

United States Patent

Murgas et al.

[15] 3,700,327

[45] Oct. 24, 1972

[54] SWITCH CONTROL MEANS FOR AN ELECTROSTATIC BOOK COPIER MACHINE

3,352,218	11/1967	Ostensen	355/14 X
3,490,843	1/1970	Charlap et al.	355/14
3,558,224	1/1971	Murgas et al.	355/51
3,594,079	7/1971	Murgas et al.	355/8

[72] Inventors: Karl M. Murgas, Village of Lincolnwood; Burton Greenberg, Village of Skokie, both of Ill.

Primary Examiner—Samuel S. Matthews
 Assistant Examiner—Kenneth C. Hutchisen
 Attorney—J. Patrick Cagney

[73] Assignee: ICP, Inc., Skokie, Ill.

[22] Filed: March 18, 1971

[21] Appl. No.: 125,559

[57] ABSTRACT

Related U.S. Application Data

An electrostatic book copier machine includes a movable carriage on which an original document is positioned, for reproducing onto a simultaneously moving length of copy paper. Switches for turning "on" the high intensity lamp and the corona and causing the carriage to move the document past a scanning area, are controlled by a cam means, activated after manually depressing a print button, and automatically activated when reproducing multiple copies.

[63] Continuation-in-part of Ser. No. 65,769, Aug. 21, 1970.

[52] U.S. Cl. 355/14

[51] Int. Cl. G03g 15/00

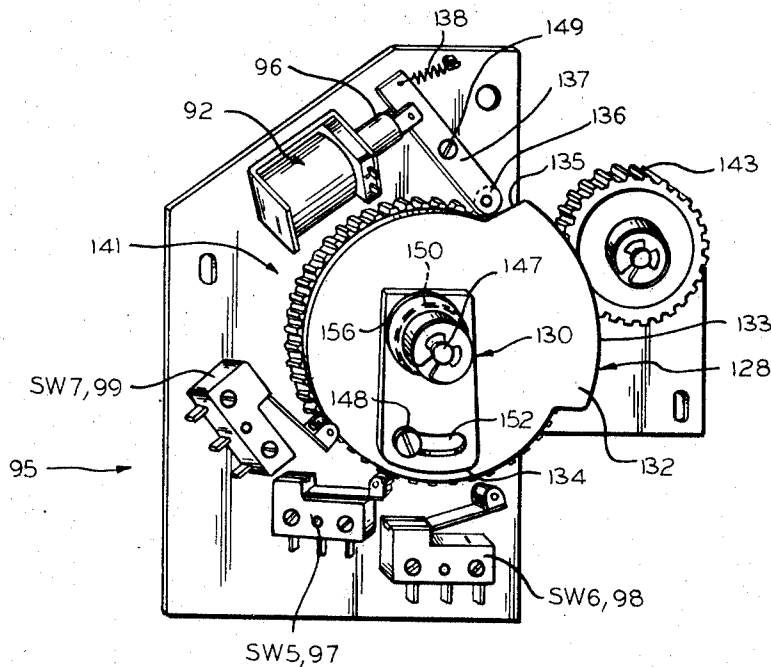
[58] Field of Search. 355/14

[56] References Cited

UNITED STATES PATENTS

3,318,213 5/1967 Kowalski 355/14

5 Claims, 12 Drawing Figures



Patented Oct. 24, 1972

3,700,327

6 Sheets-Sheet 1

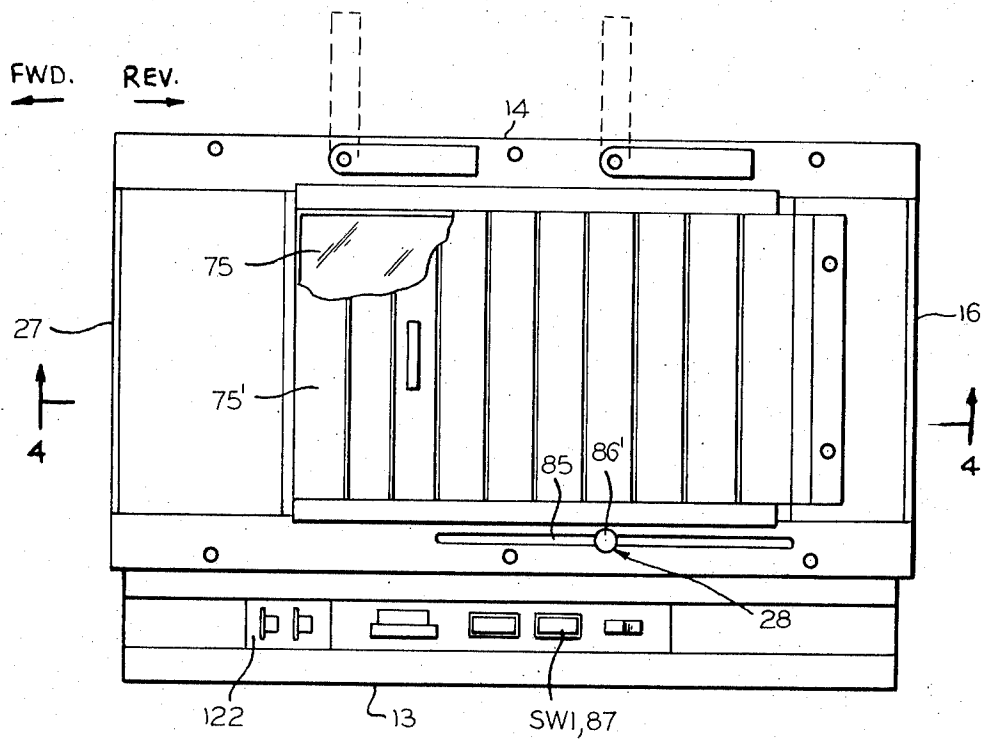
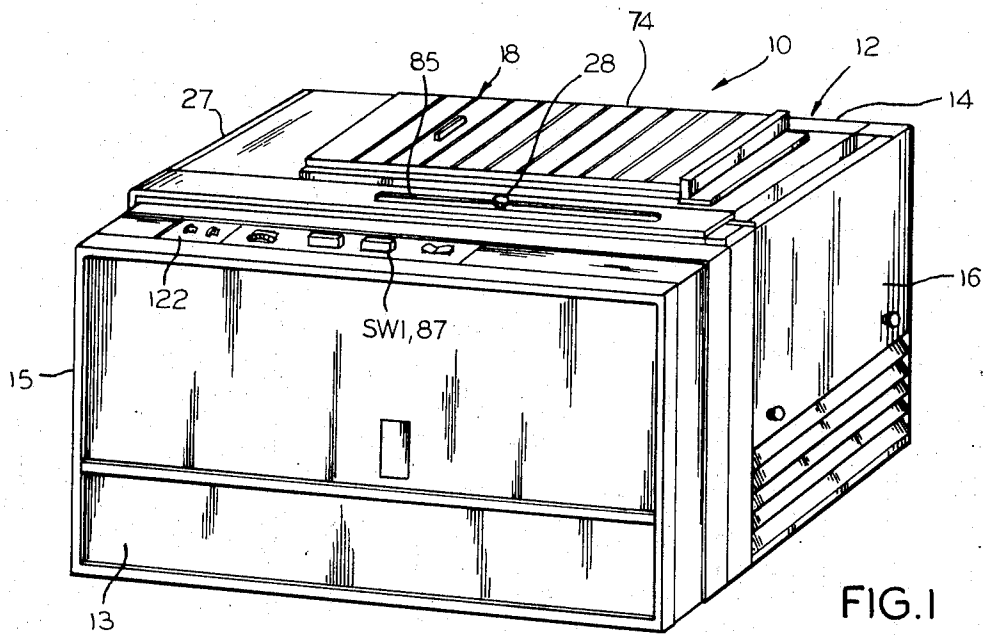


FIG. 2

INVENTORS
KARL M MURGAS
BURTON GREENBERG
BY *Robert L. Slater, Jr.*
ATTORNEY

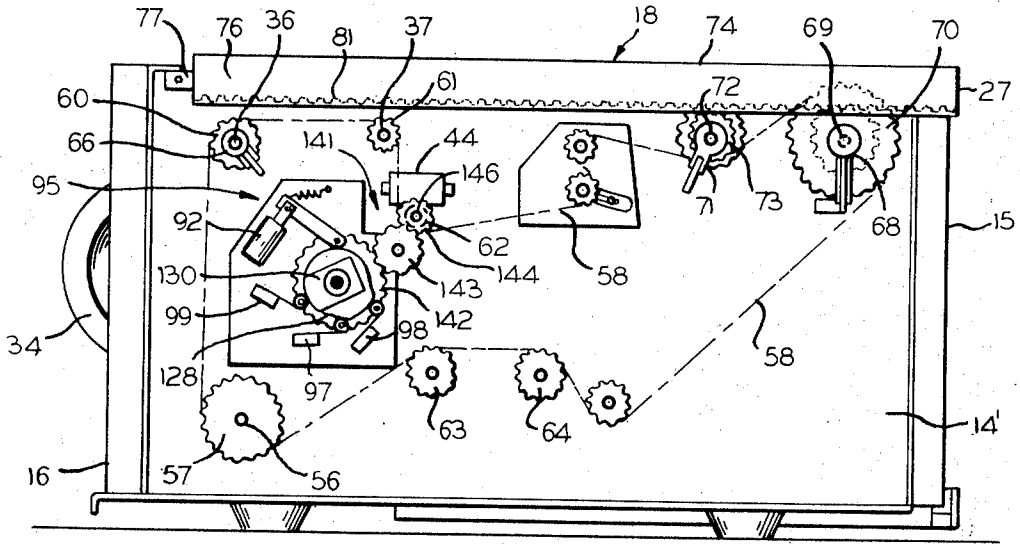


FIG. 3

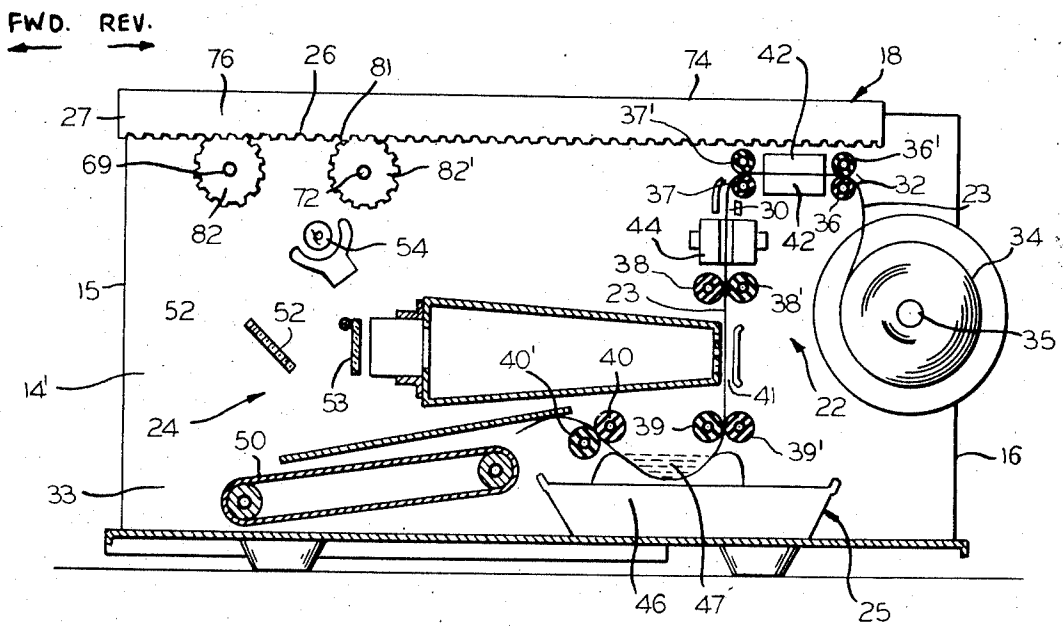


FIG. 4

INVENTORS
KARL M. MURGAS
BURTON GREENBERG
BY *Robert L. Slater, Jr.*
ATTORNEY

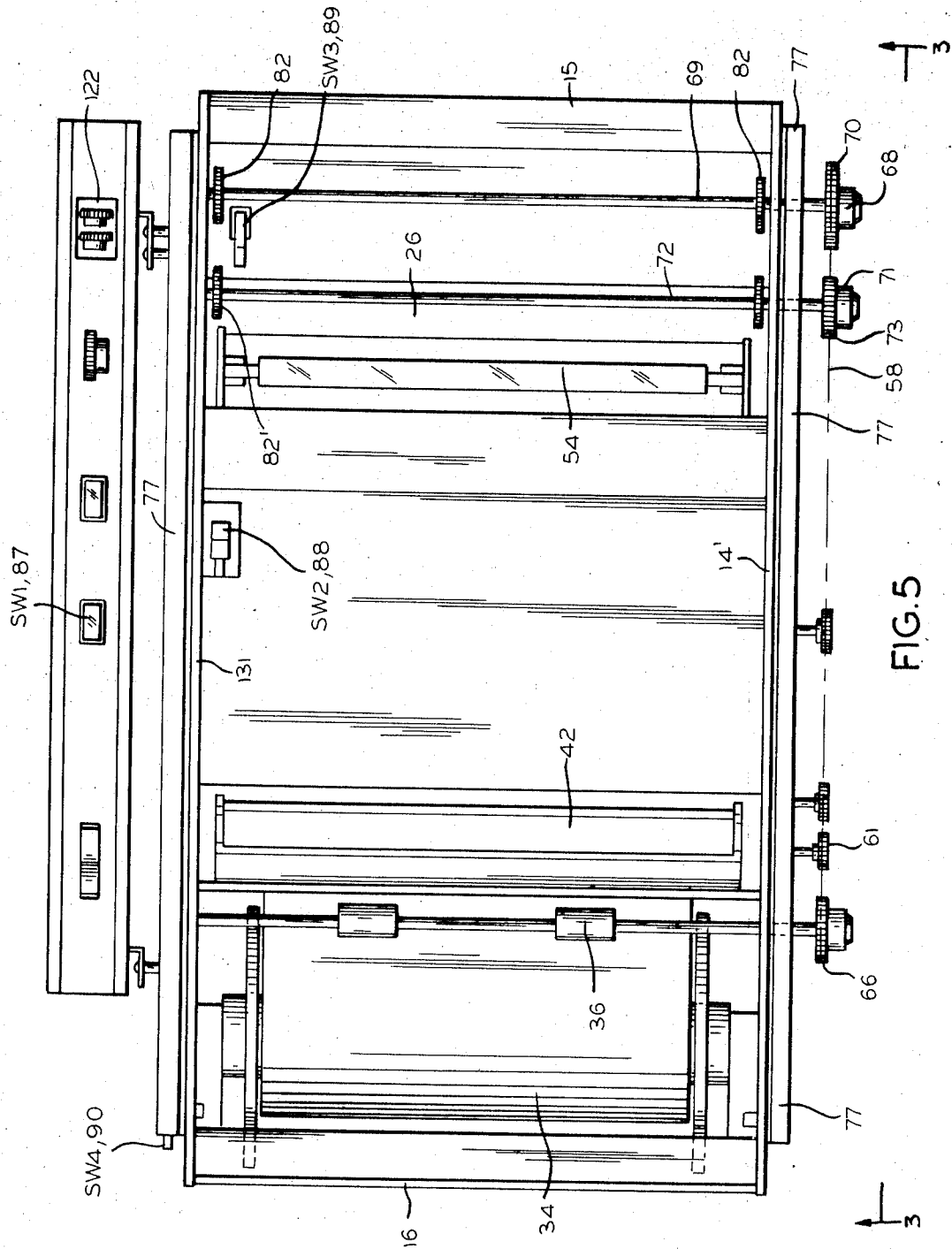


FIG. 5

INVENTORS
KARL M. MURGA
BURTON GREENBERG
BY *Robert L. Slater, Jr.*
ATTORNEY

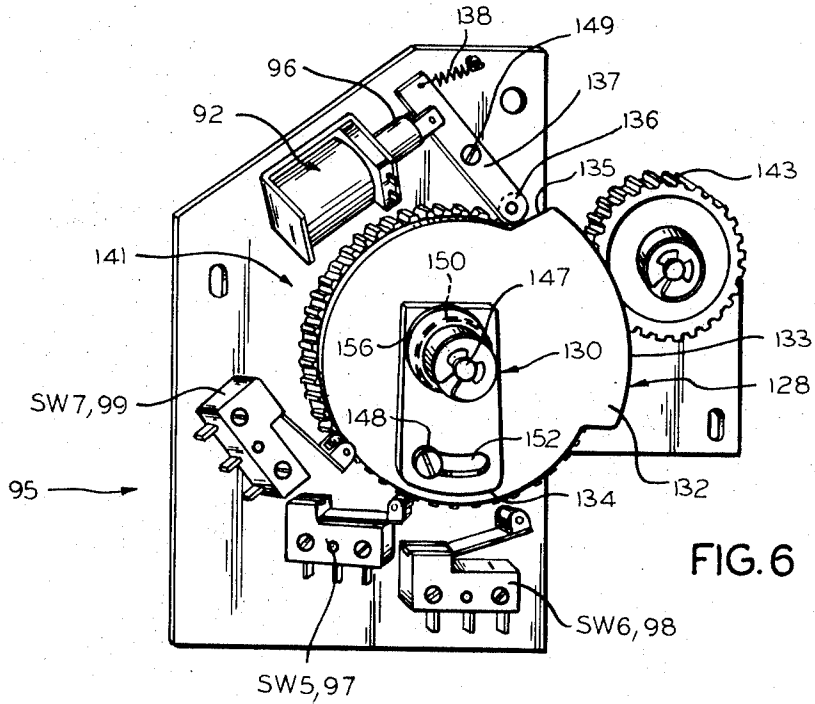


FIG. 6

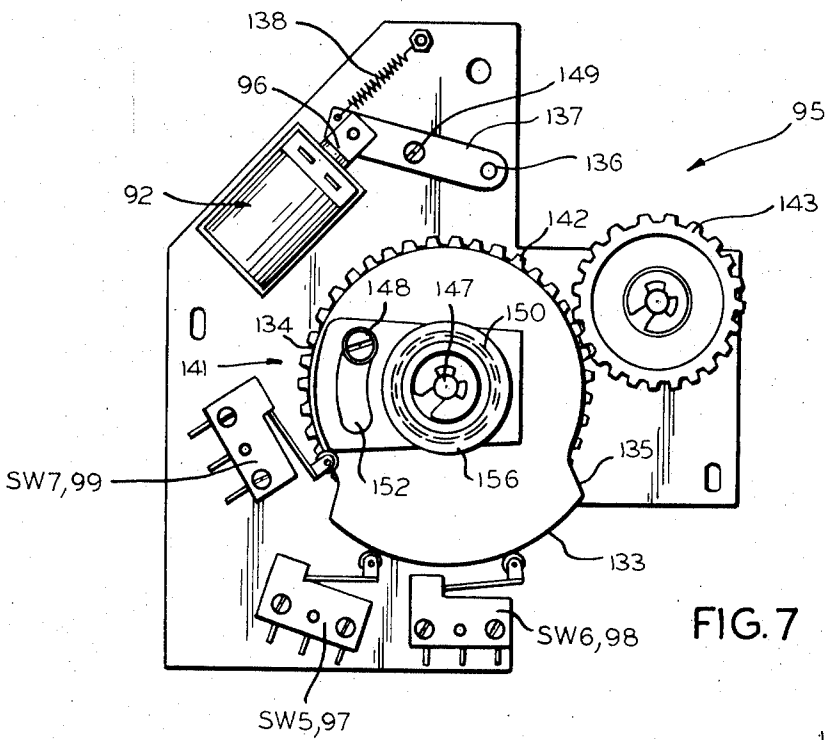


FIG. 7

INVENTOR
KARL M. MURGAS
BURTON GREENBERG
BY
Robert L. Slater, Jr.
ATTORNEYS

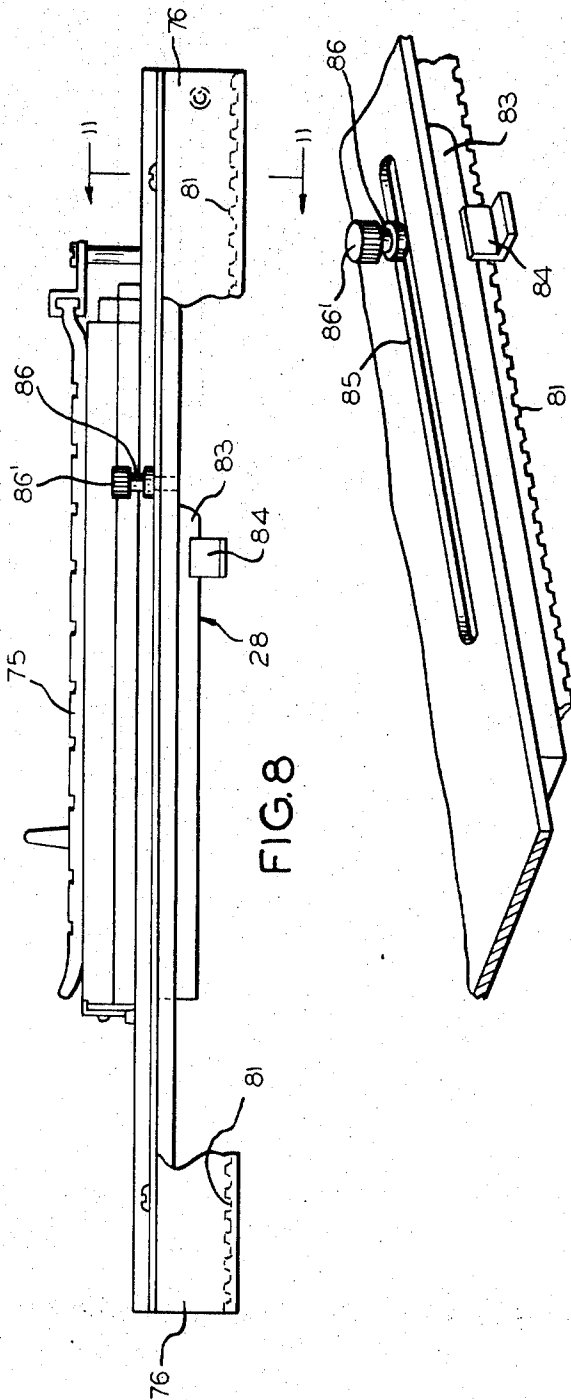


FIG. 8

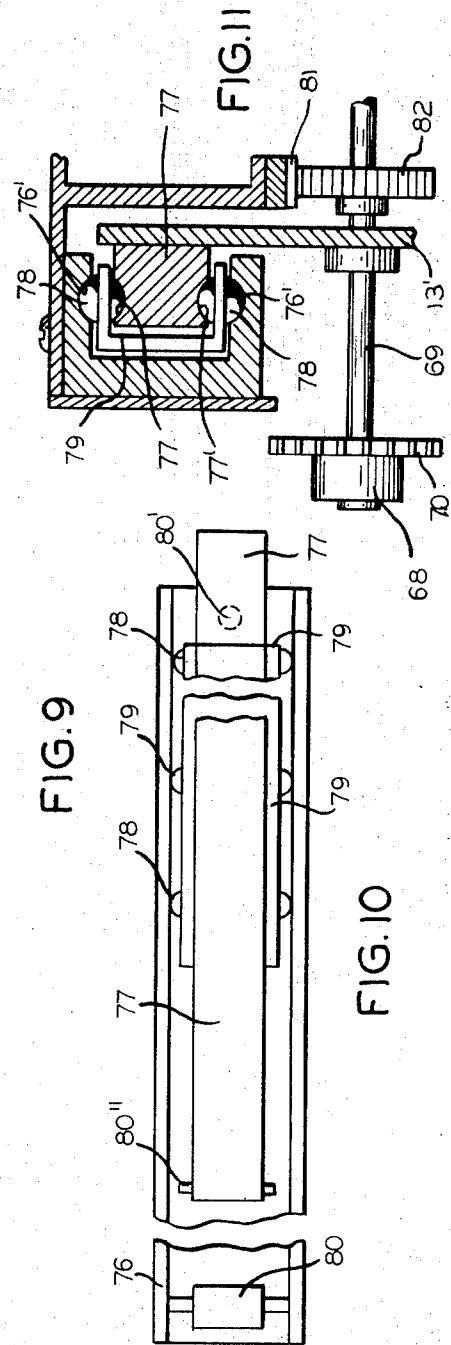


FIG. 9

FIG. 11

FIG. 10

INVENTORS
KARL M. MURGAS
BURTON GREENBERG
BY *Robert L. Slater, Jr.*
ATTORNEY

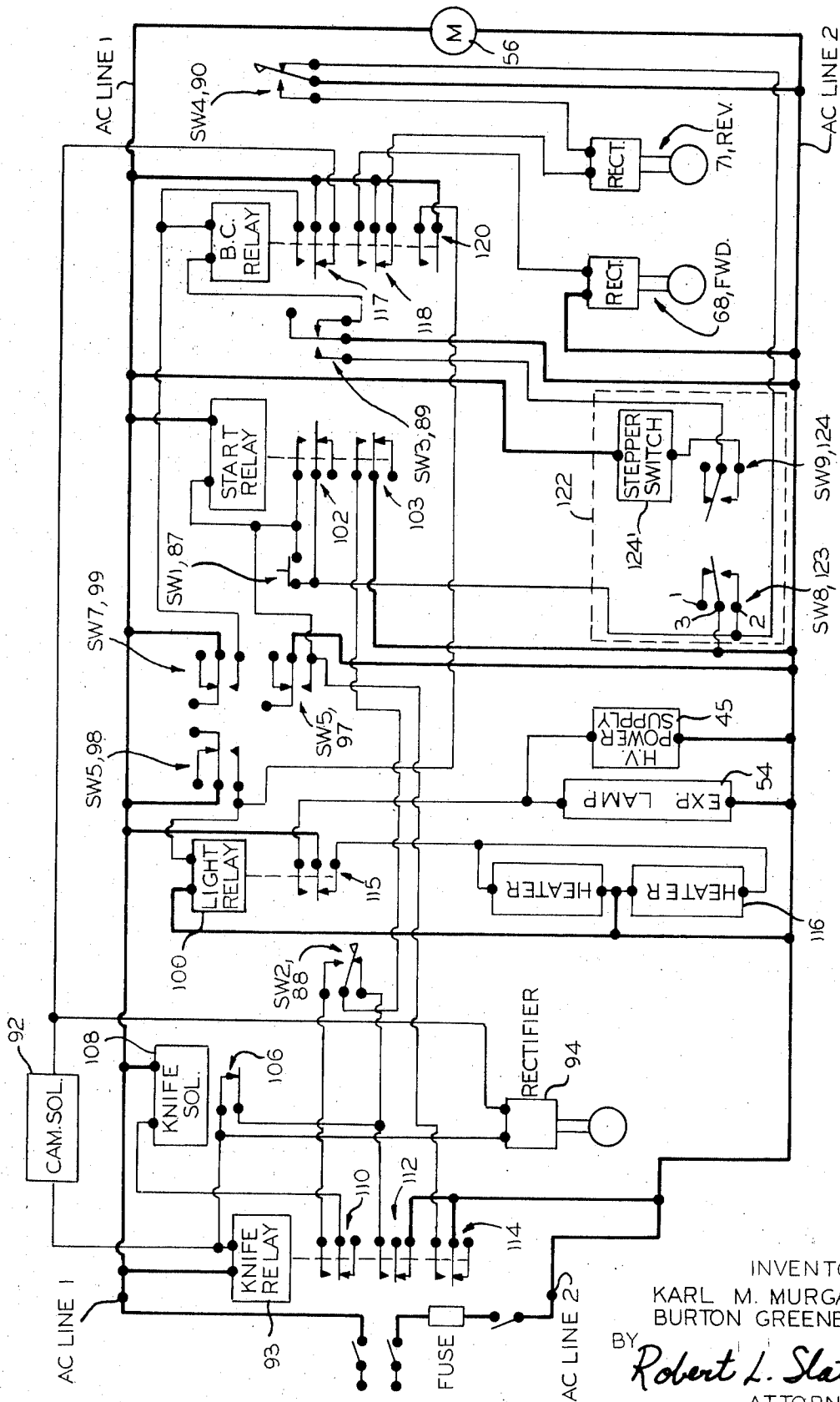


FIG. 12

INVENTORS
KARL M. MURGAS
BURTON GREENBERG
BY *Robert L. Slater, Jr.*
ATTORNEY

SWITCH CONTROL MEANS FOR AN ELECTROSTATIC BOOK COPIER MACHINE

BACKGROUND OF THE INVENTION

The subject invention is a continuation-in-part of a patent application entitled, "Switch Control Means for a Photo-copy Machine" filed Aug. 21, 1970 and having Ser. No. 65,769.

The present invention relates generally to electrostatic photocopy machines and more particularly relates to an electrostatic photocopy machine having a movable carriage for transporting an original document across a scanning window, for reproduction onto a simultaneously moving length of copy paper pulled from a rolled supply. Still more particularly, the invention relates to the switch control means for a photocopy machine.

Electrostatic photocopy devices used for book copying are commonly constructed to pass a specially coated and electrostatically charged length of copy paper through the focal plane of an optical camera system. The image of an original document to be copied is transferred through the optical camera system and onto the sensitized surface of the copy paper passing through an image-receiving section.

In the prior electrostatic photocopy machines of the aforescribed kind, the leading edge of the copy paper was utilized for depressing switches disposed in the copy paper pathway, to turn "on" and maintain the high intensity lamp and corona "on" until the trailing edge of the copy paper passed the image-receiving section. Recently, the copy paper generally used has been thinner and substantially lighter in weight than in the past, and was frequently unable to depress the switches in the copy paper pathway; and thereby caused jamming and a "pile up" of the copy paper. The photocopy machine herein eliminates all the switches previously positioned in the copy paper pathway.

SUMMARY OF THE INVENTION

The present invention provides a photocopy machine for reproducing an original document sheet or book. The document is positioned on a transparent plate of a movable carriage. A drive means transports the carriage from a start-position in a forward or scan direction across a scanning area, to reproduce the document onto a simultaneously moving length of copy paper. After the document is fully scanned, the carriage automatically reverses direction and returns to the start position.

The carriage drive means includes a pair of elongated racks spaced apart in an opposed relationship to each other and secured to the bottom of the carriage. The racks mesh with drive gears linked through a forward and reverse clutch means to a rotating continuous chain.

A pair of runners mounted to the carriage is slidably associated with a pair of stationary rails. When the carriage is sweeping during the reproduction cycle, the rotating drive gears cause linear movement of the racks and the runners slide over the rails.

A switch control means controls the sequence of operation during the reproduction cycle. The switch control means comprises a first cam and a second cam which rotate 360° for each copy reproduced. The first cam depresses a light-switch which causes the corona

and high intensity lamp to turn "on." Then, the second cam depresses a forward-clutch switch, to cause the carriage to commence moving in a scan direction from a start position, to reproduce the original onto a length of copy paper.

A stop means, blocking the movement of the cams, is initially released when a print button is manually activated. When reproducing multiple copies, the stop means is automatically released during the reverse movement of the carriage. Simultaneously, with the release of the stop means, the copy paper is pulled from a rolled supply into the copy paper pathway. The copy paper moves within the copy paper pathway before the carriage starts moving in the scan direction.

Accordingly, a primary object of the invention is to provide a switch control means for switching the corona and high intensity lamp "on."

Another object is to provide a switch control means for controlling the movement of the carriage for the original document.

Another object is to provide a cam means coupled to a chain drive of the machine, to control the turning "on" of the corona and the exposure lamp.

Another object is to provide an automatic time delay to prevent the movement of the carriage in the scan direction until after the corona and exposure lamp have been turned "on."

Still another object is to provide a timing cam for depressing a light-switch for turning "on" the corona and high intensity lamp; and an adjustable cam for depressing a forward-clutch switch, to cause the carriage to commence movement in a scan direction for reproducing the original document.

Still another object is to cause the copy paper to move within the copy paper pathway prior to the carriage moving in the scan direction.

Still another object is to cause the copy paper to begin moving within the copy paper pathway, during the reverse movement of the carriage when at least one more copy is required to be reproduced.

These and other objects and advantages will become apparent from the illustrations in the accompanying drawings and the following specifications and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the drawings in which the same characters of reference are employed to indicate corresponding or similar parts throughout the several figures of the drawings:

FIG. 1 is a perspective view of a photocopy machine particularly suitable for book copying, and embodying the principles of the invention;

FIG. 2 is a top view of the photocopy machine in FIG. 1;

FIG. 3 is a side elevational view showing the drive means and associated elements for controlling the carrier movement and rotation of the copy paper guide rollers;

FIG. 4 is a sectional side elevational view showing the image-reproducing system including the camera means and the copy paper transport system;

FIG. 5 is a top view of the machine in FIG. 1 with the carriage removed;

FIG. 6 is an enlarged perspective view of a cam switch control means in a blocked condition;

FIG. 7 is a front view of the cam switch control means of FIG. 6, during rotation;

FIG. 8 is a longitudinal sectional view of the carriage with portions cut away to show the copy length slide;

FIG. 9 is a fragmentary perspective view of the carriage with the runner removed;

FIG. 10 is a fragmentary inside view of the runner, the bearing channel member and the rail;

FIG. 11 is a fragmentary sectional view, taken on the plane of the line 8-8 in FIG. 8 and viewed in the direction indicated, to show the drive means for the carriage; and

FIG. 12 is a schematic of the electrical switching circuitry of the photocopy machine.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the several Figures of the drawings, the reference numeral 10 indicates generally a book copying machine embodying the principles of the invention. The book copying machine 10 comprises a substantially rectangular housing 12 (FIGS. 1 and 2) having a pair of opposed removable longitudinal sidewalls 13 and 14 facing respectively chassis sidewalls 13' and 14' (FIGS. 3 and 4) and opposed end walls 15 and 16. The machine 10 comprises an original document transport means including a movable carriage 18 on which a book or an original document to be copied is positioned, a copy paper transport means 22 for moving a length of copy paper 23, a camera means 24 and a developer means 25 (FIG. 4). The carriage 18 transports the original document past a rectangular scanning area 26 on the upper part of the machine, which extends laterally between the chassis sidewalls 13' and 14' and spaced a short distance from end wall 15 (FIG. 5).

The carriage 18 (FIGS. 1 and 8) is transported from a start position in a forward or scan direction and then in a reverse direction until returning to the start position. The outer lateral edge 27 of the carriage 18 is above and in close proximity with the upper edge of end wall 15 when the carriage is in the start position. The carriage 18 includes a copy length slide 28 (FIGS. 8 and 9) for setting the length of the copy paper to substantially the same length as the original. The slide 28 also controls the length of the sweep of the carriage 18 during its operating cycle. The carriage 18 will be described with greater detail below.

The copy paper transports system 22 (FIG. 4) comprises a pathway 30 for transporting a length of copy paper 23 from a copy paper input end 32 to a copy paper output end 33. The copy paper is stored in a roll 34 supported on a spindle 35. The copy paper transport system 22 includes an input roller pair 36,36', roller pairs 37,37', 38,38' and 39,39' and an output roller pair 40,40'. The roller pairs are spaced apart within the pathway 30. The rollers 36, 37, 38, 39 and 40 are the drive rollers of the corresponding roller pairs, and the other rollers of each pair are idler rollers. The rollers are rotatably mounted to sidewalls 13' and 14'.

An image-receiving section 41 is positioned in the copy paper pathway 30 between roller pairs 38,38' and 39,39'. The image of the original document positioned on the carriage 18 is conveyed by the camera means 22 onto the copy paper, simultaneously moving across the image-receiving section 41.

A knife means 42 (FIG. 4) is mounted in the copy paper pathway 30 between the input roller pair 36,36' and roller pair 37,37'. When the knife means 42 is activated, it severs a length of copy paper 23 from the roll 34. A corona means 44 is positioned between roller pairs 37,37' and 38,38'. Corona means 44 powered by a high voltage power supply 45 (FIG. 12) sensitizes the copy paper by negatively charging the copy paper prior to its reaching the image-receiving section 41. After the camera means 24 has transferred the image of the original document onto the photosensitive copy paper, the exposed copy paper then passes through the developing means 25 comprising a receptacle 46 containing a toner and dispersant solution 47 (FIG. 4). The solution develops the exposed copy paper. The output pair of rollers 40,40' transfers the copy paper to an output O-ring conveyor means 50 leading to the copy paper output end 33.

The camera means 24 (FIG. 4) comprises a reflecting mirror 52 positioned to receive the images of an original document moving across the scanning area 26 and reflects the images into the focal plane of an objective lens 53. The lens 53 focuses the images of the book through an image pathway and onto the photosensitive copy paper moving across the image receiving section 41. The image reflection and sharpness of the photocopy is controlled by the light beamed to the mirror from a high intensity lamp 54.

Referring now particularly to FIG. 3, the mechanical drive means for the copy paper transport means 22 and the movable carriage 18 will be described. A motor means 56 drives a main sprocket 57, which in turn drives a continuous revolving chain 58. The drive rollers 36, 37, 38, 39 and 40 are linked to the chain 58 respectively by sprockets 60, 61, 62, 63 and 64. A copy paper clutch means indicated generally by the reference numeral 66, couples and decouples sprocket 60 from the shaft of the input drive roller 36. When the clutch means 66 energizes, the input rollers 36,36' pull the copy paper from the roll 34 into the copy paper pathway 30, past the knife means 42 and into the nip of roller pair 37,37'.

When the carriage 18 moves in the forward direction, a forward clutch means 68 links a forward drive shaft 69 to the chain 58 via a sprocket 70; and when the carrier moves in the reverse direction to return to its original or start position, a reverse clutch means 71 links a reverse drive shaft 72 to the chain via a sprocket 73 (FIGS. 3 and 5). Drive shafts 69 and 72 are rotatably secured to the chassis sidewalls 13' and 14'.

The carriage 18 includes a substantially rectangular frame 74 (FIGS. 1 and 8). A transparent top plate 75 for supporting the original documents to be reproduced, is secured in the upper part of the frame 74. A dark flexible rubberized pad 75' hinged to the rear edge of the frame 74 is used to cover the document positioned on the plate 75.

A pair of runners 76 having a substantially C-shaped profile, are mounted to the outer longitudinal sides of the carriage frame 74, on an inside surface thereof and extend downward therefrom (FIGS. 8, 10 and 11). Elongated upper and lower grooves 76' are formed in the runners 76. The runners 76 slide over a pair of rails 77, which are rigidly mounted to the upper end of the chassis sidewalls 13', 14' on the outside surfaces

thereof. Upper and lower elongated grooves 77' are also formed in the rails 77.

A plurality of upper and lower ball bearings 78 are seated in a channel member 79, also having a substantially C-shaped profile. Channel member 79 is positioned between the runner 76 and the corresponding rail 77 (FIGS. 10 and 11). The runners 76 and channel members 79 slide over the rails 77, and the ball bearings 78 are seated within the grooves 76', 77' respectively of the runners 76 and rails 77. The runner 76 includes a rubberized or cushioned bar stop 80 at the forward end to stop the movement of the runner 76 when it returns back to the start position; and a screw stop 80' at the rear end for stopping the movement of channel member 79 when the runner 76 moves in the forward or scan direction (FIG. 10). A pin 80'' extends outward from the grooves 77' of the rail 77 at the forward end thereof, to prevent the channel member 79 from slipping off the rail 77 (FIG. 10). The channel member 79 abuts both the stop 80' and pin 80'' when the carriage is in the maximum extended position. This also prevents the runners from sliding off the rails.

A pair of elongated racks 81 (FIGS. 3, 4, 8 and 11) are secured to the bottom of the frame 74 of the carriage 18, spaced from each other and positioned inward from the runners 76. A pair of gears 82 are mounted on the forward drive shaft 69, and a pair of gears 82' are mounted on the reverse drive shaft 72. Each rack 81 meshes with one of the gears 82 and 82'.

The copy length slide 28 includes an elongated rod 83 and a finger 84 extending inward from the rod 83 adjacent the rear end thereof (FIGS. 2, 8 and 9). The rod 83 and finger 84 function as switch activators. An elongated slot 85 is formed in the longitudinal side of the frame 74. A screw member 86 protrudes upward from the rear end of the rod 83 and extends through the slot 85. Screw 86 includes a head 86' which is tightened against the top surface around the slot 85. Upon loosening the head 86', the slide 28 is moved to position the head 86' in substantial alignment with the bottom edge of the original document.

The reproduction cycle commences upon manually depressing a print switch SW1,87 located on the top of the machine. The movement of the carriage 18 controls the operation of a document-switch SW2,88, a reverse-switch SW3,89 and a rear limit-switch SW4,90 (FIG. 5). These switches each have a depressed-position and a normal-position.

When the carriage 18 is in the start-position, the bottom rear edge of the runner 76 depresses the rear-limit switch SW4,90, and the rod 83 of the copy length slide 28 depresses the document-switch SW2,88 (FIG. 5). Upon initial movement of the carriage 18 away from the start-position, the rear-limit switch SW4,90 is released. During the forward carriage movement, the rod 83 of slide 28 passes over the document-switch SW2,88 and the switch returns to its normal-position, causing the knife means 42 to sever the length 23 of copy paper from the roll 34. When the finger 84 of the slide 28 depresses the reverse-switch SW3,89, the carriage reverses its direction of movement and returns to the start-position.

When print-switch SW1,87 is depressed, it connects AC line 1 voltage via the rear-limit switch SW4,90 to a start relay 91. The start relay 91 energizes and, in turn,

causes a cam solenoid 92, a knife relay 93 and a copy paper feed clutch means 94 to energize.

A cam means 95 (FIGS. 3, 6 and 7), initially blocked when a piston 96 of the cam solenoid 92 is in an extended position (FIG. 6), is released when the cam solenoid 92 is energized (FIG. 7), and rotates one revolution. During rotation, the cam means 95 switches first a print-hold switch SW5,97, then a light-switch SW6,98 and finally, a forward-clutch switch SW7,99 from their respective normal-positions to their depressed or operative-positions. In the operative-positions, the light-switch 98 causes a light relay 100 to energize; the forward-clutch switch 99 causes a book copier (BC) relay 101 to energize; and the print-hold switch 97 connects AC line 2 voltage to the start relay 91 (FIG. 12). The print-hold switch 97 provides a hold voltage for the start relay 91, in the event of de-energizing, due to a line voltage drop caused by the substantial surge currents flowing when the exposure lamp is cold and initially turned "on" by the light-switch 98.

The start relay 91 comprises switches 102 and 103. When the start relay 91 is initially energized, switch 102 connects AC line 2 voltage via rear limit-switch SW4,90 to the relay 91, which functions as a hold voltage, and also the to the print-hold switch SW5,97; and switch 103 connects AC line 2 to the knife relay 93 via the document-switch SW2,88 and a solenoid knife switch 106 of a knife solenoid 108. The knife relay 93 is now energized.

The knife relay 93 includes switches 110, 112 and 114. When the knife relay 93 is energized, switch 110 connects AC line 2 voltage to the knife solenoid 108, after the document-switch SW2,88 is switched to its normal-position by the copy length slide 28; switch 112 connects AC line 2 to the knife relay 93 via the solenoid switch 106, which functions as a hold voltage; and switch 114 connects AC line 2 voltage to the print-hold switch SW6,98.

The light relay 100 includes a switch 115. When the relay 100 is de-energized, switch 115 connects AC line 1 voltage to a heater means 116 to turn "on" the heater means; and when the relay 100 is energized, it connects AC line 1 voltage to lamp 54 and the power supply 45 to turn "on" the lamp and the power supply.

The book copier relay 101 includes switches 117, 118 and 120. When relay 101 is initially energized, switch 117 connects AC line 1 voltage to the relay 101, which functions as a hold voltage; switch 118 connects AC line 1 voltage to the forward clutch 68 to cause the carriage 18 to start movement in the forward or scan direction; and switch 120 connects the AC line 1 voltage to the light relay 100 which functions as a hold voltage.

A multiple copy counter 122 (FIGS. 1 and 2) is mounted on the top of the machine 10 for manual dialing the desired number of copies. When the counter is dialed for more than one copy, switch arm 3 of switch SW8,123 (FIG. 12) contacts terminal 2 and connects AC line 2 voltage to start relay 90 via switch 102, to maintain the start relay energized; and switch SW9,124 triggers the counter coil of the stepper switch 124' for numerical countdown each time the reverse switch SW3,89 is activated by the carriage 18.

The rear-limit switch SW4,90 in the depressed-position (FIG. 12), connects AC line 2 voltage to the start

relay 91 via switch 102, after the print switch SW1,87 is activated; and in the normal-position connects AC line 2 voltage to the reverse clutch 71.

The document-switch SW2,88 in the depressed-position (FIG. 12), connects AC line 2 to the knife relay 93 via switch 103 of the start relay 91; and in the normal-position connects the AC line 2 to the knife solenoid 108.

The reverse-switch SW3,89 in the normal-position (FIG. 12), connects AC line 2 to the book copier relay 101; and in the depressed-position severs this AC line 2 connection, to cause the book copier relay 101 to de-energize, and also connects the AC line 2 to switch SW9,124 to cause dial 122 to countdown one number.

Referring now more particularly to FIGS. 3, 6, and 7, the cam means 95 will be described with greater detail. The cam means 95 comprises a timing cam 128 and a smaller adjustable cam 130. The timing cam 128 includes an outward extending neck portion 132 having an outer arcuate edge 133, for activating the print-hold switch SW5,97, and the light-switch SW6,98. The adjustable cam 130 includes an outer arcuate edge 134, for activating the forward-clutch switch SW7,99.

A leading side edge 135 of the timing cam 128 abuts a post 136, when the cam solenoid 92 is de-energized and the cams 128 and 130 are not in rotation. Post 136 is secured to the outer end of a bar 137 and extends perpendicularly outward therefrom. The inner end of bar 137 is attached to the outer end of piston 96 and to a spring member 138. A pivot pin 149 is attached to bar 137 at an intermediate point. When the cam solenoid 92 becomes energized, the piston 96 is pulled inwardly against the resilient force of the spring member 138, and the bar 137 is pivoted counter-clockwise to move the post 136 out of contact with the leading side edge 135 of cam 128; and the cams 128, 130 are thereby free to rotate.

A gear drive means, indicated generally by the reference numeral 141 links the cams 128, 130 with the drive chain 58. The gear means 141 includes an output gear 142, a transmission gear 143 and an input gear 144. The input gear 144 and the sprocket 62 which links with the chain 58, are mounted on a stub shaft 146 (FIG. 3). The transmission gear 143 meshes with the input gear 144 and the output gear 142.

The output gear 142, the timing cam 128 and the adjustable cam 130, are mounted on a cam shaft means 147. The adjustable cam 130 is secured to the timing cam 128 by a screw 148 and a spring means 150. The screw 148 passes through an elongated arcuate slot 152 formed in the outer portion of the adjustable cam 130 and secured in a threaded hole (not shown) bored in the timing cam 128. The spring means 150 is compressed between the adjustable cam and a collar 156.

When the screw 148 is loosened, the adjustable cam 130 may be rotated a maximum distance equivalent to the length of slot 152. The screw 148 also serves as a "stop" for the maximum adjustment in either direction. If the cam 130 is adjusted in the counter-clockwise direction, the carriage 18 commences movement later, and the image is positioned lower on the copy; and if the cam 130 is adjusted in the clockwise direction, the carriage 18 commences movement earlier and the image is positioned higher on the copy.

SYSTEM OPERATION

Referring now more specifically to FIG. 12, the system operation will be described with greater particularity. Prior to depressing the print SW1,87 and commencing the reproduction operation, the relays and solenoids are de-energized, the rear-limit switch SW4,90 is depressed by the runner 76 of the carriage 18 (FIG. 5), the document-switch SW2,88 is depressed by the rod 83 of the copy length slide 28 and the reverse-switch SW3,89 is in its normal position. The head 86' of the copy length slide 28 is aligned with the rear edge of the original document.

Depressing Print Switch

Upon manually depressing the print switch SW1,87, the start relay 91 energizes and connects AC line 2 voltage to the cam solenoid 92, to the copy paper feed clutch means 94, and to knife relay 93, via switch 103 and the depressed document-switch SW2,88 and the solenoid switch 106; and connects AC line 2 voltage to the print-hold switch SW5,97 and to the start relay 91, via switch 102 and the depressed rear-limit switch SW4,90 (or the switch SW8,123, if more than one copy is dialed in the machine). The cam solenoid 92, the copy paper feed clutch means 94 and the knife relay 93 are now energized.

The energized cam solenoid 92 pulls the piston 96 inwardly which swings post 136 out of contact with the side edge 135 of cam 128, to release the cam 128; and thereby permitting the timing cam 128 and the adjustable cam 130 to rotate.

The energized copy paper clutch means 94 couples the input feed rollers 36,36' to the chain 58 to cause the copy paper to be pulled from the roll 34 into the copy paper pathway 30.

The energized knife relay 93 connects the knife solenoid 108 with the document-switch SW2,88, via switch 110 so that the knife solenoid 108 is in a ready condition; connects AC line 2 voltage to the knife relay 93 as a hold voltage, via solenoid switch 106 and the switch 112; and connects AC line 2 voltage to the print-hold switch SW6,98 via switch 114.

The outer edge 133 of the neck 132 of the timing cam 128, switches the print-hold switch SW5,97 from the normal-position to the depressed-position, to connect AC line 2 voltage to the start relay 91, which functions as a hold voltage.

After the leading edge of the copy paper has passed the knife means 42 and gripped by roller pair 37,37' but before entering the corona means 44, the edge 133 of the timing cam 128 switches the light-switch SW6,98 from the normal-position to the depressed-position, while still maintaining the print-hold switch SW5,97 in the depressed-position. The light-switch 98 energizes the light relay 100, and thereby turns "on" the high voltage power supply 45 of the corona means 44 and the exposure lamp 54.

Prior to the copy paper length 23 reaching the image receiving section 41, the outer edge 134 of the adjustable cam 130 switches the forward-clutch switch SW7,99 from the normal-position to the depressed-position, to energize the book copier relay 101 by connecting AC line 1 voltage thereto. When the book copier relay 101 is energized, the switch 117 disconnects

the AC line 1 voltage form the cam solenoid 92 and from the copy paper clutch means 95, and connects the AC line 1 hold voltage to the relay 101; the AC line 1 voltage is connected to the forward clutch means 68 through switch 118; and the AC line 1 hold voltage is connected to the light relay 100 through switch 120. The cam solenoid 92 de-energizes and the post 136 returns to its blocking position to prevent the cams 128 and 130 from rotating more than one revolution per copy. The copy paper clutch means 94 de-energizes, and the pulling of the copy paper from the roll 34 is now controlled by roller pair 37,37'. The energizing of the forward clutch means 68 causes the carriage 18 to move in the forward or scan direction from the start-position (FIGS. 1 and 3).

Carriage Scan Movement

When the carriage moves from the start position, the rear limit-switch SW4,90 returns to the normal position and connects AC line 2 voltage to the reverse clutch means 71, (the reverse clutch remains de-energized since the AC line 1 voltage is not connected until after the original document is fully scanned).

Before the original document has completely passed the scanning area 26, the rod 83 of the copy length slide 28 passes over the document switch SW2,88, which then returns to its normal-position. When this occurs, AC line 2 voltage is connected via switch 110 to the knife solenoid 108, causing it to energize and sever the length 23 from the copy paper roll 34. The length 23 should be substantially the same length as the original document. During the cutting action, solenoid switch 106 is opened, which disconnects the AC line 2 voltage from the knife relay 93, causing the knife relay 93 to de-energize. When the knife relay is de-energized, the knife solenoid 108 de-energizes, and the start relay 91 also de-energizes, if only one or the last of the multiple copies is being reproduced.

After the entire length of the original document (or the portion thereof desired to be reproduced) has passed the scanning area 26, the finger 84 of the copy length slide 28 depresses the reverse switch SW3,89, which severs the AC line 2 voltage connection with the book copier relay 101, causing it to de-energize.

When the book copier relay 101 is de-energized, the light relay 100 is de-energized due to the disconnection of AC line 1 voltage by switch 120, to turn "off" the exposure lamp 54 and the high voltage power supply 45; the forward clutch means 68 is de-energized and the reverse clutch means 71 is energized due to the switching of switch 118 respectively by severing and connecting AC line 1 voltage, to cause the carriage to reverse its direction of movement; and the AC line 1 voltage is reconnected to the cam solenoid 92 and the copy paper clutch means 94 and the AC line 1 hold voltage is disconnected from the book copier relay 101, due to the switching of switch 117.

Carriage Reverse Movement

The carriage moves in the reverse direction after the reverse-switch SW3,89 is depressed by the finger 84 of the slide 28. During the reverse movement, the finger 84 of the copy length slide 28 passes over the switch 89 and the AC line 2 voltage is reconnected to the relay 101; the rod 83 of the slide 28 depresses the document-

switch SW2,88. Finally, when the rear end of the runner 76 reaches the start position, the rear limit-switch SW4,90 is depressed, to sever the connection of the AC line 2 voltage with the reverse clutch 71; causing the reverse clutch 71 to de-energize. The carriage stops, unless more copies are required to be reproduced.

Multiple Copies

To provide multiple copies, the carriage 18 sweeps forward and back to rescan the original document. If the multiple copy dial reads numeral one (1) or greater when the carriage is moving in the reverse direction, the switch arm 3 of the multiple copy switch SW8,123 is in contact with terminal 2, to connect AC line 2 voltage to the start relay 91 via switch 102. Therefore, the start relay 91 does not de-energize when the knife relay 93 de-energizes, after the length 23 is severed from the roll 34. Hence, when the bar 83 depresses the document-switch SW2,88 in the return part of the sweep, the cam solenoid 92, the knife relay 93 and the copy paper feed clutch means 94 are energized. The cams 128 and 130 are again released and another length 23 of copy paper is pulled from the roll 34. The carriage 18 returns to the start position prior to the adjustable cam 130, depressing the forward-clutch switch SW7,99. When the forward-clutch switch 99 is finally depressed to energize the book copier relay 101, the carriage 18 resumes its movement in the scan direction for reproducing another copy.

The descriptions of the preferred embodiment of this invention are intended merely as illustrative of the invention, the scope and limits of which are set forth in the following claims.

We claim:

1. In a photocopy machine having a power source, a first transport system operated by said power source for moving an original document through a scanning zone containing a light, a second transport system also operated by said power source for moving photosensitive sheet material on which copies are to be made through a corona apparatus and an image receiving zone in synchronization with the movement of an original document, means for coordinated actuation of said corona apparatus, said light and said first transport system comprising the combination of:

- a main cam slippably driven by said power source;
- an auxiliary cam adjustably secured to said main cam so as to move therewith;
- a cam stopper normally engaged with said main cam to prevent movement thereof;
- a start switch operably connected to said cam stopper to control disengagement thereof from said main cam;
- a first switch actuator disposed adjacent said main cam and operable thereby to actuate said corona apparatus and said light;
- a second switch actuator disposed adjacent said auxiliary cam and operable thereby to operate said first transport system.

2. The actuating means of claim 1 wherein said main cam is substantially circular with an arcuate neck portion protruding circumferentially therefrom.

3. The actuating means of claim 2 wherein said main cam has a flat side to which said auxiliary cam is secured.

11

4. The actuating means of claim 3 wherein said auxiliary cam is provided with a slot and said main cam is provided with a tightenable member projecting through said slot to permit positioning of said auxiliary cam in relation to said main cam within the limits of said slot.

12

5. The actuating means of claim 1 wherein a solenoid is provided to move said cam stopper out of engagement with said main cam and said solenoid is operated by said start switch.

* * * * *

10

15

20

25

30

35

40

45

50

55

60

65