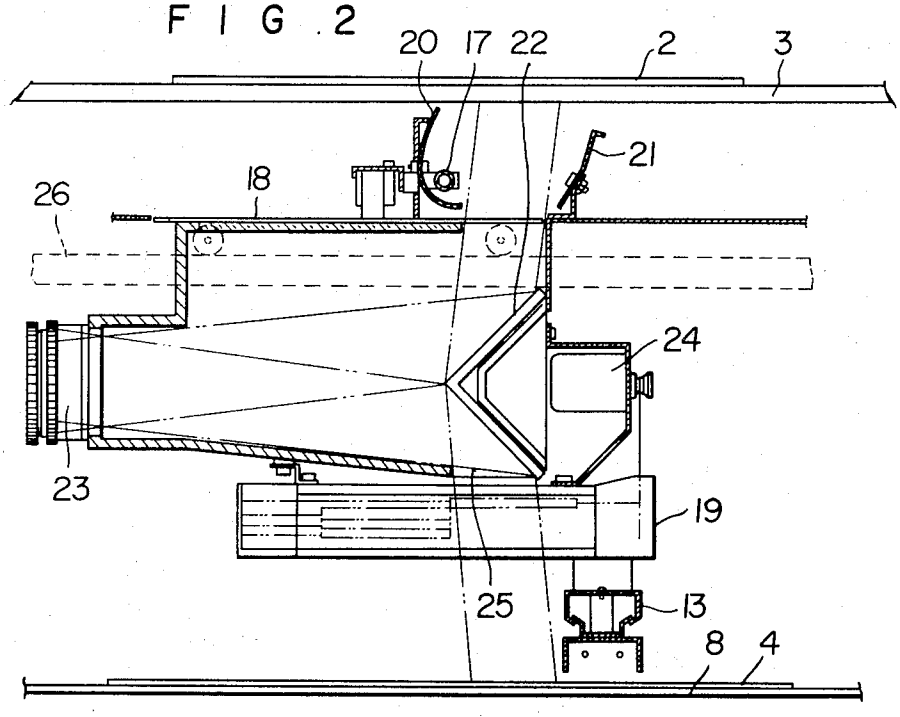
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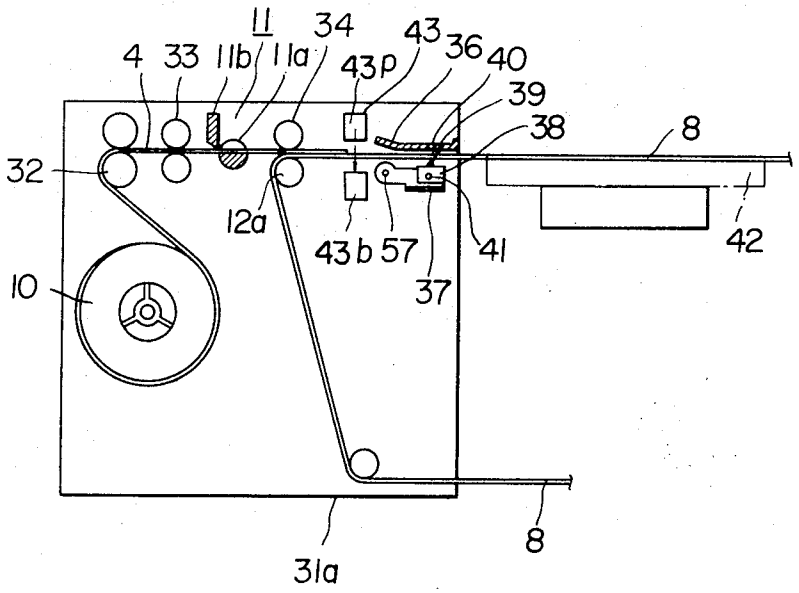
FIG. 3


11
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31a
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FIG. 4

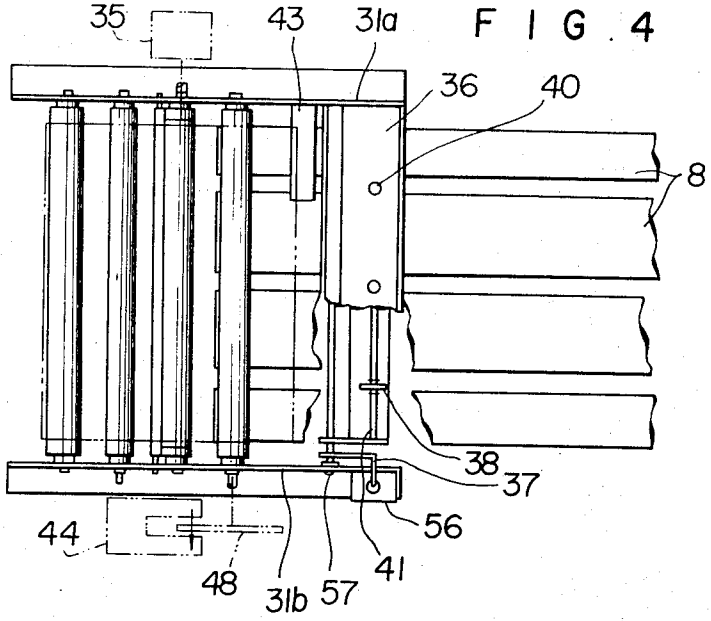
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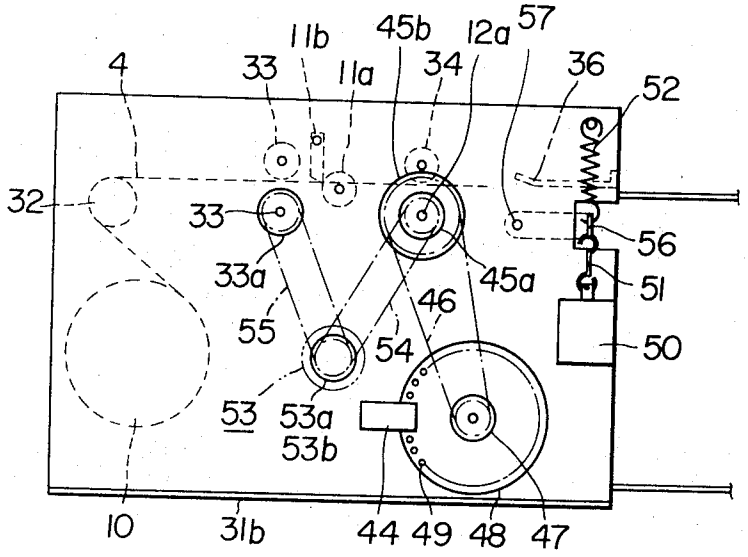
FIG. 5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45b
12a
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53b
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31b
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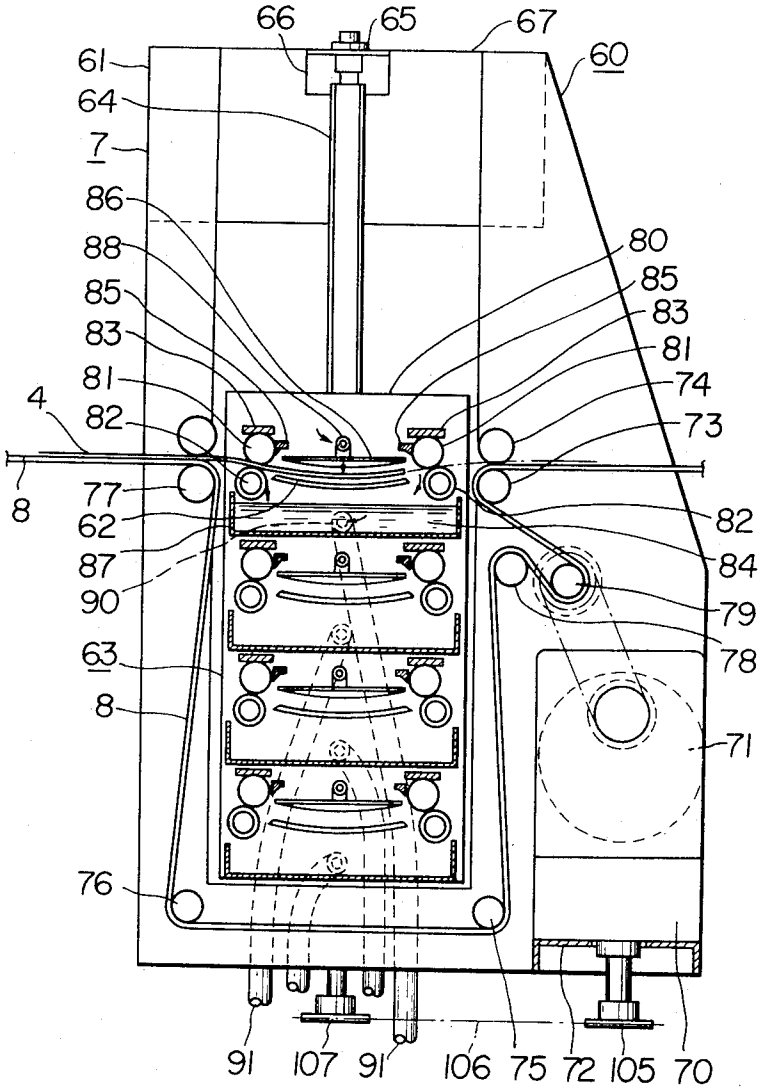
FIG. 6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4
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76
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74
73
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79
78
71
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72
105
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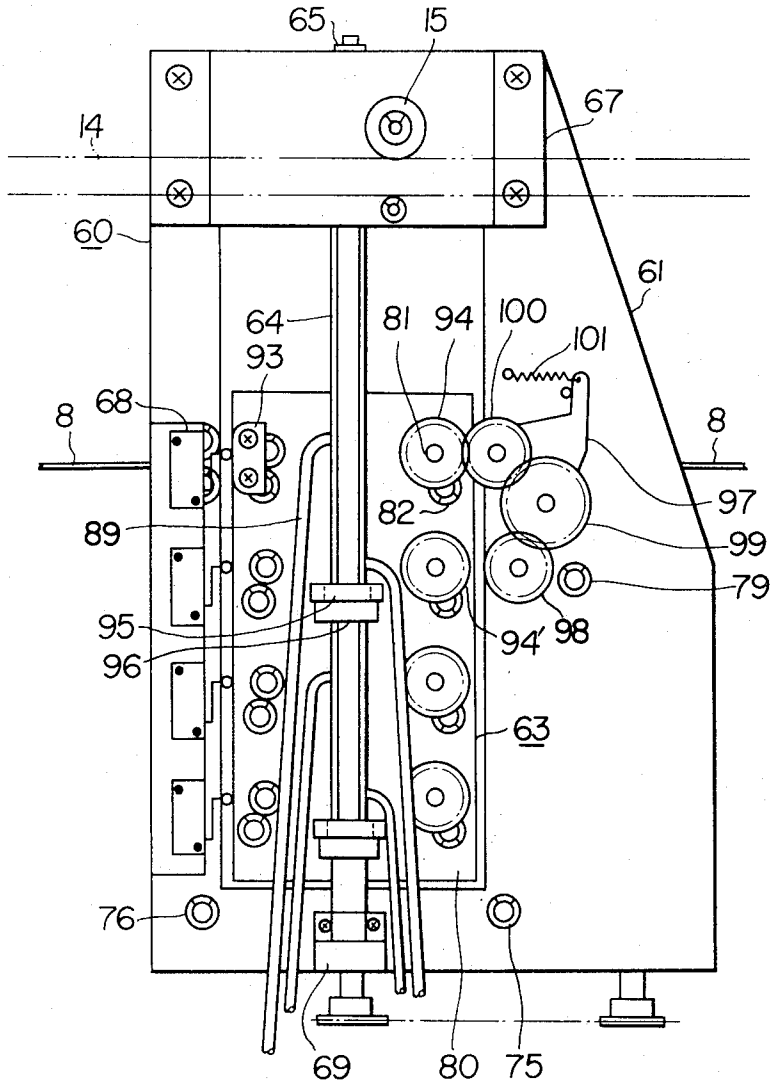
FIG. 7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67
14
60
61
64
93
81
94
100
101
8
68
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97
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96
94'
98
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76
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80
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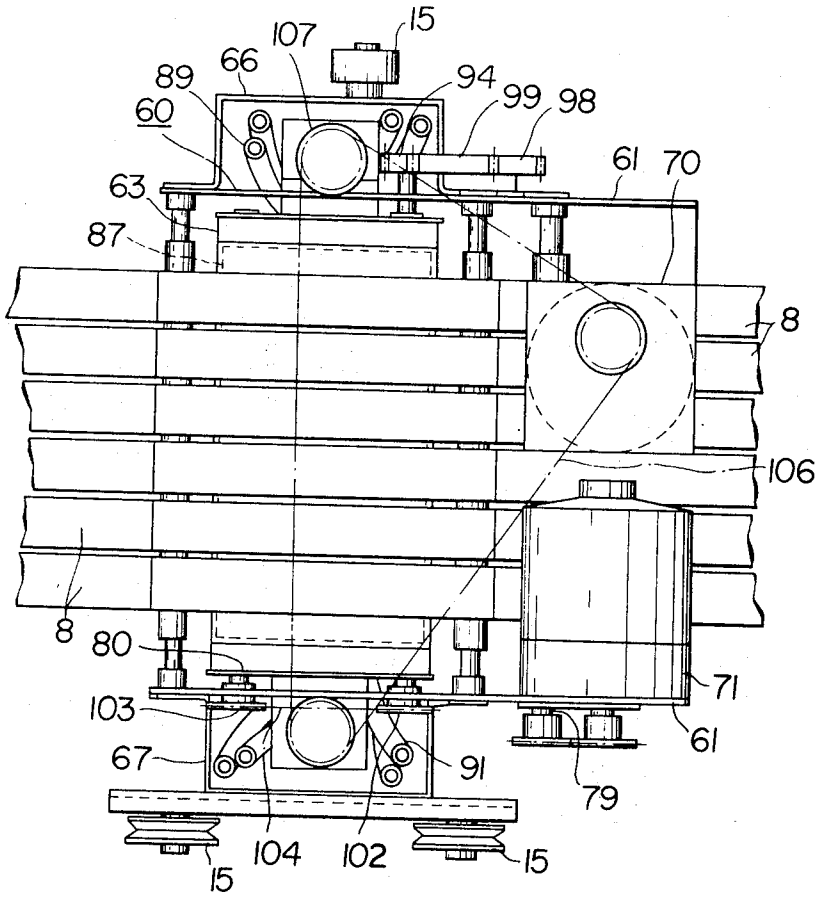
FIG. 8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94
99
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104
102
15
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FIG. 9

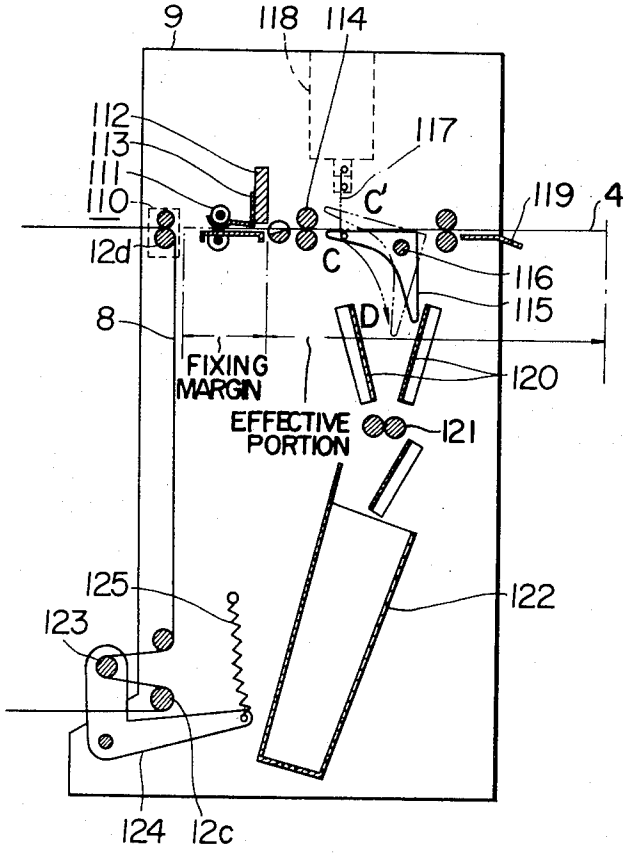

9
118
114
112
113
111
110
12d
117
C'
C
119
4
116
115
D
8
FIXING MARGIN
120
EFFECTIVE PORTION
121
125
123
122
124
12c

FIG. 10A

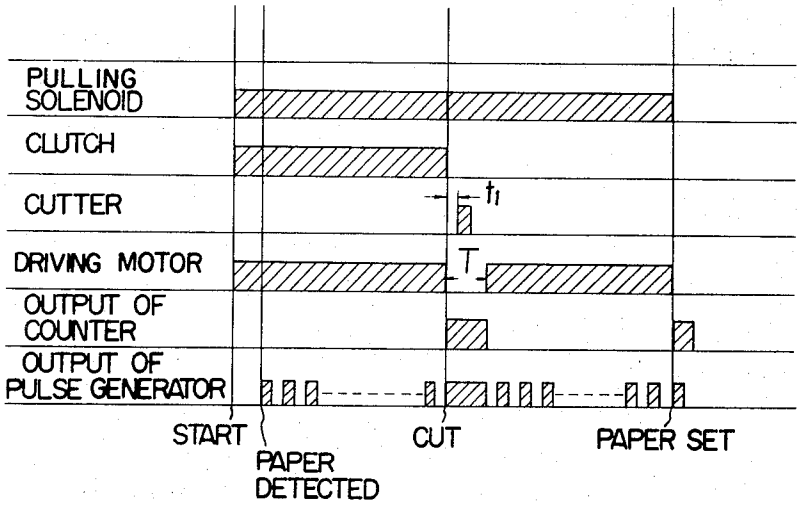
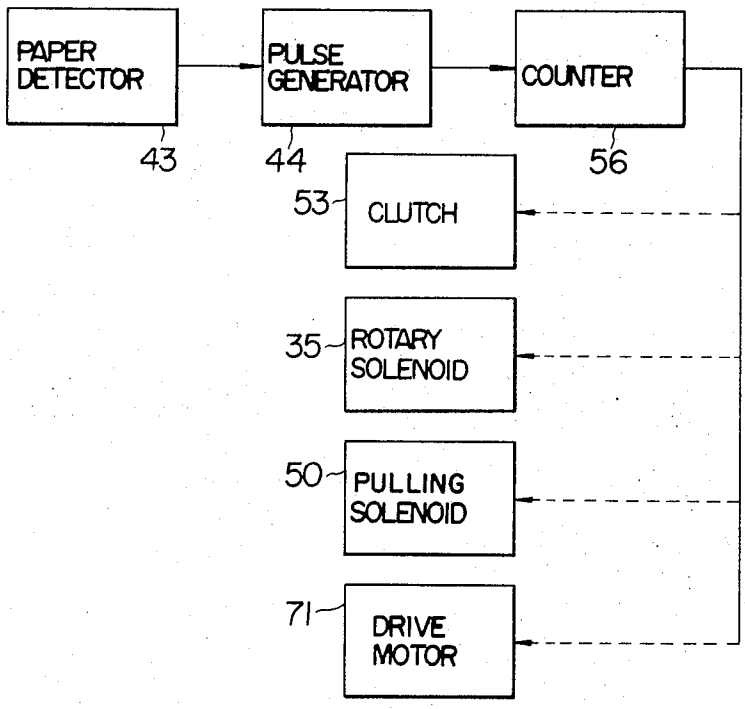


FIG. 10B



ELECTROPHOTOGRAPHIC COLOR COPYING APPARATUS

The present invention relates to an electrophotographic copying apparatus or more in particular to an electrophotographic color copying apparatus.

Unlike the conventional electrophotographic monochromatic copying apparatus in which each of the operations of electrical charging, exposure to light and development is performed in one step to copy an original on a sheet of paper, an electrophotographic color copying apparatus in such that each operation is repeated by the number of the required pigments thereby to complete a sheet of color copy. This necessarily results in a more complicated construction than the conventional monochromatic copying apparatus.

In order to faithfully reproduce a color image of an original or material, the material is processed by a color separation filter or the like and a toner corresponding to each separated primary color is attached to the appropriate positions on the paper at the optimum concentration.

In reproduction of the original color by superimposing primary colors plural times, the graduation plays a very important role.

Wet type of electrophotography is superior in gradation to the other types. In the wet type electrophotography, parallel electrodes in proximity to each other are provided for attaching a toner to the surface of the sensitized paper in a developing solution, whereby it is possible to reproduce at high speed a number of uniform copies with the same saturation of image.

In the prior art color electrophotography, a record medium or paper on which an original is to be copied comprises a base with an appropriate resistance and a photoconductive layer formed thereon. After the surface of the paper is uniformly charged electrically, the sensitized surface is exposed to the image of the original and thereby a color toner of the first primary color is deposited on the paper thereby to complete the first reproduction cycle.

In the second reproduction cycle, this paper is again electrically charged uniformly and exposed to the original through the second color separation filter thereby to deposit the second color toner on the first color toner already attached to the surface of the paper.

Similar reproduction cycles are repeated as many times as the number of the coloring materials or pigments representing the primary colors involved thereby to reproduce a color image.

In common practice, the color toners of primary colors used for the above-mentioned purpose include cyan, magenta and yellow. To this list of colors may be added "black" as occasion demands.

In the above-described conventional apparatus, the superposition of the toners is a very important factor for successful reproduction of an original image or material. In the color image reproduction, it is also important to eliminate any displacements of each component primary color image. The reproduction processes involved, however, make it impossible to set the paper in position by taking advantage of the strength of the paper itself as in the ordinary printing operation since the paper is wetted with the developing solution.

For this reason, in the conventional apparatus in which the paper is set on a reproduction drum to reproduce a color image of an original as is disclosed in U.S. Pat. No. 3,531,195, it is very difficult to achieve automatic replacement of the paper on the drum on one hand and and the construction of the apparatus itself becomes very complicated on the other.

A paper folding means now in use for a monochromatic copying apparatus is such that paper is cut into a predetermined size and fed to a paper feed belt through a detector means such as a cam, so that each sheet of paper is held in place by adsorbing it to a predetermined position by means of an adsorbing fan provided on the base under the paper feed belt.

In the color reproduction which requires a multiplicity of processes including electrical charging, exposure to light and development on the same sheet of paper, it is absolutely necessary that the position of a sheet of paper does not change for the process of deposition of each pigment in order to obtain a satisfactory color copy.

In the color copying apparatus, a record medium or paper on which an original image or material is to be copied must be fed exactly into position and held there rigidly as well as replaceably. The above-mentioned holding means for the conventional copying apparatus uses mechanical position detection with a microswitch or cam, which is accompanied by an appreciable response error of the switch. As a result, such a conventional holding means is low in positioning accuracy and often causes the surface of the paper to be damaged, making its application to a color copying apparatus impossible.

An alternative to overcome such a problem of color displacement may be to hold the paper during the process of development. However, this results in the disadvantage that an extra margin must be provided in each record medium sheet of paper for the purpose of holding, which margin is cut off from an effective portion after reproduction work. Since the manual removal of such a holding margin with scissors or other means after delivery of a completed copy from the apparatus is troublesome, it is desirable that the copying apparatus be provided with a mechanical means for removal of holding margins.

An object of the present invention is to provide a simple construction of copying apparatus which involves at least two reproduction cycles.

Another object of the invention is to reproduce a faithful image of an original on a record medium sheet of paper without any color displacement through a series of processes including electrical charging, exposure to light and development while maintaining the paper at a predetermined position.

Still another object of the invention is to provide a simple paper feed device which is capable of automatic and continual paper feed and holding.

A further object of the invention is to provide means whereby the developing means is capable of being moved in a horizontal direction relative to the paper, a developing unit for any primary color is capable of being selected and movable in vertical direction as desired, and the position where the developing means or unit is to stop is easily and accurately controlled.

Still another object of the present invention is to synchronize the rotational speed of a squeeze roller with the feed of the paper relative to the speed of the developing means and also to synchronize the running speed of the transport belt means with the rotational speed of the squeeze roller in the final process of delivery of a

copy thereby to secure smooth and accurate delivery of copies.

Still another object of the invention is to improve the accuracy with which copies are transported into place and their margins are cut off, by using pulse counter in regulating the distance covered by the paper and also to enable an attendant to select any paper size and position where the paper is held, by setting the counter at the appropriate number of pulses.

Still another object of the invention is to provide movable means for holding the paper for improved paper follow-up and rigid holding and also to facilitate paper removal at the next step.

Still another object of the invention is to support the paper holding means from both upper and lower sides between the transport belt units thereby to facilitate the extraction of a pin thrusted into the paper at the time of delivery thereof.

Still another object of the invention is to effect detecting operation with high responsibility without any damage to the paper by the use of a photelectric detector means.

According to the present invention, a color copying apparatus is provided in which a record medium sheet of paper is held in place at each process of electrical charging, exposure to light and developing and the developing means is movable in the horizontal direction through the paper transport means, and a developing trough for any primary color in the developing means is capable of being selected and movable in vertical direction.

The above and other objects, features and advantages will be made apparent by the detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a sectional diagram showing the whole construction of the apparatus according to the invention.

FIG. 2 is an enlarged sectional view of an optical unit of the apparatus of FIG. 1;

FIG. 3 is a diagram showing an enlarged sectional view of the paper feed unit;

FIG. 4 is a plan of the feed unit of FIG. 3 as viewed from above;

FIG. 5 is a side view of the feed unit of FIG. 3;

FIGS. 6 to 8 are diagrams showing enlarged sectional view, side view and bottom view respectively of the developing unit;

FIG. 9 is an enlarged sectional view of the paper delivery unit; and

FIGS. 10A and 10B are diagrams for explaining the operation of the paper feed unit.

The present invention will be now explained with reference to an embodiment thereof shown in the accompanying drawing.

Referring to FIG. 1, reference numeral 1 shows a housing for containing the apparatus proper. On the upper surface of the housing 1 is mounted a transparent plate 3 on which an original 2 is to be disposed. Reference numeral 5 shows a paper feed unit for feeding a record medium sheet of paper 4 into the housing 1, numeral 6 an optical system for exposing the paper to light images, numeral 7 a developing unit for developing the exposed paper, numeral 8 a belt for transporting the paper sent from the paper feed unit 5, and numeral 9 a delivery unit for collecting outside of the housing 1 the paper processed in the developing unit 7.

The paper 4 is supplied from the roll 10 replaceably mounted in the paper feed unit 5, and after being cut into size by the cutter 11, maintained horizontal at the exposure position on the transport belt means 8.

The transport belt means 8 may be electrically conductive and may consist of an endless belt supported on a plurality of guide rollers 12*a* to 12*d* rotatably mounted on the side plate of the housing 1. Reference numeral 13 shows charging means for uniformly charging the exposure surface of the paper supported on the transport belt means 8 prior to exposure to light, which charging means is horizontally movable over the paper while maintaining a small space therebetween. The paper 4 charged uniformly by the charging means 13 is exposed to the original 2 through the optical unit 6 thereby to form a latent charged image on the paper 4.

With the horizontal movement of the developing unit 7 on the rails 14 by the agency of the wheels 15, the paper 4 with a latent charged image and held by a paper holding means is apparently passed through the developing means 7 thereby to develop an actual image corresponding to the latent charged image with the first color toner.

The above-described image-forming cycle including a series of processes of charging, exposure and development is repeated as many times as the number of pigments of primary colors involved (usually 3 or 4 times). On completion of the final cycle, the paper held on the transport belt means 8 is released, and the unused portion of the paper, that is, the margin thereof by means of which the paper is held on the paper holding means is separated from an effective portion. Only the effective portion of the copy thus separated is delivered from an outlet 16 on the side of the housing 1.

The optical unit 16 comprises, as shown in FIG. 2, a light source 17, lens system 18 and a filter 19. The light source 17 mounted within the reflection plates 20 and 21 radiates the original 2 through the transparent plate 3. The paper 4 is exposed to light from the light source 17 through the V-shaped reflection mirror 22, reflection lens 23 and filter 19 of the lens system 18. The filter 19 is such that it is moved by the motor 24 selectively toward and away from the slit section 25 of the lens system 18. A charging means 13 is mounted at an end of the filter 19. The optical unit 6 is mounted movably on the rails 26 and driven by a motor now shown in the drawing.

The paper feed unit 5 will be now explained with reference to FIGS. 3 and 4. The paper 4 unrolled from the roll 10 by the guide rollers 32 rotatably supported on the side plates 31*a* and 31*b* is sent out through the feed rollers 33 in synchronism with the movement of the transport belt means 8. Reference numeral 34 shows a belt pulley which cooperates with an opposedly provided guide roller 12*a* to drive the paper 4 while pressing it against the belt means 8. The cutter 11 has a rotary section 11a which is rotated with the energization of the rotary solenoid 35 as shown in FIG. 4, whereby the fixed blade 11*b* cuts the paper 4. Reference numeral 36 shows a paper holding plate in spaced relationship with the belt means 8 which has a pin hole 40 for engagement with the pin 39 of the paper holding piece 38 mounted on the paper fixing arm 37. The paper holding piece 38 is rotatably mounted on the shaft 41, the rotational angle of the paper holding piece 38 being controlled by the arm 37. Thus, as shown in

FIG. 4, the paper holding plate 36 combines with the paper holding piece 38 to hold the paper 4 through the spatial intervals between the belt units, in such a manner that the paper plate 36 thereby to firmly hold the paper 4 therebetween.

Reference numeral 42 shows a belt base provided under the belt means 8 for holding in the horizontal direction the belt means 8 and the paper 4 disposed on the belt means 8. Numeral 43 shows a photelectric paper detector comprising an illuminating section 43P and light-receiving section 43R for detecting the paper utilizing the cutting off of light by the paper 4.

The arrangement of a side portion of the paper feed unit 5 is illustrated in FIG. 5. Reference numeral 44 shows a generator for generating a pulse corresponding to the pitch of the small aperture 49 of the disc mounted on the pulley 47 which is driven through the belt 46 by the pulley 45*b* interlocked with the pulley 45*a* of the guide roller 12*a*.

Reference numeral 50 shows a pulling solenoid the connecting hook 51 of which is kept at an upper position by th tension spring 52 during deenergization of the solenoid 50, while on the other hand the connecting hook is pulled down overcoming the force of the tension spring 52 when the pulling solenoid 50 is energized. As a result, the movable arm 56 connected with the pulling solenoid 50 through the connecting hook 51 is pulled down and the shaft 57 connected with the paper holding arm 37 is rotated through the movable arm 56 with the result that a space is created between the paper holding piece 38 and paper holding plate 36 as shown in FIG. 3.

Reference numeral 53 shows a clutch provided with the clutch pulleys 53*a* and 53*b* which are disengaged with each other while the clutch 53 is de-energized. On the other hand, the pulleys 53*a* and 53*b* are engaged with each other when the clutch 53 is energized, so that the turning effort of the pulley 45*a* is imparted to the pulley 33*a* of the feed rollers 33 through the belt units 54 and 55, thereby to rotate the feed rollers 33.

The developing means according to the invention will be now explained with reference to FIGS. 6 to 8.

Reference numeral 60 shows an outer block of the developing means 7 comprising side plates 61. At the top of the outer block 60, the whole developing means 7 is supported movably through the rails 14 and wheel 15 and the top of the driving screw 64 for driving vertical the inner block 63 with the developing trough 62 is fixed on the supports 66 and 67 through the plane bearing 65. Also, at the central portion of the outer block there is provided a microswitch 68 for regulating the position of the inner block 63.

At the bottom of the outer block 60 is provided a support 69 for bearing the lower end of the driving screw 64. A base 72 is also fixed on the bottom of the block 60 to support the gear motor 70 for actuating the driving screw 64 and the driving motor for rotating the belt means 8. The transport belt means 8, as it passes through the developing means 7 in the horizontal direction, forms a rectangular U-shaped recessed portion with the roller 73 and pressure roller 74 opposed to the roller 73, lower rollers 75 and 76 and the roller 77 at its four corners, as shown in FIG. 6. In this recessed portion formed by the belt means 8 is contained the inner block 63 of the developing means 7, so that the turning effort of the driving motor 71 is imparted to the belt means 8 through the roller 79.

The inner block 63 of the developing means 7 is defined by the side plates 80. The side plates 80 contain a couple of metal squeeze rollers 81, elastic squeeze rollers 82, clean pats 83 attached onto the metal squeeze rollers 81, and clean lips 85 on the side of the metal squeeze rollers 81 for preventing the developing solution 84 from flowing onto the squeeze rollers 81 and 82.

Reference numeral 86 shows a developing shower tank, which together with the developing solution tank 87 and the developing trough 62, is interposed between the two squeeze rollers. Such arrangements are provided vertically in four stages at regular spatial intervals. Reference numeral 88 shows a terminal provided on the shower tank 86 for connection with the developing solution supply pipe 89, and numeral 90 an outlet of the developing solution tank 87 which is connected to the supporting tank (not shown) through the exhaust pipe 91.

On the outer front of the side plate 80 are mounted not only an actuator 93 which is energized in response to the operation of the microswitch 68, but also a gear 94 at the end of one of the squeeze rollers 81. Numeral 95 shows a driving arm fixed on the side of the side plate 80, and numeral 96 a driving nut in engagement with the driving screw 64. The rotation of the driving screw 64 through the stop of the driving arm 95 causes the entire inner block 63 of the developing means 7 to move vertically through the driving arm 95. The gear 94 is such that the turning effort of the roller 78 imparted from the belt means 8 is transmitted to the squeeze rollers 81 and 82 through the pinion 100, idler gear 99 and pinion 98 supported by the gear support 97. Reference numeral 101 shows a gear spring provided for the purpose of causing the pinion 100 to smoothly engage the gear 94′ in the next stage.

On the ends of the squeeze roller 81 are provided sprockets 102 and 103 respectively, so that the two squeeze rollers 81 on both sides of the developing trough 62 rotate in synchronism with each other through the chain 104 in engagement with the sprockets 102 and 103.

Explanation will be made now of the paper delivery unit 9 with reference to FIG. 9.

Reference numeral 110 shows a belt brake placed opposedly to the guide roller 12d for the dual purpose of paper feed and movement of the developing unit 7 by the holding and releasing of the belt 8 respectively. Numeral 111 shows feed rollers provided forwardly of the guide 113 of the rotary cutter 112 for sending the paper 4 to the rotary cutter 112. Numeral 114 shows rollers for sending sheets of paper 4 cut by the cutter 112, and numeral 115 a switching lever rotatably mounted on the paper delivery unit 9 through the shaft 116 for switching the unused margin of the paper to a lower side. Reference numeral 117 shows a tension spring connecting the electromagnetic solenoid 118 and the switching lever 115, numeral 119 a base plate for receiving the paper on which the copying operation is completed, numeral 120 a guide plate for guiding the unused portion of the paper to the lower side by the switching lever 115, which unused portion of the paper is sent into the receptacle 122 through the feed rollers 121. Reference numeral 123 shows a roller mounted at an end of the adjusting lever 124 for adjusting the tension of the belt means 8, the other end of the adjusting

lever 124 being connected to the side plate through the adjusting spring 125.

The operation of the apparatus with the above-described construction according to the invention will be explained more in detail below.

The operating condition of each section of the paper feed unit 5 and a block diagram illustrating the flow of electrical signals within the paper feed unit 5 are shown respectively in FIGS. 10A and 10B.

When a power switch not shown in the drawings is closed, the drive motor 71 begins to rotate and the belt means 8 moves clockwise in FIG. 1, with the result that the paper 4 is transported rightward in FIG. 1 in synchronism with the speed of the transport belt means 8. Under this condition, the pulling solenoid 50 and the clutch 53 are both in an energized state.

The passage of the paper 4 through the paper detector 43 causes the pulse generator 44 to be energized in response to the output signal from the paper detector 43. As a result, the pulse generator 44 produces pulses which are counted by the counter 56 by the number corresponding to a predetermined length of paper.

An output signal corresponding to the counted number of pulses is produced from the counter 56, upon receipt of which the drive motor 71 is de-energized thereby to temporarily stop the transport belt means 8. At the same time, the clutch 53 is de-energized to stop the paper feed rollers 33. The pulses from the pulse generator 44 stop being produced and the counter 56 is de-energized. With the energization of a timer (not shown) after t seconds, the rotary solenoid 35 is energized thereby to cut the paper 4 by means of the rotary cutter 11.

After the lapse of the suspension time of t seconds, the drive motor 71 is again energized and the transport belt means 8 begins to move again, so that the pulse generator 44 generates pulses in response to the signal from the detector 43 whereby the counter 56 counts the pulses thus generated. When the number of pulses counted by the counter 56 reaches the one corresponding to the predetermined paper length, that is to say, when the rear end of a sheet of paper 4 cut off reaches a point under the paper holding plate 36, the counter 56 produces an output signal. This output signal causes the driving motor 71 to be de-energized and thereby to stop the movement of the belt means 8. The pulling solenoid 50 is de-energized in response to the output from the counter 56 and as a result the paper 4 is held between the paper holding piece 38 and the paper fixing plate 36 by means of the tension spring 52. At the same time, the pin 39 on the paper holding piece 38 holds the paper 4 more firmly through the same paper 4.

After the paper 4 has been horizontally held in a proper exposing position on the transport belt means 8, the belt means 8 is fixed by a belt brake 110. The surface of the paper 4 thus held horizontally is charged by the charging means 13 mounted on the bottom of the optical unit 6 in spaced relationship with the paper 4, as the charging device 13 is energized to move rightward in FIG. 1, i.e. from point A toward A'.

Upon completion of the charging operation by the charging means 13, the charging means 13 is de-energized while at the same time the light source 17 of the optical system 6 is energized. Then, the optical unit 6 moves from point A' toward A while radiating the original 2 with the light from the light source 17. Light reflected from the original 2 is projected on the paper 4 through the V-shaped reflection mirror 22 and lens 23 as shown by a chain in FIG. 1.

The filter 19 provided under the slit 25 of the optical unit 6 is pulled out by the motor 24 in accordance with a specific primary color thereby to pick up such a specific color out of the reflected color, and the paper 4 is exposed to such a specific color to form a charged latent image on the exposed surface of the paper 4 corresponding to the image on the original to be copied.

During the above-described exposure process, the developing process is prepared. In the developing process, the gear motor 70 is first driven in the developing unit 7 thereby to rotate two driving screws 64 through the sprocket 105, chain 106 and the sprocket 107 at the lower end of the driving screws 64, so that the inner block 63 of the developing means 7 is pushed upward in FIG. 6 and as a result the operating piece 93 provided on the side plate 80 energizes the first-stage microswitch 68 thereby to stop the gear motor 70, holding the developing trough 62 at the position shown in FIG. 6.

The drive motor 71 is again energized to drive the transport belt means 8 through the roller 79. Since part of the belt means 8 is held by the belt brake 110, the whole developing means 7 moves leftward from point B toward B' in FIG. 1 relative to the belt means 8. Under this condition, the paper 4 is guided through the developing trough 62 by the guide rollers 73 and 74, whereby the developing operation is performed by means of the developing solution 84 held within the developing trough 62.

Developing solution 84 is released from the shower tank 86 above the developing trough 62 by the actuation of a supply pump (not shown) and part of the developing solution 84 spilled out of the paper 4 and the developing trough 62 is received by the developing-solution tank 87 from which it is returned to a solution supply tank (not shown) through the exhaust pipe 91.

In the process, the turning effort of the squeeze rollers 81 and 82 is imparted to the gear 94 through the idler gear 99 and pinion 100 from the pinion 98 mounted on the shaft of the roller 78 rotated by the frictional force of the transport belt means 8, and therefore the horizontal movement of the developing means 7 is always synchronized with the rotation of the squeeze rollers 81 and 82.

With the arrival of the developing means 7 at the predetermined point B' leftward in FIG. 1 to complete the development of the whole exposed surface of the paper 4, the direction of rotation of the drive motor 71 is reversed so as to return the developing means 7 rightward to point B, thus completing the developing process with the first color toner.

The charging device 13 again moves over the paper 4 to electrically charge the appropriate portion of the surface of the paper 4 uniformly, followed by the exposure to light of the second color representing the image on the original 2 by the optical unit 6. In the meantime, the gear motor 70 rotates again in the developing means 7 thereby to push up the developing trough 62 of the second stage into place.

The above-mentioned second-stage charging operation is followed by the second-stage development with the second color by the developing solution 84.

In this way, the reproducing processes are repeated for each primary color, for example, the processes are repeated four times for cyan, magenta, yellow and black thereby to complete the whole reproduction cycles. However, it should be noted that in the developing process of the final reproduction cycle, the transport belt means **8** held by the above-mentioned belt brake **110** is released thereby to set the paper **4** free from the paper holding means consisting of the paper fixing plate **36** and the paper fixing piece **38.** As a result, the turning effort of the drive motor **71** is imparted to the belt means **8** with the developing unit **7** being held thereby to send the paper **4** through the developing unit **7** to the delivery unit **9** as shown in FIG. **9.**

After the paper **4** reaches the delivery unit **9,** the unused portion or the holding margin of the paper **4** which has been held by the paper holding means is cut off by the cutter **112.** At the same time, the electromagnetic solenoid **118** is energized, whereby the switching lever **115** is directed to move upward from point C to C′ in FIG. **9.** In the process, the paper **4** is sandwiched by the feed rollers **114** and therefore tends to be torn off. This problem is overcome by providing the tension spring **117** between the electromagnetic solenoid **118** and the switching lever **115** for preventing the switching lever **115** from moving to point C′ before the paper **4** is detached from the feed rollers **114.** At the instant that the portion of the paper on which the original has been copied departs from the feed rollers **114,** the switching lever **115** is transferred to point C′, so that the unused paper margin changes its direction toward D and is led into the receptacle **122** through the guide plate **120** and feed rollers **121.**

The switching lever **115** is such that it is returned to the original position C by such restitution means (not shown) as coiled spring provided on the shaft **116.**

It will be understood from the above explanation that according to the present invention the unrolled paper on which the original is to be copied is fixed at a predetermined position during each process of electrical charging, exposure and development, while the developing means moves horizontally relative to the paper by means of the transport belt means, and therefore there occurs no displacement between images of the original material of different primary colors at the time of development, thus making it possible to obtain a faithful color image of the original.

What we claim is:

1. An electrophotographic color copying apparatus comprising a main housing, at least one transport belt for transporting and supporting a recording paper, guide means for directing the transport belt along a predetermined path, the predetermined path having at least a first planar portion and a substantially U-shaped portion extending substantially transversely to the first planar portion, the transport belt along the U-shaped portion delimiting a recess area for accommodating a developing means, means for moving the recess area from a first position to a second position along the planar portion of the predetermined path, means for feeding a recording paper to a predetermined position along the planar portion of the predetermined path by the transport belt, means for holding the recording paper at the predetermined position, means for uniformly electrically charging the surface of the recording paper held at the predetermined position, means for exposing the recording paper held at the predetermined position to light reflected from an original, the reflected light being projected onto the recording paper through an optical filter unit so as to form a letent charged image on the recording paper, the developing means being located in the recess area for developing a visible image from the latent charged image on the recording paper with toners of at least two primary colors, the developing means being movable along the planar portion of the predetermined path when the recessed area is moved from the first position to the second position so as to engage with the recording paper to develop the visible image on the recording paper.

2. An electrophotographic color copying apparatus according to claim **1,** wherein the first planar portion lies in a horizontal plane and the recording paper is held in the predetermined position and extends in a horizontal plane, the developing means including means movable horizontally and vertically relative to the recording paper disposed on the transport belt.

3. An electrophotographic color copying apparatus comprising a main housing, a transport belt movable along a path having a flat portion and a portion defining a recess, means for moving the recess from a first position to a second position along said flat portion of the path, means for feeding a recording paper to a predetermined position defined by said flat portion of said path by said transport belt, means for holding said recording paper at said predetermined position, means for uniformly electrically charging the surface of said recording paper held at said predetermined position, means for exposing said recording paper held at said predetermined position to light reflected from an original, said reflected light being projected on said recording paper through an optical filter unit thereby to form a latent charged image on said recording paper, developing means for developing a visible image from said latent charged image on said recording paper with toners of at least two primary colors, said developing means being located in said recess and moved along the flat portion of the path when said recess is moved from said first position to said second position thereby to engage with said recording paper to develop the visible image on said recording paper.

4. An electrophotographic color copying apparatus according to claim **3,** in which said transport belt comprises an endless belt and said developing means comprises a plurality of toners equal in number to primary colors.

5. An electrophotographic color copying apparatus according to claim **3,** in which said developing means comprises an inner block and an outer block, said inner block including a plurality of developing troughs to which as many different developing solutions as said developing troughs are supplied, said outer block containing said inner block and being adapted to vertically move said inner block to a predetermined position, and part of said transport belt driven by a drive motor mounted on said outer block is adapted to be held whereby said developing means is rendered movable horizontally relative to the paper through said transport belt means.

6. An electrophotographic color copying apparatus according to claim **5,** in which both said belt for transporting said paper and said developing means are moved horizontally by means of a single driving motor mounted on said outer block.

7. An electrophotographic color copying apparatus according to claim 5, in which said plurality of developing troughs contained in said inner block of said developing means are disposed one over another in spaced relationship with each other and are vertically selectively movable for each image-forming cycle.

8. An electrophotographic color copying apparatus according to claim 5, in which said plurality of developing troughs in said inner block are adapted to be stopped vertically at a predetermined position by means of an actuator provided on said inner block and a switch provided on said outer block.

9. An electrophotographic color copying apparatus according to claim 5, in which a plurality of squeeze rollers disposed at the positions where said paper is fed through in said inner block of said developing means are rotated in synchronism with the movement of said developing means and said transport belt through rollers driven by said transport belt.

10. An electrophotographic color copying apparatus according to claim 3, in which said means for feeding paper contained in said main housing comprises means for detecting said paper, means for generating pulses in the number corresponding to the length over which said paper is to be transported in response to an output signal from said detecting means, means for stopping the movement of said transport belt in response to an output signal from a counter for counting the output pulses from said pulse generating means, and means for securely holding said paper transported into position in response to the output signal from said counter.

11. An electrophotographic color copying apparatus according to claim 10, in which said means for holding said paper comprises a holding plate with an aperture and provided on one side of paid paper transported into position and a holding piece provided on the other side of said paper, said holding piece having a pin which pierces said paper and engages said aperture of said holding plate in response to the output signal from said counter.

12. An electrophotographic color copying apparatus according to claim 3, in which said means for delivering said paper comprises a cutter for cutting off unused portions of said paper and means for disposing said unused portions by way of an ordinary path without affecting a copy proper from which said unused portions have been separated.

13. An electrophotographic color copying apparatus according to claim 12, in which said means for disposing unused portions of said paper comprises a switching lever which enters and leaves the ordinary path, a shaft for rotatably supporting said lever, and an electromagnetic solenoid connected to an end of said lever through a tension spring.

14. An electrophotographic color copying apparatus according to claim 3, wherein said transport belt is made of electrically conductive material and said transport belt is substantially charged with the same electric potential as that of said main housing.

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