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Weber

[11] **3,874,789**

[45] **Apr. 1, 1975**

[54] **APPARATUS FOR READING AND ELECTROPHOTOGRAPHIC REPRODUCTION OF MICROPHOTOGRAPHS**

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[30] **Foreign Application Priority Data**

Apr. 20, 1972 France 72.13899

[52] **U.S. Cl.** ..... **355/5**, 96/1 C, 250/326, 355/16, 355/45

[51] **Int. Cl.** **G03g 15/00**

[58] **Field of Search** ..... 355/5, 45, 3 R, 16; 250/324, 326; 96/1 C

[56] **References Cited**

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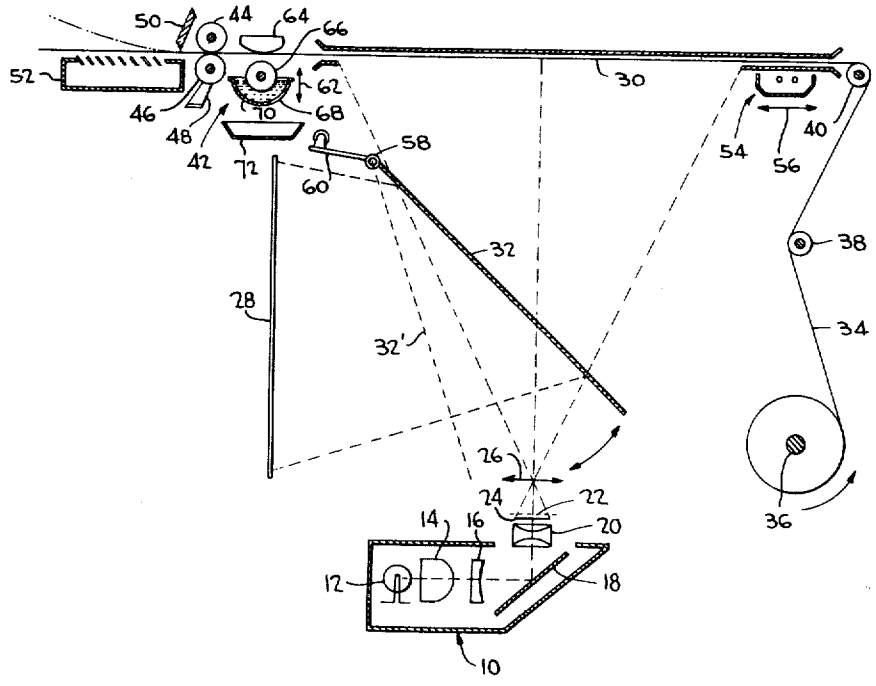
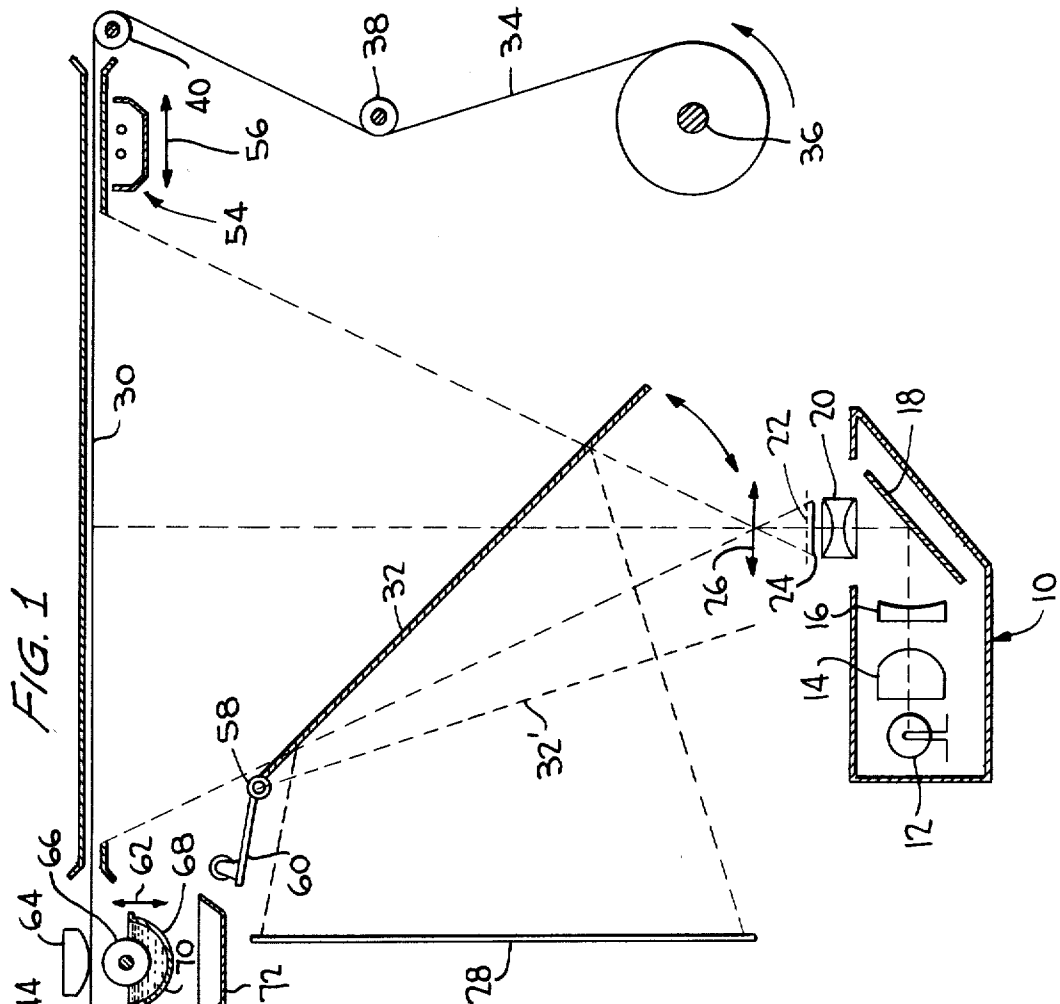
Primary Examiner—Richard L. Moses
Attorney, Agent, or Firm—Sherman & Shalloway

[57] **ABSTRACT**

Apparatus for reading and electrophotographic reproduction of microphotographs including an exposure station where copy paper is held stationary while a corona charging device is moved therealong to charge the copy paper appropriately for positive and negative reproduction, a screen for reading microphotographs, an optical system transmitting a light image of a microphotograph to either the reading screen or the exposure station dependent upon the pivotal position of a mirror, a developing station including a toner applying member responsive to pivotal movement of the mirror from the reading position to the reproduction position to move from a retracted position out of the path of copy paper through the developing station to a developing position to contact copy paper and apply toner thereto, and a control system for automatically controlling the apparatus to provide electrophotographic reproductions.

9 Claims, 5 Drawing Figures




38
34
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36
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32'
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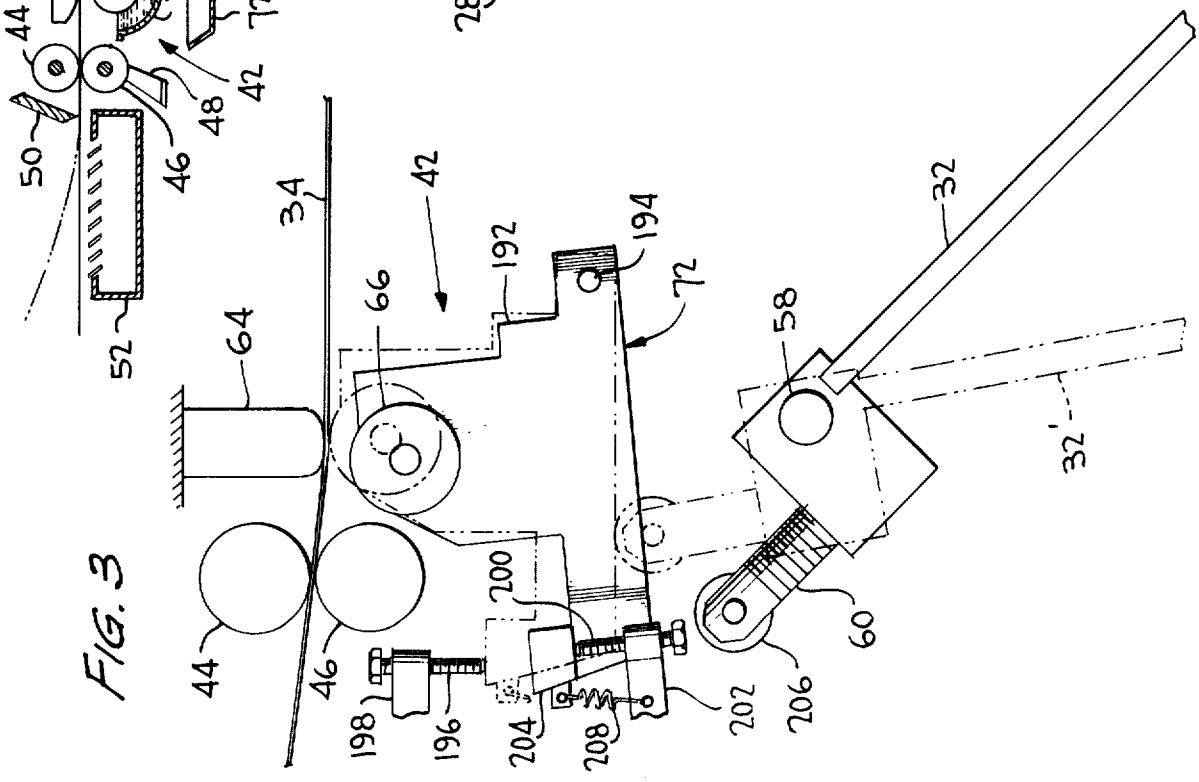
FIG. 1


34
42
192
194
66
72
64
58
32
32'
52
44
46
200
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196
204
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206
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FIG. 3

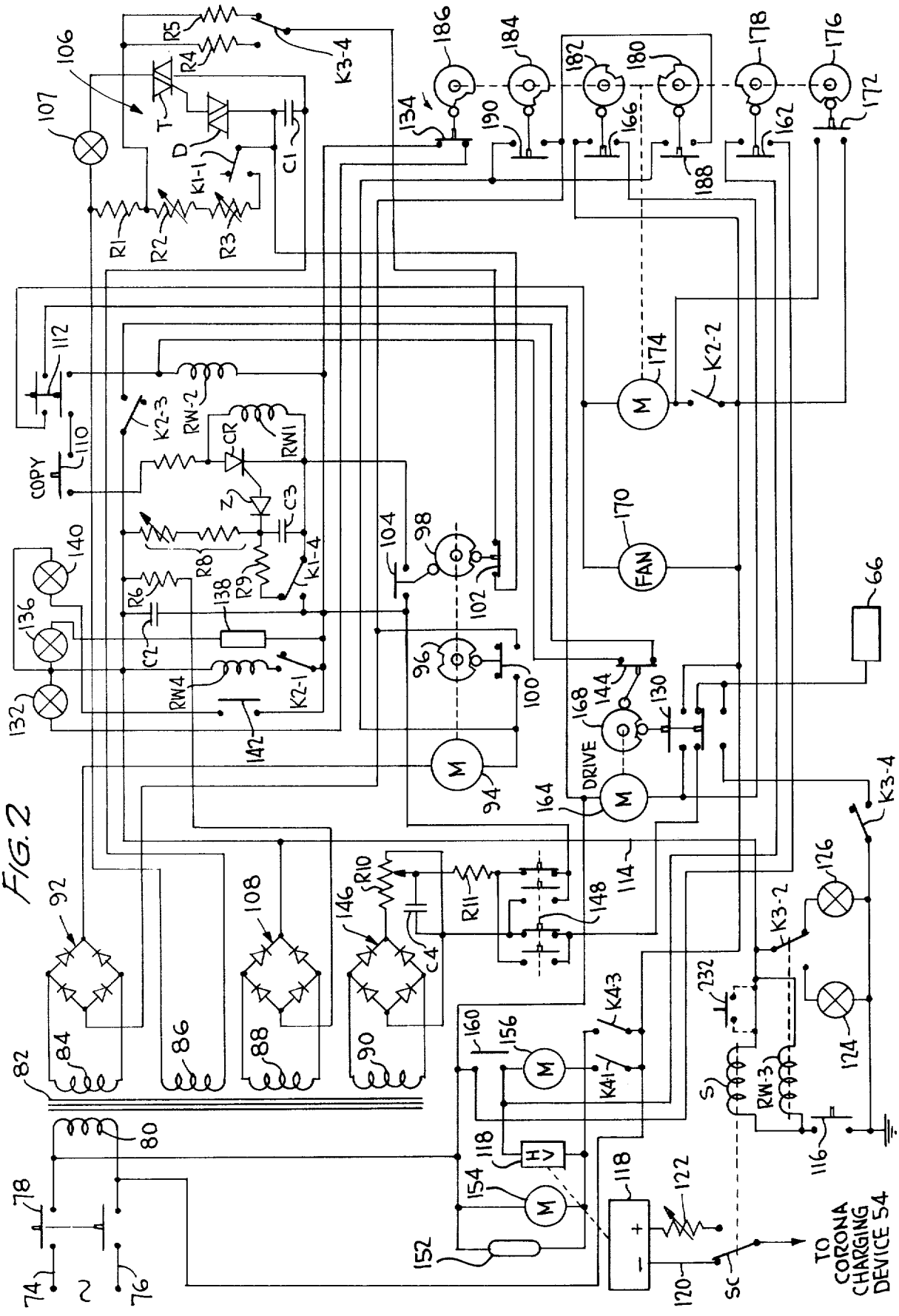
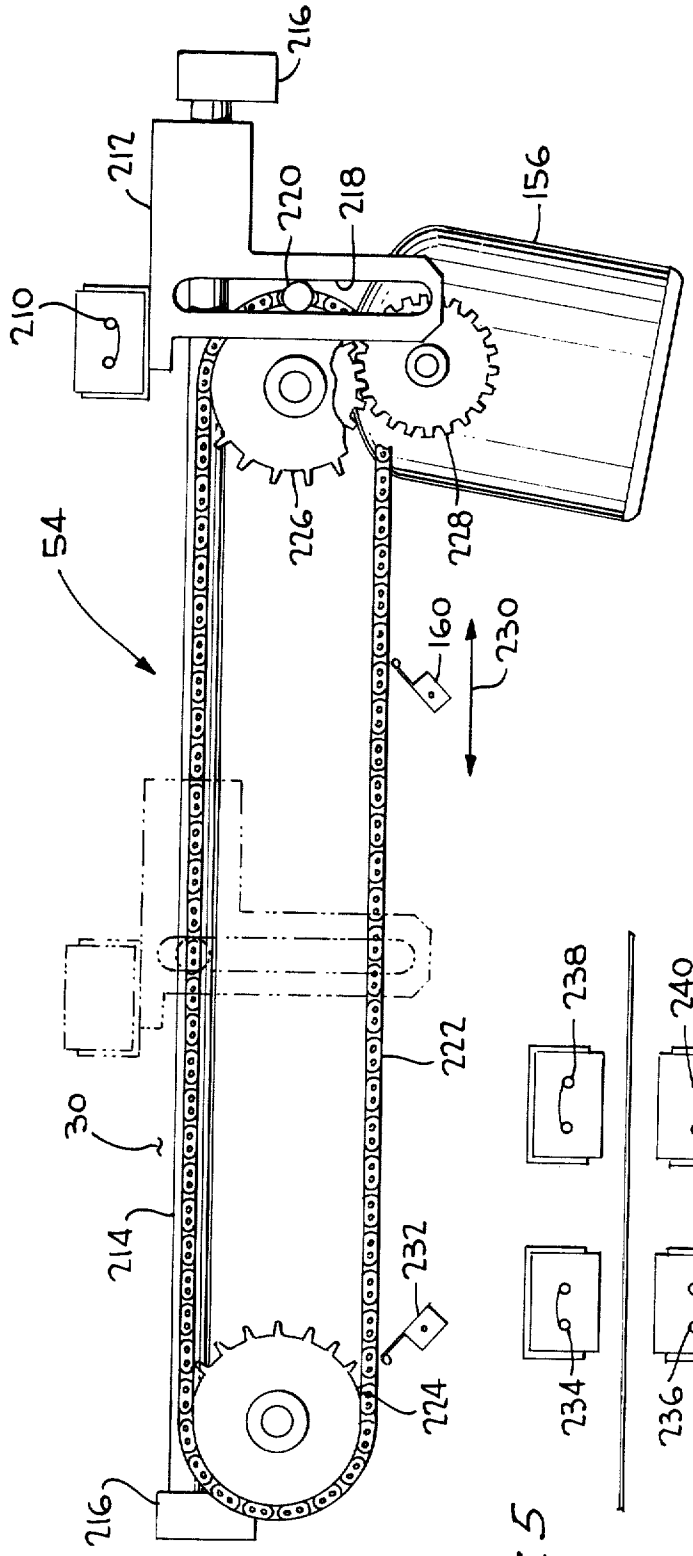

TO CORONA CHARGING DEVICE 54
COPY
DRIVE
FAN
K1-1
K1-4
K2-1
K2-2
K2-3
K3-2
K3-4
K41
K43
RW1
RW2
RW3
RW4
CR
D
T
Z
HV

FIG. 2


216
212
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156
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54
226
228
160
230
222
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232
224
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FIG. 4

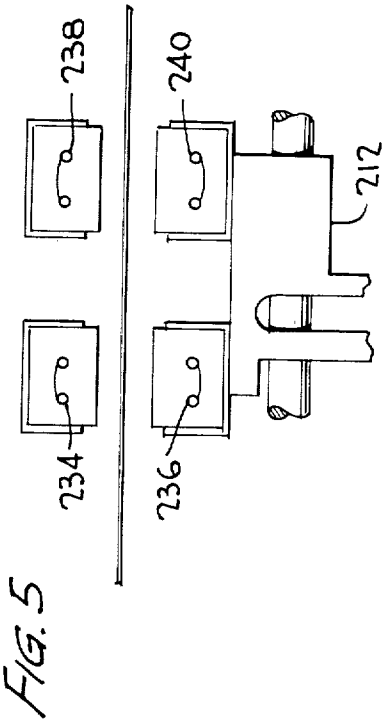
238
240
212
234
236

FIG. 5

APPARATUS FOR READING AND ELECTROPHOTOGRAPHIC REPRODUCTION OF MICROPHOTOGRAPHS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to elecrophotographic reproduction and, more particularly, to apparatus for reading and electrophotographically reproducing microphotographs.

2. Discussion of the Prior Art

In order to permit a great volume of material to be stored in an extremely small space, it has recently become the prevailing practice to record material, such as files or other documents, in reduced size on film, such film being commonly referred to as microfilm or microfiche and being hereinafter referred to generically as microphotographs. With the material stored in reduced size, suitable means must be provided for enlarging the microphotographs sufficiently for reading purposes and, further, to provide enlarged reproductions of the microphotographs. In the past, apparatus for reading and reproducing microphotographs have been overly complex and have not adequately permitted the reading and reproduction of microphotographs of varying sizes with relatively simple apparatus not requiring a great number of adjustments. Another problem with prior art apparatus is that such apparatus has not been effective to accurately reproduce both positive and negative copies of original microphotographs.

U.S. Pat. No. 3,692,409 is exemplary of apparatus for reading and reproducing microphotographs wherein reproduction of originals of different size can be made in the same size during a constant time period. The apparatus of this patent utilizes an optical system to concentrate light on a microphotograph original so that a lens, after reflection by intermediate mirrors, provides an image of predetermined dimensions on a translucent reading screen, one of the mirrors being pivotally mounted so that the image of the original can also be formed of predetermined dimensions at an exposure plane. In operation, after a microphotograph to be reproduced is properly positioned, the operator pushes a control button to start a cyclic control mechanism which unwinds photoconductive copy paper from a roll, moves the copy paper past a corona charging device to the exposure plane, cuts the paper to the desired length, exposes the copy paper to the image of the original and moves the copy paper carrying the latent image past a developing and fixing station.

While the apparatus according to U.S. Pat. 3,692,409 offers many advantages over the prior art including increased reliability and avoiding deterioration of the surface of the copy paper, the cyclic control mechanism is necessarily complex in order to provide the above described sequential operations including the precise movement of the copy paper, the cutting of the copy paper and the stopping of the copy paper at the exposure station in exact position for exposure, and such apparatus is not arranged to provide good negative and positive reproductions.

The prior art, as exemplified by U.S. Pat. No. 3,385,161, is cognizant of apparatus for reading and reproducing microfilm images where a corona charging device is movable over copy paper at an exposure station and a developer unit is advanced and retracted with initiation of the reproduction cycle; however, such

prior art apparatus requires relatively complex control mechanisms and has not been effectively utilized to provide both positive and negative copies of an original.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide electrophotographic reproduction apparatus wherein copy paper is positioned at an exposure plane prior to initiation of a reproduction cycle such that the precision copy paper driving, cutting and positioning functions of the prior art are obviated.

Another object of the present invention is to construct microphotograph reading reproduction apparatus wherein copy paper is positioned at an exposure plane prior to charging and a cyclic control mechanism operates to expose the copy paper to a light image of the original by operating a pivoting mirror and controlling the development of the latent image on the copy paper, the cyclic control mechanism charging the copy paper at the exposure plane by moving a corona charging device back and forth along the copy paper.

The present invention has an additional object in that copy paper is severed from a roll after development of a latent image thereon with toner, such as by tearing the copy paper by hand along a stationary cutting blade.

A further object of the present invention is to provide apparatus for reading and electrophotographic reproduction of microphotographs with a movable toner applying member at a developing station, the toner applying member being movable into and out of a path for copy paper through the developing station in response to movement of a mirror in the optical system such that the copy paper can be moved to an exposure plane prior to charging without adversely affecting development operation.

Yet, another object of the present invention is to construct apparatus for reading and reproducing microphotographs wherein different size originals can be reproduced in a constant time period and in a predetermined size with the copy paper being in position at the exposure plane prior to initiation of the reproduction cycle, the copy paper being charged only in the area to receive a latent image by back and forth movement of a corona charging device.

The present invention has an additional object in the charging of copy paper according to the polarity and charging potential required for positive and negative reproductions, such charging further being modified either during a single pass or during successive passes to improve the quality of the image.

Some of the advantages of the present invention over the prior art are that the apparatus can provide reproductions of satisfactory quality from microphotographs delivered by computers, commonly referred to a COM (Computer Output Microfilms), the apparatus is compact and simple in structure, and the exposure station is operated in response to movement of the mirror to prevent cold contact of the copy paper with the toner, jamming of copy paper within the apparatus is practically eliminated, installation of a new roll of copy paper is facilitated by requiring only the removal of the counterplate at the exposure plane and the reproduction portion of the apparatus is independent of the optical system and can be utilized with optical systems for use

with originals other than those intended for microphotographs.

The present invention is generally characterized in apparatus for reading and electrophotographic reproduction of microphotographs including a roll of copy paper, an exposure station having an exposure plane for receiving a light image of a microphotograph to be reproduced, a developing station including a member for applying toner to the copy paper, a cutting device for severing the copy paper, a drive mechanism for moving the copy paper from the roll through the exposure station and the developing station, a charging device movable back and forth along the exposure plane of charge the copy paper thereat, a screen for displaying microphotographs for reading, an optical system for transmitting a light image of a microphotograph to the exposure plane or the screen, the optical system including a mirror pivotal between a reading position where the light image is transmitted to the screen and a reproduction position where the light image is transmitted to the exposure plane, and control means for operating the drive mechanism, the charging device and the mirror to move the copy paper to the exposure station prior to movement of the charging means and to move the mirror from the reading position to the reproduction position, the control means including means for changing the polarity of the charging means during movement along the exposure plane to permit positive and negative reproductions.

Other objects and advantages of the present invention will become apparent from the following description of the preferred embodiment taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagrammatic representation of apparatus for reading and electrophotographic reproduction of microphotographs of the present invention.

FIG. **2** is a schematic diagram of a control circuit for the apparatus of FIG. **1**.

FIG. **3** is a broken diagrammatic side elevation of the developing station of the apparatus of FIG. **1**.

FIG. **4** is a diagrammatic side elevation of the corona charging device of the apparatus of FIG. **1**.

FIG. **5** is a broken side elevation of a modification of the corona charging device of FIG. **4**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Apparatus for reading and electrophotographic reproduction of microphotographs according to the present invention is illustrated in FIG. **1** and includes a source of light generally indicated at 10 having a lamp **12**, a condensor assembly including lenses **14** and **16**, a mirror **18** and a lens **20** for concentrating light emitted by lamp **12** on a microphotograph **22** supported on a plate **24**. Light through the microphotograph is enlarged by a projection lens **26** and is directed either to a translucent viewing screen **28** to an exposure plane **30** by a mirror **32** which is pivotally mounted to be moved from the reading position shown in full lines to a reproduction position **32'** shown in dashed lines in FIG. **1**. A roll of photoconductive copy paper **34** is carried on a reel **36** and supplied to the exposure plane **30** after movement around a tension roller **38** and a guide roller **40** which is freely rotated. From the exposure plane **30**, the copy paper **34** is moved through a developing station **42** by a pair of foam rubber covered drive rollers **44** and **46** which operate to dry the developed copy paper and as well as to move the copy paper, a drying felt **48** being positioned beneath roller **46** to remove excess toner therefrom. From the rolls **44** and **46**, copy paper **34** moves past a cutting mechanism **50** and a fixing device **52**, such as a heater.

A corona charging device **54** is movable along the exposure plane in a reciprocating manner, as illustrated by the arrow **56**, and the mirror **32** is pivotally mounted on a pin **58** and has an arm extending thereform carrying a counterweight **60** at the end thereof such that movement of the mirror **32** between the reading position and the reproduction position moves a portion of the developing station **42** in a reciprocating fashion, as shown by arrow **62**, toward and away from the path of the copy paper **34** through the developing station. The developing station includes a stationary counterelectrode **64** disposed above the copy paper **34** and a toner applying roller member **66** which is disposed in and movable with a tank **68** having a toner reservoir **70** therein. The roller **66** and tank **68** are mounted on a common support **72** which is movable in response to pivotal movement of the mirror **32**.

A schematic diagram of a control circuit for the apparatus of FIG. **1** is illustrated in FIG. **2**, wherein normally available alternating current is supplied on lead **74** and **76** through a power on-off switch **78** to a primary winding **80** of a transformer **82** having secondary windings **84**, **86**, **88** and **90**. Secondary winding **84** supplies electricity through a full wave rectifier **92** to a mirror pivoting motor **94** which controls the movement of cams **96** and **98** to operate cam controlled switches **100**, **102** and **104** and provide mirror control, reading light control and exposure time control, respectively. Secondary winding **86** supplies alternating current electricity to a control circuit **106** which controls the electricity supplied to a reading lamp **107**. Control cicuit **106** includes a triac T having its main electrodes connected in series with lamp **107** and a gate electrode connected through diac D to the junction of a capacitor C1 with normally open contacts K1-1 connected with a bank of resistors R1, R2 and R3 in series. The junction of capacitor C1 and diac D is also connected through lamp control switch **102**, relay contacts K3-4 and either a resistor R4 or a resistor R5 to the junction between resistors R1 and R2.

Secondary winding **88** supplies power through a full wave rectifier **108** across a resistor R6 connected in parallel with a capacitor C2 and across a control circuit including a controlled rectifier CR having its anode and cathode connected in series across the full wave rectifier **108** through switch **104** or contacts K1-4, a resistor R7, a copy start switch **110**, a stop which **112** and a relay winding RW2. The gate of the controlled rectifier CR is connected through a Zener diode Z to the junction between a capacitor C3 and a variable resistance R8, a resistor R9 being connected with the junction between the capacitor C3 and the resistance R8 and having its opposite terminal connected to a pole under the control of contacts K1-4. Full wave rectifier **108** also has its positive terminal connected through a lead **114**, a solenoid winding S, and a charge polarity select switch **116** to ground, solenoid winding S controlling a single pole, double throw switch SC to connect negative and positive terminals of a high voltage source **118** with the corona charging device **54** directly through a

lead 120 and through a variable resistor 122, respectively. A relay winding RW3 is connected in parallel with solenoid winding S and control contacts K3-2 to alternately connect negative reproduction lamp 124 and positive reproduction lamp 126 to lead 114 and contacts K3-4 which connect toner applying roller 66 through charge polarity control switch 130 to ground. Also connected across full wave rectifier 108 is a cycle complete lamp 132 in series with a cam controlled switch 134, a toner level lamp 136 in series with a toner level sensor 138 and a copy paper supply lamp 140 in series with a low paper supply switch 142, and a relay winding RW4 is connected in series with normally open contacts K2-1 across the full wave rectifier 108. Normally open contacts K2-3 and a cam controlled switch 144 are connected in series between the positive terminal of the full wave rectifier 108 and a relay winding RW2 which a relay winding RW1 is connected in parallel with the controlled rectifier CR.

Secondary winding 90 supplies power from a full wave rectifier 146 to an RC network including a resistor R10 and a capacitor C4 with resistor R10 being provided with a tap connected with capacitor C4 and through a resistor R11 and a switch 148 to switch 104 and to roller 66. The alternating current from leads 74 and 76 is supplied to heating elements 154 and a toner pump motor 154 under the control of contacts K4-1 and K4-3, for fixing device 52 and energization of a motor 156 for moving the corona charging device 54 and high voltage source 118 is controlled by the parallel switching combination of a push button switch 160 and a cam controlled switch 162. The alternating current also controls a copy paper drive motor 164 through a cam controlled switch 166, the motor 164 also driving a cam 168 to control the operation of cam controlled switches 130 and 144. The stop switch 112 controls the application of the alternating current to a fan 170 and, along with the parallel combination of contacts K2-2 and a cam controlled switch 172, to a reproduction cycle control motor 174 controlling movement of cams 176, 178, 180, 182, 184 and 186, which control cam operated switches 172, 162, 188, 166, 190 and 134, respectively, cam controlled switch 188 operating to control energization of mirror pivoting motor 94 and cam controlled switch 190 being connected in parallel with cam controlled switch 188.

A portion of the developing station 42 is illustrated in FIG. 3 including a plate 192 of the support 72 pivotally mounted on a rod 194 secured to the frame of the apparatus. Between plates 192, the toner applying roller member 66 is rotatably mounted to be disposed on a side of a path for the copy paper 34 through the exposure station opposite the counterelectrode 64. The support 72 carries tank 68, not shown in FIG. 3, having the reservoir of toner 70 therein for contact with the toner applying roller 66, and a bolt 196 is received in a bracket 198 mounted on the frame of the apparatus to provide an adjustable stop for movement of the support 72 toward the path of the copy paper 34 while a bolt 200 is received in a bracket 202 mounted on the frame to provide an adjustable stop for movement of the support 72 away from the path of copy paper 34. The plate 192 carries a flange 204 forming shoulders to engage the adjustable stops 196 and 200 to precisely position the toner applying roller 66 in a developing position illustrated in dashed lines in FIG. 3 and in a retracted position illustrated in full lines in FIG. 3.

Mirror 32 is pivotal about the pin 588 and has arm 60 extending therefrom and acting as a counterweight for the mirror. Mounted on arm 60 is a cam roller 206, and the arm 60 is offset from the pivot pin 58 such that movement of the mirror 32 to the position 32' causes the cam roller 206 to abut the plate 194 and move the frame 72 against the force from spring 208, mounted in tension between flange 204 and the frame of the apparatus, to the developing position illustrated in dashed lines. Once the mirror 32 is returned to the reading position, the frame 72 will be returned to the retracted position by the force from spring 208.

The corona charging device 54 is illustrated in FIG. 4 and includes a single corona charging electrode unit 210 mounted on a carriage 212 adapted for sliding movement along a pair of parallel rods 214 extending along the exposure plane 30, the rods 214 being mounted by brackets 216 secured to the frame of the apparatus. Carriage 212 has an elongate slot 218 formed in a depending portion thereof, the slot extending transverse to the rods 214 and receiving a lug 220 carried by a chain 222. The chain 222 is moved between pinions 224 and 226 with pinion 226 being rotated by a gear 228 driven by the motor 156. The action of the lug 220 in the slot 218 thus drives the carriage 212 and the corona charging electrodes 210 back and forth along the exposure plane 30 with the lug 220 being in an upper portion of the slot 218 during the initial traverse of the carriage and being in the bottom portion of the slot 218 during the return traverse of the carriage. Switch 160 is movable disposed along the reciprocating path of movement of the carriage 212, as shown by arrow 230, and is preferably mechanically linked with an indicator that can be moved to determine the portion of a microphotograph original to be copied, the switch 160 being in the form of a microswitch actuated by movement of the carriage 212 thereby. In order to permit sequential charging of the copy paper with opposite polarities, as will be described in more detail hereinafter, a microswitch 232 can be disposed adjacent pinion 24 and connected in the circuit.

In operation, the mirror 32 is normally in the position illustrated in full lines in FIG. 1 such that microphotographs 22 can be viewed on the translucent reading screen 28, the lamp 107 providing leading light with phase control determined by resistor R1 in series with resistor R5 through switch 102. Power switch 78 is normally closed; and, when it is desired to copy a selected microphotograph, copy start switch 110 is depressed, stop switch 112 being normally actuated to energize fan 170 to place the apparatus in condition to reproduce copies. When copy start switch 110 is actuated, relay winding RW1 is initially energized to close contacts K1-1 and alter the phase control of the lamp through the triac T, and contacts K1-4 are operated to connect the cathode of controlled rectifier CR to the negative terminal of full wave rectifier 108. The copy paper 34 is initially positioned at the exposure plane, and actuation of copy start switch 110 energizes relay winding RW2 to close contacts K2-2 to energize cycle control motor 174 and initiate rotation of the cams 176–186. Relay winding RW2 is maintained energized by holding contacts K2-3 and cam controlled switch 144, and drive motor 164 is maintained inoperative due to the open cam controlled switches 130 and 166. After a predetermined period of time required to sufficiently

charge capacitor C3, controlled rectifier CR is triggered to deenergize relay winding RW1 and return the lamp **107** to its reading state.

Cam controlled switch **162** closes immediately after energization of motor **174** to energize high voltage source **118** and motor **156** to move the corona charging device back and forth along the exposure plane to appropriately charge the copy paper thereat. If a positive copy is desired by the operator, depression of copy start button **110** will suffice to provide such positive copy due to the normal connection of the corona charging device **54** to the negative terminal of high voltage source **118**, and the operator is advised that a positive copy is being reproduced by energization of lamp **126** through contacts **K3-2**. If a negative copy is desired, charge polarity select switch **116** is depressed to energize solenoid winding S and pull in switch SC to connect the positive terminal of the high voltage source **118** through the variable resistor **122** to the corona charging device **54** relay winding RW3 is simultaneously energized to pull in contacts **K3-2** and energize lamp **124** indicating that a negative copy is being reproduced. As is more fully described in U.S. Pat. application Ser. No. 181,297, the specification of which is incorporated herein by reference, the variable resistor **122** is utilized to charge the photoconductive material of the copy paper with a positive potential within the range of from 40 to 60 percent of the saturation potential of the photoconductive material, it having been found that charging to such a potential permits a single charge polarity toner material to be utilized to provide both positive and negative reproductions with conventional photoconductive material, such as zinc oxide. In accordance with the embodiment of FIG. **2** of Patent application Ser. No. 181,297, switch **232** is connected such that on the initial traverse of the exposure plane **30** by the corona charging device **54**, the copy paper **34** is negatively charged and thereafter, on the return traverse, switch **232** is closed by the carriage **212** and positively charge the copy paper within the range of 40 to 60 percent of its saturation potential. When a negative copy is to be reproduced, contacts **K3-4** are closed such that during the developing step, the toner applying roller **66** will be connected to ground therethrough.

After the copy paper is charged by reciprocating movement of the corona charging device **54**, switch **160** will open to deenergize the high voltage source **118** and the motor **156**. The mirror pivoting motor **94** is thereafter energized through cam control switch **188** to permit the optical system to transmit the light image of the microphotograph to the appropriately charged copy paper and discharge selective areas thereof to form a latent image. Energization of the motor **94**, along with moving the mirror to position **32'** to place the toner applying member **66** in its developing position along the path of the copy paper through the developing station, closes cam control switch **100** to maintain energization of the mirror pivoting motor, and further opens cam control switch **102**. The exposure time of the copy paper is determined by cam **98** which permits energization of relay winding RW1 only until capacitor C3 is sufficiently charged to trigger controlled rectifier CR and short circuit relay winding RW1 thereby controlling the exposure time by operating contacts **K1-1** to prevent energization of lamp **107**. Thus, the circuit including controlled rectifier CR provides a time delay controlling exposure time while the control circuit **106** regulates light intensity supplied to the optical system.

After exposure of the copy paper to form a latent image thereon, copy paper drive motor **164** is energized through cam control switch **166** to move the copy paper through the developing station where toner is applied thereto by roller **66** to develop the latent image carried thereby. Energization of drive motor **164** also rotates cam **168** to pull in motor holding contacts **130** and connect the roller **66** to ground if a negative copy is being reproduced. After motor **164** has driven a predetermined amount of copy paper corresponding to the size of the copy past the developing station, cam control switch **144** will open to deenergize relay winding RW2 and open contacts **K2-3** and **K2-1**, the latter deenergizing relay winding RW2 to open contacts **K4-1** and **K4-3**, and the motor **164** is deenergized after a single revolution of cam **168** to open holding switch **130**. The mirror pivoting motor **94** operates at the end of the reproduction cycle to return the mirror to the reading position such that the copy paper will not be in cold contact with the toner to prevent starting. The developed copy or copies can be torn from the copy paper **34** when desired along the cutting blade **50** and thereafter the apparatus is ready for another reproduction cycle as indicated by the energization of cycle complete lamp **134** through cam control switch **134**.

If the level of toner in the reservoir should drop below a predetermined level, level sensor **138** will be actuated to energize lamp **136** to indicate that more toner is required; and, similarly, should the supply of copy paper be reduced to a predetermined amount, switch **142** will be closed to energize lamp **140** and provide an appropriate indication.

A modification of the corona charging device illustrated in FIG. **4** is shown in FIG. **5** wherein the carriage **212** carries two pairs of opposed corona charging electrodes **234, 236** and **238, 240** in order to charge the copy paper at the exposure station with opposite polarity charges in the manner discussed with respect to FIG. **2** of the above-mentioned Patent application Ser. No. 181,297. Of course, in accordance with the present invention, only a single pair of opposed corona charging electrodes could be utilized with the polarities thereof reversed upon reversing movement of the carriage **212**; and, similarly, the control circuit of FIG. **2** can easily be modified to cause the corona charging device **54** to make two passes along the exposure plane to provide sequential opposite charging of the copy paper if desired.

Any suitable toner may be utilized to develop the copies in accordacne with the present invention, preferably such toner being a liquid of the type described in French Patent application No. 71 28732 thereby providing improved electrophotographic reproductions and eliminating the edge effect phenomenon.

Briefly, from the operation described in detail above, after a microphotograph is properly positioned, the operator merely presses a push button corresponding with the copy start switch which initiates the reproduction cycle to charge the copy paper according to the potential and polarity desired by moving a corona charge device back and forth along the copy paper at the exposure station. Simultaneously, a toner applying member is moved into a developing position and developing electrodes including the roller and the counterelectrode are subject to proper voltages to assure adher-

ence of the toner to the copy paper and the heating elements of the fixing device **52** are energized to fix the copy paper as it moves thereby. During the reproduction cycle, the mirror **32** is returned to its initial reading position after a predetermined time period and the drive rollers are operative to move a portion of the copy paper of predetermined length for fixing the developed image thereon. The apparatus will, at this time, have returned to its initial state such that the operator, when desired, can detach the reproduction by severing the same along the cutting blade. If several reproductions of the same original are desired, the operator can press the button each time or, as is conventional, a suitable device can be utilized with the apparatus of the present invention to produce a predetermined number reproductions.

From the above, it can be seen that the apparatus for reading and electrophotographic reproduction of microphotographs according to the present invention is extremely compact and utilizes simplified mechanical and electrical control mechanisms to provide both reading and electrophotographic reproduction. The use of thepivotal movement of the mirror to simultaneously move the developing station contributes substantially to the compactness and simplicity of the apparatus of the present invention, and the unique structure of the control system to utilize a single corona charging electrode unit carried by the carriage **212** either during a single pass or two passes to provide both positive and negative reproductions on the same copy paper utilizing the same toner substantially reduces initial cost and maintenance of the apparatus of the present invention.

Inasmuch as the present invention is subject to many variations, modifications and changes in detail, it is intended that all matter described above or shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense.

What is claim is:

1. Apparatus for reading and electrophotographic reproduction of microphotographs comprising:

a roll of copy paper;

an exposure station having an exposure plane for receiving a light image of a microphotograph to be reproduced;

a developing station including a member for applying toner to said copy paper;

cutting means for severing said copy paper;

drive means for moving said copy paper from said roll through said exposure station and said developing station;

charging means movable back and forth along said exposure plane to charge said copy paper at said exposure station;

an optical system for transmitting a light image of a microphotograph to said exposure plane or said screen, said optical system including a mirror pivotal between a reading position where said light image is transmitted to said screen and a reproduction position where said light image is transmitted to said exposure plane; and

control means for operating said drive means, said charging means and said mirror to move said copy paper to said exposure station prior to movment of said charging means and to move said mirror from said reading position to said reproduction position, said control means including means for changing the polarity of said charging means as said charging means reciprocates to charge the copy paper with one polarity while the charging means moves in one direction and with the opposite polarity when the charging means changes direction.

2. Apparatus for reading and electrophotographic reproduction of microphotographs as recited in claim **1** wherein said charging means includes a high voltage source having positive and negative terminals and corona charging elecrodes, and said means for changing the polarity of said charging means includes switch means selectively connecting said corona charging electrodes to said positive terminal of said negative terminal of said high voltage source.

3. Apparatus for reading and electrophotographic reproduction of microphotographs as recited in claim **2** wherein said means for changing the polarity of said charging means includes a switch actuated by movement of said charging means along said exposure plane to control the position of said switch.

4. Apparatus for reading and elecrophotographic reproduction of microphotographs as recited in claim **1** wherein said charging means includes a plurality of corona charging electrodes movable along said exposure plane and a high voltage source supplying opposite polarity voltages to said corona charging electrodes.

5. Apparatus for reading and electrophotographic reproduction of microphotographs comprising:

a roll of copy paper;

an exposure station having an exposure plane for receiving a light image of a microphotograph to be reproduced;

a developing station including a member for applying toner to said copy paper;

cutting means for severing said copy paper;

drive means for moving said copy paper from said roll through said exposure station and said developing station;

charging means movable back and forth along said exposure plane to charge said copy paper at said exposure station;

a screen for displaying microphotographs for reading;

an optical system for transmitting a light image of a microphotograph to said exposure plane or said screen, said optical system including a mirror pivotal between a reading position where said light image is transmitted to said screen and a reproduction position where said light image is transmitted to said exposure plane; and

control means for operating said drive means, said charging means and said mirror to move said copy paper to said exposure station prior to movement of said charging means, and to move said mirror from said reading position to said reproduction position;

said developing station including means responsive to movement of said mirror from said reading position to said reproduction position to move said toner applying member from a retracted position away from the path of said copy paper through said exposure station to a developing position for contacting said copy paper to apply toner thereto.

6. Apparatus for reading and electrophotographic reproductions of microphotographs as recited in claim **5** wherein said toner applying member is pivotally mounted and said mirror has a cam member extending

therefrom for movement with said mirror to abut said toner applying member and move said toner applying member to said developing position.

7. Apparatus for reading and electrophotographic reproductions of microphotographs as recited in claim 6 wherein said developing station includes support means mounting said toner applying member and a pair of adjustable stops for engaging said support means to precisely position said toner applying member in said retracted position and in said developing position.

8. Apparatus for reading and electrophotographic reproduction of microphotographs comprising:

a roll of copy paper;

an exposure station having an exposure plane for receiving a light image of a microphotograph to be reproduced;

a developing station including a member for applying toner to said copy paper;

cutting means for severing said copy paper;

drive means for moving said copy paper from said roll through said exposure station and said developing station;

charging means movable back and forth along said exposure plane to charge said copy paper at said exposure station wherein said charging means includes a high voltage source having positive and negative terminals and corona-charging electrodes;

an optical system for transmitting a light image of a microphotograph to said exposure plane or said screen, said optical system including a mirror pivotal between a reading position where said light image is transmitted to said screen and a reproduction position where said light image is transmitted to said exposure plane; and

control means for operating said drive means, said charging means and said mirror to move said copy paper to said exposure station prior to movement of said charging means and to move said mirror from said reading position to said reproduction position, said control means including means for changing the polarity of said charging means during movement along said exposure plane to permit positive and negative charging of said copy paper, wherein said means for changing the polarity of said charging means includes switch means selectively connecting said corona-charging electrodes to said positive terminal or said negative terminal of said high voltage source and wherein said means for changing the polarity of said charging means further includes a switch actuated by movement of said charging means along said exposure plane to control the position of said switch.

9. Apparatus for reading and electrophotographic reproduction of microphotographs comprising:

a roll of copy paper;

an exposure station having an exposure plane for receiving a light image of a microphotograph to be reproduced;

a developing station including a member for applying toner to said copy paper;

cutting means for severing said copy paper;

drive means for moving said copy paper from said roll through said exposure station and said developing station;

charging means movable back and forth along said exposure plane to charge said copy paper at said exposure station wherein said charging means includes a plurality of corona-charging electrodes movable along said exposure plane and a high voltage source supply opposite polarity voltages to said corona-charging electrodes;

an optical system for transmitting a light image of a microphotograph to said exposure plane or said screen, said optical system including a mirror pivotal between a reading position where said light image is transmitted to said screen and a reproduction position where said light image is transmitted to said exposure plane; and

control means for operating said drive means, said charging means and said mirror to move said copy paper to said exposure station prior to movement to said charging means and to move said mirror from said reading position to said reproduction position, said control means including means for changing the polarity of said charging means during movement along said exposure plane or permit positive and negative charging of said copy paper.

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