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[54] HIGH SPEED PHOTOELECTROSTATIC COPYING MACHINE

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[58] Field of Search 355/13, 14

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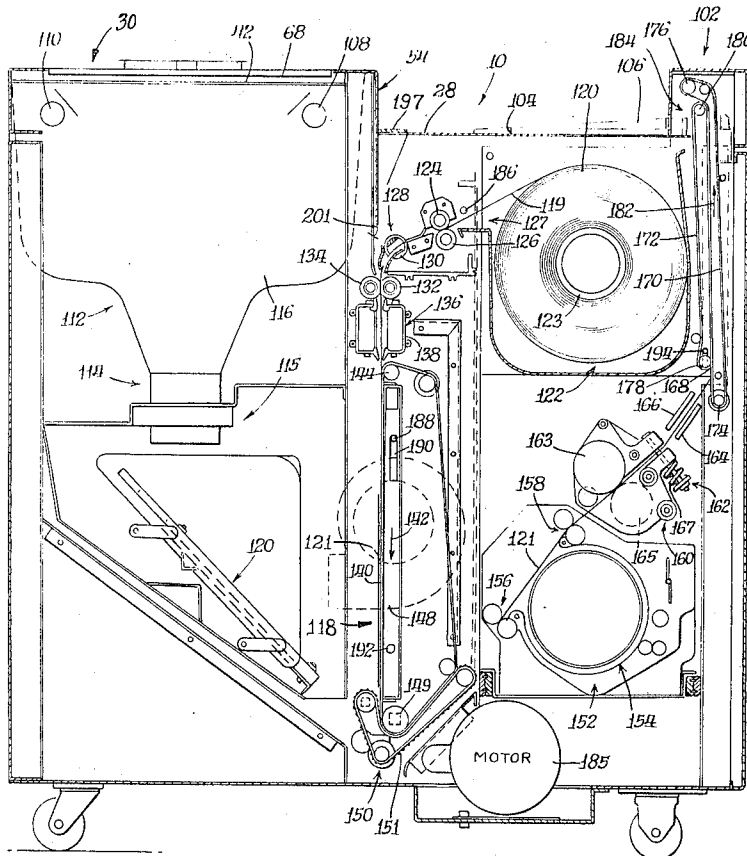
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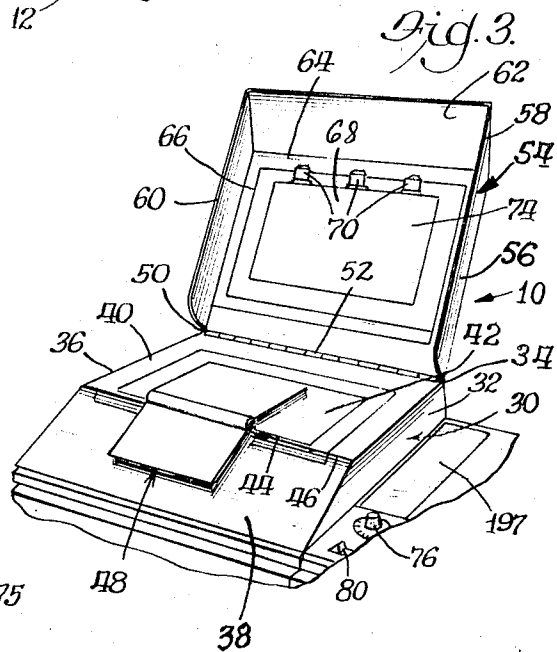
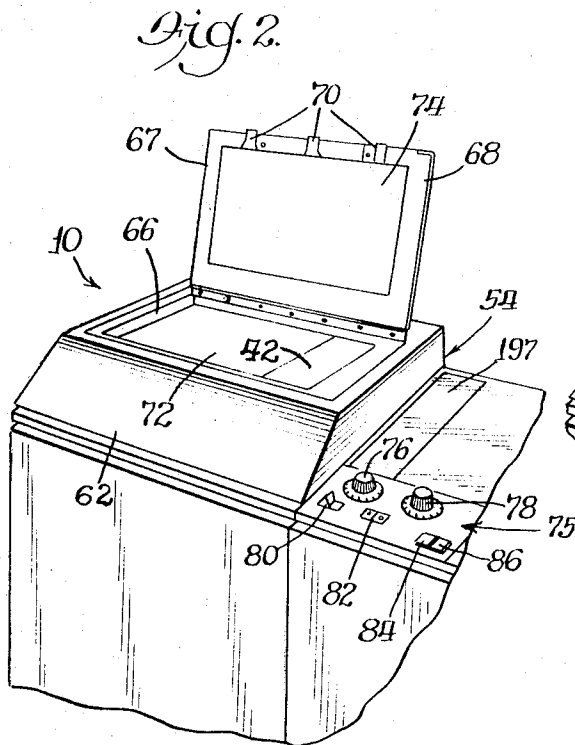
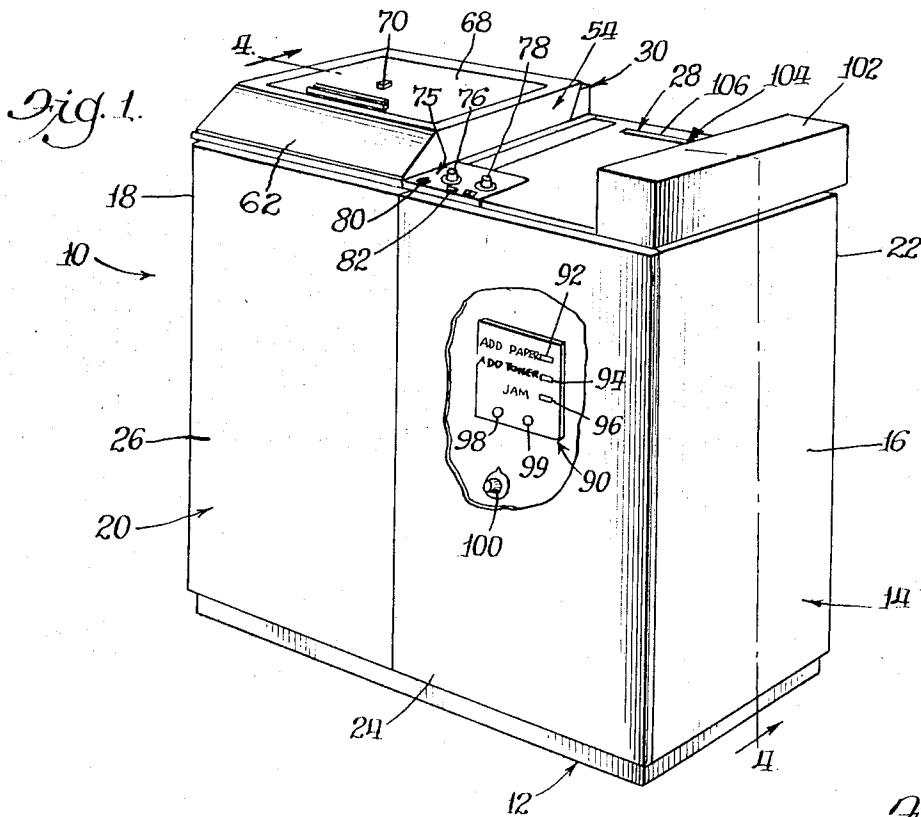
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ABSTRACT

A high speed copying machine for making copies of an original on copy material fed from a roll supply includes cutting, charging, exposing and developing stations disposed along a copy path. A print switch is actuated to operate at least a portion of the copying instrumentalities at the various stations and to initiate the feeding of copy material from the roll supply. A first sensor detects the movement of copy material therepast and in response thereto, discontinues the feeding of copy material from the roll and actuates a cutter in the cutting station to sever a length of copy sheet. A second sensor detects the movement of the severed copy sheet, and in response thereto, operates an original illuminating source for exposing the copy sheet. Manually resettable jam check circuitry monitors the movement of copy material along the copy path and inhibits the operation of the machine if a jam occurs. An opening communicating with the copy path receives pre-cut copy sheets to be processed in the machine. Circuitry actuated when processing pre-cut sheets inhibits the operation of the copy roll feed and cutter.

20 Claims, 5 Drawing Figures





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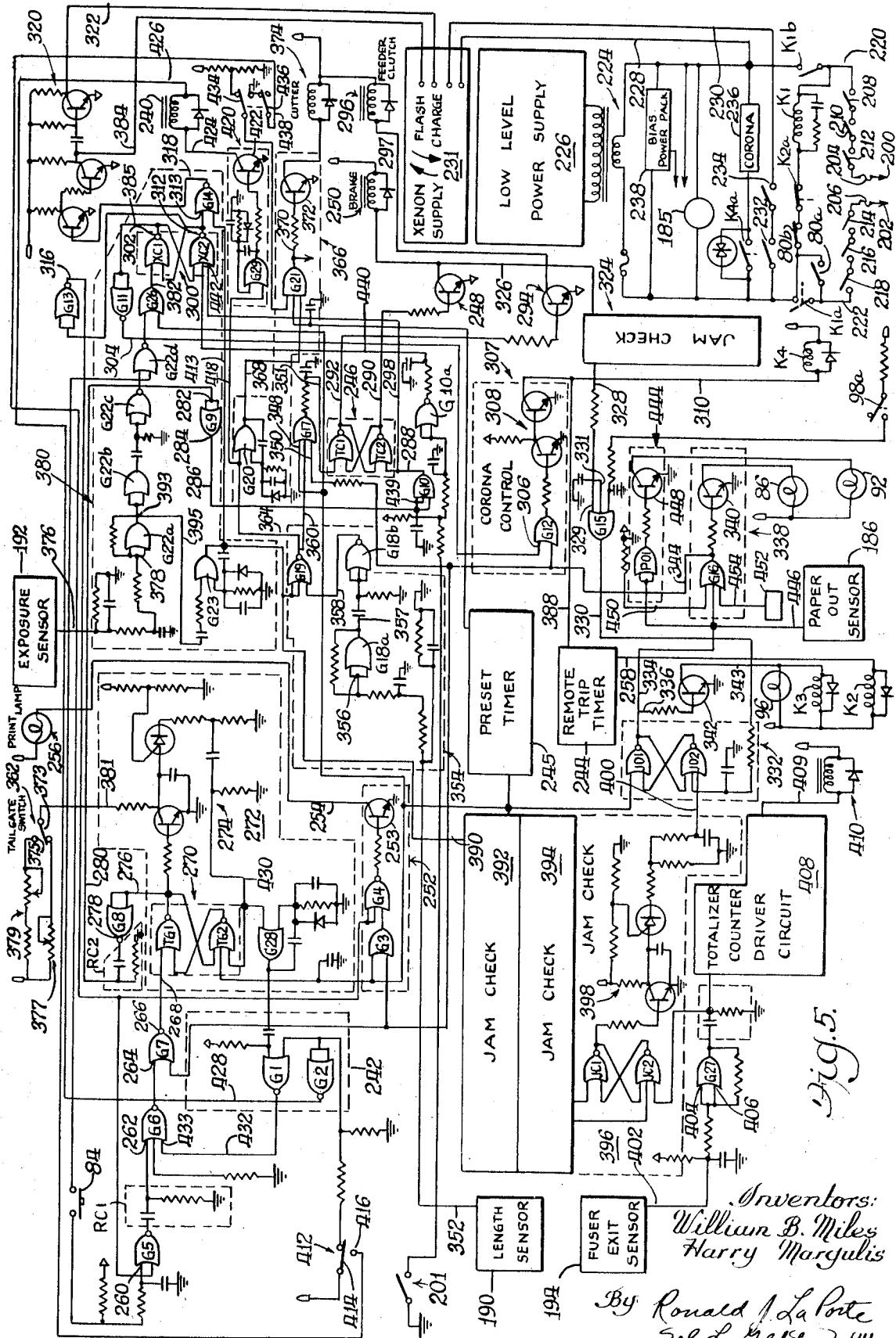


Fig. 5.

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HIGH SPEED PHOTOELECTROSTATIC COPYING MACHINE

BACKGROUND OF THE INVENTION

This invention relates generally to copying apparatus and more particularly to high speed electrostatic copiers.

The technology of making copies of a graphic original electrostatically involves the application of a uniform electrostatic charge in the dark to a photoconductive surface, selectively discharging the surface by exposure to a pattern of light and shadow in accordance with the original being copied to provide a latent electrostatic image, and rendering the latent image visible by applying finely divided electroscopic particles. The latent image can be developed directly on a photoconductive copy sheet or on another surface from which the visible image is subsequently transferred to a plain sheet.

A wide range of copying machines are available to carry out the foregoing operations. Many copiers of the type which develop the latent image directly on a photoconductive copy sheet employ a liquid developing technique. The use of such a technique makes it necessary to wet the copy sheet so as to apply the electroscopic particles, and subsequently to dry the copy sheet with electrical heating equipment provided in the machine, thereby to evaporate the wetness on the sheet and produce ultimately a dry copy.

While the above is a satisfactory developing technique, it is time consuming and tends to limit the number of copies produced in a given period of time. Furthermore, a great amount of heat is required to dry the wet copies. This, in turn requires a considerable consumption of electrical energy, making it necessary to provide high voltage wiring for the machine.

Other machines use, instead of a liquid developer, a dry toner or developer powder. Development through the use of such toner, however, normally requires a fuser which provides heat to the copy sheet causing the toner to melt and adhere or become fixed to the sheet. Such a fusing device uses a considerable amount of electrical energy to produce the heat necessary to melt and fix the toner. Also, a warm-up time is required to bring the fuser to a high enough temperature to begin making copies. Once warmed up, the fuser must be maintained at least somewhat heated to be able to make copies without a further waiting time.

In addition to the above, many of the electrostatic copying machines discharge the photoconductive surfaces of the copy sheets by exposure to incandescent lighting means. The incandescent light provides good exposure of the photoconductive surface, however, the copy sheet must be held in a stationary condition in the illuminating area and exposed for a given length of time in order that the photoconductive surface is adequately discharged by the light source. This too, increases the time cycle for making copies in the machine.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide a new and improved high speed copying machine.

It is another object of this invention to provide a copying machine of the above-described type which can be operated on common 115-volt AC household current.

It is a more specific object of the present invention to provide a high volume electrostatic copying machine which utilizes zinc oxide or the like, coated photoconductive sheets.

It is another object of the present invention to provide a high speed copying machine using a roll of copy material from which manually pre-selected lengths of copy material are severed.

It is yet another object of the invention to provide a copying machine of the above-described type for processing copies of an original, and including sensor means for operating automatically the copy making instrumentalities in accordance with the positioning of the copy material along the copy path.

It is yet another object of the present invention to provide a copying machine including manually resettable jam check

means for monitoring the movement of copy material through the machine and for inhibiting further operation of the machine upon the detection of a jam.

It is still another object of the present invention to provide a copying machine of the above-described type capable of processing pre-cut sheets and during the processing thereof inhibiting the operation of the feeding and severing of copy material from the roll supply.

Briefly, a preferred embodiment of a high speed copying machine according to the invention comprises a housing with a generally uniplanar upper surface. An illuminating station is provided at one end of the housing along a raised upper surface thereof and it includes a transparent glass platen. An integral hinged cover portion and door arrangement is provided along the top wall to permit pages from bound volumes, as well as sheets of original material to be copied easily and accurately on the glass platen. A pair of xenon flash lamps mounted beneath the glass platen within the housing in a specially designed light box configuration provides the light source for a reflected light image which is supplied through an optical system including a reflecting assembly and a lens assembly, to an exposure station disposed in a substantially vertical plane within the housing. Because of the high intensity light given off from the xenon lamp, it need only be operated for a fraction of the time required with an incandescent light source. Furthermore, the copy sheet need not be stopped at the exposure station while being exposed as in the case where an incandescent light source is used.

The exposure station comprises one of the stations along the copy sheet path provided within the housing of the copying machine. Initially, the copy sheet makes up a portion of a roll of photoconductive paper, preferably zinc-oxide coated, mounted for rotation within the housing. The roll of photoconductive paper is passed through a series of rollers and a cutting assembly, and past a movable sensor which selects the length of a copy sheet.

A charging station, including a corona type charging unit, is provided downstream of the cutter assembly and upstream of the exposure station. Thus prior to exposure, the sheet is charged by the corona unit. While continually moving through the exposure station, the severed copy sheet is selectively discharged.

From the exposure station, the copy sheet passes to a developing station. The developing station in a preferred embodiment of the copying machine according to the invention includes a high speed developer of the dry magnetic brush type wherein electroscopic toner particles are transferred from the brush to the imaged areas of the copy sheet. It is to be understood, however, that other types of developers such as, for example cascade, etc., may be used if desired.

Immediately downstream of the developing station there is provided a fusing station which causes the electroscopic toner particles applied to the copy sheet by the developer to be permanently affixed to the sheet. The fuser station includes a pressure fusing device which without the use of heat, and only by the application of a uniform pressure to the copy sheet causes the toner particles to adhere permanently to the paper. The pressure fuser is extremely fast in fixing the toner and because no heating is required as in the case of conventional heat fusers or dryers, no great power consumption is necessary. Consequently, the copying machine according to the invention is operable on common 115-volt AC household current.

In addition to the instrumentalities described there is provided in the copying machine according to the invention, jam detecting sensors and associated circuitry which is effective to indicate copy paper jams occurring during the copying process. Furthermore interlock safety switches are provided at various locations about the copying machine housing to disable the operation of the machine in the event cabinet doors are open, the instrumentalities of the machine are out of normal operating position, etc.

The copying machine according to the invention is further equipped to handle pre-cut copy sheets if desired. Circuitry provided in the machine disables the copy paper roll feeding mechanism upon insertion of a pre-cut sheet into the machine. The copy sheet is processed in the same manner as a sheet cut from the roll.

DESCRIPTION OF THE DRAWINGS

A better understanding of the present invention and its organization and construction may be had by referring to the description below in conjunction with the accompanying drawings wherein:

FIG. 1 is a perspective view of a preferred embodiment of a high speed electrostatic copying machine according to the invention;

FIG. 2 and FIG. 3 are enlarged fragmentary perspective views of the original receiving glass platen of the copying machine of FIG. 1 illustrating in greater detail the hinged door and cover arrangement used in copying single sheets or bound volumes and the like, respectively;

FIG. 4 is a longitudinal cross-sectional view of the copying machine of FIG. 1 taken along the line 4—4; and

FIG. 5 comprises a schematic diagram of the electrical circuitry of a preferred embodiment of a high speed copying machine according to the invention.

DETAILED DESCRIPTION

Referring now to the drawings more in detail, FIGS. 1-3, thereof illustrate a high speed electrostatic copying machine 10 according to the invention. The machine includes a base support 12, a housing portion 14 mounted on the base support 12, including a part of end walls 16, 18 (18 not shown) and a front and back wall 20, 22, respectively (22 not shown). Front wall 20 includes a pair of hinged doors 24, 26 which can be opened for access to the instrumentalities of the machine.

The top or upper wall 28 of the copying machine 10 includes a raised original sheet illuminating station or table 30 (FIG. 3). The raised illuminating table 30 includes three vertically oriented side walls, 32, 34, 36 (34, 36 not being shown in FIG. 3), and in inclined side wall 38. The side walls support a top wall 40 which includes an original receiving window or glass platen 42 (FIG. 3). One edge 44 of the glass platen 42 is coextensive with the upper edge 46 of wall 38 to accommodate a book or bound volume original 48 as shown in FIG. 3.

Attached along edge 50 of upper wall 40 by a hinge 52 (FIG. 3) is a cover portion and door assembly 54 for covering an original being copied on the glass platen 42 to suppress the flash effects of the light and to hold the original against the glass platen.

The assembly 54 includes a cover portion 56 having opposite side walls, 58, 60 an inclined wall 62 attached therebetween and a top wall 64 interconnecting the aforementioned walls. The cover portion 56 is of a size large enough to be closed over raised original sheet receiving table 30 with the walls 58, 60, 62 extending along side respective walls 32, 36, and 38 of the table 30 (FIG. 2). An aperture 66 is provided in the top wall 64 of the cover portion 56 and a hinged door member 68 is provided therein for closing off the aperture. A latch mechanism 70 serves to lock door member 68 in a closed position if desired.

In the case wherein a book or bound volume such as 48 is to be copied, the door 68 is latched and the cover portion is pivoted about hinge 52 to an open position. The book is placed on the glass platen and the other half of the book extending over inclined wall 38. The cover portion 56 is then closed over the book 48 to eliminate light other than that of the illuminating source of the machine.

If a single sheet original, such as 72, is to be copied, the cover portion 56 is positioned over the table 30, and the door 68 is opened as shown in FIG. 2. After the sheet is placed on the glass platen, the door 68 is closed to shield the operator

against the flash generated during the copy cycle, and the copy process can begin. A white or reflective center portion 74 of an area similar to that of the glass platen 42, is provided on the inside surface 67 of door member 68 to aid in illuminating original documents to be copied by reflecting the light from the light source of the machine. The white center portion 74 is especially useful when copying translucent or transparent originals.

Adjacent table 30 along upper wall 28 of the copying machine is an operator control panel 75, best seen in FIG. 2 of the drawings, comprising a first control dial 76 for selecting the copy sheet length desired, an exposure selector control dial 78 for varying the energy provided to the illumination source of the copy machine, an on-off control button 80, a copy number selector dial 82, a print switch or button 84 and a service lamp 86 which indicates the need for attention to the machine.

The last-mentioned service lamp 86 indicates that one of three conditions has occurred in the machine to prevent further operation thereof. In order for the operator to determine which malfunction condition exists, door 24 of machine 10 is opened to reveal another control panel 90, shown in the cut away portion of door 24 in FIG. 1. On control panel 90 there are provided three lamps, 92, 94, 96 and corresponding indicia indicating the function of the lamp. Lamp 92 when lighted indicates the need for additional paper in the machine. Thus, paper must be added before the machine again functions. Lamp 94 indicates the need for the replenishment of toner in the developer of the machine, and lamp 96 when lighted, indicates that a jam has occurred in the machine.

With the jam detection arrangement of the copying machine 10 when a jam occurs, the lamp is lighted. However, after the cause of the jam is corrected, the machine remains inoperative until a jam reset button 98 is depressed. Thereafter the machine is returned to normal operation. The reset button has been provided as a safety measure which requires a positive action by the machine operator subsequent to the curing of a jam to cause the machine to function properly. Another button 99 is provided to manually add toner to the developer of the machine in the event copies are showing less contrast.

Below the panel 90 there is provided a bias control dial 100 which permits an operator to increase or decrease the bias potential in the developer of the machine. The above-described controls will be discussed in greater detail hereinafter when a full description of the operation of the machine 10 is given.

Moving to the right side of top or upper wall 28 of the copying machine 10 as seen in FIG. 1 there is provided a copy sheet outlet or exit, station 102 whereat a completed copy emerges from the machine to be stacked on the top wall 28 in the space 104. A stacking guide 106 is provided in space 104 to aid in stacking completed copies.

Referring now to FIG. 4 of the drawings there is shown the interior of the machine 10, revealing the instrumentalities used in carrying out the copy making process.

At the upper left of the copying machine 10 there is shown the illuminating station 30 including glass platen 42 for receiving an original document to be copied, along with the cover portion and door assembly 54 used to block out external light as well as to shield the operator from the pair of Xenon light sources 108, 110 used to illuminate the original. A light box 112 designed for efficient illumination of the original document is provided below platen 42 in the interior of the machine. An optical system including a lens assembly 114 communicating with the interior 116 of the light box is provided for projecting an image of the original to a copy sheet exposure station 118. A mirror 120 included in the optical system mounted at approximately a 45° angle beneath lens system 114 and in optical alignment between the lens system and exposure station 118 is employed to reflect an image of the original projected by the lens assembly to sensitized copy material 119 moving past exposure station 118.

A roll 120 of sensitized copy material 119 is positioned in container 122 on a spindle 123 provided thereon at the upper right hand corner of the machine just beneath upper wall 28, as seen in FIG. 4. Copy material 119 from the roll passes from container 122 via feed rollers 124, 126 along copy paper path 127 through cutter station 128 whereat there is included a rotary cutter assembly 130 used to sever selected lengths of copy sheets from the roll 120.

Downstream of cutter station 128 along the copy paper path is a pair of feed rollers, 132, 134, used to carry sensitized copy material 119 through charging station 136. Charging station 136 includes a double corona charging unit 138 which effectively charges the sensitized copy material as it is moved therepast prior to the selective discharging thereof in exposure station 118.

A sensitized copy sheet 121 after being severed from the roll of copy material 119 is carried through exposure station 118 by means of belts 140 which are carried in an anti-clockwise direction as shown in FIG. 4 about rollers 144, 149. A vacuum plenum 148 provided behind the moving belts, 140, serves to cause a reduction in pressure along the surface of the belts in exposure station 118 so that the now severed sensitized copy sheet 121 is held flat against belts 140 as it is imaged. The copy sheet is imaged while being moved through exposure station 118 without stopping.

As the imaged copy sheet leaves exposure station 118 its direction is changed by means of belt arrangement 150, to be carried past the developer station 152 of the copying machine. The belt arrangement 150 includes belt member 151, so that the charged surface is engaged by the surfaces of the belt members. At developer station 152 there is provided a high speed magnetic brush developer assembly 154, capable of developing copy sheets at the speed of approximately 60-70 feet per minute. Feeder roller pairs 156, 158 are employed to carry the imaged copy sheet past the developer whereat toner particles are attracted to charged areas thereon.

After the toner particles have been applied to the imaged copy sheet paper at developer station 152, the developed copy sheet is carried through fuser station 160. At fuser station 160 there is provided a highly efficient, extremely fast fixing, fuser device 162 which uses only pressure (no heat) to fix the loose toner particles adhering to the charged areas of the copy paper. The fuser device includes a pair of roller members, 163, 165, mounted in relatively high pressure driving engagement with respect to each other. The pressure is applied by means of coil spring member 167. A developed copy sheet 121 is transported between the roller members, the pressure applied by the rollers rapidly and efficiently causes the fixing of the toner particles to the surface of the sheet.

The use of such a fuser device plays an important part in the speed at which copies can be made in the copying machine according to the invention. Furthermore, because there is no heat requirement, the machine consumes far less energy and can operate on conventional household current. For a more detailed description of a fuser device of the type shown in FIG. 4, reference should be made to copending patent application, Ser. No. 694,515 now abandoned assigned to the same assignee.

Subsequent to passing through the pressure fuser device 162 in fuser station 160, the completed copy sheet is channeled via guide member 164, 166 to the nip 168, of a pair of endless belt feeders 170, 172 mounted for movement about respective rollers 174, 176, and 178, 180. The completed copy sheet is sandwiched between the moving belts and is carried upwards in the direction of arrow 182, to the exit 184 of exit station 102 whereat the sheets are delivered to area 104 provided to receive completed copies, along top wall 28 of the copying machine 10.

It should be noted that the copy material is transported along the copy paper path 127, through the copying machine 10 at slightly increasing speeds as it passes from station to station. The progressive, slight increase in speed of the paper prevents buckling as the latter passes to a subsequent

processing station. A single drive motor 185 supplies the power to the rollers and belts transporting the copy material along the copy path. Gear arrangements (not shown) are provided to alter the speeds as described. Belts 140, feed rollers 132 and 134, belt arrangement 150 and belts 170, 172 are operated continually. The operation of feeder rollers 124 and 126, however, is controlled through circuitry to be described hereafter.

There are provided in copying machine 10, along copy paper path 127 sensors for monitoring the paper as it passes therealong to ensure efficient operation of the machine.

Just prior to feed rollers 124, 126, upstream of cutter station 128, whereat the leading edge of the roll of sensitized copy paper 119 is normally positioned, there is provided a sensor 186 for indicating the presence of copy material. In the event the paper is depleted from roll 120, the sensor 186 causes lamp 92 (FIG. 1) as well as lamp 86 (FIG. 2) to be lighted. Furthermore, the operation of the instrumentalities of the machine are inhibited until such time as the paper is replaced.

Downstream of the charging station 136 there is provided a copy sheet length sensor 188 which is manually movable in a predetermined vertical path 190, adjacent exposure station 118, by means of control knob 76 discussed heretofore. As will be explained in greater detail hereinafter, the positioning of the length sensor determines the length of copy sheet 121, cut from the roll 120 of copy paper 119.

The length sensor 188 serves another purpose also. Upon the depression of the print button 84 (FIG. 2) to initiate the copying cycle, including the feeding of copy paper from its normal position along the copy paper path, a failsafe timing circuit jam check is energized. The timing circuit, which will be described in greater detail hereinafter, once energized, times out for a predetermined time period sufficient to permit the movement of the leading edge of the copy paper from its normal position to sensor 188. If the paper reaches sensor 188, prior to the "timing-out" of the timing circuit, the copying cycle proceeds normally. On the other hand, if the copy paper should be detained for any reason without reaching the sensor 188 and the timing circuit "times-out," a jam is indicated at service lamp 86 and lamp 96, and the copy making instrumentalities of the machine are automatically shut down. Because the sensor 188 is movable toward and away from the normal position of the leading edge of copy paper 119, the timing circuit time-out period is sufficiently great to permit the copy material to reach sensor 188 at a point farthest from the initial position of the copy material, thus ensuring the normal movement of the copy material without a false jam alarm.

Further along the copy paper path 127 near the exit of exposure station 118, there is provided an exposure sensor 192. Sensor 192 is used to monitor the movement of the leading edge of a severed, charged copy sheet 121, proceeding along the copy paper path 127. Upon sensing the leading edge of a copy sheet 121, illumination of the original document and exposure of the copy sheet takes place. The copy paper is exposed while being moved through exposure station 118.

In addition to causing the exposure of the copy sheet to take place, second multi-stage jam check circuitry is actuated. The jam check circuit cumulative time out period is sufficient for an exposed copy sheet exiting the exposure station to pass through developer and fusing stations 152, 160 respectively, and emerge from the latter station at the entrance to the exit feed belts 170, 172. Located at the fuser exit is a fuser exit sensor 194. If the copy paper passes from the exposure station through the developer and fusing stations and reaches sensor 194 prior to the timing out of the jam check circuitry, actuated when the paper passed sensor 192, the circuitry is interrupted and the paper continues to pass into the nip of belts 170, 172. On the other hand, if the paper, for some reason (jam, etc.) does not reach the sensor 194 within the "time-out" period, then a jam signal is provided and the operation of the feed rollers and copy processing instrumentalities is discontinued.

Once safely past the sensor 194, the completed copy sheet 121 is carried out of the machine at exit 184, and is stacked on the upper wall 28 in the area 104 provided therefor.

A more detailed description of the sensor and timing circuit arrangements will be given hereinafter when discussing the circuitry of copying machine according to the invention illustrated in FIG. 5.

FIG. 5 illustrates a preferred embodiment of the circuit diagram for a high speed copying machine according to the invention wherein conventional symbols are used to identify the various logic gates employed in the circuit, i.e., is an "OR" gate is a "NOR" gate, and is an "AND" gate.

Referring to the lower right hand corner of the circuit diagram, there is shown the input terminals 200, 202, each connected through a respective circuit breaker or fuse 204, 206, to a 115-volt, AC source (not shown) for powering the circuit.

A plurality of interlock switches 208, 210, 212, 214, 216, and 218, is provided to ensure that the instrumentalities of the machine are positioned correctly before the machine will function. When all stations of the machine are in a normal operational condition, and the exterior doors of the machine are closed, the above-mentioned switches are also closed, so that current flows via leads 220, 222.

Connected between lines 220, 222 are the contacts 80a, 80b of on-off switch 80 (FIG. 2). The momentary operation of switch 80 closes normally open contact 80a to in turn energize relay K1 through normally closed contact 80b and normally closed contacts K2a of the remote trip relay K2 to be discussed hereinafter. The energization of relay K1 closes relay contacts K1a, K1b to provide power via transformer 224 to low level power supply 226. A holding circuit through contacts K1a and normally closed on-off switch contacts 80b maintains relay K1 operated so that power continues to be provided to the power supply 226. Another momentary actuation of switch 80 causes normally closed contacts 80b to open, shutting down the machine.

Also connected to 115-volt power leads 220, 222, via leads 228, 230, is the Xenon supply 231 which supplies power to lamps 108, 110 (FIG. 4) during exposure. A pair of interlock switches 232, 234, connected to lead 230, ensures the operational preparation of the xenon supply 231 before power can be supplied thereto.

A corona supply unit 236 used to power the corona charging unit 138, (FIG. 4) is connected across the 115-volt leads 220, 222, through a relay contact K4a of corona control relay K4. In addition, motor 185 (FIG. 4) which drives the copy material transport rollers and belts (FIG. 4) is connected between the 115-volt power supply leads 220, 222. A bias power pack 238 likewise is connected to the power lead 220 to provide a bias potential in the developer station 152 (FIG. 4).

It is to be understood that the low level power supply 226, powered through transformer 224 provides low level operating voltages on the order of +5 volts and +27 volts to the copying machine circuitry at various locations (not shown), through standard filter networks (not shown).

The circuitry of copying machine 10, includes a print button or switch 84 (FIG. 2) for initiating the copy process. For single copies, the switch 84 must be depressed each time a copy is to be made. In the event many copies of an original are to be made, the copy number selector 82 (FIG. 2) is dialed to the number of copies desired, and the count down counter 240 (FIG. 5) counts off one digit after the processing of each copy. To initiate the copying process for each copy during the multiple copy mode, there is provided a multiple copy enabling gate arrangement 242 (FIG. 5) including gates G1 and G2. This will be discussed in greater detail hereinafter.

Upon actuation of the on-off switch 80 to supply power to the copying machine circuitry, the remote trip timer 244 and the preset timer 245 shown in FIG. 5 in block form, each of which includes the usual timing circuit components known in the art, are supplied power from power supply 226. The timers 244, 245 immediately begin "timing out." The preset timer "

time out" period is approximately 0.6 second. During this brief period, the logic of the machine circuitry is set at a normal state and made ready for operation. The copy paper transport control register 246 including gates TC1, TC2, is set to its normal state which in turn operate transport brake transistor driver 248. The last-mentioned transistor driver causes the copy roll brake 250 to be energized, thereby to prevent the movement of copy paper roll 120 (FIG. 4). The print light control and driver circuitry 252, including gates G3, G4 and transistor 253, and energizer via lead 254 print lamp 256, indicating the machine is ready to accept a copy command.

If no print command is given the copying machine, within approximately 25 seconds, the "time out" period for the remote trip timer 244, the last-mentioned timer via lead line 258, causes remote trip relay K2 to be energized. The energization of relay K2 opens contacts K2a in the holding circuit for relay K1, to in turn deenergize the last-mentioned relay and open contacts K1a, K1b, thus preventing power from the AC source from operating the power supply 226 and the copy machine circuitry. To operate the machine, on-off switch 80 must be reactuated.

In the event a print command is given to the machine, prior to the remote trip timer 244 timing out, whereby print button 84 is depressed the machine proceeds as follows to produce a copy of an original positioned on the original sheet receiving table 30 (FIG. 3) along the top wall of the machine.

Upon depression of button 84, a pulse is received at the input 260 of gate G5. The output of gate G5 passes through RC network RC 1 to provide a position pulse at the input 262 of gate G6, which in turn provides a pulse to gate G7 at the input 264 thereof. A pulse at the output 266 of gate G7 is sent via lead 268 to the tailgate register 270, including gates TG1 and TG2, of the tailgate register and timer circuitry 272, (shown in dotted lines). The register 270 changes states to begin the "timing out" of the timer portion 274 of the circuitry. The change of state in register 270 causes, via lead 276, gate G8 to supply a pulse at the output 278 thereof. The pulse emanating from RC circuitry RC2 which is approximately of an 80 micro-second duration, travels over lead 280 to the input 282 of gate G9 and in turn from the output 284 thereof, along lead 286 to gate G10. An output from gate G10 over lead 288 changes the state of transport control register 246. A resulting signal over lead 290, renders transport brake driver 248 non-conductive and releases copy roll transport brake 250. The change of state of register 246 also causes, via lead 292, transport clutch driver transistor 294 to become conductive, operating roll feeder clutch 296 over lead 297 to begin the feeding of copy paper from roll 120 (FIG. 4).

The output from gate G10 also provides, over lead 298, an operating signal to xenon and corona control register 300 including gates XC1, XC2. The changing of the state of register 300 accomplishes three things: (1) a signal is sent from the output 302 of gate XC1 through gate G11 and over lead 304 to the input 306 of gate G12 of the corona control circuit 307. The output of gate G12 operates transistor relay driver circuitry 308 to energize relay K4 over lead line 310. The operation of relay K4 closes contacts K4a to operate the corona supply unit 236; (2) a signal from the output 312 of gate XC2 is sent via lead 314 to gate G13. The output of gate G13 is carried over lead 316 to the input of gate G4 in the print lamp driver circuitry 252 to in turn, turn off the print lamp 256 indicating a copy is being processed; (3) a signal from the output 312 of gate XC2 is established at the input 313 of gate G14 and the output of the last-mentioned gate provided over lead 318 to the xenon control transistor circuit 320 causes, via lead 322, the charging of xenon supply 231.

When the copy roll transport control register 246 changed states to begin feeding copy paper from roll 120 (FIG. 4), a failsafe timer mechanism or jam check 324 also was energized over lead 326 from the output of transistor driver 248. The function of the jam check 324 is to ensure that the moving copy paper from roll 120 reaches the paper length sensor 188 provided along the copy paper path of the copying machine

(FIG. 4) without jamming. The "time out" period of jam check 324, is such that copy paper traveling at the normal speed of the machine can reach the farthest possible setting of the length sensor 188 along the copy paper path 127 (FIG. 4).

In the event the copy paper gets jammed in the machine between its normal idle position, at the entrance to cutter 130 (FIG. 4), and the length sensor, the machine is stopped from further operation to prevent further jamming etc. In fact, if the jam check 324 "times out" before the copy paper reaches length sensor 188 which preferably includes a photo responsive or the like device, a pulse appears at lead 328 and at the inputs 329, 331, to gate G15. The output from gate G15 carried over lead 330 causes the changing of state of the jam detecting register 332 including gates JD1, JD2. An output signal from JD1 via leads 334, 336, respectively, causes malfunction detector circuitry 338, including gate G16 and transistor driver 340, to operate the service lamp 86 (FIG. 2) and transistor driver 342 to operate via lead 343, jam lamp 96 (FIG. 1 and energizes the normally deenergized manual jam reset relay K3).

The output of gate G16 is also connected via lead 344 to the input of gate G12, and inputs 348, 350 of gate G17 which in turn is connected via lead 351 to the input of gate TC1 of the transport control register 246. Signals via the last-mentioned leads, serves to disable the feeding of copy paper from roll 120, resetting transport control register 246, to actuate brake 250 and deactuate feeder clutch 296, and the operation of corona supply 236, respectively. Once a jam is cured, manual reset button 98, which operates switch 98a (FIG. 5) must be reset to once again reset relay K3. The latter must be done before the copying machine instrumentalities are functional.

If no jam occurs and the copy paper from roll 120 reaches the pre-positioned length sensor 188 prior to the "timing out" of jam check 324, when the leading edge of the copy paper is sensed by length sensor 188, a pulse is provided thereby along lead 352. The pulse is received at the length sensor circuit 354 at the input 356 to gate G18a which in turn provides an output signal via lead 357 to gate G18b. A pulse from the output of gate G18b along lead 358 is provided at the input of G19. An output signal from gate G19 provides, in turn a signal along lead 360 to gate G17 which causes transport control register 246 to be reset, via a signal along lead 351 to the input of gate TC1. The last-mentioned occurrence stops the feeding of roll feeder clutch 296 and applies brake 250. Simultaneously with the cessation of the feeding of copy paper by feed rollers 124, 126 (FIG. 4) (20 milliseconds later) the output signal from gate G19 is carried over lead 364 to gate G20 of the cutter control circuit 366, shown in dotted lines. An output signal from gate G20 over lead 368 to gate G21, causes an output pulse over lead 370 from the last-mentioned gate to cause transistor driver 372 to conduct and operate cutter solenoid 374. The cutter 128 (FIG. 4) is rotated to sever a copy sheet 121 (FIG. 4) of a predetermined length from copy paper roll 120. In addition to actuating the cutter, the timing arrangement of jam check 324 is disabled so as not to indicate a jam condition. The signal which rests the jam check circuit is conveyed to jam check 324 via lead 326 from transport brake transistor driver 248. During the previously described occurrences, tailgate timer circuitry 274 continues to "time out."

As the copy paper passed through the corona charging station 136 which was operated upon initiation of the copy making process it was charged. The now severed copy sheet 121, carried by the continually operated belts 140, proceeds toward sensor 192 (FIG. 4) to cause the exposure of the copy sheet as it moves through exposure station 118. From the time subsequent to the cutting of copy sheet 121 from copy roll 120, to the time the sheet reaches sensor 192, tailgate timer circuitry 274 times out and the tailgate register 270 is reset.

The "time-out" period for the tailgate timer 274 varies, depending upon the copy sheet length selected; i.e., by the positioning of length sensor 188. In every case, however, the "time-out" period is greater than the length of time it takes for the copy paper to reach the length sensor 188. For a copy

sheet length less than 12 inches, the time-out period is approximately 1.2 seconds. For a copy sheet length greater than 12 inches, the "time-out" period is increased to approximately 1.8 seconds. This is accomplished when the copy length selector knob 76 (FIG. 2) is moved to the desired length. Connected to the shaft of the manually operable knob 76 is a tailgate switch 362. At a length setting less than 12 inches switch 362 is in the position shown in FIG. 5. At a length setting greater than 12 inches, the switch armature 373 is moved upwardly as shown in the figure, to contact 375. At the two settings a resistance circuit 377 or 379, as the case may be, is incorporated via lead 381, into the tailgate timer circuit 274, thereby to alter the "time-out" period thereof. The "time-out" periods are selected to maintain a predetermined distance between and thereby prevent the overlapping or successive copy sheets along the copy paper path of the copying machine according to the invention during the multiple copy mode. This will be explained in more detail hereinafter when discussing the multiple copy mode.

When the leading edge of the severed copy sheet 121 (FIG. 4) reaches exposure sensor 192, a signal emanating therefrom is sent over lead 376 to the input 378 of the first of a series of gates, G22a, G22b, G22c, G22d, G26, included in the exposure sensor circuit 880. A signal developed at the output 382 of gate G26 resets xenon corona control register 300, causing, via xenon control circuit 320 and lead 384, the xenon supply to flash, exposing the copy sheet passing through exposure station 118. At the same time due to the resetting of register 300, a signal is carried over lead 385 to gate G11 and from there via lead 304 to the input 306 of gate G12 of the corona control 307 to in turn deenergize relay K4, turning off the corona control 236 and charging unit 138 (FIG. 4). In addition, a signal via gate G13, serves to relight the print lamp 256 indicating to the operator that another copy can be processed. Simultaneously with the operation of print lamp 256 the remote trip timer 244 is actuated over lead 388 to begin "timing out."

The pulse developed when the copy sheet 121 tripped the exposure sensor 192, also causes a pulse at the output 393 of gate G22a. This pulse is carried over lead 395 to gate G23 whereat an output therefrom is produced and carried via lead 390 to the input of a series of jam check circuits 392, 394, 396. Each of the jam check circuits includes a register, such as that shown for jam check 396, comprising gates JC1, JC2, and timer circuitry, such as 398. The jam checks 392, 394 have been illustrated in block form for simplicity and to avoid duplication of structure. The pulse via lead 390 sets the register (not shown) of jam check 392 and starts the timer circuitry thereof "timing out." The jam checks 392, 394, 396, operate consecutively to check for the jamming of copy sheets between the exposure sensor 190 and the fuser exit sensor 194, (FIGS. 4 and 5).

Subsequent to the "timing out" of the timer circuitry of jam check 392, the register thereof is reset, and it in so doing sets the register of the subsequent jam check 394. The last-mentioned jam check 394 in turn "times out" and thereafter sets the register of jam check 396. The provision of a series of jam checks operated consecutively permits the monitoring of several copy sheets in close succession along the copy paper path between the exposure sensor 192 and fuser exit sensor 194.

In the event a jam occurs between sensors 192 and 194, a signal is provided via lead 400 from jam check 396 to gate JD2 of the jam detection register 332 to change the state thereof and operate the jam lamp 96 and energized manually resettable relay K3. At the same time, through gate G16, the malfunction lamp 86 is lighted indicating a jam has occurred. A signal via lead 344 to the input 348 of gate G17, to the transport control register 246, stops the further feeding of copy paper from roll 120 by actuating brake 250 and deactuating feeder clutch 296.

If no jam occurs and the sheet reaches fuser exit sensor 194 safely, a signal emanating from fuser exit sensor 194, carried along lead 402 to the inputs 404, 406 of gate G27, serves to

actuate totalizer circuit 408 to in turn via lead 409 operate totalizer counter 410. The last-mentioned counter totals the number of copies made by the copying machine 10 according to the invention, and may be used for billing purposes, etc.

During the course of travel of copy sheet 121 between exposure sensor 192 and fuser exit sensor 194, the copy sheet is developed at developer station 152 (FIG. 4) by the application of toner powder to the electrostatic image formed on the copy sheet at exposure station 118, and to toner powder is affixed to the copy sheet 121 in the fuser station 160 (FIG. 4) by pressure fuser device 162 provided therein.

Upon reaching the fuser exit sensor 194, the leading edge of copy sheet 121 enters the nip of rotating belts 170, 172. The copy sheet is held between the moving belts and carried thereby upwardly toward the exit station 102 of the copying machine to the deposited ultimately in a stack at the top of the copying machine (FIG. 4).

The remote trip timer which was started earlier, "times out" if no further copy processing command is given machine 10, to turn off the machine as described heretofore.

In the case of multiple copies of an original being processed by the copying machine, the operator selects by means of copy number selector 82 (FIG. 2), the number of copies desired. The copying process is initiated in the same manner as in the single copy mode, and the first copy is made as described above. However, when a single copy is requested, an inhibit signal from gate G28, connected to the tailgate register 270, is applied to the multiple copy enabling gates G1, G2. Thus, no signals can be transmitted to the last-mentioned gates and only one copy can be made. On the other hand, in the multiple copy mode, the count-down counter is set at a number greater than zero. Furthermore, the multiple copy request switch 412 is placed automatically in an operated condition so that armature 414 thereof makes contact with contact 416. Thus, each time the cutter control gate G20 is actuated, a pulse is sent via lead 418 to the input of gate G29 of the count-down control 420. Transistor driver 422 of the last-mentioned control operates count-down counter 240 via lead 424. This takes place until the count-down counter reaches a zero setting. When this occurs, switch 412 is returned to a normal condition.

During the multiple copy mode, the xenon and corona control register 300 remains in a set state and the print lamp remains unlighted through the processing of the number of copies selected. The signal provided to flash the Xenon supply each time a copy is exposed emanates from gate G23 upon the copy sheet being sensed at exposure sensor 192. The signal is carried over lead 413 to the input of gate G14, which in turn via lead 318, and circuitry 320 causes the xenon supply to flash. In addition, the remote trip timer 244 is prevented from timing out until the corona control is unoperated, since the last-mentioned timer is controlled thereby over lead 388.

The removal of the inhibit on the print line permits a pulse to be generated each time the tailgate timer circuitry 274 "times out." The pulse traveling over lead 430 to gate G28 provides a pulse to gate G1 of the multiple copy enabling gates. Gate G1 in turn generates a print pulse over lead 432 to the input 433 of gate G6 to reset the tailgate register 270 and beings the timer circuitry 274 operating again. This occurs for each of the selected numbers of copies, until the last copy is made.

As mentioned heretofore, the distance between copy sheets in the multiple copy mode is determined by the "time-out" period of the tailgate timer circuitry 274. The "time-out" period is variable in accordance with the movement of the copy length selector knob 76. Thus, for relatively long sheets, (i.e., greater than 12 inches) a print pulse is provided by the tailgate circuitry approximately every 1.8 seconds until the last of the selected number of copies is made, and for sheets less than 12 inches in length, a print pulse is provided approximately every 1.2 seconds. Since the transport register is reset to stop the feeding of copy material when the copy material reaches the length sensor, prior to the "timing out" of the tail-

gate timer, (i.e., less than the "time-out" period) a safe distance is provided between successive copies, and no overlapping of sheets occurs.

The copying machine according to the invention is equipped to handle pre-cut copy sheets or offset-masters as well as roll fed copy paper from roll 120. In the case wherein it is desired to process copies on pre-cut copy sheets, manual in-feed door 197 (FIGS. 2, 3, and 4) is opened so that the pre-cut sheets may be fed through a paper directly into the copy paper path of the machine. Upon opening door 197, switch contacts 434, 436 (FIG. 5) are operated to inhibit the operation of cutter 374. Also, via lead 438 the print switch is disabled so that an inadvertant actuation of the print switch causes no operation of the machine.

When the pre-cut sheet is inserted, the manual bypass switch 201 causes a signal from gate G10a to be transmitted via lead 440 to the input 442 of gate XC2 of xenon and corona control register 300, and the remote trip timer 244 is disabled. The register changes states causing xenon supply 231 to charge corona unit 236, to "turn on" for the charging of the pre-cut sheet and to turn the print lamp 256 off. The last-mentioned register remains set until the lead edge of the pre-cut sheet reaches exposure sensor 192. In the time prior to reaching exposure sensor 192 the sheet is charged-up by passing through charging station 136 (FIG. 4).

Upon the lead edge of the sheet reaching exposure sensor 192, the xenon and corona control register 300 changes states, causing the corona unit 236 to cease functioning, the xenon supply to flash exposing the pre-cut copy sheet via the optical system lens 114 (FIG. 4) to image the sheet, and the print lamp 256 turns on. In addition, the remote trip timer 244 is operated to begin timing out. Furthermore, the jam checks 392, 394, 396 are actuated via lead 390 to ensure the safe, jam-free passage of the copy sheet from the exposure station 118 to the fuser exit sensor 194 (FIG. 4). The latter is accomplished in the manner described earlier for a copy sheet severed from the roll 120 of copy material.

The copying machine 10 according to the invention, as mentioned earlier, is also equipped with an out of paper detector 444 operated by paper out sensor 186 (FIGS. 4 and 5). Sensor 186 provides a signal along lead 446 to gate PO1 of the out of paper detector 444. An output signal from the last-mentioned gate serves to place transistor driver 448 in a conductive state. The transistor driver 448 in turn operates the add paper lamp 92. The signal along lead 446 serves also to provide at input lead 450 of gate G16 to the malfunction detector 338 to, in the manner described heretofore, light service lamp 86 on the top wall of the copying machine. In addition to lighting the lamps, an output from gate G16 along lead 344 resets the xenon and corona control register 300, to prevent operation of the corona unit 236 and the xenon supply 231. The transport register 246 is also reset, preventing operation of feeder clutch 296 which controls the movement of roll 120, etc. In addition, print lamp 256 is maintained in an off condition, and the print switch 84 is locked out and prevented from being operated.

An out of toner sensor 452 is included in the developer station 152 (FIG. 4) to indicate the depletion of toner mixture therefrom. Upon detecting the lack of toner material, a signal is generated at lead 454 to gate G16, shutting down the operation of the copying machine in the manner described above in the case of the out of paper detector 444. In addition, service and add toner lamps, 86, 94, (not shown in FIG. 5) respectively, are lighted.

Also, included in the developer station 152, but not shown or described herein, is an arrangement for maintaining the amounts of toner powder and carrier particles at a constant ratio to provide optimum print density, etc. A detailed explanation of such an arrangement may be found in U.S. Pat. No. 3,399,652.

Thus there is provided by the instant invention, a copying machine for processing at a relatively high speed (on the order of 60-70 feet per minute) copies of an original document.

Through the utilization of xenon lamps in the illumination of an original to expose copy sheets as they pass through the exposure station as well as pressure fusing, the copy machine is able to process a copy with substantially no stoppage thereof. Because of the pressure fusing arrangement which requires no heat for fusing toner material to the surface of a copy sheet, the machine may be operated on household current and requires no warm-up period prior to processing copies.

While a particular embodiment of the copying machine according to the invention has been shown and described, it should be understood that the invention is not limited thereto since many modifications may be made. It is therefore contemplated to cover by the present application any and all such modifications as fall within the true spirit and scope of the appended claims.

What we claim is:

1. In an apparatus for making copies of an original on copy material comprising: copy handling means including:
 - a charging station equipped with charging means,
 - an exposing station;
 - an illuminating station including a xenon illuminating source directed at an illuminating area for irradiating an original
 - and a developing station, at spaced locations along a material processing path,
 - a copy material supply, transport means for feeding copy material from said supply into said path,
 - first means for operating at least a portion of said copy handling means including the activation of said transport means to start the feeding of the copy material into said path,
 - second means for detecting the arrival of copy material disposed along said copy material path in the vicinity of said exposure station,
 - control circuit means interconnecting said first and second means for placing said copy handling means in an operative condition responsive to the actuation of said first means and for energizing said xenon source responsive to the arrival of said copy material at said exposure station as detected by said second means for imparting an image to said copy material,
 - and third means movably positioned between said first and second means for deactivating said transport means to stop the feeding of said copy material into said path upon detecting the arrival of said copy material.
2. An apparatus as claimed in claim 1 wherein said control circuit is further operable in response to the sensing of said copy material by said second means to discontinue the operation of said charging means.
3. An apparatus as claimed in claim 1 wherein said illuminating source is provided with power supply means, said power supply being operable to a first charging condition, whereby energy to operate said xenon light source is stored in said power supply, and to a second discharge condition, whereby said energy is dissipated through said xenon light source to produce a momentary flashing thereof, and wherein said power supply means is operated to said first condition upon the actuation of said first means and to said second condition upon the sensing by said second means of the arrival of said copy material at said exposure station.
4. Apparatus as claimed in claim 1 wherein said first means includes a manually operable switch.
5. In an apparatus for making copies of an original on copy material, comprising:
 - a copy material supply including a roll of copy material; copy material transport means for feeding copy material from said supply along said path; copy handling means including:
 - a cutting station including cutting means for severing lengths of copy material from said roll, a charging station equipped with charging means, an exposing station and a developing station;
 - switch means for operating at least a portion of said copy handling means;

- sensor means mounted along said copy material path at a predetermined location for detecting copy material as the latter is moved along said copy path past said location;
- jam check means for monitoring the movement of said copy material from said supply to said sensor means including timer means having a predetermined time-out period of a duration sufficient for said copy material to be transported normally from said supply to said sensor means;
- and control circuit means interconnecting said switch means, jam check means and sensor means, said control circuit means being operable in response to the actuation of said switch means to initiate operation of said copy material transport means, thereby to start the feeding of copy material from said supply and to operate said jam check timer means to begin said predetermined time-out period, said control circuit means further being operable in response to the arrival of said copy material at said sensor means within said predetermined time-out period to discontinue the operation of said copy material transport means to thereby stop the feeding of copy material from said supply, to cause said cutting means to be operated to sever a length of copy material from said roll and to discontinue the operation of said jam check timer means.
- 6. Apparatus as claimed in claim 5 further including manually operable copy material length selector means for adjusting the location of said sensor means along said copy material path.
- 7. Apparatus as claimed in claim 5 wherein said jam check means includes means for providing a signal in the event said copy material fails to arrive at said sensor means within said predetermined time-out period, and wherein said control circuit is responsive to said signal to prevent further operation of said copy material transport means.
- 8. Apparatus as claimed in claim 5 wherein said copy material transport means includes feeder rollers and feeder clutch and brake means connected to said feeder rollers, said feeder clutch and brake means each being energizable and deenergizable for operating said feeder rollers, said feeder clutch means being energized and said brake means being deenergized upon the actuation of said switch means to begin the feeding of copy material and said feeder clutch means being deenergized and said brake means being energized upon the detection of the arrival of said copy material by said sensor means to discontinue the feeding of copy material and wherein said jam check means is coupled to said brake means for operation in accordance therewith.
- 9. Apparatus as claimed in claim 5 further including means for providing a light image of said original to said copy material at said exposure station including a light source operable to illuminate said original and means to project an image of said original to said exposure station, second and third sensor means, said second sensor means positioned in the vicinity of said exposure station and said third sensor means positioned downstream of said developing station along said copy path, and second jam check means for monitoring the movement of said copy material between said second and third sensor means, said second jam check means including timer means having a predetermined time-out period of a duration sufficient for said copy material to be carried normally from said second sensor means to said third sensor means, said timer means being operable to begin said time-out period upon said copy material arriving at said second sensor means, and the timing-out of said timer means being interrupted upon said copy material being detected at said third sensor means within said time-out period.
- 10. Apparatus as claimed in claim 9 wherein said light source is operated to illuminate said original thereby to provide a light image thereof at said exposure station upon the arrival of said copy material at said second sensor means.
- 11. Apparatus as claimed in claim 9 wherein said third sensor means includes means operable in the event said copy material fails to arrive at said third sensor means within the time-out period of said second jam check means to prevent further operation of said copy material transport means.

12. In an apparatus for making copies of an original on copy material comprising

- copy handling means including copy material cutting, charging, exposing, developing and fixing stations spaced consecutively along a path for processing copies,
- a copy material supply including a roll of copy material and first copy material transport means for feeding copy material from said supply into said path towards said exposure station,
- second copy material transport means for carrying said copy material through said exposure station,
- said exposure station including an exposing area, said charging station including charging means for applying an electrostatic charge to said copy material and said cutting station including cutting means for severing predetermined lengths of copy material from said roll,
- an illumination station including a chargeable light source means and an illuminating area at which an original is illuminated by the discharge of said light source means to provide a light image that is applied to the copy material at the exposing area,
- switch means for initiating the processing of copy material at said stations to provide copies of said original,
- first sensing means located downstream of said charging station, prior to said exposure station, for detecting the arrival of copy material thereat and second sensing means located in the vicinity of said exposure station for detecting the arrival of said copy material at said last-mentioned station,
- and logic control circuit means including first gate means operable to a first condition for charging said light source means and for operating said charging means in said charging station and to a second condition for discharging said light source means to illuminate said original and to discontinue the operation of said charging means, and second gate means operable to a first condition to operate said first copy material transport means to feed copy material along said path from said supply towards said exposure station and to a second condition to discontinue the operation of said first copy material transport means, said first and second gate means being operated to said first condition upon the operation of said switch means to move said copy material from said supply along said path through said cutting and charging station,
- said cutting means and said second gate means being operable in said second condition in response to the detection of said copy material at said first sensor to sever a length of copy material from said roll, and to discontinue the feeding of copy material, respectively,
- said first gate means being operated to said second condition to illuminate said original and to provide a light image to image said severed copy material in response to the severed copy material arriving at said second sensing means,
- said second copy transport means transporting said severed copy material from said exposing area toward said developer and fixing stations.

13. In an apparatus for making copies of an original on copy material, comprising:

- copy handling stations including charging, exposing, and developing stations spaced along a copy path, a copy material supply,
- copy material transport means for feeding copy material from said supply into said path,
- switch means coupled to said transport means for initiating the operation of said copy material transport means to feed copy material into said path.
- sensing means positioned prior to the exposing station along said path for detecting the arrival of said copy material thereat subsequent to the actuation of said switch means and for terminating the operation of said copy material transport means to stop the feeding of copy material into said path,

jam check means coupled to said sensing means wherein upon the failure of said sensing means to detect the copy material moving past said point at said prescribed time, a jam signal is provided by said jam check means, and,

means coupled to said jam check means and actuated by said jam signal for discontinuing the operation of said transport means and the feeding of copy material into said path, said means including resettable latching means being in a normally unlatched condition, said latching means operated to a latched condition by said jam signal to maintain said transport means inoperative until said latching means is reset to said unlatched condition.

14. Apparatus as claimed in claim 13 wherein said resettable latching means includes a manually resettable latching relay.

15. In an apparatus for making copies of an original on copy material comprising:

- copy handling means including:
- a charging station equipped with charging means;
- an exposing station;
- an illuminating station including a high intensity discharge illuminating source directed at an illuminating area for irradiating an original and means for storing electrical energy to be discharged through said source and for discharging said stored energy whereby said source is lighted to irradiate said original;
- and a developing station, at spaced locations along a material processing path;
- a copy material supply;
- transport means for feeding copy material from said supply into said path;
- first means for operating at least a portion of said copy handling means;
- second means for detecting the arrival of said copy material located along said copy material path in the vicinity of said exposure station;
- and control circuit means interconnecting said first and second means for controlling said copy handling means to an operative condition including the operation of said transport means to feed copy material from said supply along said path and the initiation of the operation of said energy storing means, responsive to the actuation of said first means, and the discharging of said energy storing means to light said illuminating source in response to the arrival of said copy material at said second means for imparting an image to said copy material.

16. Apparatus as claimed in claim 15 wherein said first means includes manually operated switch means.

17. In an apparatus for making copies of an original on copy material transported along a copy processing path having first and second copy path portions, past charging, exposing and developing means, and including a copy material supply,

- first copy material transport means for feeding copy material from the supply into said copy path,
- second copy material transport means for transporting said copy material along said copy path portions,
- and jam check means for detecting the failure of said copy material from moving normally along said copy path portions,
- said jam check means including first and second jam check arrangements, each having a predetermined time-out period,
- said first jam check arrangement actuated simultaneously with the feeding of copy material from said supply into said copy path and said second jam check arrangement actuated upon said copy material leaving said first copy path portion,
- each said jam check arrangements operable to discontinue the operation of said first transport means thereby to prevent further feeding of copy material into said copy path in the event said copy material fails to move along said respective copy path portions within said predetermined time-out periods,

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said first jam check arrangement being operable to interrupt the running of its time-out period in response to said first copy material transport means ceasing to feed copy material into said copy path and said second jam check arrangement being operable to interrupt the running of its time-out period in response to said copy material leaving said second copy path portion,

said second copy material transport means remaining operative at least a predetermined time after a jam is detected, thereby to permit copy material traveling along said copy path beyond said jam location, to leave said copy path.

18. A device for making copies of an original document on copy material comprising:

means for feeding said copy material into a processing path; first means for detecting the occurrence of a jam of said copy material along a first portion of said path and for causing said feeding means to thereby interrupt the feeding of said copy material into said path,

said first jam detecting means including plural, consecutive timing means, each of said timing means having a predetermined time-out period,

one of said plural consecutive timing means being operable to be placed in a first condition in response to the arrival of said copy material at a first predetermined point along said path to start the running of its predetermined time-out period and being operable to place itself in a second condition at the expiration of its time-out period,

another of said plural, consecutive timing means being operable to be placed in a first condition in response to the expiration of the time-out period of a prior one of said plural, consecutive timing means to start the running of its predetermined time-out period, being operable to place itself in a second condition and to cause said feed-

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ing means to interrupt the feeding of said copy material into said path at the expiration of its time-out period and being operable to interrupt its predetermined time-out period and to place itself in said second condition in response to the arrival of said copy material at a second predetermined point along said path, whereby said first jam detecting means is effective in monitoring the transfer of more than one segment of said copy material along said first portion of said processing path.

19. The device for making copies as defined in claim 18 further comprising a second means for detecting the occurrence of a jam of said copy material along a second portion of said path to thereby cause said feeding means to interrupt the feeding of said copy material into said path,

said second jam detecting means having a predetermined time-out period and operable to be placed in a first condition in response to the initiation of the feeding of said copy material into said path by said feeding means to start the running of its predetermined time-out period, operable to cause said feeding means to interrupt the feeding of said copy material into said path at the expiration of its time-out period and operable to interrupt its predetermined time-out period and to be placed in a second condition in response to the arrival of said copy material at a predetermined point along said path,

whereby said second jam detecting means is effective in monitoring the transfer of said copy material along said second portion of said processing path.

20. The device for making copies as defined in claim 19 further comprising sensing means placed at said predetermined points along said path for detecting the arrival of said copy material at said predetermined points along said processing path.

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