

Dec. 24, 1968

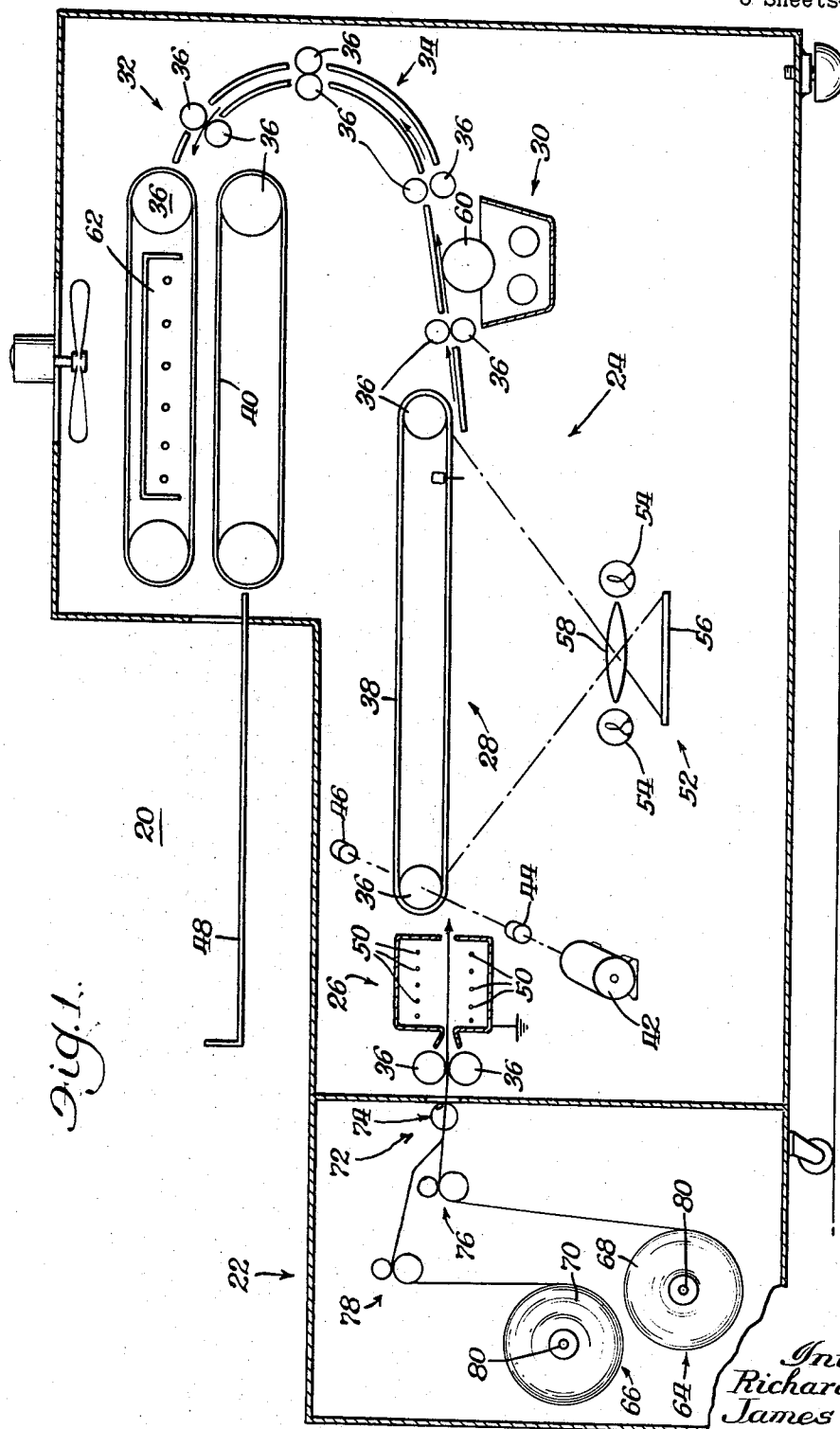
R. G. LEE ETAL

3,418,047

COPY MAKING APPARATUS

Filed March 4, 1966

6 Sheets-Sheet 1



Inventors:
Richard G. Lee
James S. Groom

By: *Mason, Kolehmainen, Rathburn & Wyss*
Attys.

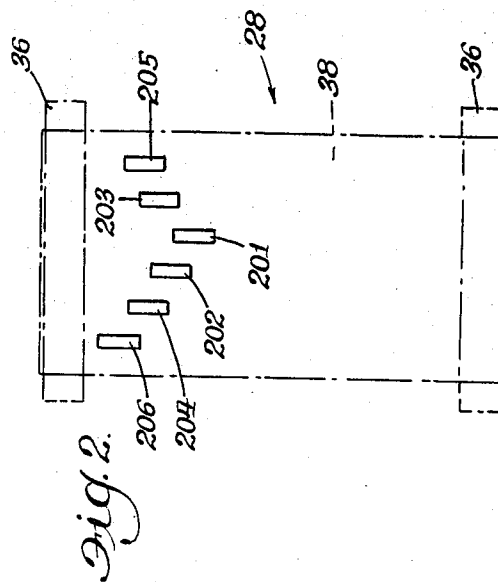
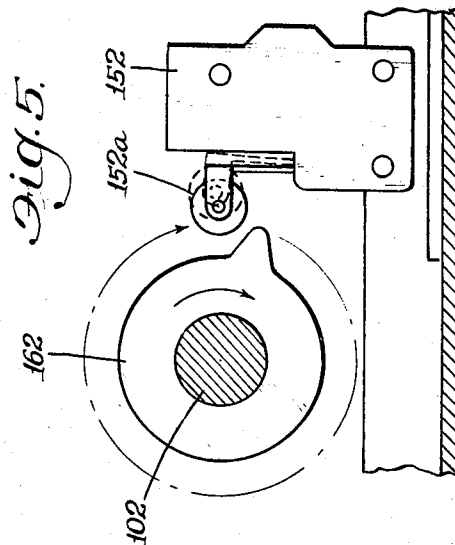
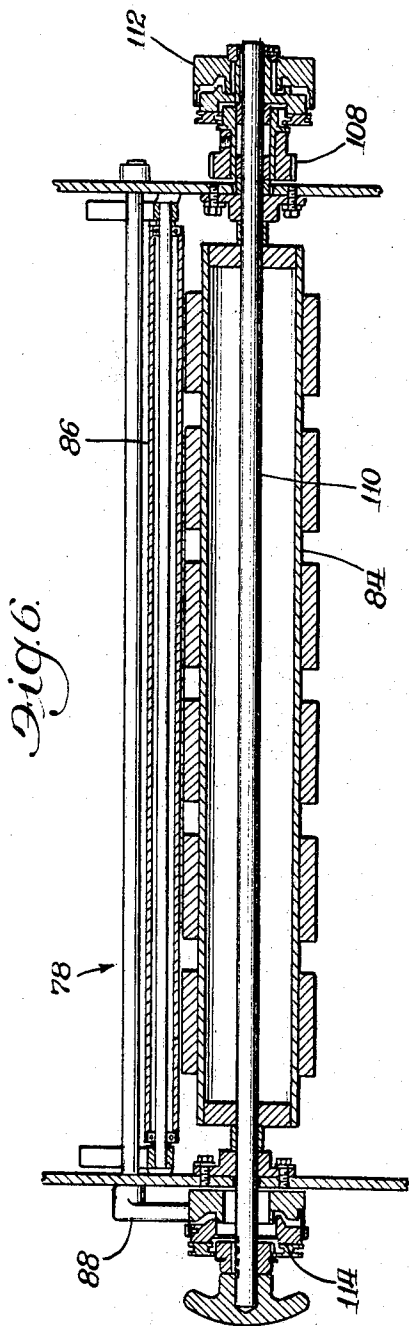
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COPY MAKING APPARATUS

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6 Sheets-Sheet 2



Inventors:
Richard G. Lee
James S. Groom
By *Mason, Kolehmainen, Rathburn & Wyss*
Attys.

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COPY MAKING APPARATUS

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6 Sheets-Sheet 3

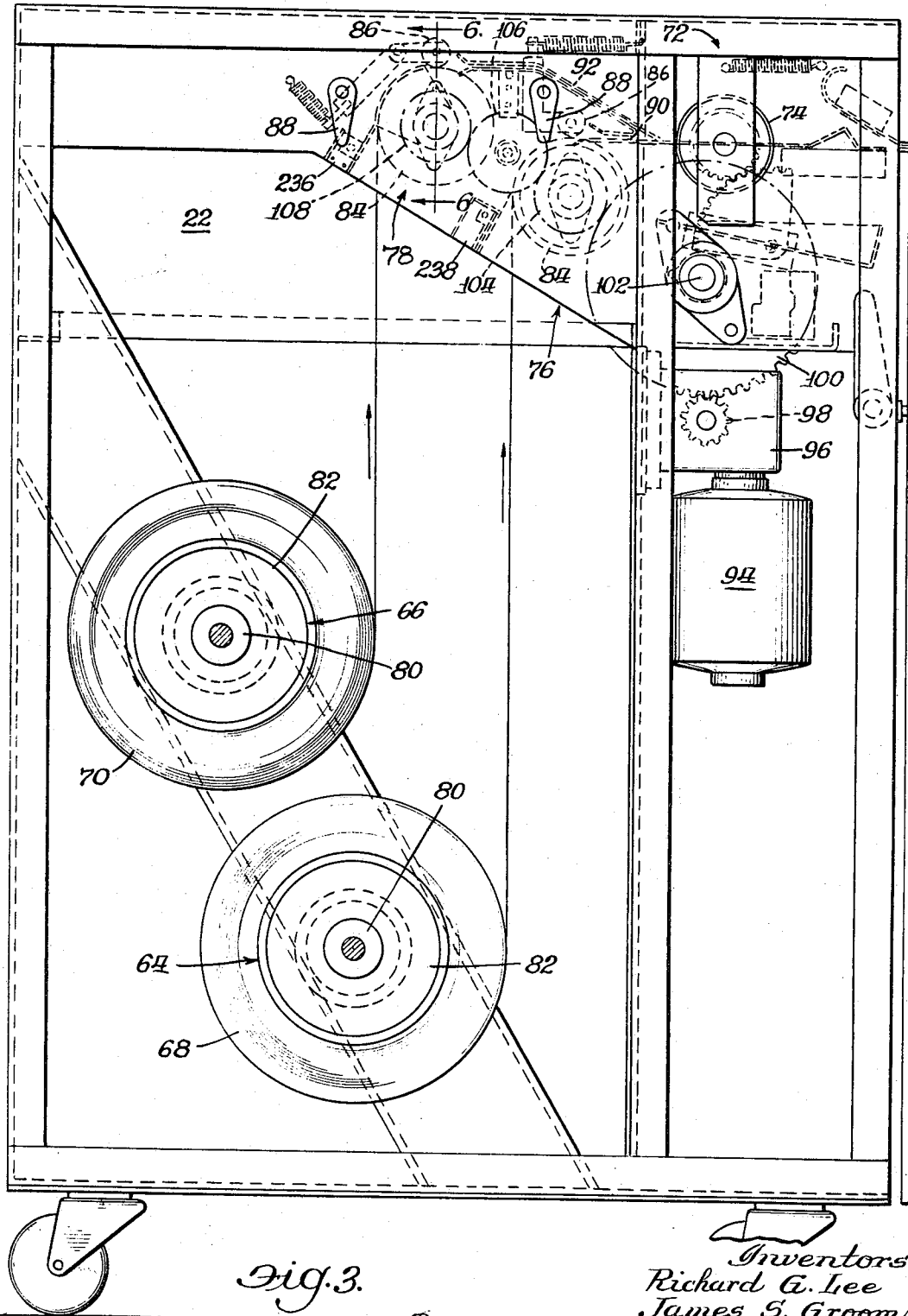


Fig. 3.

Inventors:
Richard G. Lee
James S. Groom
By: Mason, Kolehmainen, Rathburn & Wyss
Attys.

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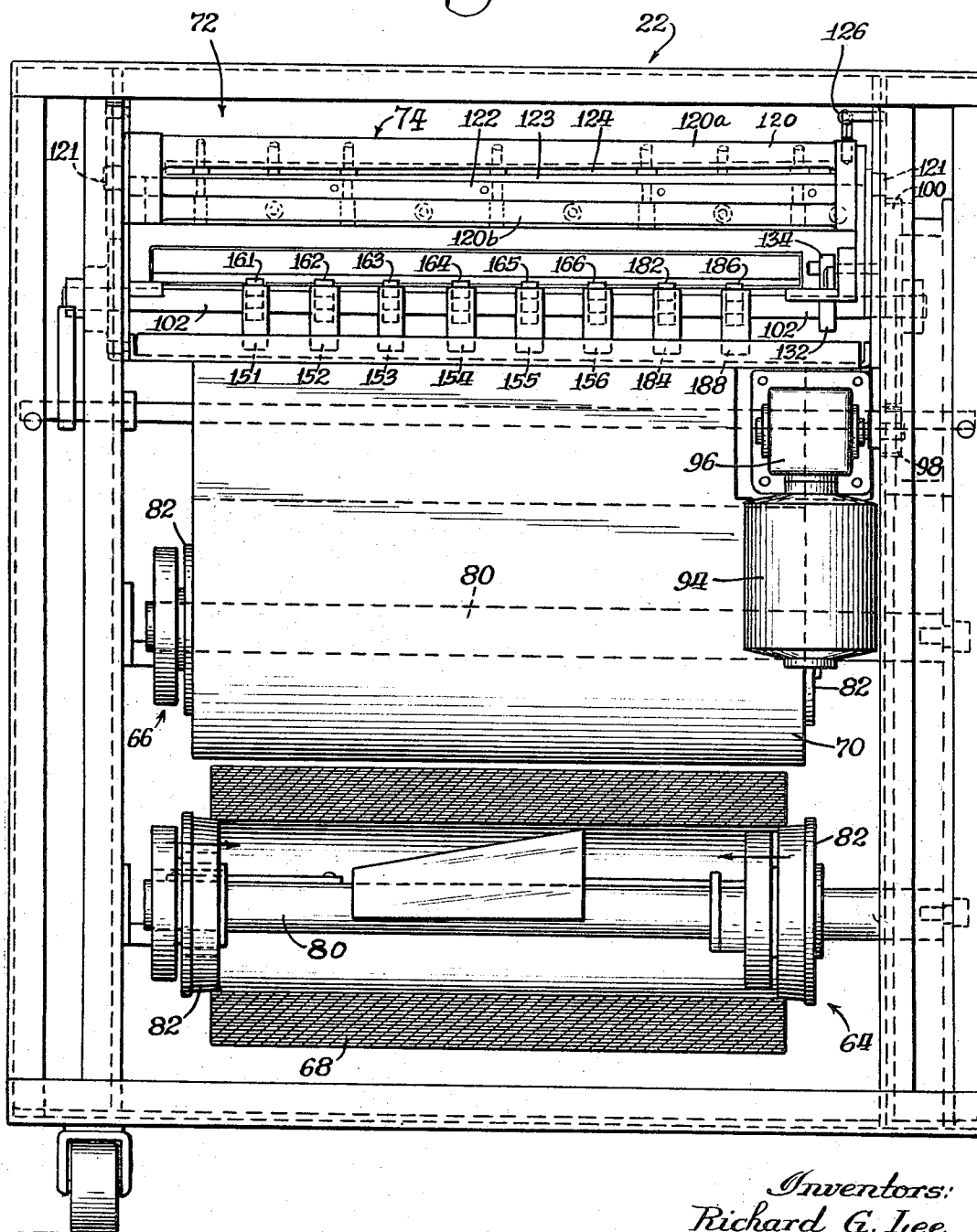
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6 Sheets-Sheet 4

Fig. 4.



Inventors:
Richard G. Lee
James S. Groom

By Mason, Kolehmainen, Kahlburn & Wyss
Attys.

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COPY MAKING APPARATUS

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6 Sheets-Sheet 5

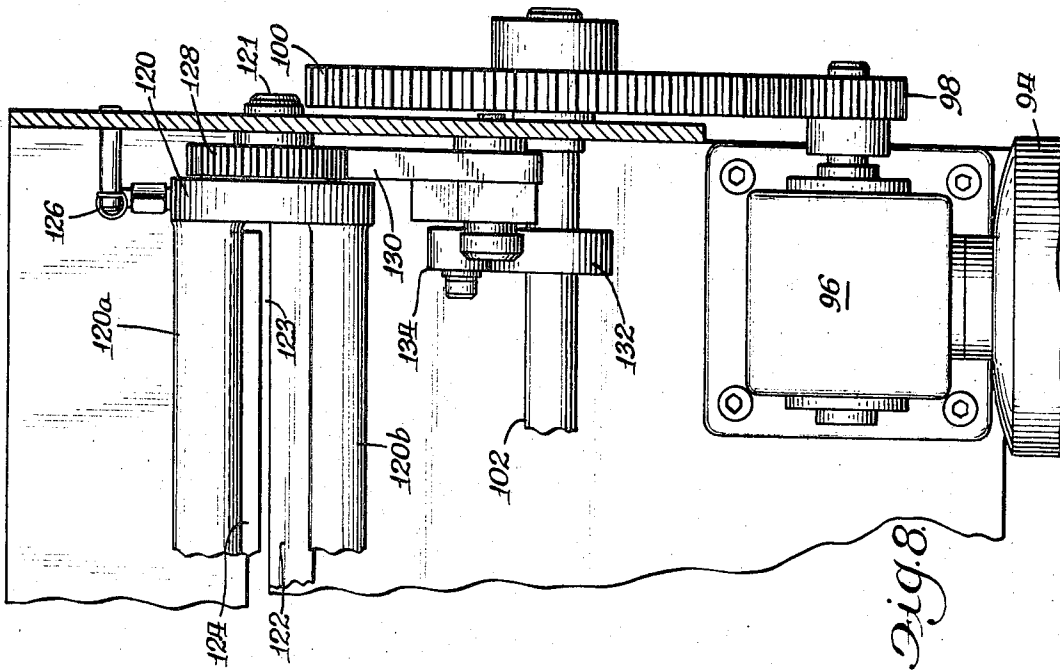


Fig. 8.

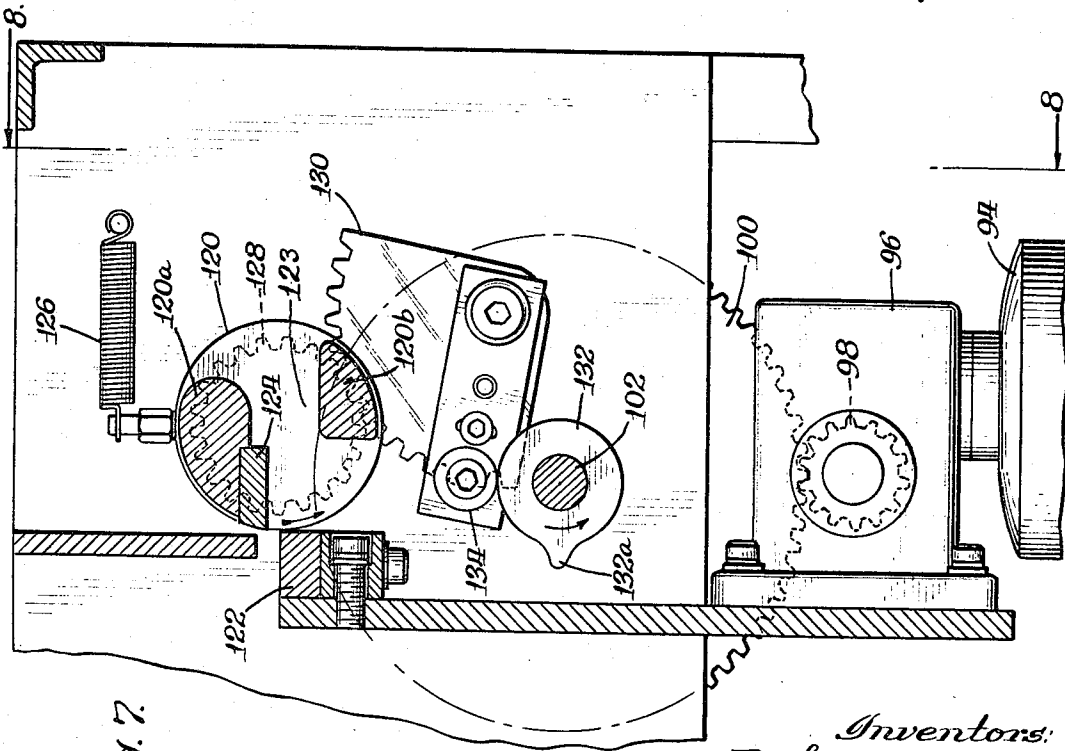


Fig. 7.

Inventors:
Richard G. Lee
James S. Groom
By: Mason, Kolehmainen, Rathburn & Wyss
Attys.

Dec. 24, 1968

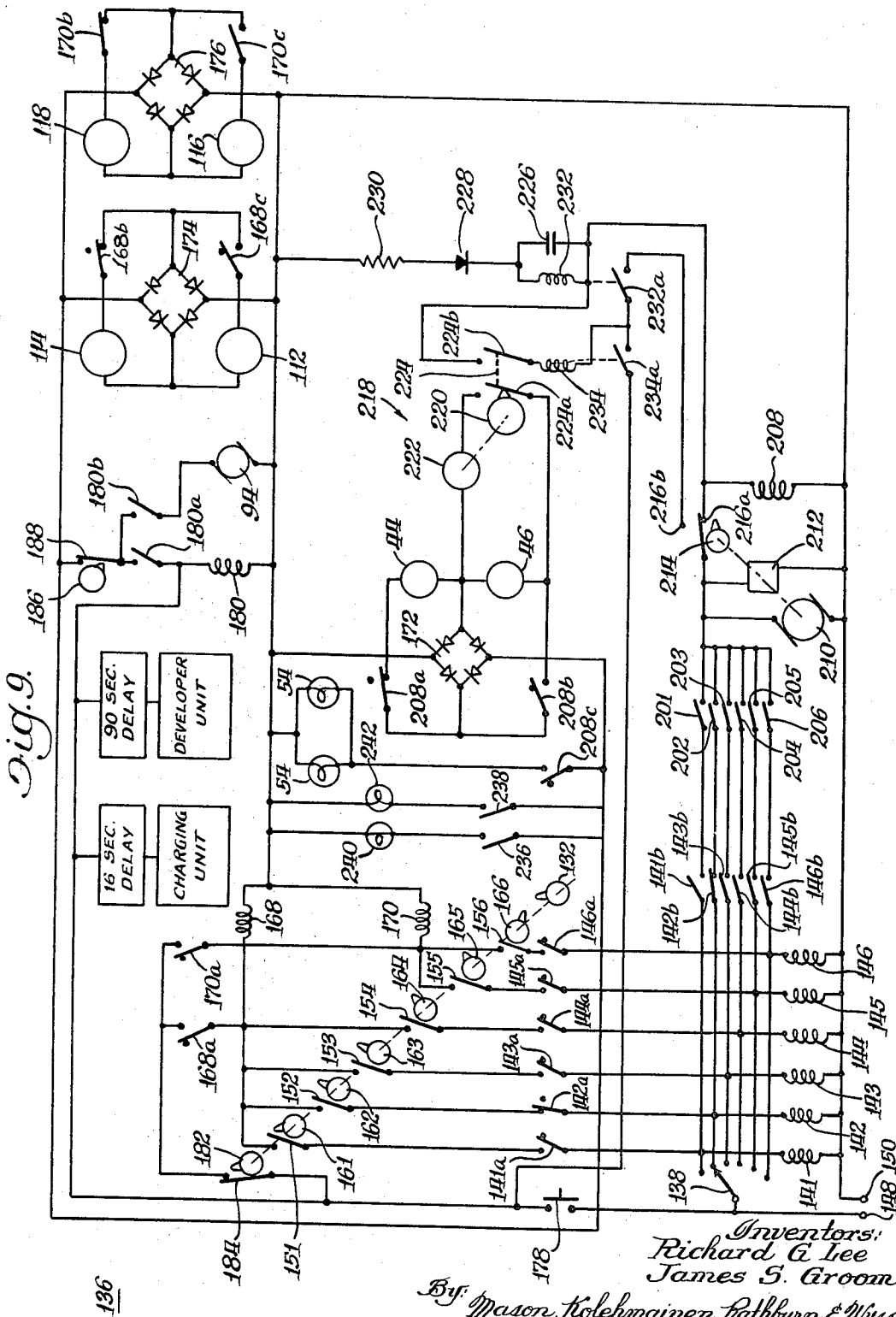
R. G. LEE ETAL

3,418,047

COPY MAKING APPARATUS

Filed March 4, 1966

6 Sheets-Sheet 6



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3,418,047

COPY MAKING APPARATUS

Richard G. Lee, Weston, and James S. Groom, Brookline, Mass., assignors to Addressograph-Multigraph Corporation, Mount Prospect, Ill., a corporation of Delaware

Filed Mar. 4, 1966, Ser. No. 531,918
16 Claims. (Cl. 355—28)

ABSTRACT OF THE DISCLOSURE

A copying machine provides copies on copy sheets of various lengths and widths. Two rolls of sheet material are selectively fed through a cutting assembly and severed into sheets of selected length. Sheet sensing means at the exposure station are controlled by selection of a sheet length to halt the severed sheet at a centered location for exposure in accordance with an original. The cutting assembly is rotatable to engage stationary and movable blades, and the advancing web is fed through a slot in the assembly. The web is cut without halting the feed of the web into the machine by developing a slack portion which is fed while the web is stopped and cut by the cutting assembly.

The present invention relates to photoelectrostatic copying machines, and more particularly to an improved machine for making copies on copy sheets severed from one or more rolls or webs of light sensitive material.

Photoelectrostatic copying machines are known for making copies on copy sheets by depositing an electrostatic charge on a photoconductive surface, selectively discharging the surface by exposing the charged surface with a pattern of light corresponding to an original graphic item to be copied, and by rendering the resulting latent image visible by the application of finely divided electroscopic particles. The process may be carried out by using a light sensitive copy sheet as the photoconductive surface, or alternatively by using a transfer member from which the image is transferred to a copy sheet.

In many copying operations, it is desirable to use copy sheets of different sizes for copying original items of different sizes, or for making copies of various sizes from one original. With photoelectrostatic machines of the type adapted to supply copy sheets from a stack of sheets, it is necessary to change the supply of sheets each time a different size is required. In order to overcome this disadvantage, and in an attempt to provide a more convenient method of supplying sheets, devices have been developed for feeding copy sheets severed from a roll or web of copy sheet material. However, machines of this type developed heretofore have not been entirely satisfactory for the reason that the variety of sizes of sheets available with this type of device is limited. A further disadvantage of some machines is that the copy making operation must be halted while the web is stopped and the copy sheet is severed. In machines wherein the copy sheet is severed while the web is moving, the copy sheet is not cut neatly and evenly. Another problem encountered in past machines is that the cutting apparatus is unduly large and must be moved a substantial distance in order to sever the web and thus is inefficient.

Accordingly, it is an object of the present invention to provide a new and improved photoelectrostatic copying machine.

It is a further object of the invention to provide a copy making machine including improved copy sheet supply apparatus.

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A further object is to provide improved copy sheet supplying apparatus capable of supplying a wide variety of copy sheet sizes.

Yet another object of the invention is to provide copy sheet supplying apparatus for selectively supplying copy sheets of differing width as well as differing length.

Still another object of the invention is to provide an improved copying machine including a novel control arrangement for causing a copy sheet of a desired size to be supplied from a web, and for simultaneously conditioning the copy making machine for the selected sheet size.

Another object is to provide a novel copy making machine wherein the copy sheets are supplied from a roll or web, and wherein cleanly and evenly cut sheets are provided without interruption of the copy making process.

Still another object of the invention is to provide new and improved apparatus for cutting a web of material to sever copy sheets from the end thereof.

Another object is to provide highly efficient cutting apparatus compact in size and requiring only slight movement in order to sever a web of copy sheet material.

In accordance with these and other objects of the invention, an embodiment of the invention may comprise a photoelectrostatic copying machine including sheet handling means comprising apparatus for sequentially charging, exposing and developing a copy sheet propelled through the machine by copy sheet driving apparatus. In order to supply copy sheets to the sheet handling means, there is provided a copy sheet supply section including cutting apparatus for severing copy sheets from web-form light sensitive material.

In accordance with a feature of the invention, the sheet supplying section is controlled by a selector arrangement to supply sheets of different length from rolls or webs of different width, whereby a wide variety of copy sheet sizes is available. The copying machine includes apparatus for stopping the copy sheet at the exposure station while it is illuminated in accordance with the original item, and in accordance with the invention selection of a copy sheet size conditions sheet positioning apparatus at the exposure station to assure that each sheet is properly positioned according to its size.

The copy sheet supply section includes supports for a pair of rolls of light sensitive material of different widths, and also includes web advancing apparatus controlled by the copy sheet size selector apparatus for moving a selected length of a selected one of the webs past a web cutting station to the sheet handling means where it is picked up and further propelled by the sheet driving apparatus. In accordance with one feature of the invention, the web advancing apparatus advances the web faster than the sheet driving apparatus, and as a result a slack portion of web is built up between the cutting station and the sheet handling means. When the web is stopped and severed at the cutting station by the cutting apparatus, the sheet driving means continues to take up the slack portion. Accordingly, the copy making operation is not interrupted during severing of a sheet, and cleanly and evenly cut sheets are obtained by halting the web at the cutting station.

In accordance with a further feature of the invention, new and improved web cutting apparatus is provided. The web is severed by engagement of a movably mounted blade with a stationary blade, and the movably mounted blade is mounted for rotation about an axis transverse to the direction of web movement. Thus, only a small amount of rotational movement is required to sever the web. A compact arrangement is achieved by mounting the movable blade at the periphery of a generally cylindrical

cutting assembly having a slot-like opening, defined in part by the movable blade, through which the web is fed prior to being cut.

Many other objects and advantages of the present invention will become apparent from considering the following detailed description in conjunction with the drawings in which:

FIG. 1 is a partly diagrammatic view of a photoelectrostatic copying machine constructed in accordance with the present invention;

FIG. 2 is a diagrammatic view illustrating part of the exposure station sheet positioning apparatus;

FIG. 3 is an enlarged side view of the copy sheet supply section of the machine of FIG. 1 taken with part of the housing removed;

FIG. 4 is a front view of the apparatus of FIG. 3 with a different part of the housing removed;

FIG. 5 is an enlarged fragmentary sectional view of a portion of the copy sheet supply section particularly illustrating one of the operation controlling cams and switches;

FIG. 6 is an enlarged sectional view of part of the web advancing apparatus taken along the line 6—6 of FIG. 3;

FIG. 7 is an enlarged fragmentary sectional view of the web cutting apparatus of the machine of FIG. 1;

FIG. 8 is a sectional view taken along the line 8—8 of FIG. 7; and

FIG. 9 is a schematic and diagrammatic illustration of part of the circuit for controlling the operation of the photoelectrostatic copying machine of FIG. 1.

Referring now to the drawings, and initially to FIG. 1, there is illustrated a photoelectrostatic copying machine embodying the features of the present invention and generally designated as 20. The machine is provided with a copy sheet supplying section generally designated as 22 for severing copy sheets of selected sizes from webs of light sensitive material. Within the housing of the machine 20 is positioned sheet handling means generally designated as 24 for receiving copy sheets advanced from the sheet supplying section 22 and including a charging station 26, an exposure station 28, a developer station 30, and a fusing station 32.

In order to propel copy sheets through the various stations of the sheet handling means 24, the machine 20 includes sheet driving apparatus referred to as a whole by the reference numeral 34 and including several rollers 36, drive belts 38 at the exposure station, and drive belts 40 at the fusing station. The various rollers 36 and belts 38 and 40 of the sheet driving apparatus 34 are driven in conventional manner by means of a drive motor 42 coupled to one of the rollers 36 by a drive system including an electrically operated clutch 44 and brake 46. The sheet driving apparatus 34 serves to propel copy sheets through the charging station 26 to the exposure station 38, and from the exposure station through the developer 30 and fuser 32 to a copy receiving tray 48.

The operation of the sheet handling means 24 is generally similar to many known arrangements wherein the charging station 26 includes corona discharge wires 50 for depositing opposite charges upon the opposed faces of the copy sheet. At the exposure station 28, the copy sheet is stopped and held stationary while it is exposed to a light pattern developed at an original illuminating station generally designated as 52 by means of lamps 54 for illuminating an original item 56 and a suitable lens 58 for focusing the light pattern on the copy sheet. The original may be a graphic sheet or a film such as microfilm. After exposure, the copy sheet is propelled through the developing station 30 where finely divided electroscopic particles are deposited upon the copy sheet by means of a particle transferring arrangement including a magnetic brush 60. At the fuser station 32 the image on the copy sheet is rendered permanent by heat from an electric resistance heating unit 62.

In accordance with a feature of the invention, the copy

sheet supplying section 22 is adapted to supply copy sheets of different widths to the sheet handling means 24. Accordingly, the sheet supplying section 22 includes a pair of supports generally designated as 64 and 66 for supporting a pair of rolls or webs 68 and 70 of light sensitive copy material (FIGS. 1, 3 and 4). The webs may be of different widths, and if desired, may differ in other characteristics. There is also provided a web cutting station generally designated as 72 including web cutting apparatus 74 for severing copy sheets from the webs 68 and 70. In order to move copy sheet material from the rolls 68 and 70 through the web cutting station 72, the sheet supplying section 22 additionally includes sheet advancing means generally designated as 76 and 78, one for each web 68 and 70. As described hereinafter, the operator of the machine 20 can select either the web 68 or the web 70 to be advanced through the cutting station 72 for providing a copy sheet to be forwarded to the sheet handling means 24.

The web supports 64 and 66 are substantially identical and each includes an arbor member 80 supporting a pair of laterally adjustable and frictionally rotatable hubs 82. The rolls 68 and 70 of copy sheet material are mounted between the hubs 82, and rotation of the hubs is frictionally retarded to prevent overrunning of the web material during the copy making operation.

The webs from the rolls 68 and 70 are advanced respectively by means of the web advancing apparatus 76 and 78. These are substantially identical in construction, and having reference to FIG. 6, the web advancing apparatus 78 is illustrated in detail. Each web advancing apparatus includes a driven roller 84 and a pressure roller 86 spring biased against the driven roller. A hand lever 88 is coupled to each pressure roller 86 whereby the pressure rollers 86 may be moved away from the driven rollers 84 in order to thread the webs of copy sheet material between the rollers. The webs 68 and 70 are guided past the web-advancing apparatus to the web cutting station 72 through a pair of paper guides 90 and 92.

In order to drive the driven rollers 84, the copy sheet supplying section 22 includes a supply drive motor 94 coupled through a drive linkage 96 to a spur gear 98 (FIGS. 2, 3, 7 and 8). The spur gear 98 engages a drive gear 100 mounted upon a programming shaft 102, the function of which will be described in more detail hereinafter. As appears in FIG. 3, the drive gear 100 engages a gear 104 associated with the driven roller 84 of the web advancing apparatus 76. A transfer gear 106 drives another gear 108 associated with the driven roller 84 of the web advancing apparatus 78. Each driven roller 84 is mounted upon a drive shaft 110, and as appears in FIG. 6, the rotation of the shaft 110 of the web advancing apparatus 78 is controlled by means of an electrically operated clutch 112 coupled between the gear 108 and the shaft 110, and by means of an electrically operated brake 114 coupled between the housing and the shaft 110. Similarly, the rotation of the driven roller 84 of the web advancing apparatus 76 is controlled by a clutch 116 and a brake 118 (FIG. 9). In accordance with one feature of the invention, apparatus hereinafter described in detail is provided for controlling the clutches 112 and 116 and the brakes 114 and 118 in order to cause the web advancing apparatus 76 and 78 to propel a selected length of either the web 68 or the web 70 past the cutting station 72.

When a selected length of either the web 68 or the web 70 is fed past the cutting station 72, severing of a copy sheet from the web is accomplished by means of the novel web cutting apparatus 74 provided in accordance with a feature of the invention. Having reference now to FIGS. 4, 7 and 8, the web cutting apparatus includes a generally cylindrical cutter assembly 120 mounted for rotation about its axis by means of axle pins 121 journaled for a rotation in a stationary portion of the machine housing. The cutter assembly 120 lies in the path of the

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advancing web, and in accordance with a feature of the invention, includes an axially elongated central slot 123 defined by spaced portions 120a and 120b of the assembly 120. The advancing copy sheet web is fed through the slot 123 in the assembly 120, and thereby a very compact and convenient arrangement is provided.

In order to sever the copy sheet web after it has been advanced a selected distance through the cutter assembly 120, there is provided a stationary cutting blade 122 lying at the periphery of the cylindrical cutter 120, and a movable blade 124 mounted against the portion 120a of the cutter assembly 120 and in part defining the recess 123 in the cutter assembly. In order to cut the web, the cutting assembly carrying the movable blade 124 is rotated a very slight amount in a counter-clockwise direction as viewed in FIG. 7 whereby the movable blade 124 engages the stationary blade 122. As appears most clearly in FIG. 4, the blades 122 and 124 are inclined relative to one another in order to reduce the force necessary to sever the web. The novel cylindrical design of the cutter assembly 120 and the rotational movement of the cutting blade 124 provide a compact and highly efficient apparatus for severing the web.

A spring 126 serves to hold the cutting assembly 120 in the inoperative position while the advancing web of copy sheet material passes between the blades 122 and 124. In order to rotate the cutting assembly 120 thereby to sever the web, a spur 128 is mounted at one end of the assembly 120 and engages a peripherally toothed rocker element or segmental gear 130 pivotally mounted on the machine housing. The cutter is powered by the supply drive motor 94 through the drive gear 100, the programming shaft 102, and a cutter cam 132 supported on the programming shaft 102. At a predetermined point in the cycle of operation of the machine 20, as discussed hereinafter, a projection 132a on the cam 132 lifts a cam follower 134 connected to the rocker element 130 and as a result the rocker element is rotated slightly in a clockwise direction as viewed in FIG. 7 thereby rotating the cutter assembly 120 and causing the web to be severed between the blades 122 and 124. Thereafter, the cutter assembly 120 is returned to the inactive position by the spring 126.

In accordance with one feature of the invention, the operator of the machine may select any one of several available lengths and widths of copy sheets to be supplied by the copy sheet supplying section 22. Further in accordance with the invention, selection of a sheet size is effective not only to cause the selected size to be provided by the supplying section, but also to control the operation of positioning means at the exposure station properly to position each sheet in accordance with its size.

Having reference now to FIG. 9, there is illustrated a control circuit generally designated as 136 for controlling the operation of the copy sheet supplying section 22 and other portions of the photoelectrostatic copying machine 20, and comprising a part of the electrical circuit of the machine. The control circuit 136 includes a selector switch 138 movable between six positions corresponding to six available copy sheet sizes, thereby to connect one of six size selector relay windings 141, 142, 143, 144, 145 or 146 across a pair of supply terminals 148 and 150. Each relay controls one of a first set of contacts 141a, 142a, 143a, 144a, 145a and 146a. In the illustrated condition of the circuit 136, the relay 142 is energized by the selector 138 and the contacts 142a are in a closed condition thereby selecting a switch 152 of a group of six normally opened switches 151, 152, 153, 154, 155 and 156, each adapted to be controlled by one of a series of cams 161, 162, 163, 164, 165 and 166.

Referring to FIG. 4, it can be seen that the series of cams 161-166 are mounted upon the programming shaft 102, the switches 151-156 being mounted in a stationary position adjacent to the cams. The switches 151-154 serve

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to select a copy sheet from the web 70 and are thus connected to a first web selector relay winding 168 controlling a normally open pair of holding contacts 168a, a normally closed pair of brake contacts 168b and a normally open pair of clutch contacts 168c. Similarly, the switches 155 and 156 serve to select a copy sheet from the web 68 and are connected to a second web selector relay winding 170 having holding, brake and clutch contacts 170a, 170b and 170c.

Each of the switches 151-156 corresponds to a predetermined length of copy sheet material severed from a predetermined one of the webs 68 and 70. Thus, movement of the selector switch 138 to one of its positions serves to condition the machine to provide a preselected copy sheet size from a number of available sizes differing in length and in width.

The circuit 136 is illustrated in the standby condition wherein the copy sheet driving clutch 44 is energized through a fullwave rectifier 172 and the copy sheet brake 46 is deenergized. In addition, the brakes 114 and 118 of the web advancing apparatus 76 and 78 are energized by means of fullwave rectifiers 174 and 176 through the normally closed brake contacts 168b and 170b. The web advancing clutches 114 and 116 are deenergized by virtue of the normally open contacts 168c and 170c.

When it is desired to initiate a copying operation, the selector 138 is first moved to select a desired copy sheet size. As noted above, with the selector in the illustrated position, the size selector relay winding 142 is energized and the contacts 142a are closed thus connecting into the circuit the switch 152 corresponding to a desired one of the several available combinations of copy sheet lengths and widths.

To start the machine, a start button 178 is momentarily depressed thereby energizing a motor controlling relay 180. Energization of the relay 180 closes a normally open pair of holding contacts 180a and a normally open pair of motor controlling contacts 180b whereby the supply drive motor 94 is energized and begins to rotate causing the programming shaft 102 in the copy sheet supplying section 22 to begin a cycle of rotation. The cams 161-166 are positioned in different angular positions on the programming shaft 102 in order to supply different lengths of copy sheet web and thus copy sheets of different lengths. After the programming shaft 102 has rotated for a predetermined period of time as determined by the angular position of the cam 162, the cam 162 serves to momentarily close the switch 152 by depressing a cam follower 152a to the position illustrated in dotted lines in FIG. 5. Closure of this switch energizes the first web selector relay winding 168 thus closing the holding contacts 168a and holding the winding 168 in an energized condition during further rotation of the cam 162. Simultaneously, the brake controlling contacts 168b are opened and the clutch contacts 168c are closed. As a result the brake 114 is deenergized and the clutch 112 is energized and the supply drive motor 94 rotates the driven roller 84 of the web advancing means 78 and the web 70 is fed through the cutting assembly 72.

After a predetermined time has elapsed during which a predetermined selected length of copy sheet web passes through the cutting station 72, a feed stop cam 182 also mounted on the programming shaft 102 (FIGS. 4 and 9) opens a normally closed feed stop switch 184. This serves to disconnect the web selector relay winding 168, thus closing brake contacts 168b and opening clutch contacts 168c thereby energizing the web advancing brake 114 and deenergizing the clutch 112. Accordingly, the movement of the web 70 through the cutting station 72 stops.

In accordance with a feature of the present invention, it is possible to stop the web in the cutting station 72 without interrupting the copy making operation. When the web is stopped in the cutting station, the leading edge of the web is already advanced to the sheet handling

means 24 and is being moved by the sheet driving apparatus 34 including one or more pairs of rollers 36 and belts 38. In order to permit the web to be stopped at the cutting station 72 without straining or tearing the web, the sheet advancing apparatus 76 and 78 propel the web at a higher speed than does the sheet driving apparatus 34. Accordingly, as a web is advanced by the web advancing apparatus and is taken up by the sheet driving apparatus a slack portion of web is developed between the cutting station 72 and the sheet handling means 24. Thus, when the web is stopped at the cutting station 72, the sheet driving apparatus 34 continues to operate and continues to take up this slack portion. As a result, it is possible cleanly and evenly to sever a copy sheet from the web of copy sheet material without interrupting the movement of the copy sheet through the sheet handling means 24 including the charging station 26. Thus, the charge is deposited by the corona discharge wires 50 in an even and continuous fashion.

Resuming now the description of the copy making operation, after the feed stop switch 184 has been opened thus deenergizing the web selector relay winding 168, the cutter cam 132 described above causes the cutter assembly 120 to be rotated and thereby severs a copy sheet from the web by engaging the movable blade 124 and the stationary blade 122. Thereafter the severed copy sheet of selected size continues its movement through the sheet handling means 24. After the sheet is severed, a cycle stop cam 186, also mounted on the programming shaft 102 (FIGS. 4 and 9) opens a normally closed cycle stop switch 188, thereby deenergizing the motor controlling relay 180 and the supply drive motor 94 and bringing to an end the supply cycle. The slight inertia of the shaft 102 and motor 94 serves to move the programming shaft 102 slightly after the switch 188 is opened, thereby assuring that each operation of the copy sheet supplying section 22 serves to move the programming shaft 102 through a complete cycle of 360° of rotation. Accordingly, the circuit 136 returns to its initial standby condition ready to supply another copy sheet of the same size, or after manipulation of the selector switch 138, of any other desired size.

After the copy sheet is severed in the cutting station 172, it continues its movement through the machine 20. After being charged at the charging station 26, and advanced to the exposure station 28, the sheet is stopped in order to be illuminated. In accordance with a feature of the present invention, means are provided at the exposure station for properly positioning copy sheets of different sizes, and these means are controlled by the selector means 138 simultaneously with the selection of a copy sheet of a desired size. Accordingly, each of the size selector relays 141-146 includes a set of sheet positioning contacts 141b, 142b, 143b, 144b, 145b and 146b each connected to one of a group of normally open positioning switches 201, 202, 203, 204, 205 and 206. Each of these switches is positioned at a predetermined point in the exposure station to be contacted by the leading edge of the advancing copy sheet when the copy sheet has reached its properly centered position for exposure, each switch corresponding to one of the selected sizes (FIG. 2). Thus, when the advancing copy sheet depresses the switch which has been connected into the circuit by the selected sheet positioning relay winding, the sheet is halted in the proper position and exposed.

More specifically, closure of the selected one of switches 201-206 completes a circuit for the energization of an exposure controlling relay winding 208. Energization of this relay serves to open a normally closed set of clutch control contacts 208a and to close a normally open set of brake control contacts 208b so that the copy sheet drive controlling clutch 44 is deenergized while the brake 46 is energized, thus stopping the copy sheet in the proper position at the exposure station. An additional set of

normally open contacts 208c are closed to energize the illuminating lamps 54 in order to expose the copy sheet. Thus, it can be seen that the operation of the single selector switch 38 serves not only to control the copy sheet supplying section 22 to provide a copy sheet of the desired one of a wide variety of sizes, but also serves to condition the machine to properly position the copy sheet for exposure.

Closure of the selected one of the switches 201-206 additionally serves to energize an exposure timing motor 210 and an electrically operated timing clutch arrangement designated as 212. As a result, a timing cam 214 begins to rotate from a home position until a predetermined exposure time has elapsed, at which time a pair of switch contacts 216a are opened and a complimentary pair of contacts 216b are closed. Opening of the contacts 216a serves to deenergize the exposure controlling the relay winding 208 whereby the lamps 54 are turned off, the brake 46 is deenergized and the clutch 44 is energized in order that the copy sheet again begins to move through the machine 20. The timing clutch 214 may be controllable by the operator of the machine to adjust the exposure time, and the timing cam 214, after the exposure time is completed, may be returned to the home position by a spring arrangement.

As indicated diagrammatically in FIG. 9, the charging unit and the developer unit are additionally controlled by the control circuit 136. Thus, at the time the start switch 178 is closed, suitable circuitry associated with each of these units is actuated to maintain them in operation during the time that the copy sheet is passed there-through. The copy sheet is advanced through the charging, developing and fusing stations in known manner, and the completed copy is deposited in the tray 48.

The machine 20 is also capable of automatically making a selected number of copies in sequence from an original without operation of the start switch 178 for each copy. Accordingly, the circuit 136 includes a multiple copy controlling circuit generally designated as 218 and including a selector control 220 which can manually be moved to select any one of a range of desired numbers of copies. A counter solenoid 222 is coupled to the selector control 220 to step the control one step toward the zero or home position each time the solenoid 222 is energized. When the control 220 is moved from the zero position, a double pole multiple copy switch 224 including two sets of contacts 224a and 224b is moved from the normally open to the closed position.

In multiple copy operation, it is necessary to begin the first copy by momentarily closing the start switch 178. Thereafter, copy production is automatic. More specifically, whenever the sheet drive controlling brake 146 is energized by energization of the exposure control relay 208, the counter solenoid 222, connected across the brake 146, is also energized to step the counter control 220 toward the home position. Furthermore; energization of the exposure relay 208 is accompanied by charging of a timing capacitor 226 through a diode 228 and limiting resistor 230. Simultaneously, a relay winding 232 in parallel with the capacitor 226 is energized, and its normally open pair of contacts 232a are closed.

At the end of the exposure period when the timing cam 214 moves to the position for opening the contacts 216a and closing the contacts 216b, the capacitor 226 commences to discharge through winding 232, thus holding the contacts 232a closed for a period of time which may be about two seconds. During this period of time, a restart relay winding 234 is energized thus closing a pair of restart relay contacts 234a. Thus, during the discharge delay time of the timing capacitor 226, the start switch 178 is bypassed by a circuit including the selector switch 138, one of the set of relay contacts 141b-146b, one of the switches 201-206, the closed switch contacts 216b, the closed timing relay contacts 232a and the closed restart

contacts 234a. As a result, the copy making cycle starts over again. This operation is repeated with each copy until the selector 220 is stepped to the home position, at which time the switch contacts 224a and 224b are opened and the circuit 136 returns again to the standby position.

In order to provide an indication of a discontinuity such as a tear, or of exhaustion of one of the webs 68 and 70, a pair of web sensing switches 236 and 238 are provided along the path of movement of the web (FIG. 3 and 9). These are connected in series between the supply terminals with a pair of indicator lamps 240 and 242, the lamps being energized whenever the switches are closed by exhaustion of the web material.

Although the present invention has been described with reference to a single illustrative embodiment thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this invention.

What is claimed and desired to be secured by letters patent of the United States is:

1. An apparatus for making copies on sheets severed from light sensitive material, said apparatus comprising supports for first and second webs of material, a web cutting station, sheet handling means including means for copying an image onto a severed sheet, first and second web advancing means for advancing said first and second webs respectively from said supports through said cutting station, drive means for moving the advanced web to said sheet handling means, means for stopping the web in the cutting station, cutting means at the cutting station for severing a sheet from the stopped web, web selecting means for operating one of said first and second advancing means in order to advance a selected one of said webs, and sheet length selecting means coupling said web stopping means and said first and second advancing means for operating said web stopping means after a selected length of web is advanced through said cutting station.
2. Apparatus as defined in claim 1 wherein said first and second webs are of different widths, and additionally comprising a single manual control coupled to said web selecting means and said length selecting means for selecting one copy sheet size from a plurality of possible sizes differing in length and in width.
3. Apparatus as defined in claim 1 wherein said sheet handling means includes an exposure station having means for exposing a severed copy sheet, and means for disabling said drive means in order to stop the copy sheet at said exposure station for exposure, said disabling means being coupled to said length selecting means for stopping each copy sheet in a position corresponding to its selected length.
4. Apparatus as defined in claim 3 including a single selector control coupling said web selecting means, said length selecting means, and said disabling means for causing a sheet of selected length to be severed from a selected web, and for causing the severed sheet to be positioned according to its selected length.
5. Apparatus as defined in claim 4 wherein said webs are of different widths, and wherein said selector control comprises a switch movable between a series of positions each corresponding to a copy sheet size, a series of relays one connected to be energized in each position of said switch, each relay having a first set of contacts responsive to energization of the relay for controlling said web selecting means and said length selecting means, and each of said relays having a second set of contacts responsive to energization of the relay for controlling said disabling means.
6. Apparatus for making copies on sheets severed from web-form light sensitive material, said apparatus comprising a support for one web of material, a web cutting station, sheet handling means including means for

copying an image onto a severed sheet, first advancing means for advancing a length of said one web from said support through said cutting station at a first speed, drive means for moving the advanced web to said sheet handling means at a slower speed thereby to develop a slack portion of web between said cutting station and said sheet handling means, means for stopping the web in the cutting station while said drive means continues to move the slack portion of web, and cutting means at the cutting station for severing a sheet from the stopped web.

7. Apparatus as defined in claim 6 additionally comprising selector means coupling said first advancing means and said web stopping means to operate said web stopping means after a selected length of web is advanced through said cutting station.

8. Apparatus as defined in claim 7 wherein said web stopping means includes means for disabling said first advancing means and simultaneously operable brake means for holding said web in a stationary position.

9. Apparatus as defined in claim 6 additionally comprising an additional support for another web of material, second advancing means for advancing a length of said other web from said additional support through said cutting station, and web selecting means for energizing one of said first and second advancing means in order to make a copy on a sheet severed from a selected one of said webs.

10. Apparatus as defined in claim 9 additionally comprising length selecting means coupling said web stopping means and said first and second advancing means for operating said web stopping means after a predetermined length of web is advanced through said cutting station.

11. Apparatus as defined in claim 10 additionally comprising a single manual control for simultaneously operating both said web selecting means and said length selecting means for choosing one of a series of copy sheet sizes.

12. Apparatus for making copies on copy sheet material comprising a support for a web of copy sheet material, sheet supply means including a cutter for severing individual copy sheets from the web and including web advancing means for advancing the web from said support and past said cutter, selector means for selecting one of a plurality of copy sheet lengths, said sheet supply means being controlled by said selector means to provide a sheet of the selected length, an exposure station including means for exposing severed copy sheets, copy sheet drive means for moving copy sheets from said sheet supply means and into said exposure station, sheet sensing means at said exposure station for sensing the location of copy sheets moved into said exposure station, and control means controlled by said selector means and by said sheet sensing means for disabling said sheet drive means to stop an advancing copy sheet at a predetermined location corresponding to the selected length.

13. The apparatus of claim 12, said sensing means comprising a plurality of sensing devices each corresponding to a copy sheet length, each device being operable by the leading edge of a copy sheet of the corresponding length when it reaches a desired exposure position, and said selector means being operable to connect a selected device in controlling relation to said copy sheet drive means.

14. The apparatus of claim 13, said devices being positioned to center copy sheets of corresponding lengths.

15. For use with a copying machine, apparatus for supplying copy sheets severed from a web of light sensitive material comprising means for supporting the web of material, web advancing means for advancing the web along a path from said supporting means, a generally cylindrical cutting assembly having an elongated axial slot opening therethrough, means mounting said assembly for rotation around its axis between normal and cutting positions, a stationary blade mounted at the periph-

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ery of said assembly, a movable blade mounted on said assembly and engageable with said stationary blade upon movement of said assembly to the cutting position, and means for guiding the advancing web through said slot and between said stationary and cutting blades.

16. Apparatus as defined in claim 15 additionally comprising drive means, control means coupled between said drive means and said web advancing means for actuating said web advancing means to advance a selected length of web, and means controlled by said control means for rotating said assembly after advancement of the web to sever said selected length from the web.

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References Cited

UNITED STATES PATENTS

3,167,996	2/1965	Adler	88—24
3,250,165	5/1966	Schoonmaker et al.	83—203
3,309,960	3/1967	Delplanque	88—24

NORTON ANSHER, *Primary Examiner.*

R. A. WINTERCORN, *Assistant Examiner.*

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83—203; 355—13, 42